PROGRAM PROGRESS PERFORMANCE REPORT

APRIL 1, 2018 TO SEPTEMBER 30, 2018

PPPR #3

SAFE-D: SAFETY THROUGH DISRUPTION UNIVERSITY TRANSPORTATION CENTER

SAN DIEGO STATE UNIVERSITY

Texas A&M Transportation Institute

VT VIRGINIA TECH TRANSPORTATION INSTITUTE

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Signature of Submitting Official	

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Accomplishments

Major Goals of the Program

Fueled by the inevitable changes in our transportation system, the Safety through Disruption (Safe-D) National University Transportation Center (UTC) endeavors to maximize the potential safety benefits of disruptive technologies through targeted research that addresses the most pressing transportation safety questions. With the outstanding leadership of the Virginia Tech Transportation Institute (VTTI) and the Texas A&M Transportation Institute (TTI) in a mentoring collaboration with the new transportation research group at San Diego State University (SDSU), a Hispanic-Serving Institution known for educating the transportation workforce, our geographically balanced consortium encompasses the largest collection of transportation safety researchers in the nation and provides unparalleled expertise, facilities, and resources to conduct impactful research towards our long-term vision. The Safe-D National UTC focuses its efforts in three key areas: (1) cutting-edge research by leading transportation safety experts and their students; (2) education and workforce development (EWD) with programs for all levels from grade school through college and extending to continuing education for professionals; and (3) fully supported technology transfer (T2), including practitioner training partnerships, social networking, commercialization, and intellectual property management.

Accomplishments During This Reporting Period

Stakeholder Advisory Board Meeting

The meeting of the Safe-D Stakeholder Advisory Board was convened during this reporting period. Over the lifetime of the grant, the Board assists in setting the strategic direction of the Safe-D National UTC and prioritizing proposed research activities. The Stakeholder Advisory Board convenes approximately twice per year electronically, with potential opportunities for in-person assembly when deemed appropriate. During these meetings, the Safe-D Leadership Team reviews the Center's charter, gathers new research topics, evaluates proposed research activities, and discusses the outcomes of Safe-D research products. Each board member is expected to engage at a deeper level in at least one Safe-D project. In this role, the stakeholder serves as the primary 'customer' for the project and interact directly with the research team to define the research plan and objectives to maximize benefit to the stakeholder organization.

The Safe-D Stakeholder Advisory Board Engagement Meeting was held on August 14, 2018 via a Zoom web conference facilitated by the Safe-D Leadership Team. Following this meeting, stakeholders were asked to submit targeted research topic ideas for consideration by research teams participating in the Fall 2018 Call for Proposals. Targeted topics include projects with the possibility of direct stakeholder participation and support via matching funds and/or other resources. These topics were presented during the Fall 2018 Safe-D Workshop to researchers at VTTI, TTI, and SDSU as prospective topics for their teams to address in their proposals. It is expected that multiple projects awarded during this cycle will focus on these topics.

Safe-D Fall 2018 Workshop and Call for Proposals

During this reporting period, the Safe-D National UTC held the Fall 2018 Workshop on

September 12, 2018 via Zoom web conference. Consortium members VTTI, TTI, and SDSU also provided optional physical meeting spaces at their respective institutions. The workshop consisted of 10 subsequent sessions with presentations from various Safe-D Leadership Team members, Safe-D researchers, and other administrative personnel (Table 1).

Table 1. Topics Presented at the Fall 2018 Safe-D UTC Workshop

Item	Presentation Topic	Presenter
1	Introduction and Safe-D Overview	Zac Doerzaph, Safe-D Director
2	Proposal Process	Zac Doerzaph, Safe-D Director
3	Technology Transfer (T2) Process	Mike Mollenhauer, Safe-D T2 Coordinator
4	Project Pitch	Mike Mollenhauer, Safe-D T2 Coordinator
5	Selected Project Presentations	Johanna Zmud, Sr. Research Scientist, TTI; Justin Owens, Sr. Research Associate, VTTI
6	IRB Process	Julie Cook, Research Associate and IRB Specialist, VTTI
7	Safe-D UTC Data Repository and Data Management Plan (DMP)	Jeremy Sudweeks, Group Leader, Data Analysis Support Group, VTTI
8	Targeted Research Topics	Zac Doerzaph, Safe-D Director
9	Call for Proposals Information	Zac Doerzaph, Safe-D Director
10	Discussion	Safe-D Leadership Team

The Fall 2018 Workshop kicked off the third Call for Proposals under the Safe-D National UTC. The multi-step proposal process commenced with the submission of Research Statements, due October 21, 2018. Submissions received this round will follow the new Safe-D Technology Transfer (T2) Plan, which was approved during this reporting period.

Safe-D Technology Transfer Plan and Redesigned Proposal Process

During this reporting period, the Safe-D UTC program has changed how participating researchers are required to think about the products of their research and how to maximize the effect on industry practice. Safe-D recently redesigned the proposal process to include significant participation from industry partners throughout the project lifecycle. Key aspects of this modified process include:

Stakeholder Input to Research Agenda. During each proposal cycle, Safe-D now requests input from industry partners to define research topics. The preferred research topics are then shared with potential Safe-D research teams to ensure that Safe-D research aligns with industry needs. This strategy was applied during the most recent proposal cycle, providing Safe-D researchers with specific topics that industry partners are interested in co-funding. The Safe-D Leadership Team anticipates that this input from industry will allow Safe-D to better meet industry needs, resulting in greater impacts within the transportation industry.

Matchmaking and Project Champion. Each new Safe-D project will be matched with a project champion from industry who will provide a built-in "customer" for the research, further aligning the project with industry needs. If proposed project teams are unable to find their own champion, the Safe-D Leadership Team will implement a matchmaking process where a research team is selected and project concept development is facilitated during proposal generation. The champion will help define the project work plan, attend regular status meetings, and help focus the project products towards implementable results. Ideally, the champions will help shape the research products so that they can be immediately implemented by the champion organization.

Project Pitch Session. The research statement review process now includes a project pitch session and select project teams are invited to provide a seven-minute entrepreneurial pitch presentation. These pitches give the project team an opportunity to present the value of the project to industry partners and allow for direct questions and answers that may help refine the project. This direct involvement also gives industry partners the opportunity to help select the most impactful projects and may generate additional interest in co-funding.

Final Industry Presentations. Finally, upon the completion of each project, the project team will develop a presentation for the champion organization to summarize the findings and facilitate broader opportunities for adoption. This final step ensures that the research outcomes are given the widest possible exposure within the partner industry organization.

Project Awards and Activity

At the end of this reporting period, Safe-D had a project portfolio totaling over $7.9 million dollars, with nearly half of project funding sourced from non-federal matching funds. Safe-D projects are selected according to their focus on the four Center theme areas: automated vehicles, connected vehicles, big data analytics, and transportation as a service. The coverage of Safe-D theme areas by portfolio to-date is shown in Figure 1.

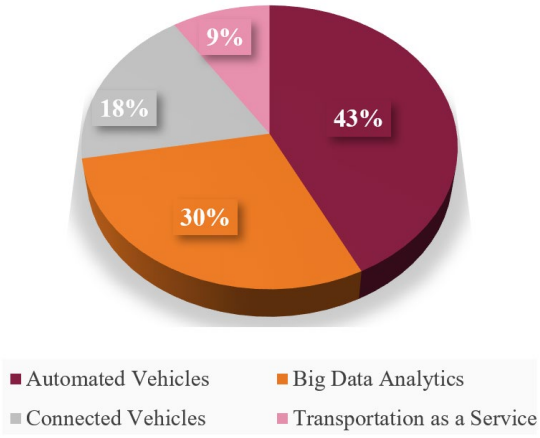


Figure 1. Portfolio of Safe-D Projects by Theme Area

While no awards were made to projects under competitive calls for proposals during this reporting period, Safe-D consortium member VTTI awarded three directed projects for the purpose of facilities and/or resources development in the primary Safe-D theme area of automated vehicles. These projects were awarded to bolster the physical, institutional, and/or information resources available to researchers at VTTI and Safe-D consortium members in the rapidly evolving area of automated transportation.

Completed Projects

During this reporting period, the following projects completed their activities:

- **02-010: Safety Perceptions of Transportation Network Companies by the Blind and Visually Impaired**
- **02-020: Behavior-based Predictive Safety Analytics – Pilot Study**
- **02-026: Sources and Mitigation of Bias in Big Data for Transportation Safety**
- **02-027: Street Noise Relationship to Vulnerable Road User Safety**
- **TTI-01-03: Comparison of SHRP2 Naturalistic Driving Data to Geometric Design Speed Characteristics on Freeway Ramps**
- **TTI-01-05: K-12 STEM Program: Exploring the Science of Retroreflectivity** (Program Development)

The products of these projects are currently under review and are expected to be published as per the Safe-D data management plan (DMP) and grant requirements in the next reporting period.

Safe-D Programming

Safe-D has supported a number of programs targeting our Leadership, Education and Workforce Development (EWD), Technology Transfer (T2), and Diversity initiatives. The following sections highlight major accomplishments under these directives during this reporting period.

Professional Skills Training Series

During this reporting period, Safe-D continued its Professional Skills Training series. Geared toward graduate students, these seminars will continue for the duration of the Safe-D grant. Consortium member TTI coordinates the webinars, which are held in association with the Center for Advancing Research in Transportation Emissions, Energy and Health (CARTEEH). The seminars are available to students across each consortium institution, with physical meeting spaces reserved at VTTI, TTI, and SDSU to help facilitate group interaction even in a digital forum. The seminars that were presented during this reporting period are listed in Table 1.

Table 2. Seminar Series Information

Date	Seminar Title	Speaker
5/21/2018	CAREER READINESS: Leveraging Social Media for Business	Roland Block, Associate Director, Engineering and Experiential Education, TAMU

As this reporting period covers much of the summer months and is largely outside the academic year, only one seminar occurred during this period. The Professional Skills Training Series will resume during the next reporting period when students are in regular school-year sessions.

Seminar Series

As part of an initiative to develop new EWD activities, Safe-D hosts periodic visits by leaders in the transportation field to convey transportation challenges and opportunities to students and faculty. During this reporting period, TAMU Researcher Dr. Swaroop Darbha visited VTTI and spoke on VT campus to students in the Department of Electrical and Computer Engineering. During his presentation, entitled “Benefits of V2V Communications for Automatic Vehicle Following Systems,” Dr. Darbha spoke on how vehicle models, information flow among vehicles, and spacing policies play an important role in the propagation of errors. Following his presentation, Dr. Darbha met with researchers at VTTI and Safe-D to discuss ongoing research.

Visiting Scholars Program

The Safe-D Visiting Scholars Program aims to facilitate the development of mentoring relationships between experienced senior research faculty and junior faculty. During this reporting period, Dr. Yoshito Kinoshita from Komatsu Ltd. began his term as a visiting scholar at VTTI. During his term, Dr. Kinoshita will be working on Safe-D Project 03-073: Autonomous Emergency Navigation to a Safe Roadside Location alongside researchers from VT and VTTI. Dr. Kinoshita is a research engineer with eight years of experience in development design at Komatsu with a focus on autonomous driving. Under this project, he is studying autonomous estimation and control and developing a drive-by-wire vehicle in the laboratory of VT Professor Tomonari Furukawa. His contributions include selecting vehicle sensors along with implementing and testing them on a golf cart that serves as a test platform for early-stage testing.

Student Awards Program

Safe-D is proud of our students' accomplishments and continues to encourage students to seek opportunities for awards and scholarships. During this reporting period, Jayson Stibbe, a student at Texas A&M University (TAMU), won the William R. Dick McCasland Fellowship in Traffic Engineering. This fellowship is awarded to master's degree students in the Department of Civil Engineering at TAMU who have an interest in freeway management. Mr. Stibbe was also awarded the Keese-Wootan Transportation Fellowship, which honors two former TTI directors.

At the end of this reporting period, Safe-D initiated its call for nominations for the 2018 Student of the Year Award to be honored by the USDOT during the CUTC Annual Awards Banquet prior to the TRB Annual Meeting in January 2019. Faculty from each Safe-D consortium member institution have been encouraged to submit nominations of outstanding students for this esteemed award, and a selection is expected during the next reporting period.

Educational Courses Taught and Students Supported

Safe-D researchers are actively engaged in teaching efforts at each of the consortium universities and in supporting students through the conduct of research activities. While formal metrics are reported annually in the Program Performance Indicators, the following is a description of the metrics regarding courses taught and student support provided through the Safe-D program.

Table 3. Description of Students Supported under Safe-D Research Activities

Academic Level	Total Number of Students Supported	Number of Underrepresented Students Identified
Undergraduate	15	5
Masters	21	8
PhD	26	9

During this reporting period, researchers involved in Safe-D research projects taught 22 graduate courses, reaching 455 students, along with 27 undergraduate courses, reaching 1,056 students. Safe-D research teams supported 62 undergraduate- and graduate-level students during this reporting period, including 22 students from underrepresented populations. In addition, research teams reported ten students graduating during the course of research activities, including seven that were placed for employment in the private sector. The breakdown of the students supported are presented in Table 3.

Highlighted EWD & Other Outreach Activities

Safe-D faculty, staff, and students participate in numerous EWD and outreach activities throughout the year, both on a program-level and through each individual Safe-D project. The activities listed below are some of the many events that have been reported during this period.

TTI Undergraduate Summer Internship

Under Safe-D Project 03-049: Data Fusion for Nonmotorized Safety Analysis, TTI established a five-week summer internship to provide an undergraduate student with a unique opportunity for guided learning. The internship was designed to help the student gain knowledge about the Safe-D program, build transferrable research skills, and develop leadership skills by working closely with Safe-D researchers. For this internship, TTI selected Atom Arce, a recent high

school graduate (High School for Math, Science and Engineering at CCNY - Class of 2018) and newly admitted first-year undergraduate student (Fall 2018) at the University of Toronto. The internship ran July 5 – August 10, 2018. The key activities in which the intern participated included an article review, summarizing research articles into reports, and the preparation and delivery of a presentation to the project team. During this process, Atom acquired knowledge about nonmotorized traffic patterns and use, safety issues related to bicycle and pedestrian traffic, bicycle and pedestrian forecasting tools, and the use of emerging and big data sets in the transportation area.

> "The two main skills I practiced the most were analyzing the information and distilling the most important details from my readings. I believe my ability to write about academic research vastly improved, and the feedback I received on my reports were especially helpful in finding the weaknesses in my analysis."
>
> -Atom Arce, TTI Intern
> *Project 03-049: Data Fusion for Nonmotorized Safety Analysis*

K-12 Outreach

The Safe-D leadership team continued its efforts to enhance public understanding and spur interest in transportation careers through K-12 outreach programs. For example, Safe- D researcher and EWD Coordinator Miguel Perez worked with stakeholders in Radford City Public Schools (Virginia) in Fall 2017 to discuss hands-on learning opportunities (e.g., internships) under Safe-D. Safe-D researcher Andy Schaudt worked with 5th-grade students in the Montgomery County Public School system to complete a passion project on autonomous vehicles. Safe-D student Alexis "Lexi" Basantis supported a request from VDOT Chief Engineer to showcase and demonstrate an automated vehicle from the VTTI fleet to students at an elementary school in Manassas, VA. Safe-D Project TTI-01-05: K-12 STEM Program: Exploring the Science of Reflectivity also visited Allen Academy Career Day in Bryan, Texas on May 10, 2018 to conduct demonstrations of the project products. Under multiple Safe-D projects, Safe-D researcher Dr. Sivakumar Rathinam presented project information at a summer camp organized by the High Performance Research Computing (HPRC) at TAMU on July 26, 2018.

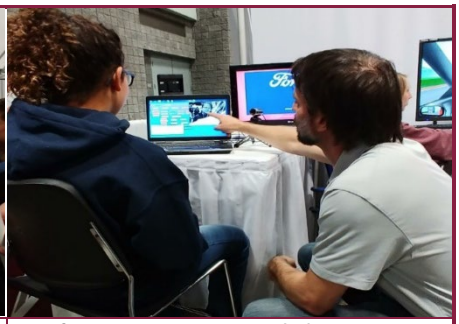
USA Science & Engineering Festival

On April 6–8, 2018, Safe-D researchers attended the USA Science & Engineering Festival in Washington, DC, which showcased a variety of STEM organizations and demonstrations for attendees of all ages. The event attracted over 340,000 K–12 students along with more than 500 exhibitors. Safe-D affiliates organized three demonstrations related to transportation safety and innovative technology in the transportation industry. The first demonstration showcased retroreflectivity activity, where students looked at retroreflective materials with small handheld microscopes to see how the different materials and shapes affected the reflection of light.

A second demonstration showcased software which uses a camera to recognize key elements of a person's face (nose, mouth, eyes) and creates a map, or "mask", of the rest of the face. Students had their faces mapped and learned about facial recognition software and its applications in transportation safety research. Finally, Safe-D demonstrated a vehicle simulator to let students experience a potential automated vehicle malfunction. Students "drove" the simulated vehicle and were required to intervene to try to correct the simulated issues (Figure 2).

In addition, in preparation for this event, Safe-D student from TAMU, Lea Huntington, led demonstrations of the developed driving simulation scenarios with various groups of visiting students at TTI, including groups of 5th graders, 8th graders, and 12th graders.

Students "drive" a simulated vehicle at the 2018 USA Science & Engineering Festival



Safe-D Director Dr. Doerzaph demonstrates facial recognition software at the 2018 USA Science & Engineering Festival

Figure 2

Sudley Elementary Demonstration

On April 9, 2018, Alexis Basantis, a Safe-D student and graduate research assistant at VTTI, visited Sudley Elementary in Manassas, Virginia to showcase transportation research. Ms. Basantis demonstrated a 2013 Tesla Model S to the five classes of elementary students, including explanations of how the vehicle works and how it can improve driving safety. She demonstrated the Auto-Park and Summon features of the Model S and fielded questions from the students about self-driving cars along with the work being done at VTTI.

Diversity

As outlined in our grant proposal, Safe-D recognizes the importance of diversity and has interwoven diversity efforts into Center programs. Safe-D believes that hands-on funded research experience is a great mechanism for attracting young, underrepresented students to the transportation profession and maintaining that interest throughout their attainment of advanced degrees and rewarding careers. The following sections describe activities conducted during this reporting period that highlight Safe-D's commitment to diversity.

Introduce a Girl to Engineering Day

TTI partnered with Halliburton to participate in the Introduce a Girl to Engineering Day, which was hosted by the Women in Engineering Program at the University of Texas at Austin on February 24, 2018**.** The event was attended by over 6,000 girls ranging from kindergarten through 8th grades plus their parents and Girl Scout Troop leaders, and teachers. Over 10,000 were estimated to have engaged during the weekend event in some capacity.

Advancement via Individual Determination (AVID)

Safe-D faculty and staff at TTI worked with the Advancement via Individual Determination (AVID) program at their institutes during this reporting period. AVID is a program designed to help underachieving students with high academic potential prepare for entrance to colleges and universities. The AVID approach to untracking places previously underachieving students (who are primarily from low-income and ethnic or linguistic minority backgrounds) in the same

college preparation academic programs as high-achieving students (who are primarily from middle- or upper-middle income and "majority" backgrounds). AVID features a rigorous academic elective course with a sequential curriculum for grades 7 through 12 that focuses on writing, inquiry, and collaboration as methodologies to accelerate student progress. Multiple schools participating in this years' event have committed to return.

Dissemination of Results

Research Project Results

Research results from Safe-D projects continued to be finalized during this reporting period. Safe-D researchers have been submitting and publishing results of their projects in peer-reviewed journals and presenting results at conferences nationwide. The publications and presentations which researchers have reported thus far are listed in the Products section of this report. In addition to these publications and presentations, researchers report disseminating their project results through various outreach, and EWD and T2 activities. Some of the other dissemination activities conducted during this reporting period are listed below.

01-002: Countermeasures to Detect and Combat Driver Inattention While Driving Partially Automated Systems. Safe-D promoted this project's presence at the 2018 USA Science & Engineering Fair in April 2018 in Washington, D.C. through social media and news media.

01-005: Factors Surrounding Child Seat Usage in Ride-Share Services. The project team discussed this project in an interview with Wired magazine, on-camera and on-air interviews with WUSA9 and WTOP (local Washington, DC news outlets). All interviews have been completed, but airing is pending. During the previous reporting period, the project team also published preliminary research results in the UTC Spotlight newsletter (February 2018).

02-010: Safety Perceptions of Transportation Network Companies by the Blind and Visually Impaired. On April 10, 2018, members of the research team provided an overview of the study on the podcast "Eyes on Success." On August 29, 2018, the team presented to the findings of the study through a webinar.

02-016: Older Drivers and Transportation Network Companies: Investigating Opportunities for Increased Safety and Improved Mobility. The project team presented the findings of this study at an in-person presentation at AARP.

02-026: Sources and Mitigation of Bias in Big Data for Transportation Safety. Upon invitation by the Transportation Research Board Bicycle and Pedestrian Data Subcommittee, PI Greg Griffin presented the findings of this project as part of a webinar titled "What do the Experts Do? Insights from Interviews & Literature to Deal with Bias in Big Data" (June 26, 2018).

03-072: Preventing Crashes in Mixed Traffic with Automated and Human-Driven Vehicles. The team presented the results of this study to General Motors visitors.

TTI-01-01: Analysis of an Incentive-Based Smartphone App for Young Drivers. Safe-D researchers created an exhibit focused on this study at the Lifesavers Conference, held on April 22–24, 2018 in San Antonio, Texas.

TTI-01-05: K-12 STEM Program: Exploring the Science of Retroreflectivity. The Exploring the Science of Retroreflectivity curriculum is published at https://tti.tamu.edu/safe-d and linked on the Safe-D website.

Safe-D affiliated faculty at SDSU have also presented the findings of research to practitioners through several local transportation agencies and companies. For example, SDSU faculty met with Caltrans and SANDAG in July 2018, the City of San Diego in Sep 2018, and the City of Chula Vista in Aug 2018. As a result, Caltrans proposed a new project idea related to the adaptation of infrastructure for automated vehicle technology. This project is currently in the

proposal development stage; SDSU researchers plan to submit this proposal during the next round of Safe-D project selection.

Additional information regarding Safe-D project results and product dissemination is found in the Products section. Additional EWD and T2 components of Safe-D projects were submitted during this reporting period and are expected to be finalized and reported during the next period.

Plans for the Next Reporting Period

Fall 2018 Safe-D Call for Proposals

The Fall 2018 Safe-D Call for Proposals will conclude during the next reporting period. This call will follow a newly-implemented process that includes a PI pitch session along with stakeholder matching (see Safe-D Technology Transfer Plan and Redesigned Proposal Process). New project awards are expected to be made in December 2018 and will be reported in the next PPPR.

Select Outreach and Diversity Activities Planned

SDSU Student Research Symposium

Safe-D students from SDSU have participated in the annual SDSU Student Research Symposium in previous periods and plan to participate again in the March 2019 symposium. This event is a public forum where SDSU students present their research, scholarship, and creative activities. Last year, 524 students, including 278 undergraduates, presented their research at the symposium. The two-day symposium occurs each spring semester and recognizes the outstanding scholarly accomplishments of SDSU students. It is a great way to learn about the projects that both graduate and undergraduate SDSU students are engaged in.

VDOT Transportation Career Fair

On October 4, 2018, VDOT will host their 14th annual transportation career fair to showcase different careers in transportation to high school students in the Northern Virginia area. Local representatives from careers ranging from construction to emergency roadway management will discuss their jobs and how they arrived on their current career paths. Lexi Basantis, a graduate research assistant at VTTI, will be talking to students about Safe-D projects being conducted at VTTI. VTTI researchers will also showcase a 2018 Tesla Model X, a research vehicle used at VTTI. The VDOT career fair provides participants with the unique opportunity to both learn and get excited about the future of transportation.

Explore SDSU Open House

As a Hispanic-serving institute, most of the activities at SDSU involve underrepresented communities. Explore SDSU is a free all-campus event, open to all alumni, members of the SDSU community, and prospective students. Presentations, workshops and tours are held for admitted and prospective students, parents, military students, veterans, and more for attendees of all ages. At the Explore SDSU Open House on March 23, 2019, Safe-D faculty, staff, and students plan to present the mission of Safe-D in terms of research themes and EWD activities and to encourage prospective students to get involved with the Safe-D center.

Products

All research projects awarded by Safe-D are required to submit EWD and T2 plans, identifying specific products from their projects for development and dissemination. To ensure that EWD and T2 plans for each project receive continued attention, the Safe-D EWD and T2 Coordinators contact each of the research teams shortly after the project start date. The purpose of this initial communication is to establish a point of contact within the research team, clearly lay out expectations, offer help and guidance, and encourage research teams to expand their activities in this area as much as possible. The EWD and T2 products that have emerged from Safe-D research projects during this reporting period are described below; those currently under development are discussed in the Research Project Results section.

Publications, Conference Papers, and Presentations

Publications, conference papers, and presentations that were submitted, accepted, or published during this reporting period are listed below.

Presentations

Barowski, L., Womack, K., & Owens, J.M. (2018). Factors surrounding child seat usage in ride-share vehicles. Talk presented by Laura Barowski at 2018 Lifesavers Conference, San Antonio, TX, Session: Vacation Travel Risks & What Parents Need to Know.

Basantis, A., Miller, D., Doerzaph, Z., Neurauter, L. (2018, May). Assessing Alternate Approaches for Conveying HAV 'Intentions'. Poster presented at the SBES Annual Symposium, Winston-Salem, NC.

Brewer, M.A., & Stibbe, J. (2019, January). Investigation of Design Speed Characteristics on Freeway Ramps Using SHRP2 Naturalistic Driving Data. Presented at the 2019 Transportation Research Board Annual Meeting

Das, S., K. Fitzpatrick, M. C. (2018, June). Effects of Bicyclists on Vehicle Operating Speed: A Study on urban Arterial Roadway. ITE Joint Meeting of the Western District and the Texas District.

Eick, E., Faunce, C., Roediger, M., Hickman, J.S., & Geller, E.S. (2018). Safety-related pedestrian behaviors among University students: Naturalistic observations from a moving vehicle. Paper presented at the annual Virginia Association of Behavior Analysis in Roanoke, VA.

Fisher, D., Klauer, S. G., & Manser, M. (2018, July 10). Training Needs for Automated Driving. Lecture presented at Automated Vehicles Symposium in CA, San Franscisco.

Griffin, G. P., Hankey, S., Buehler, R., Dai, B., Le, H., & Simek, C. (2019). Exploring Street Noise and Bicycle Safety: Initial Evidence from Austin, TX and the Washington, DC Capital Area. In Transportation Research Board Annual Meeting. Washington, D.C.: Transportation Research Board.

Han, W. White, E., Mollenhauer, M. and Roofigari-Esfahan, N. A Connected Work Zone Hazard Detection System for Highway Construction Workers. Abstract submitted to ASCE International Conference on Computing in Civil Engineering (2019)

Hasani, M. Arash Jahangiri, Ipek N. Sener, Sahar Ghanipoor Machiani (2018). Identifying High Crash Risk Intersections for Walking and Biking. Center for Human Urban Mobility (CHUM) Summit, University of California at San Diego, September 20, 2018.

Hasani, M. Arash Jahangiri, Sahar Ghanipoor Machiani (2018). Developing Models for Matching of Short-term and Long-term Data Collection Sites to Improve the Estimation of Average Annual Daily Bicyclists. The 21st IEEE International Conference on Intelligent Transportation Systems. November 4-7, 2018, Maui, Hawaii, USA

Henk, R.H., Tisdale, S and Munira, S, An Incentive-Based Smartphone App for Young Drivers, April 24, 2018, Annual Lifesavers Conference, San Antonio, Texas

Hsu, Y., Gopalswamy, S., Saripalli, S., Shell, D. A., (August 2018) An MDP Model of Vehicle-Pedestrian Interaction at an Unsignalized Intersection. Presented at the 88th IEEE Vehicular Technology Conference, Chicago, IL.

Huang, W., Engstrom, J., Miller, A., Dreger, F. A., Soccolich, S., de Winter, J. C. F., & Ghanipoor Machiani, S. (2018). Analysis of Differential Crash and Near-Crash Involvement Based on Naturalistic Driving Data. Presented at the 7th International Symposium on Naturalistic Driving Research. Blacksburg, Virginia.

Jahangiri, A., Sahar Ghanipoor Machiani, Atsushi Nara, Ming Tsou (2018). Visualization and Spatiotemporal Modeling of Aggressive Driving using Connected Vehicle data. Summer Specialist Meeting on Analyzing Social Perception and Amplification using Social Media and Big Data in Human Dynamics, San Diego, CA, August 7-8, 2018.

Jin, H., Sharma, R., Untaroiu A., Silvestri Dobrovolny, C., Untaroiu, C.D. (2018) Evaluation of the injury risks of truck occupants involved in a crash as a result of errant truck platoons, IRCOBI Conference, Athens, Greece.

Liang, D., Baker, S., Lau, N., & Antin, J. (2018). Examining senior drivers adaption to mixed level automated vehicles: focus group results from a naturalistic driving study. Poster Session presented at the 7th International Symposium on Naturalistic Driving Research, August 27-30th, 2018. Virginia Tech Transportation Institute, Blacksburg, VA, USA

Nayak, A. S. Dey, S. Rathinam, S. Gopalswamy,3rd Annual Texas A&M Transportation Technology Conference, May 2018

Nayak, A. S. Rathinam, S. Gopalswamy, Texas A&M Transportation Technology Conference, 2018.

Nayak, A. S. Rathinam, S. Gopalswamy, Vision-based techniques for identifying Emergency Vehicles, SAE World Congress, 2019

Rahmati, Y., A., Samimi Abianeh, M., Tabesh, A., Talebpour, and F., Sharifi. Driving to Safety: Who Is at Fault in CAVs Rear-End Collisions. Accepted for presentation at the 98th Annual Meeting of the Transportation Research Board of National Academies, January 13-17, 2019.

Roediger, M., Eick, E., Faunce, C., Hickman, J.S., & Geller, E.S. (2018). Behavioral Impact of an Autonomous Vehicle: A naturalistic study of pedestrian-vehicle communication and pedestrian behavior. Paper presented at the annual Virginia Association of Behavior Analysis in Roanoke, VA.

Roediger, M., Hickman, J.S., & Geller, E.S. (2018). Exploring human-vehicle communication to balance transportation safety and efficiency. Paper presented at the 7th International Symposium on Naturalistic Driving Research, Blacksburg, VA.

Stibbe, J., & Brewer, M.A. (2019, January). Processing SHRP2 Time Series Data to Facilitate Analysis of Relationships Between Speed and Roadway Characteristics. Presented at the 2019 Transportation Research Board Annual Meeting

Zhou, F., Hu, S., Chrysler, S., Kim, Y., Damnjanovic, I., Talebpour, A., & Espejo, A. (2018, July). Optimization of Lateral Wandering of Automated Vehicles to Reduce Hydroplaning Potential and to Improve Pavement Life. To be presented at TRB, Washington D.C., 2019

Publications

Alambeigi, H., Tankasala, R., and McDonald, A.D. (2018). Contrasting automated vehicle experiments and real-world crash databases: A review of literature and analysis of the California Department of Motor Vehicles automated vehicle crash database. Submitted.

Das, S., K. Fitzpatrick, M. C. (2018, June). Effects of Bicyclists on Vehicle Operating Speed: A Study on urban Arterial Roadways. ITE Joint Meeting of the Western District and the Texas District.

De Winter, J. C. F, Dreger, F. A., Huang, W., Miller, A., Soccolich, S., Ghanipoor Machiani, S., & Engstrom, J. (2018). The relationship between the Driver Behavior Questionnaire, Sensation Seeking Scale, and recorded crashes: A brief comment on Martinussen et al. (2017) and new data from SHRP2. Accident Analysis and Prevention, 118, 54-56.

Fitzpatrick, K., S. Das. (2019 anticipated). Using Crowdsourced Data to Estimate Operating Speed on Suburban Arterials. Submitted for consideration for the 2019 TRB Annual Meeting.

Griffin, G. P., Mulhall, M., Simek, C., & Riggs, W. W. (2019). Mitigating Bias in Big Data for Transportation. Transportation Research Board Annual Meeting.

Huang, W., Engstrom, J., Miller, A., Dreger, F. A., Soccolich, S., de Winter, J. C. F., & Ghanipoor Machiani, S. (2018). Analysis of Differential Crash and Near-Crash Involvement Based on Naturalistic Driving Data. Presented at the 7th International Symposium on Naturalistic Driving Research. Blacksburg, Virginia.

Jin, H., Sharma, R., Meng, Y., Untaroiu, A., Silvestri Dobrovolny, C., Untaroiu, C.D. (2018) Evaluation of the injury risks of truck occupants involved in a crash as a result of errant truck platoons, 15th International LS-Dyna Conference, Dearborn, MI

Jin, H., Sharma, R., Untaroiu A., Doerzaph, Z., Silvestri Dobrovolny, C., Meng, Y., Untaroiu, C.D. (2018) Evaluation of the injury risks of truck occupants involved in a crash as a result of errant truck platoons, Accident Analysis & Prevention (Elsevier)

Jin, H., Sharma, R., Untaroiu A., Silvestri Dobrovolny, C., Untaroiu, C.D. (2018) Evaluation of the injury risks of truck occupants involved in a crash as a result of errant truck platoons, IRCOBI Conference, Athens, Greece

Mao, H., Deng, H., Lord, D., Guo, F., 2018. Adjusting Finite Sample Bias for Poisson and Negative Binomial Regression in Traffic Safety Modeling. Submitted to Accident Analysis & Prevention.

McDonald, A.D., Alambeigi, H., Engstrom, J., Markkula, G., Vogelpohl, T., Dunne, J., and Yuma, N. (2018). Towards computational simulations of behavior during automated driving take-overs: A review of the empirical and modeling literatures. In Revision.

Nayak, A. S. Rathinam, S. Gopalswamy, Vision-based techniques for identifying Emergency Vehicles, SAE World Congress, 2019.

Thesis/Dissertations

The following Safe-D projects have identified that they have contributed to a thesis and/or dissertation during this reporting period:

01-002: Countermeasures to Detect and Combat Driver Inattention While Driving Partially Automated Systems: Suh, Y. (2018). Supporting Visual Attention of Drivers Interacting With In-Vehicle Touchscreens (Doctoral dissertation). Texas A&M University, College Station, TX.

Website(s) or Other Internet Sites

Safe-D Website

During this reporting period, the Safe-D National UTC website was regularly updated with developments from the Safe-D program, including links to project products (e.g., EWD and T2 outputs) and Safe-D outreach activity descriptions. As the website is Safe-D's primary method of external interfacing, the Center is committed to providing up-to-date information through this public website using a modern, minimalist approach to rapid information sharing.

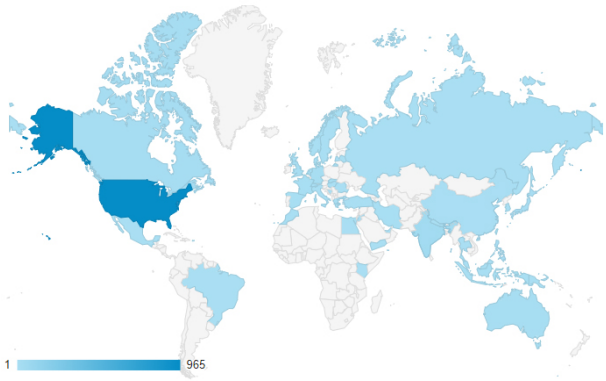


Figure 3. Website visitors by country.

The Safe-D website averaged over 183 users per month, with 2,101 new users during this period. Users viewed pages 11,273 times during this period, visiting an average of 3.24 pages per session. These website traffic measures indicate an increase in activity in this reporting period from the last, and this trend is expected to continue as projects complete their activities, and

project products become available for download via the website. Figure 2 shows the worldwide website traffic by country for this reporting period.

Safe-D Researcher Portal

With 229 users at the end of this reporting period, the Safe-D Researcher Portal continues to successfully facilitate inter-consortium collaboration and access to Center-level resources across our geographically dispersed universities. During this reporting period, the Safe-D leadership team used the portal to disseminate information about the Fall 2018 Workshop and Call for Proposals, including video recordings from the workshop for future review. Information on the portal is continually updated so that research team members are aware of upcoming reporting deadlines, processes for the submission of deliverables, and other Safe-D project requirements.

Technologies and Techniques

While several applications and tools are currently under development by Safe-D project teams, these products have not yet been finalized. Below are descriptions of the T2 products from Safe-D projects as reported by project teams. It is expected that as these technologies and tools are finalized, results will be reported in this section during future reporting periods.

01-002: Countermeasures to Detect and Combat Driver Inattention While Driving Partially Automated Systems: A partial automation control box that can interact with driving simulator controllers, in parallel with the human manual input, through a software interface. It is called the PATO-Box.

01-005: Factors Surrounding Child Seat Usage in Ride-Share Services: in development of website created to help parents, caregivers, and drivers of ride-share vehicles better understand the laws and regulations surrounding child passenger safety.

03-050: Design and Evaluation of a Connected Work Zone Hazard Detection and Communication System for CAVs: The team is continuing work on a WZ Mapping Application for VDOT that will digitize the work zone location and barrier types.

03-064: Automated Vehicle Behavior Monitoring for Vulnerability Management: The team has continued the development of several algorithms.

03-073: Autonomous Emergency Navigation to a Safe Roadside Location: Developing an application.

Inventions, Patent Applications, and/or Licenses

Nothing to report.

Other Products

Nothing to report.

Participants and Collaborating Organizations

Partners & Collaborators

Collaboration is a key part of the Safe-D program, and collaborative research is prioritized when selecting projects for award. During this reporting period, Safe-D has worked to promote partnerships and collaborations with academic institutions, other nonprofits, industrial/commercial firms, state and local governments, schools and school systems, and other organizations. Many collaborations have begun or were reported as ongoing during this reporting period, and more direct industry involvement in projects in the next year is foreseen. The

domestic and international collaborations formed as part of Safe-D research projects during this reporting period are summarized below.

Domestic Collaborators

02-010: Safety Perceptions of Transportation Network Companies by the Blind and Visually Impaired. Safe-D researchers at TTI collaborated with the following individuals to evaluate how the blind and visually impaired (BVI) perceive and use transportation network companies (TNCs): Dr. Anne Corn, Independent Consultant; Dr. Robert Wall Emerson, Western Michigan University, Panel Member; Donna Dean, Stephen F. Austin University, Panel Member; and Aaron Fox, Lyft, Panel Member.

02-020: Behavior-based Predictive Safety Analytics Pilot Study. SmartDrive is working with the Safe-D research team to provide data for the project in an effort to develop a predictive model of driver behavior.

TTI-01-01: Analysis of an Incentive-Based Smartphone App for Young Drivers. Cambridge Mobile Telematics delivered the smartphone application deployment for this project from April 11-August 3, 2018.

TTI-01-05: K-12 STEM Program: Exploring the Science of Retroreflectivity. Domestic industry contacts reviewed the course materials produced by this project.

International Collaborators

02-014: Formalizing Human-Machine Communication in the Context of Autonomous Vehicles. The project team is working with Dr. Joost de Winter and his graduate student, Pavlo Bazilinskyy, at Delft University of Technology to replicate results in a European study. Data collected in this UTC study will be compare with those obtained in Europe. Dr. de Winter and Mr. Bazilinskyy are using the coding scheme developed in this study so results can be compared.

03-036: Modeling Driver Responses during AV Platooning Failures. VTTI and TTI are collaborating with Dr. Gustav Markkula of Leeds University (U.K.) on this project. Dr. Markkula serves as the advisor for the modeling work involved in this study.

03-073: Autonomous Emergency Navigation to a Safe Roadside Location. The VT project team is working with a faculty member from a Chinese university, under an effort partially supported by the Chinese Scholarship Council and the visiting scholar's university. She has been focusing on the tuning of localization, mapping and road surface estimation as well as trajectory planning and vehicle control alongside other project team members.

Impact

Impact on Transportation Safety

Safe-D focuses on the Fixing America's Surface Transportation (FAST) Act priority area of "Promoting Safety." Safe-D believes that innovative research on emerging technology will translate into improvements in transportation safety. At the individual project level, Safe-D research is expected to have near-term effects on the safety of our transportation system. For example, the project "Driver Training for Automated Vehicle Technology" is expanding the base of knowledge related to driver training by developing training protocol requirements for the next generation of vehicles. The "Big Data Visualization and Spatiotemporal Modeling of Aggressive Driving" project is developing a user-friendly tool to exploit big data obtained from automated vehicles to evaluate safety and develop countermeasures. The VTTI-led "Standardized Performance Evaluation of Vehicles with Automated Capabilities" project is developing a standard set of testing procedures to evaluate mixed-function automated vehicle feature performance, limitations, and consistency. The outcomes of these projects will be immediately implementable to enhance safety as vehicle automation becomes more common.

Safe-D is also affecting transportation safety through interactions with key stakeholders. As

mentioned above, the Safe-D Stakeholder Advisory Board Engagement Meeting was held in August of this year, and stakeholders provided feedback on research needs. This stakeholder input will influence the research funded during the next cycle of project awards. Several current projects involve close collaboration with the Stakeholder Board, and the Safe-D program has provided new opportunities to engage with stakeholders. These interactions will ensure that the products of research are implemented in the real world. For example, Safe-D researchers are working directly with Blackberry to shape their research and development process. TTI has established a five-year research partnership with 3M, who is sponsoring research, providing graduate student fellowships, and providing funding for facility construction.

The translation of Safe-D activities into positive impacts on transportation safety is facilitated by a robust Technology Transfer program. This program focuses on engaging industry in the implementation of research products and disseminating information through educational opportunities such as STEM programs and lectures/presentations for a variety of audiences. Please see the Impact on Technology Transfer section for more details.

Impact on Other Disciplines

The impact of Safe-D research is expected to extend beyond the principal discipline of the program. The interdisciplinary themes of Safe-D have attracted research proposals and participation from faculty with interests extending beyond the disciplines traditionally involved in transportation research (e.g., engineering). Current Safe-D projects involve faculty and students in the areas of public health, urban planning, psychology, computer science, and law. For example, the project entitled "Legal Tools for Barriers to Accessing Data Sets in the Age of AV/CV Technologies," which is addressing data privacy and ownership issues, is led by a TTI staff member with a law degree. Two TAMU law students have also contributed to this project as research assistants, and the research team has made presentations to the TAMU Law School and raised awareness of transportation data issues in the legal field. Other ongoing Safe-D projects are expected to have impacts on cybersecurity, statistics, computer science, and robotics.

Impact on Transportation Workforce Development

At all levels of education from K-12 to college undergraduates to graduate students, Safe-D activities aim to inspire and educate the next generation of transportation professionals. At the K-12 level, various Safe-D programs have engaged young students through hands-on demonstrations to spur interest in transportation careers. At the 2018 USA Science & Engineering Festival and Virginia Tech Science Festival, Safe-D affiliated researchers and students presented their projects and findings to K–12 audiences in hands-on settings. In addition to helping students understand how high-level scientific research affects them, these activities improve the ability of researchers to synthesize complex concepts into its most important (and easy to comprehend) elements. They also provide undergraduate/graduate students important practice in speaking clearly, concisely, and effectively about their research to naïve audiences. Additional educational and workforce development efforts of Safe-D are summarized below for each partnering institution.

San Diego State University

SDSU is a Hispanic-serving institute offering the only transportation program in the San Diego region, and many members of the local transportation workforce are SDSU graduates. Safe-D projects have enhanced the teaching and learning opportunities, thereby improving the quality of education for the students graduating to be local traffic engineers. For example, Safe-D has provided unique opportunities for both undergraduate and graduate students to get involved in research activities. Safe-D graduate assistantships have allowed students to directly participate in leading-edge research projects, which would not have been possible without the Safe-D program. Most graduate assistants in Civil Engineering at SDSU are paid hourly wages; Safe-D has provided the opportunity for full-time assistantships (wage plus students' tuition/fees), resulting in better quality research activities and more interest in the transportation program.

Safe-D affiliated faculty at SDSU now present research findings in the classrooms and help develop teaching modules. These project materials are directly used in class discussions, improving the quality of teaching and learning at SDSU. In addition, Safe-D researchers at SDSU presented project findings at the Explore SDSU event in the spring of this year. Explore SDSU is a free all-campus event open to alumni, members of the SDSU community, and prospective students. SDSU's Safe-D affiliated faculty have also held several meetings to discuss research findings with local transportation agencies and companies, including Caltrans and SANDAG in July 2018, the City of San Diego in September 2018, and the City of Chula Vista in August 2018. These interactions between Safe-D researchers and the employers of transportation professionals will help ensure that the next generation of the transportation workforce is up to date with the latest transportation research.

Texas A&M Transportation Institute

In 2018, TTI's undergraduate summer intern program placed five students with faculty mentors for a ten-week research experience culminating in a poster session held jointly with other undergraduate research programs on campus. The interns came from Industrial, Chemical, Electrical, and Civil Engineering along with Urban and Regional Planning and included three students from underrepresented groups. Most of these students had not worked in transportation-related fields or taken any courses in transportation; thus, the summer program exposed them to new career opportunities. TTI also offers a Professional Development seminar series to all Safe-D consortium members to provide workforce development education. Seminars by staff from the TAMU Career Center focused on effectively using Linked In for job searches and how to structure a resume and conduct an interview.

Since 2017, research team members from Safe-D Project TTI-01-05: K-12 STEM Program: Exploring the Science of Retroreflectivity have worked with a middle school science teacher to develop a curriculum that meets state and federal core standards for grades 4–6 science units on light. The Science of Retroreflectivity curriculum includes teacher lesson plans, slide decks, and student worksheets. In addition, teachers can request a kit of classroom demonstration materials which is mailed to them. Instructional videos explaining how to conduct these demonstrations are available on the TTI website https://safed.tti.tamu.edu/

Virginia Tech Transportation Institute

At VTTI, the InternHUB program accepted its first students last winter. These students are currently working with InternHUB's first industry partner, Continental. InternHUB is an interdisciplinary advanced-learning program supported by Safe-D to accelerate practical skill development in students through internships with high-tech employers in the transportation industry. Under the guidance of a faculty mentor, interns work on high-tech automotive projects that match their current interests and future career aspirations. Unlike traditional internships, InternHUB positions span the traditional academic and summer semesters, giving students unique opportunities to make substantial contributions to the future of transportation while developing the real-world skills demanded by high-tech employers. Graduates of the program will be equipped with the skillsets and knowledge to become the next generation of leaders in the transportation industry and may receive employment offers from their sponsoring industry partner. The group of InternHUB industry sponsors and students are expected to expand significantly over the next reporting period following the completion of the InternHUB building on VTTI's campus at the end of this calendar year.

Each year, VTTI holds an Open House and School Day focused on K–12 students, including students from low-income areas. The students are exposed to the different research projects at VTTI and how those projects affect their daily lives through the transportation choices that they make. During the 2018 School Day held on April 19, students learned first-hand about transportation science and technology through a behind-the-scenes tour of the Virginia Smart Roads, including a drive through a simulated "rain storm" event. Students also got to tour the Smart Road Control Room and check out some of VTTI's research cars and motorcycles. Following the School Day, the general public was invited to an Open House event to learn about VTTI and tour the Smart Roads.

Education and Workforce Development Outlook

The Safe-D UTC has reached dozens of undergraduate and graduate students along with hundreds (if not thousands) of K-12 students through the examples described above. However, these programs tell only part of the story. The less visible component is the novelty, actuality, and practicality of the work being done. This allows students to see science in action, understand why science is important, and appreciate how this type of work improves their own lives and the lives of those they care about. In turn, they can see themselves making an impact through their own contributions. Another intangible component is the passion that UTC researchers and staff put into their work. This enthusiasm is contagious and permeates both the experimental work and the education/outreach activities. In this way, students exposed to UTC materials and activities also become excited about science and understand the importance of caring deeply about one's work. Ultimately, these factors will encourage young students to pursue fulfilling careers in science and engineering.

Impact on Physical, Institutional, and Information Resources

The USDOT grant which created the Safe-D National UTC has afforded consortium universities with great opportunities to make an impact on physical, institutional, and information resources that would otherwise be unsupported or under-supported. For example, at TTI, Safe-D project

funding enabled software and hardware upgrades on two driving simulators, one at TTI and one in an Industrial Engineering faculty laboratory. Under another Safe-D project, traffic flow datasets were purchased from a commercial vendor, and the software license was expanded to allow other researchers to use the data. Similarly, the recognition brought by Safe-D to the SDSU transportation program helped SDSU negotiate an upgraded student and research lab for our transportation group with the College of Engineering. The lab is currently under construction and will be ready by the end of 2018. Safe-D affiliation has also been instrumental in SDSU obtaining resources such as datasets from local transportation agencies.

Furthermore, the Safe-D program has enhanced communications between partner institutes and university faculty. At VTTI and TTI, Safe-D researchers have successfully engaged new faculty on campus in Safe-D research projects and seminars. At TTI, these new relationships have resulted in more faculty and students making more use of the institute's facilities, including the driving simulator, test track, instrumentation, and laboratory facilities.

At VTTI, Safe-D funding has helped coalesce a group of researchers with the goal of speeding the development of advanced technologies, resulting in test track development and facility improvements to support advanced vehicle safety research and development. Under a Safe-D directed project, researchers acquired roadway props to explore the limitations of production automated vehicles, identify areas for improvement, and support further testing. Safe-D funding has also contributed to the efforts of VTTI's Hardware Engineering Lab, who design and develop data acquisition systems, automated vehicle systems, and evaluations methods for rapidly evolving systems. Safe-D expanded the information technology resources of VTTI through the creation of a Safe-D dataset repository hosted on the VTTI Dataverse (https://dataverse.vtti.vt.edu/dataverse/safed). This site houses all of the digital data produced by Safe-D research projects and allows interested parties to download and use the publicly-available data produced to continue to build on research results.

During this reporting period, a Safe-D directed project led by Luke Neurauter, Group Leader of the Connected and Automated Vehicle Systems Group at VTTI, had a strong impact on the physical resources available to Safe-D researchers and beyond. This developed and implemented a fixed, belt-driven, device that assists researchers in evaluating conflicts between vehicles and pedestrians/cyclists. This device allows for repeated, and consistent, testing of a variety of conflict scenarios through full control over kinematics of interest (speed, acceleration, distance traveled), along with communication protocols between it and VTTI's in-vehicle data acquisition system. This device can use a variety of 'targets' that represent a pedestrian or cyclist, including versions that are 'strike-able' for evaluating advanced vehicle features, driver reaction to unexpected events, etc. As an improvement to the general Virginia Smart Road infrastructure, this device is available to support any applicable Safe-D or VTTI projects, to assist researchers gain a better understanding of how to combat the increasing trend of pedestrian fatalities.

The Safe-D program has also been instrumental in the development of InternHUB at VTTI. The InternHUB building on the campus of VTTI is slated for completion by the end of the year. This building, which is adjacent to the Surface Street facility of the Virginia Smart Roads, is designed to support innovative research and development projects. The final building will include over

15,000 ft^2 of shared garage and shop facilities equipped with tooling for vehicle instrumentation along with mechanical and electrical system development. It will house a flexible design studio space with features intended to encourage collaboration, including reconfigurable spaces, large-format media screens, digital ink, individual work stations, and ubiquitous connectivity. The space will accommodate students working in teams as the primary users with additional provisions for faculty and industry members to visit and collaborate with their teams of interns.

Impact on Technology Transfer (T2)

Safe-D T2 efforts are designed to ensure that research results are disseminated to a broad audience and implemented in practice. During this period, the Safe-D T2 Plan was developed and approved by OST-R, which redesigned the T2 process for all Safe-D projects. This redesigned process is described in detail in the Accomplishments During This Reporting Period section of this report.

In addition to redesigning the Safe-D proposal process with a focus on T2 outputs, Safe-D is committed to disseminating research products through various outlets, including results presented at conferences and in peer-reviewed journals. Each Safe-D project completed has or will result in publications that help disseminate the results of the research to the broader industry audience. As of the writing of this report, Safe-D projects have resulted in the submission of eight and acceptance/publication of another nine journal publications. In addition, a total of 38 conference proceedings, presentations, and posters have been generated as a result of Safe-D projects. Safe-D projects have also generated multiple other T2 products, including the publishing of public websites, webinars streamed to national and international participants, and the development of multiple technologies and tools. These accomplishments and more are detailed in the Products section of this report.

Impact on Society Beyond Science and Technology

The research conducted by Safe-D continues to make an impact beyond the bounds of science, engineering, and the academic world. For example, in June of this year, Safe-D Director Dr. Zac Doerzaph testified before the U.S. Senate Committee on Environment and Public Works in a hearing entitled, “Innovation and America’s Infrastructure: Examining the Effects of Emerging Autonomous Technologies on America’s Roads and Bridges.” Following his testimony, Dr. Doerzaph provided thorough answers to outstanding questions by senators to inform a number of current and future regulatory efforts. His testimony and follow-up responses covered topics such as infrastructural requirements for the widespread deployment of automated vehicles, challenges to vehicle automation in rural areas, considerations for truck platooning, the fuel efficiency of automated vehicles, automation-related job loss and corresponding retraining programs, and the expected timeframe for widespread vehicle automation.

Safe-D Associate Director Dr. Sahar Machiani along with Safe-D faculty member Dr. Arash Jahangiri were invited to participate in the Regional Smart Mobility kickoff event held at Caltrans on Oct 3, 2018. The goal of this regional collaborative effort organized by the San Diego Association of Governments is to update the regional ITS Strategic Plan that sets the vision, goals, objectives, and strategies to guide the implementation of smart mobility in the San

Diego region. The updated plan will integrate smart mobility strategies and emerging technologies to improve the way people travel in San Diego County while mitigating negative effects on the environment. The participants, named "ITS Influencers," were hand-selected to provide input throughout this process.

Individual Safe-D projects have also influenced society beyond their contributions to science and technology. For example, a Safe-D project on the utilization of rideshare service usage by people with visual disabilities was featured on a national podcast for individuals with blindness and visually impairments. This podcast is regularly downloaded by people from 100 countries and is carried by 14 radio reading services for the blind. The specific podcast can be found at: www.EyesOnSuccess.net/eos_1832_podcast.mp3. Another project under the Transportation as a Service theme area focused on the use of child safety seats in rideshare vehicles. Products developed during this project are contributing to Internet-based resources for parents regarding child safety seat laws in each state and properly securing children in rideshare vehicles.

Changes/Problems

Changes in Approach

Nothing to report.

Actual/Anticipated Problems/Delays

Nothing to report.

Changes Affecting Expenditures

Nothing to report.

Changes in Study Protocols

Nothing to report.

Changes in Performance Site Location

Nothing to report.

Additional Information Regarding Products and Impacts

Outputs

Nothing to report.

Outcomes

Nothing to report.

Impacts

Nothing to report.

Special Reporting Requirements

N/A