SAPR Report for University Transportation Centers

This is a semi-annual report of program progress and performance for the Collaborative Sciences Center for Road Safety, a national UTC focused on safety.

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1. Accomplishments

1.1 What are the major goals and objectives of the program?

In PPPR #3, CSCRS outlined in detail the goals and objectives from our Strategic Roadmap, established in 2018. Those goals and objectives are listed throughout this document to provide context for our accomplishments.

1.2 What was accomplished under these goals?

Selected highlights for this performance period include:

- Devoted significant resources to planning the rescheduled Safe Systems Summit. Pre-registration for the 2019 dates was 341, higher than the 256 pre-registration total in 2018.
- Streamlined the Year 3 research call process for proposals by first reviewing letters of intent, then recommending select proposals from that pool. Resulted in 56 letters of intent, with 19 full proposals submitted.
- Engaged in more than 70 activities at the 2019 Transportation Research Board (TRB) Annual Meeting in Washington, DC, January 2019. CSCRS researchers, students and other team members presented posters, spoke in sessions, participated in workshops and posters, participated in committee meetings, and more.
- Held a second successful Safety Sunday @ TRB reception. Despite bad weather, almost 100 people attended the safety conversations/networking reception, co-sponsored by CSCRS and the Southeastern Transportation Center.
- Chose our second Outstanding Student of the Year, Alexandra "Ali" Boggs of UTK, who was honored at the Council of University Transportation Center's 28th Annual Outstanding Student of the Year Awards ceremony.
- Conducted two webinars with two different national organizations focused on different aspects of the Safe Systems approach to road safety, reaching approximately 170 people attendees.
- Generated more than 110 CSCRS research-related publications, presentations, websites, videos, and other information resources.
- Produced a library of US Vision Zero plans.
- Created a website with bicycle and pedestrian safety-related online datasets.
- Engaged hundreds of undergraduate, graduate, and doctoral students in CSCRS research, education, and professional development projects.
- Taught approximately 20 transportation safety-related university courses.

The bulleted sections below describe the accomplishments according to specific goals and objectives of CSCRS.

Goal 1:

To support Goal 1—ensuring that Safe Systems and systems science principles and approaches are shared, understood, and adopted by traffic safety professionals—we performed activities related to the following objectives:

Objective 1-1: Conduct research to generate a model(s) for what a Safe Systems approach, enhanced with systems science tools, can look like now and in the future and identify promising policies/practices that can be adopted to reduce fatalities and serious injuries.

- Completed research Project R1 revealed potential new influential US partners for engagement in transportation safety and explored the structure and function of organizational networks among Vision Zero cities.

  - PIs: Seth LaJeunesse, UNC Highway Safety Research Center (UNC HSRC); Steve Marshall, UNC Gillings School of Public Health and UNC Injury Prevention Research Center (IPRC); Co-Investigator: Jill Cooper, University of California, Berkeley (UCB)
  - Full report and research brief posted online. The project identified opinion-leading and boundary-spanning US cities with Vision Zero programs and elucidated the structure and function of two cities' Vision Zero coalitions.
- Project R2 developed a prototype tool for conducting a systemic safety analysis for a scalable area. The project team coordinated research to practice delivery via a matching project funded by CALTRANS to implement systemic analysis in California.
  - PI: Offer Grembek, UCB / Co-Investigator: Libby Thomas, UNC HSRC
- Project R3 entailed a literature review to define safe systems application in the US, which has culminated in information that will be shared at the Safe Systems Summit.
  - PI: Eric Dumbaugh, Florida Atlantic University (FAU) / Co-Investigator: Wes Kumfer, UNC HSRC
  - Final report is currently under peer review and will be added to the website next quarter.
- Project RR1, CSCRS's first Rapid Response project, convened a diverse group of cross-sector experts and stakeholders and applied systems methods to explore factors driving the national rise in pedestrian deaths and share and develop insights into strategies to prevent pedestrian injuries and deaths.
  - PIs: Laura Sandt, UNC HSRC, and Becky Naumann, UNC IPRC
  - Submitted two papers for publication discussing systems thinking integration into road traffic injury prevention practice with a specific focus on using system dynamics tools to better understand the factors leading to increasing pedestrian death rates. Work from the project was shared in well-attended TRB Annual Meeting workshops on using systems approaches in road safety.

Objective 1-2: Lead training, outreach, and professional development related to Safe Systems approach and related policies and practices.

- Related in part to Project R3, CSCRS staff completed extensive planning for the rescheduled Safe Systems Summit, designed to provide an interactive, multidisciplinary venue for exploring Safe Systems and systems science and what they mean for transportation safety in the US. The Summit, postponed due to Hurricane Florence in September 2018, was rescheduled for Apr. 23-24, 2019, in Durham, NC.
- Presented two webinars on Safe Systems in December 2018:
  - CSCRS and the National Peer Learning Team for Systems Thinking at the North Carolina Division of Public Health Injury and Violence Prevention Branch presented "Systems Thinking for Injury and Violence Prevention Practice." 95 attendees.
  - CSCRS and the Vision Zero Network conducted the webinar "Safety & Systems for Vision Zero–Putting Theory Into Practice" with several Safe Systems Summit speakers. 75 attendees.
- FAU continued its Safe Streets Lecture Series with Michael Meyer's "Integrating Safety into the Transportation Planning Process: Challenges and Opportunities" in November 2018. 60 attendees.
- Several team members presented the workshop "Exploring the complexity of pedestrian fatality trends: understanding the underlying system to inform more effective action" to about 40 attendees at the 2019 TRB Annual Meeting, Washington, DC, January 2019. The workshop focused on systems tools (e.g., causal loop diagramming) that can be used in practice.
- The second iteration of UNC HSRC's Coffee & Conversation discussion series focused on autonomous vehicles and was held in Fall 2018, with a total attendance of 210. Launched the third season, Coffee & Conversation III: Building Resilience into a Transportation System for All, in January 2019.
- Two traffic safety videos highlighting current CSCRS road safety research were published to the SafeTREC YouTube channel under a new "Safe Systems" playlist:

  - "How do we measure cyclist comfort and safety?" published October 22, 2018, with 475 views.
  - "What is 'safe systems' approach to road safety?" published October 23, 2018, with 275 views.
- Three graduate student CSCRS Road Safety Fellows at UCB launched a student-led Autonomous Vehicles + Safety Roundtable in February 2019 to present work on the topic, as well as facilitate discussions on the potential and pitfalls of AV technology and deployment. Ten graduate students from various departments attended, and there was a sign-up list of 23 expressing interest in the topic and future activities.

Objective 1-3: Integrate Safe Systems principles into other road safety/public health/planning initiatives.

- CSCRS researchers continued to take part in the Core Learning Community Systems National Peer Learning Team, a working group that meets regularly to explore defining what a systems approach to road safety will look like and how best to convey the concepts and practices. A related effort, the Action Inquiry Group (AIG) on Systems Thinking, was also formed to learn more about systems thinking.

Objective 1-4: Facilitate states and cities in implementing a Safe Systems approach in different contexts, utilizing the tools and research from CSCRS.

- CSCRS staff are engaged with multiple agencies, particularly in consortium member states and cities, to determine the needs of state and local governments in implementing Safe Systems. We anticipate future progress in this area in the next reporting period.

Goal 2:

To support Goal 2—ensuring that cutting-edge research, tools, data, and resources compatible with a Safe Systems approach are developed and utilized—we performed activities related to the following objectives:

Objective 2-1: Perform road safety research that explores core safety issues and transformational changes (i.e., from technology, ride-sharing services, etc.) and integrates public health concepts and methods.

- Completed project Project R4 identified safety data linkage and integration opportunities not formalized in the past.
  - PI: Chris Cherry, University of Tennessee, Knoxville (UTK) / Co-Investigators: Eric Dumbaugh, FAU; David Ragland, UCB; and Laura Sandt, UNC HSRC
  - Final report and project brief available on the project page. The project demonstrated many opportunities for linking data with five applications that are illustrative of possible types of analysis.
- Project R5 sought to understand the transportation safety needs of major cities in the U.S.
  - PI: Eric Dumbaugh, FAU / Co-Investigator: Dan Gelinne, UNC HSRC
  - The work for this project is complete; the final report is currently under peer review and will be posted.
- Project R6 explored bicyclist and pedestrian behavioral and safety issues related to connected and automated vehicles (CAVs).
  - PI: Noreen McDonald, UNC-CH Department of City and Regional Planning (DCRP) / Co-Investigator: Asad Khattak, UTK
  - Project completed; final deliverables are in development and will be posted online in the next reporting period. The project concluded that crosscutting safety and technology-oriented research, development and deployment efforts should encompass CAVs and infrastructure, and safety technologies and strategies to promote safe and smart communities.
  - Research outputs included journal articles (some under review) and presentations listed in Products section.
- Project R9 explores the operational needs and characteristics for an autonomous vehicles dispatch center.

  - PI: Missy Cummings, Duke
  - This project is ongoing. A simulation environment is near completion to simulate the mixed traffic of autonomous vehicles and human-driven vehicles. A manning model is also near completion that looks at how different levels of traffic would likely affect dispatcher workload. A preliminary re-routing aid is being developed to make alternate routing suggestions to the dispatcher.
- Project R10 investigates how machine learning techniques can be used to design countermeasures that improve system safety.
  - PI: Missy Cummings, Duke / Co-Investigator: Michael Clamann, UNC HSRC
  - This project is near completion. Two datasets that include driver and pedestrian traffic fatality predictions have been analyzed using different machine learning models. An initial report that summarizes the subjective differences in two researchers' analytical approaches and implications for transportation safety policy in near completion.
- Project R11 examines the moderating role of the built environment on the relationship between crash incidence and socio-economic status.
  - PI: Yanmei Li, FAU / Co-Investigator: Eric Dumbaugh, FAU
  - Data have been collected and the analysis is complete. A draft of the final report is currently underway.
- Project R12 aims to provide an accurate picture of California traffic injuries by utilizing medical data to fill in police crash reports, and to get an accurate picture of emergency medical services response times.
  - PI: David Ragland, UCB / Co-Investigator: Chris Cherry, UTK
  - The project team met with the California Medical Outcomes Data team at the California Department of Public Health about their project to link crash and medical data and will be working with them on the linked data to evaluate factors influencing success or failure of linkage and evaluate geographic/demographic patterns in matching.
  - The team has also been working with CEMSIS (California version of NEMSIS) and have been able to identify how geographic and other factors that influence EMS response, on-site, and transport times. These findings will be used to identify ways to reduce EMS response times.
- Project R13 assesses how technological change embodied by shared mobility services has and will impact road safety.
  - PI: Noreen McDonald, UNC DCRP / Co-Investigator: Tabitha Combs, UNC DCRP
  - DCRP postdoctoral research fellow Ria Kontou and Dr. McDonald aggregated data (including crashes, ridesourcing use, and other socio-demographic, economic and transportation-related datasets). Dr. Kontou has developed and proposed a research method, which she has presented to an on-campus statistical and data science consulting service for feedback.
  - Drs. Kontou and McDonald have begun preliminary analyses of the impacts of ridesourcing demand on road crashes in Austin, TX.
- Project R15 aims to help policymakers and transportation safety professionals evaluate safety impacts of the transportation system and identify neighborhoods with a higher risk of traffic crash involvement.
  - PI: Chris Cherry, UTK / Co-Investigator: Louis Merlin, FAU
  - The addresses of individuals involved in traffic crashes were used (i.e., home-based approach; HBA) instead of the location of the crashes (i.e., location-based approach; LBA) to evaluate road safety. The project is ongoing.
- Project R16 aims to provide evidence to provide insight into the impact of prescribing opioids for acute pain relief after a traffic crash, and for transportation professionals to help understand the systems impact of opioid use on traffic safety.
  - PI: Chris Cherry, UTK / Co-Investigators: Steve Marshall and Becky Naumann, UNC IPRC

  - Reviewed opioid monitoring programs and data across states hardest hit by opioid addiction, investigated promise and barriers of data available to explore the relationship between opioids and crashes, developed a system map of data and causal feedback relationships between addiction, crashes, and prescription rates.
- Project R18 entails an examination of national trends in light rail safety performance and an investigation of the factors related to light rail-related crash risks.
  - PI: Eric Dumbaugh, FAU / Co-Investigator: Candace Brakewood, UTK
  - Data for Orlando and Charlotte have been collected, and the descriptive analysis of crashes occurring along the route and in proximity to stations is complete. Secondary analysis of the resulting database is underway.
- Project R20 explores the impacts of various treatments that can be explored using the Motorcycle Crash Causation Study data, collected by the US Department of Transportation.
  - PI: Asad J. Khattak, UTK / Co-Investigator: Arthur Goodwin, UNC HSRC
  - Two journal papers about the findings were developed, and the findings were presented in two separate lectern presentations at the TRB 98th Annual Meeting in Washington, DC.

Objective 2-2: Develop research-driven tools, resources, and data sets to support problem identification and understanding.

- Project R7 is developing and evaluating a prototype Android mobile app that will alert pedestrians when they are near areas of high traffic density.
  - PI: Missy Cummings, Duke University
  - Project completed; experimental results have been analyzed. Final deliverables to be posted online, and a report and a journal paper about the findings are near completion.
- Project R14 aims to create an online CSCRS centralized data clearinghouse for bicycle and pedestrian safety-related data as a national resource for safety researchers.
  - PI: Krista Nordback, UNC HSRC / Co-Investigators: Seth LaJeunesse, UNC HSRC, and Julia Griswold, UCB
  - Last summer, the team compiled list of thousands of US bicycle and pedestrian safety-related online datasets. In the Fall, the team created a dataset rating system and rated all state databases.
  - Drafted a report summarizing the data and its quality and created the website pedbikedata.org/ for the data clearinghouse that allows searches to produce relevant lists of online datasets. This website provides a strong tool to support future research on vulnerable road users.
- Project R19 looks at developing a deeper understanding of human errors that lead to crashes.
  - PI: Asad J. Khattak, UTK / Co-Investigator: Eric Dumbaugh, FAU
  - Presented the research at national conferences; a conference paper was presented at the TRB 98th Annual Meeting in Washington, DC. A journal paper about the findings has been prepared and the team plans to submit it to a journal soon.

Objective 2-3: Translate research knowledge to support the development of comprehensive programs, policies, and practices that are proven to reduce fatalities and severe injuries.

- Project R8 is a two-year project developing tools to assist parents of new NC drivers and beyond.
  - PI: Arthur Goodwin, UNC HSRC
  - A debriefing form was developed for driver education instructors to inform parents of the progress and proficiency of their teen driver, and a guidance document for parents was created called “Choosing a Safe Vehicle for Your Teen.” The project team held two meetings with the NC DMV Commissioner to discuss the program for parents.
- Project R17 aims to strengthen existing and facilitating new Vision Zero plans.

- PI: Kelly Evenson, UNC Gillings School of Public Health / Co-I's: Seth LaJeunesse, UNC HSRC, and Steve Marshall and Becky Naumann, both with UNC IPRC
- Created a Vision Zero Plan abstraction tool; abstracted elements from 26 Vision Zero Plans; analysis completed. Developing a best practice Vision Zero Plan Guide to inform development of high-quality Vision Zero plans, and added the 26 existing plans to a library in the Dataverse.

Objective 2-4: Broadly disseminate research products and findings, with emphasis on reaching new and non-traditional audiences:

Several presentations covering CSCRS research were featured at the 2019 TRB Annual Meeting (see the Outputs section for examples). Table 1 highlights additional presentations made in this reporting period to disseminate research findings to diverse groups.

Table 1: Select CSCRS outreach highlights

Duke	Presentations of R7 and R9 findings to members in Humans and Autonomy Laboratory at Duke University.
UCB	Offer Grembek presented on "Systemic Strategies for Reducing Pedestrian Injury in California" as part of a Federal Highway Administration STEP Program Webinar about Systemic Safety Analysis on October 11, 2018.
	Offer Grembek participated as the Safety Subtopic Lead for the UC Forum on Innovative Mobility in Sacramento CA on November 30, 2018.
	Pravin Varaiya presented "Analysis and Simulation of Intersection Crashes" at the UC Berkeley Fall 2018 Berkeley Deep Drive Day on November 27, 2018.
	Offer Grembek presented "Vision Zero and the Safe System Approach: What is it and how can we use it to improve safety" at the Institute of Transportation Engineers, Student Leadership Summit in Berkeley CA on January 27, 2019.
	Offer Grembek presented "Safe System considerations for safer teens and other vulnerable populations" at the 2019 Vision Zero Summit in Bellevue, WA on February 13, 2019.
	Graduate student researcher Joy Pasquet presented "From Reaction to Proaction: Developing a Systemic Approach to Road Safety in San Diego" at the California Transportation Planning Conference in San Diego on Monday, February 25, 2019.
	David Ragland, Kate Beck, and Cynthia Armour presented "The 3 Revolutions (autonomous vehicles, electric vehicles, shared mobility) impacts on Public Health", on Wednesday, February 6, 2019 for Public Health 200k, a course on public health impacts (about 100 students participated).
UNC	Noreen McDonald presented to a gathering of the NC Chapter of the Urban Land Institute in Raleigh, NC, December 2018 (10 attendees including the planning director of Raleigh).
	Tabitha Combs and Danielle Spurlock led a discussion on safety and equity of pedestrian and bicycle projects at the Carolina Thread Trail Conference, Mooresville NC, December 2018 (~250 participants from across the southeast).
	Tabitha Combs presented preliminary findings on the evolution of local transportation planning practices, including the incorporation of concerns over safety for VRUs, at TRB (Jan 2019; with graduate student Will Leimenstoll) and the Association of Collegiate Schools of Planning (ACSP) annual conference, Buffalo, NY, October 2018.
	Becky Naumann presented the guest lecture "Systems Thinking and Transportation Safety" for "Urban Transportation Planning," UNC Department of City & Regional Planning, October 2018.
	Becky Naumann presented the guest lecture "Systems Approaches to Road Traffic Injury Prevention" for the course "Injury as a Public Health Problem," UNC School of Public Health, November 2018.
UTK	Asad Khattak served as: 1) editor-in-chief of Science Citation Indexed Journal of Intelligent Transportation Systems; 2) associate editor of SCI-indexed International Journal of Sustainable Transportation; 3) special adviser to the Journal of Transportation Safety and Security; and 4) advisory board member of Analytic Methods in Accident Research.
	Chris Cherry and Seth LaJeunesse presented at the City of Knoxville active transportation seminar "Tactical Urbanism."
	Chris Cherry presented "Electric Scooters. Making friends not foes" at LAB Bike Summit in March 2019.
	Mohamadi Hezaveh A. & Chris Cherry, "A new method for examining seat belt use and identifying seat belt non-use hotspots, Nationwide children's hospital center for injury research and policy, 2019.
	Chris Cherry was a panelist for the session "Electric Scooters: Making Friends, not Foes" at the League of American Bicyclists Bike Summit, March 2019.

Goal 3:

To support Goal 3—to ensure that a growing body of students and future leaders are engaged and well-trained in road safety principles, Safe Systems approaches, and systems science methods—we performed activities related to the following objectives:

Objective 3-1: Develop and deliver courses at consortium member universities that integrate CSCRS concepts. Highlights:

- UCB Fall 2018 graduate course Injury Prevention and Control. Instructors: David Ragland, Glenn Shor (8 students).
- UCB Spring 2019 graduate course Traffic Safety and Injury Control. Instructors: David Ragland, Offer Grembek, and guest lecturer Dr. Koohong Chung. (11 students).
- Duke University Spring 2019 undergraduate and graduate course Human-Robot Interaction. Instructor: Missy Cummings.
- FAU Fall 2018 course Introduction to Transportation. Instructor: Louis Merlin (10 students).
- UNC Spring 2019 course Complete, Safe, Equitable Streets. Instructor: Tabitha Combs (32 students).
- UNC Fall 2018 course Transportation planning methods. Instructor: Noreen McDonald (30 students).
- UNC Fall 2018 graduate course Injury as a Public Health Problem. Instructor: Steve Marshall (UNC IPRC) UTK's Civil & Environmental Engineering faculty offered 14 transportation courses during Fall 2018 and Spring 2019 including courses on transportation engineering, geometric design, transportation planning, and intelligent transportation systems (264 students).

Objective 3-2: Engage students through student-directed activities and professional opportunities:

Table 2 describes key student engagement and awards offered during this reporting period.

Table 2: Select CSCRS student engagement activities

UCB	UCB awarded 7 graduate students CSCRS Road Safety Graduate Student Fellowships, providing the opportunity to generate high quality CSCRS research pertaining to road safety topics: • Evaluation of Autonomous Vehicle Safety Based on California DMV Crash Reports • Real-Time Prevention of Risky Vehicular Maneuvers Using Deep Reinforcement Learning, Microsimulation, and Cognitive Sciences • Investigate Regulation and Standardization of Continuous Data Collection in Autonomous Vehicles (AVs) to Ameliorate the Incidence of AV Accidents • Recognizing Unsafe Roads Using Online Open Data • The Impact of Dynamic Speed Limits on Road Safety • Evaluating the effects of a bicycle education intervention on mode shift, confidence, and riding frequency • Red Light, Green Light: Traffic and Anglo-American World Order, 1890-1940
	Sarah Doggett, City and Regional Planning/Transportation Engineering: Sarah is working on the "Linking Crash and Post-Crash Data" project and studying how to merge crash and medical files for transportation safety research, and how EMS response times vary throughout California.
	Thesis and dissertation (co-)supervision by Offer Grembek, UCB: • Mengqiao Yu, PhD Candidate in Transportation Engineering; dissertation title: Modeling change of lifestyle-based behavior: from static to dynamic from exogenous to integrated • Jiajian Li, PhD Student in Transportation Engineering. • Lin Yang, PhD Student in Transportation Engineering.
Duke	One postdoctoral associate and one master's student at Duke worked on R9.
	For R10, one PhD student is working on the manning model, one master's student is working on the re-routing algorithm development, and one undergraduate student is working on the simulation environment to demonstrate the problem and the re-routing algorithm.
FAU	One graduate student was provided with a research assistantship.

UNC	DCRP master's student William Leimenstoll was awarded a Road Safety Graduate Student Fellowship to support research into how municipalities incorporate road safety concerns into traffic impact analyses
	DCRP sponsored the Road Safety Scholars program, which has brought together 59 students and research fellows from across the UNC campus to participate in activities focusing on interdisciplinary research on road safety. These Road Safety Scholars participate in seminars and have opportunities for research mentoring and networking with road safety professionals
	DCRP doctoral student Lindsay Oluyede was awarded a teaching assistantship to assist with the course Complete, safe, equitable streets
	DCRP doctoral students Mary Wolfe & Lindsay Oluyede won Eisenhower Fellowships to support their on-going research incorporating transportation and roadway safety concepts; DCRP doctoral student Mary Wolfe & master's student Tory won WTS fellowships; DCRP doctoral student Lindsay Oluyede and master's student Tory Gibler were awarded summer professional development awards to support safety-relevant professional development activities during Summer 2019
	Hosted 5 sessions of Coffee & Conversation 2: Autonomous Vehicles and Road Safety with an average attendance of 30 students per session. Also, hosted 4 sessions of Coffee & Conversation III: Building Resilience into a Transportation System with an average attendance of 30 students.
	One injury epidemiology doctoral student received tuition and stipend support for Fall 2018 to examine the effects of implementing different combinations of evidence-based road safety interventions on lives and costs saved.
	Three doctoral-level & one master's-level student working on CSCRS-related projects (Schilsky, Cuthbertson, Spade) gained experience abstracting and reviewing Vision Zero plans for high-quality elements and one student (Singichetti) gained analysis and manuscript writing experience on examining deaths and costs averted through increased implementation of road safety policies.
	Promoted the Safe Systems Summit poster session to a wide variety of university partners (resulted in 44 student posters accepted to be presented).
UTK	University of Tennessee doctoral student, Alexandra "Ali" Boggs, was awarded the 2018 Collaborative Sciences Center for Road Safety Student of the Year.
	More than 1,500 students from various high schools in Tennessee, Florida, Georgia, and Kentucky participated in events around the UTK Tickle College of Engineering Engineers Day. Students rode electric bikes, used real-time license plate recognition devices, used the driving simulator, and visited the on-campus Traffic Management Center.
	More than 1,000 freshmen engineering students at the University of Tennessee were able to learn more about transportation engineering at the UTK Freshman Engineering Fair. Students rode electric bikes and decided where these vehicles and electric scooters belong on the roadway, e.g., sidewalk, bike lane, travel lane.
	UTK's student chapter of Institute of Transportation Engineers (ITE) was very active, including holding eight meetings with a total attendance of 140 students. UTK's Traffic Bowl team placed first in the State of Tennessee in the Traffic Bowl competing with 5 other schools and proceeding onto the Sectional Competition in Arlington, Virginia.
	University of Tennessee Women in Transportation Seminar Student Chapter was approved as an official student organization on campus.
	18 UTK graduate students and 6 visiting scholars attended the 98th Annual Meeting of TRB in Washington, DC. 15 UTK graduate students presented papers at the event.
	Five UTK graduate students attended the TransportationCamp DC 2019 in Arlington, Virginia before TRB Annual meeting.
	Graduate research assistant positions under Drs. Brakewood, Cherry, and Khattak were supported for 11 students including Amin Mohamadi Hezaveh, Nitesh Shah, Abubakr Ziedan, Amin Mohammadnazar, Iman Mahdi Nia, Ramin Arvin, Alexandra Boggs, Numan Ahmad, Abdul Rashid Mussah, Sevin Mohammadi, and Mohsen Kamrani
	Five UTK students (3 - graduate, 2 - undergraduate) attended the Tennessee Section of Institute of Transportation Engineers Winter Meeting at Tennessee State University in Nashville, Tennessee.
	Six UTK students assisted with the UTK's American Society of Civil Engineers (ASCE) in hosting the 2019 Southeast Region Student Competition at the end of March.

Objective 3-3: Develop mentorship and internship opportunities for students to engage in critical thinking about road safety issues from a variety of disciplinary perspectives and connect with traditional and non-traditional partners.

- UNC DCRP sponsored a transportation career panel in November 2018 that was moderated by transportation professional and DCRP lecturer Leta Huntsinger. Six DCRP alumni served as panelists, and 25 current DCRP students attended.

- UTK faculty held regular Graduate Student Researcher meetings with eight graduate students that provided opportunities for professional development, such as best practices for effectively communicating research, research presentations, observation visits with practitioner organizations, and utilizing social media.
- UCB continued holding weekly graduate student researcher group meetings including ten graduate students are from City and Regional Planning, Transportation Engineering, and Engineering and Project Management. The meetings provided opportunities for professional development, including best practices for effectively communicating research, research presentations, observation visits with practitioner organizations, and utilizing social media to support professional activities.

Objective 3-4: Provide exposure to road safety principles in K-12 settings, to enhance early interest in traffic safety work.

- UCB SafeTREC held discussions with Almetria Vaba, KQED's Associate Director of Partnerships and Distribution, Education, to explore opportunities to feature UCB's traffic safety videos that feature CSCRS related research on their K-12 educational online portals for students and educators, including PBS Learning Media and KQED Learn. Investigation ideas around the topics of AVs, dockless shared-mobility, pedestrian/bicycle safety, distracted driving, and driving under the influence were also developed and proposed to feature on KQED Learn.

1.3 What opportunities for training and professional development has the program provided?

- Weekly traffic safety seminars were held at SafeTREC on Fridays to provide platforms to discuss research happening at the center and beyond. Select topics:
  - "Automated Vehicles, State Policies and Public Health" (15 participants).
  - "Considerations for Road User Factors from a Safe Systems Perspective" (14 participants).
  - "Pedestrian Crossing Behavior: Modeling and Simulation" (14 participants).
- UTK led the Tennessee Transportation Assistance Program (TTAP), offering practice-oriented courses on work zones, traffic signals, traffic markings and signs, railroads, and highway safety analysis.
- UTK held six transportation seminars in collaboration with UTK ITE to promote further learning and career development for the students. Recordings of the transportation seminars are available.
- Five UTK students attended the Tennessee Section of Institute of Transportation Engineers Winter Meeting at Tennessee State University in Nashville, Tennessee.
- Two UTK students attended the Clemson ITE Student Leadership Summit in Clemson, SC.

1.4 How have the results been disseminated?

Results are being disseminated in accordance with the Technology Transfer Plan that guides Center activities. In addition to the goal-specific activities described above, staff developed and disseminated one issue of *CSCRS Crossroads* newsletter in January 2019 (archives are available here). The Consortium coordinated to co-promote CSCRS news/updates on their websites, in newsletters, and on social media.

Communications staff continuously maintain the CSCRS Twitter feed, which has grown to 379 followers. A recent month's analytics showed 13,600 impressions, an increase of more than 105% over the previous month. Staff also maintained the CSCRS Facebook page, reaching roughly 123 people in an average month. Social media engagement appears to have increased again as a result of Safe Systems Summit promotions.

CSCRS staff updated project descriptions, titles, and end dates on the CSCRS website and in the Transportation Research Board Research in Progress (RiP) Database, tagged as UTC research. Project-related publications and presentations from this reporting period are listed in the Products section.

1.5 What do you plan to do during the next reporting period?

The following sections provide a description of activities CSCRS plans to complete during the next reporting period (4/1/2019-10/30/19) to accomplish the goals and objectives previously described.

- **Research**: We will continue to complete research projects funded since the Center was initiated, as well as announce projects funded with Year 3 funds (which were selected through a peer-reviewed process). Completed research will be evaluated, according to the Tech Transfer Plan, for opportunities for additional dissemination and implementation efforts.
- **Professional development:** Several training, professional development, and capacity-building efforts will take place in the next reporting period, including development of the Road Safety Academy 201 course (led by UNC HSRC), Traffic Signal Academy course (led by UTK), a TTAP online traffic safety course (led by UTK, and a Safe Streets lecture series (led by FAU). The Safe Systems Summit will also be a signature event to showcase CSCRS research and engage professionals in various sectors. In collaboration with ITE, we will also publish an article in the April ITE Journal regarding Safe Systems and approaches to speed management.
- **Teaching and student enrichment**: Our consortia will teach at least five courses (UNC and UCB), as well as incorporate CSCRS research findings and opportunities into other/existing courses and seminars. For example, we will be assigning CSCRS-related capstone projects in the Duke University Human Robot Interaction class, and Road Safety Scholars will assist with data collection (pedestrian safety and walkability assessments) in support of a Town of Chapel Hill pedestrian safety action plan. We will also continue offering student fellowship and research grants (led by UCB), student scholar awards (led by UTK); the CSCRS Scholars program (led by UNC DCRP); as well as regular meetings, student conferences, and seminar series across all campuses. We will also coordinate across campuses to identify strategic K-12 education/engagement opportunities. In addition, the CSCRS Safe Systems Summit will feature a Research Poster Showcase to highlight university student transportation-related research.

In addition to activities specific to the three goals, we will continue conducting administrative functions that support all Center activities, including managing the Center's website, communications platforms, engaging with the Advisory Board, responding to USDOT or other requests, and developing efficient project management systems.

2. Participants and Collaborating Organizations

2.1 What organizations have been involved as partners?

The following organizations, including seven that are *new, have been involved as CSCRS partners:

Table 3: Select CSCRS Collaborator and Sponsor Organizations

Business
*New this period: SoftServe, Inc., Austin, Texas (Financial and Collaborative Support)
Foundation
John D. and Catherine T. MacArthur Foundation, Chicago, Ill. (Financial Support)
Local Government
Town of Chapel Hill Staff, Chapel Hill, N.C. (Collaborative Support)
Other Non-Profits
America Walks, Portland, Ore. (Collaborative Support)
American Planning Association, Chicago, Ill, and Washington, D.C. (Collaborative Support)
American Public Health Association, Washington, D.C. (Collaborative Support)
Association of Pedestrian and Bicycle Professionals, Lexington, KY (Collaborative Support)
Broward Metropolitan Planning Organization, Fort Lauderdale, Fla. (Collaborative Support)
Institute of Transportation Engineers, Washington, DC (Collaborative Support)
*New this period: Insurance Institute for Highway Safety, Vehicle Research Center, Ruckersville, VA

Miami-Dade Transportation Planning Organization, Miami, FL (Collaborative Support)
Mobility Lab, Arlington, VA (Collaborative Support)
National Association of City Transportation Officials, New York, NY (Collaborative Support)
National Cooperative Highway Research Program, Washington, DC (Financial Support)
*New this period: National Indian Justice Center, Santa Rosa, CA (Collaborative Support)
National Local Technical Assistance Program Association, US (Collaborative Support)
North Carolina Center for Automotive Research, Garysburg, NC (Collaborative Support)
Palm Beach Transportation Planning Agency, West Palm Beach, FL (Collaborative Support)
Palm Beach Planning Congress, Palm Beach, FL (Collaborative Support)
Transportation Research Board Standing Committee on Pedestrians, Washington, DC (Collaborative Support)
*New this period: Transportation Research Board Standing Committee on Transportation Safety Management, Washington, DC (Collaborative Support)
Vision Zero Network, San Francisco, CA (Collaborative Support)
WTS International, Washington, DC (Collaborative Support)
School District
Knox County School District, Knoxville, TN (Collaborative Support)
State Government
*New this period: California Emergency Medical Systems Authority (Collaborative Support, Data Request)
*New this period: California Medical Outcomes Data, California Department of Public Health, Sacramento, CA (Collaborative Support, Data Request)
North Carolina Department of Transportation, Raleigh, NC (Financial Support)
North Carolina Governor's Highway Safety Program, Raleigh, NC (Collaborative and Financial Support)
Tennessee Department of Transportation, Nashville, TN (Matching Request & Data)
Tennessee Dept. of Safety & Homeland Security, Nashville, TN (Data Request)
Tennessee Department of Health, Nashville, TN (Data Request)
Tennessee Technology Access Program, Nashville, TN (Collaborative Support)
U.S. Agency
National Science Foundation, Washington, DC (Sponsor of Projects)
Centers for Disease Control and Prevention, Atlanta, GA (Collaborative Support)
U.S. Facility
Oak Ridge National Laboratory, Oak Ridge, TN (Collaborative Support)
U.S. Government
U.S. Dept. of Energy, Washington, DC (Collaborative Support)
U.S. Dept. of Transportation, Washington, DC (Sponsor of Projects & Collaborative Support)
University
Duke Initiative for Science & Society Science Policy Tracking Program, Durham, NC (Financial Support)
East Tennessee State University (Collaborative Support)
*New this period: North Carolina State University Institute for Transportation Research and Education (Collaborative Support)
Planning Society @ FAU, Boca Raton, FL (Collaborative Support)
Renaissance Computing Institute, Chapel Hill, NC (Collaborative Support)
University of Tennessee Chattanooga (Collaborative Support)
Various Jiaotong Universities in China (Collaborative Support)

2.2 Have other collaborators or contacts been involved?

Nothing to report beyond the table above.

3. Outputs

CSCRS included two performance measures related to outputs in its Technology Transfer Plan:

- Organize and hold conferences through 2021.
- Annual journal manuscripts, publications, articles, posts, media stories, etc.

In addition to planning for the rescheduled Safe Systems Summit, CSCRS is working with FHWA and other partners on planning the 2020 National Travel Monitoring Exposition and Conference (NaTMEC), to be held in Raleigh, NC, June 2020. The goal of this event will be to apply a Safe Systems lens to increasing the effectiveness of multimodal traffic monitoring programs to enhance data-driven decisions in areas of performance management, planning and design, asset management, safety and program administration.

The rest of this section presents the significant number of outputs related to CSCRS research and tech transfer.

3.1 Publications, conference papers, and presentations

Following are select highlights of publications and presentations produced by CSCRS team members:

Table 4: Select CSCRS publications, conference papers, and presentations

Peer-Reviewed Publications
Arvin, R., Kamrani, M., & Khattak, A. (2019). How instantaneous driving behavior contributes to crashes at intersections: Extracting useful information from connected vehicle message data. *Accident Analysis & Prevention*, 127, 118-133.
Boggs, A., Hezaveh, A. M., & Cherry, C. (2019, in press). Shortage of commercial vehicle parking and truck-related interstate ramp crashes in Tennessee. *Transportation Research Record: Journal of Transportation Research Board*.
Cummings, M. L. (in press). Adaptation of licensing examinations to the certification of autonomous systems. In Li, X., Murray, R., Tomlin, C.J., & Yu, H. (Eds.). *Safe, Autonomous and Intelligent Vehicles.* Unmanned System Technologies series. New York: Springer.
Cummings, M. L., & Britton, D. (in press). Regulating safety-critical autonomous systems: Past, present, and future perspectives. In Richard Park (Ed.), *Everyday Robots*.
Cummings, M. L., Huang, L., & Clamann, M. (2019). *HAL2019-1: Development and evaluation of vehicle to pedestrian (V2P) safety interventions.* Durham, NC: Duke University.
Cummings, M. L., Li, L. S., & Wang, Y. (2019). *HAL2019-2: Machine learning tools for informing transportation technology and policy.* Durham, NC: Duke University.
Dong, C., Khattak, A., Clarke, D., & Xie, K. (2019, in press). Exploring the factors that contribute to the injury severities of vulnerable roadway users involved crashes. *International Journal of Injury Control and Safety Promotion* (NICS).
Grembek, O., Kurzhanskiy, A., Medury, A., Varaiya, P., & Yu, M. (2019, in press). An intelligent intersection. *Transportation Research Part C: Emerging Technologies*. New York: Elsevier.
Liu, J., Khattak, A., Chen, C., Wan, D., Ma, J., & Hu, J. (2018). Revisiting hit-and-run crashes: A geo-spatial modeling method. *Transportation Research Record: Journal of the Transportation Research Board,* 2672 (38), 81-92. https://doi.org/10.1177/0361198118773889
Medury, A., Griswold, J. B., Huang, L., & Grembek, O. (2019). Pedestrian count expansion methods: Bridging the gap between land use groups and empirical clusters. *Transportation Research Record: Journal of the Transportation Research Board*. doi: 10.1177/0361198119838266
Naumann, R. B., Heiny, S., Evenson, K. R., LaJeunesse, S., Cooper, J. F., Doggett, S., & Marshall, S. W. (2019, in press). Organizational networks in road safety: Case studies of U.S. Vision Zero cities. *Traffic Injury Prevention*.
Under review in peer-reviewed journals
Azad, M., Hoseinzadeh, N., Brakewood, C. E., Cherry, C. R., & Han, L. D. (2019). A *literature review on fully autonomous buses*. Manuscript submitted for publication.
E. Dumbaugh, Merlin, L., & Saha, D. *Towards safe systems: Traffic safety, cognition, and the built environment.* Manuscript submitted for publication.
Hoseinzadeh, N., Arvin, R., Khattak, A. J., & Han, L. (2019). I*ncorporating safety in a pathfinding problem using big data*. Manuscript submitted for publication.
Kamrani, M., Srinivasan, A. R., Chakraborty, S., & Khattak, A. J. (2019). *Applying Markov decision process to understand driving decisions using basic safety messages data*. Manuscript submitted for publication.
Ma, Y., Wen, C., Yu, M., & Grembek, O. (2019). *Understanding pedestrian safety at uncontrolled mid-block crosswalks using conflict probability estimation*. Manuscript submitted for publication.
Naumann, R.B., Kuhlberg, J., Sandt, L., Heiny, S., Apostolopoulos, Y., Marshall, S.W., & Lich, K.H. (2019). *Integrating complex systems science into road safety research and practice, Part 1.* Manuscript submitted for publication.
Naumann, R.B., Kuhlberg, J., Sandt, L., Heiny, S., Kumfer, W., Marshall, S.W., Lich, K.H. (2019). *Integrating complex systems science into road safety research and practice, Part 2*. Manuscript submitted for publication.

Owens, J. M., Sandt, L., Habibovic, A., McCullough, S. R., Snyder, R., Emerson, R. W., Varaiya, P., Combs, T., Feng, F., Yousuf, M., & Soriano, B. (2019). *Automated vehicles & vulnerable road users: Envisioning a healthy, safe and equitable future.* Manuscript submitted for publication.
Saha, D., Dumbaugh, E., & Merlin, L. (2019). A *theoretical framework to understand the role of built environment on traffic crashes: Implications for transportation planning and policy practice*. Manuscript submitted for publication.
Shay, E., Khattak, A. J., & Boggs, A. (2019). *Safety in the connected and automated vehicle era: A U.S. perspective on research needs.* Manuscript submitted for publication.
Wali, B., Khattak, A. J., & Ahmad, N. (2019). *Examining correlations between motorcyclist's conspicuity, apparel related factors and injury severity score: Evidence from new motorcycle crash causation study*. Manuscript submitted for publication.
Presentations
Arvin, R., Kamrani, M., & Khattak, A. J. (2019). *Instantaneous driving behavior at intersections: Insights on rear-end and head-on crash frequencies using connected vehicles*. [Presentation].
Arvin, R., Kamrani, M., & Khattak, A. J. (2019, January). *Examining the role of speed and driving stability on crash severity using SHRP2 naturalistic driving study data*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Arvin, R., Khattak, A. J., & Rios Torres, J. (2019). *Evaluating safety with automated vehicles at signalized intersections: Application of adaptive cruise control in mixed traffic*. In Oak Ridge National Lab (ORNL), Oak Ridge, TN.
Boggs, A., Hezaveh, A. M., & Cherry, C. (2019, January). *Shortage of commercial vehicle parking and truck-related interstate ramp crashes in Tennessee.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Boggs, A., Khattak, A. J., & Wali, B. (2019, January). *Analyzing automated vehicle crashes in California: Application of a Bayesian binary logit model.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Dumbaugh, E. (2018, October 26). *Achieving Vision Zero: Applying the lessons of systems engineering to land use & transportation planning*. [Presentation]. ACSP 58th Annual Conference. Buffalo, NY.
Dumbaugh, E. (2018, October). *Achieving Vision Zero: A safe systems approach to transportation planning and design.* [Presentation]. Annual Meeting of the Florida Section of the Institute of Transportation Engineers.
Dumbaugh, E. (2019, February). *Integrating safe systems into the U.N.'s sustainable development goals*. [Presentation]. World Health Organization Expert Panel Meeting.
Eteifa, S., & Khattak, A. J. (2019, January). *Understanding factors contributing to rising fatal crashes: A social network analysis approach.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Goodwin, A. H. (2019). *GDL effectiveness: Engage parents, strengthen laws*. [Presentation]. Lifesavers Annual Conference, Louisville, KY.
Hezaveh, A. M., Arvin, R. & Cherry, C. R. (2019, January). *Comprehensive cost of traffic crashes at zonal level.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Hezaveh, A. M., Nordfjærn, T., Everett, J., & Cherry, C. R. (2019, January). *Considering spatial heterogeneity and time of day in self-reported seat belt use.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Hoseinzadeh, N., Arvin, R., Khattak, A. J., & Han, L. D. (2019, January). *Incorporating route safety in the pathfinding problem using big data*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Kamrani, M., Arvin, R., & Khattak, A. J. (2019, January). *The role of aggressive driving and speeding in road safety: Insights from SHRP2 naturalistic driving study data*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Khattak, A. J., Wali, B., & Ahmad, N. (2019, January). A *taxonomy of naturalistic driving errors and violations and its variations across different land-use contexts – A path analysis approach*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Kumfer, W., & LaJeunesse, S. (2019, January). *Safe systems and systems science: The CSCRS approach*. Presented at the Transportation Safety Management Committee Meeting (ANB10). 98th Annual Meeting of the TRB, Washington, D.C.
Kumfer, W., Naumann, R., & Sandt, L. (2019, January). *Exploring the complexity of pedestrian fatality trends: Understanding the underlying system to inform more effective action.* Workshop sponsored by ANF10: Committee on Pedestrians. 98th Annual Meeting of the TRB, Washington, D.C.
Lich, K.H., Kuhlberg, J., Naumann, R., Lemke, M., Lockwood, I., Kumfer, W., & Sandt, L. (2019, January). *Exploring the complexity of pedestrian fatality trends: Understanding the underlying system to inform more effective action*. Workshop presented at the 98th Annual Meeting of the TRB, Washington, D.C.
Marshall, S., Naumann, R., White, A. M., McClure, R., Sandt, L., & Smith, S. (2018, December). *Systems thinking for injury and violence prevention practice*. Webinar sponsored by the National Peer Learning Team for Systems Thinking at the NC Division of Public Health Injury and Violence Prevention Branch and the Collaborative Sciences Center for Road Safety.
Merlin, L., Cherry, C. R., Hezeveh, A. M., & Dumbaugh, E. (2019, January). *Residential accessibility's relationship with crashes per capita*. [Presentation]. 98th Annual Meeting of the TRB.
Mohammadi, S., Kamrani, M., Khattak, A. J., & Chakraborty, S. (2019, January). *Social influence on driver decisions using modeling and gossip algorithms*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.

Naumann R. (2018, November). *Systems approaches to road traffic injury prevention: Injury as a public health problem.* Guest lecture at the UNC School of Public Health.
Naumann, R. (2018, October). *Systems thinking and transportation safety: Urban transportation planning*. Guest lecture at the UNC Department of City & Regional Planning.
O'Brien, N., & Goodwin, A. H. (2019). *A comprehensive program to support parents of new drivers in North Carolina*. [Presentation]. North Carolina Driver Education Advisory Committee, Raleigh, NC.
Shay, E., Khattak, A. J., & Boggs, A. (2019, January). *Safety in the connected and automated vehicle era: A U.S. perspective on research needs*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Wali, B., Khattak, A. J., & Ahmad, N. (2019, January). *A heterogeneity based case-control analysis of motorcyclist's injury crashes: Evidence from motorcycle crash causation study.* [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Wali, B., Khattak, A. J., & Ahmad, N. (2019, January). *Modeling injury severity score as a more precise measure of motorcyclist injuries: A correlated random parameter corner solution framework*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Wali, B., Khattak, A. J., & Karnowski, T. (2019, January). *Exploring intentional driving volatility in naturalistic driving environment prior to involvement in unsafe events*. [Presentation]. 98th Annual Meeting of the TRB, Washington, D.C.
Wang, Y. (2019, March). *Machine learning tools for informing transportation technology design*. [Presentation]. Humans and Autonomy Lab, Duke University.
Books or other non-periodical, one-time publications
None to report for this period.

3.2 Policy Papers

None to report for this period.

3.3 Website(s) or other Internet site(s)

- A product of the R14 project, this website includes bicycle and pedestrian safety related online datasets: http://pedbikedata.org/
- As part of the R17 project, Kelly Evenson, UNC Gillings School of Public Health, produced a library of US Vision Zero plans that help guide strategies to reduce traffic fatalities and injuries, while increasing safe, equitable and healthy mobility: https://dataverse.unc.edu/dataverse/VZPlans
- As part of the R7 project, Duke's HAL Lab created a video showing an experiment using a safety app intended to alert pedestrians when they are near areas of high traffic density: https://www.youtube.com/watch?v=Zl0bCDXS6VA&feature=youtu.be
- The Transportation Engineering and Science Program at UTK created a new website that is under development (https://tesp.utk.edu). This website allows the program to have an online presence that markets students and faculty along with CSRCS research.

The CSCRS website, www.roadsafety.unc.edu was regularly updated with new information regarding research, educational and professional development research, resources, and opportunities.

3.4 New methodologies, technologies or techniques

These are documented in the final reports published by each completed project and highlighted in an "Info Brief" that is posted next to the final report on the CSCRS website.

3.5 Inventions, patent applications, and/or licenses

None to report for this period.

3.6 Other products

- Two datasets of traffic fatality data were created by Duke: One dataset was from the Highway Safety Information Systems about traffic crashes associated with variables of the roadway, driver, and environment, and the second dataset focused on pedestrian crashes, which was collected by National

Automotive Sampling System. Both cleaned datasets will be available on HAL's website with clear descriptions.
- An ongoing Tennessee Department of Transportation (TDOT)-sponsored project deals with application of Highway Safety Manual in Tennessee.

4. Outcomes

CSCRS included two performance measures related to outcomes in its Technology Transfer Plan:

- Average annual number of opportunities/instances to share transportation safety expertise at conferences, professional meetings and through media. (Please see conference presentations listed in Section 3.1 and media described in Section 4.1.)
- Annual number of adoption, use or reference to CSCRS products, or influence on national or state research agendas.

4.1 Increased understanding and awareness of transportation issues

CSCRS staff engaged with several high-profile media outlets, as well as student university papers. Examples:

- Offer Grembek, UCB, interviewed for "Intrepid Business Travelers Are Finding Another Way to the Airport: Bike," *The New York Times*, Nov. 26, 2018.
- Noreen McDonald, UNC, featured in "Why hospitals are becoming increasingly popular Uber and Lyft destinations," UNC *The Daily Tar Heel,* Feb. 12, 2019.
- Laura Sandt was interviewed for the *The New York Times* about trends underlying the rise in pedestrian fatalities, Feb. 21, 2019.
- Offer Grembek, UCB, was interviewed for the segment, "Electric Scooter Injuries Are on the Rise, Consumer Reports Says," NPR's Marketplace, Feb. 20, 2019.
- Missy Cummings, Duke, was featured in the following articles:
    - "**8 Predictions for What the World Will Look Like in 20 Years**," *New York Intelligencer,* Jan. 6, 2019
    - "**Even Elon Musk Abuses Tesla's Autopilot**," *Wired,* Dec. 10, 2018
    - "**Uber, Lyft ... And Now Waymo: The Self-Driving Car Service Hits The Road**," *On Point,* Dec. 10, 2018
    - "**Tesla Incident Shows the Challenges of Stopping a Driverless Car**," *Automotive,* Dec. 4, 2018
    - "**2019 may be year of the driverless car: Here's where top automakers stand**," *Washington Examiner,* Nov. 30, 2018
    - "**When Will My Self-Driving Car Get Here?**" *New York Intelligencer,* Nov. 7, 2018
    - "**Shaken by hype, self-driving leaders adopt new strategy: Shutting up,**" *The Washington Post,* Oct. 18, 2018
    - "**Fully driverless Waymo taxis are due out this year, alarming critics,**" *Ars Technica,* Oct. 1, 2018

Based on the nature of questions received, there is a growing media savvy regarding enduring transportation safety issues (e.g., the pedestrian fatalities epidemic) and emerging safety issues (related to automated vehicles, micromobility, etc.).

Also, Project R8 is pilot testing a program for parents of new drivers called *Time to Drive* that is designed to reach parents with critical information at the moment when it is most needed, when parents are most receptive, and in a format that is most likely to influence their subsequent behavior. Most young driver experts believe improving

parental involvement with novice drivers is among the most promising approaches for reducing young driver crashes and fatalities.

In addition, CSCRS has been coordinating with other key stakeholder groups and national initiatives in order to share research and to increase understanding of key transportation issues. For example, the CSCRS director has been invited to join ITE's Road to Zero Leadership Council (to begin meeting in May), as well as invited to be part of USDOT's Office of the Secretary's Safety Data Initiative Expert Forum (to be held in April).

4.2 Passage of new policies, regulation, rulemaking, or legislation

UTK faculty, staff, and students worked closely with safety and defense departments in Tennessee, such as the Department of Safety & Homeland Security and the Tennessee Department of Transportation, on enhancing safety. A TDOT-sponsored project titled "Highway Safety Manual, Safety Performance Functions (SPF) and Roadway Calibration Factors" is directly related to enhancing safety through application of the Highway Safety Manual.

Another example is the work of Missy Cummings, Duke, with NC State University to prepare a report for the NC Department of Transportation on the impact of driverless cars for the state.

4.3 Increases in the body of knowledge

CSCRS's contributions to the body of scientific knowledge continue to build. Final reports (distilled down into easily digestible info briefs), numerous journal articles, regular presentations at professional conferences, webinars, and many more dissemination avenues are continually increasing CSCRS's reach.

In February 2019, Eric Dumbaugh was invited by the World Health Organization to participate in the development of traffic safety goals to be included in the 2020 update to the United Nation's Decade for Action in Road Safety Program. The objective of this effort was to establish safety targets for inclusion into the UN's Sustainable Development Goals.

4.4 Improved processes, technologies, techniques and skills in addressing transportation issues

Time to Drive emphasizes what parents can do to help their teen develop more quickly into an experienced, safe driver. During two-hour in-person sessions, parents view and discuss actual video clips of parents and teens during supervised driving. This helps parents understand the situations and challenges that are likely to occur during practice driving, and how they can best handle those situations.

Other developments in this area are documented in the Final Reports published by each completed project and highlighted in an "Info Brief" that is posted next to the Final Report on the CSCRS website.

4.5 Enlargement of the pool of trained transportation professionals

Many of CSCRS's university programs and student activities have served to attract new students to each campus and enlarge the pool of future professionals that are invested in improving safety. While difficult to measure, the presentations and other tech transfer activities implemented in the past several months are also anticipated to have expanded the number of trained professionals in the field.

4.6 Adoption of new technologies, techniques or practices

Safe Systems and systems thinking principles, literature, and tools that emerged from CSCRS work are currently being integrated into a national curriculum related to pedestrian and bicycle planning and design, funded by the FHWA Office of Safety. This course, once completed in Fall 2019, is planned to be shared with and deployed by

hundreds of course instructors in planning and engineering programs across the US. The course modules are also designed to be used in other programs, such as public health, landscape architecture, and others.

Systemic safety analyses processes, such as those developed in a Year 1 project (R2, led by UCB) and a CSCRS match-funded project (NCHRP project 17-73, which produced Report 893 and an award-winning TRB paper, led by UNC-HSRC), are being further advanced by FHWA and a number of states and cities. CSCRS-funded staff members participated in a TRB-produced webinar on Systemic Analysis for Pedestrians, which had record-breaking attendance and has since led TRB to fund an implementation grant to the state of Oregon to adopt the practices established in the Guidebook. We anticipate further adoption of systemic analysis approaches and continue to support efforts to share information and guidance based on CSCRS research about systemic approaches with key leadership at AASHTO and individual states.

The completed project R1 identified influential professionals, organizations and cities, toward accelerating other places' adoption of Vision Zero programs, and explored the structure of cross-sectoral relationships in cities' Vision Zero coalitions. The study identified several opinion-leading and boundary-spanning U.S. cities that operate Vision Zero programs and explained the structure and function of opinion-leading Vision Zero coalitions, all with the goal of providing direction for future research and road safety intervention work.

5. Impacts

CSCRS included two performance measures related to impacts in its Technology Transfer Plan:

- Annual instances integrating CSCRS research results into agency or stakeholder practices that demonstrate use of research results in practice.
- Annual instances integrating CSCRS research results into organizational/workforce capacity building that demonstrate use of research results in capacity building activities conducted by local, regional, state or national level agencies.

5.1 Impact on the effectiveness of the transportation system

While it may be too soon to see what we are hoping will be our ultimate impact, CSCRS is already seeing engagement with decision-makers in the transportation safety realm. For example, Google analytics appear to show that agencies have already accessed the pedbikedata.org resource. Also, our resource of Vision Zero plans has streamlined our ability to guide strategies to reduce traffic fatalities and injuries, while increasing safe, equitable and healthy mobility.

Findings from research projects such as R3 provided insights into Safe Systems practices and evidence of effectiveness around the world. Planning the Safe Systems Summit provided a unique opportunity to engage various professions in the process of developing a program that would highlight both Safe Systems and systems science principles and showcase CSCRS research along with real-world practices.

5.2 Impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company

CSCRS continues to build relationships with agency stakeholders around the country, creating the channels needed for implementation. Planning the Safe Systems Summit provided an opportunity to engage professionals from a wide variety of traffic safety fields.

Other examples:

- UTK has access to members of TennSMART, which is a consortium of public agencies and private companies focused on advancing intelligent mobility in Tennessee. Members' interests align with the commercialization of CSCRS research. Dr. Asad Khattak has given talks at the TennSMART Member Meetings, mentioning CSCRS research. Companies like SoftServe, Inc. have expressed their interest and support for commercializing safety research and supporting CSCRS activities.
- The R8 program *Time to Drive* is being pilot tested with parents of new drivers in high schools in Wake County, NC.
- Michael Clamann is in talks with the British company Humanising Autonomy, a start-up developing technology to predict human movement around traffic infrastructure, to create a partnership

5.3 Impact on the body of scientific knowledge

Using the numerous and varied methods listed previously, CSCRS is continuing efforts to contribute to the body of knowledge surrounding Safe Systems and systems-science approaches to road safety.

5.4 Impact on transportation workforce development

CSCRS's workforce development activities have been bringing people together who have not traditionally worked together, breaking down siloes, and recognizing roles that technology, land-use planning, and other disciplines play in safe transportation. We continue to explore ways to bring new stakeholders to the table; planning for the Safe Systems Summit has already accelerated progress in that area. We will continue our outreach at events like the TRB Annual Meeting, Coffee & Conversations, webinars, and other campus-specific seminars.

6. Changes/Problems

6.1 Changes in approach and reasons for change

Nothing to report.

6.2 Actual or anticipated problems or delays

Nothing to report.

6.3 Changes that have a significant impact on expenditures

Nothing to report.

6.4 Significant changes in use or care of animals, human subjects, and/or biohazards

Nothing to report.

7. Special Reporting Requirements

Nothing to report. This entire report is available on the CSCRS website.