



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?

The goals and objectives from our [Strategic Roadmap](#) provide context for our accomplishments in this document.

1.2 What was accomplished under these goals?

Selected highlights for this performance period include:

- Held the UNC-Chapel Hill Safe Systems Transportation Research Forum in October 2020, a day devoted to meeting with Congressional staffers about transportation safety research.
- Selected the third Outstanding Student of the Year, Mary Wolfe of UNC, who was honored at the Council of University Transportation Center's 29th Annual Outstanding Student of the Year Awards ceremony.
- Engaged in more than [130 activities](#) at the 2020 Transportation Research Board (TRB) Annual Meeting in January 2020.
- Held the third Safety Sunday @ TRB reception in conjunction with the TRB Annual Meeting in January 2020.
- Held a CSCRS Advisory Board meeting in conjunction with the TRB Annual Meeting in January 2020.
- Concluded several CSCRS research projects, with several more nearing completion.
- Generated more than 100 CSCRS research-related publications, presentations, websites, videos, and other information resources.
- Engaged hundreds of undergraduate, graduate and doctoral students in CSCRS research, education and professional development projects.
- Taught approximately 23 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 [Project RR1](#) final report, which describes the process to explore factors underlying the rise in pedestrian crashes using system-oriented tools and methods.
 - Co-PIs: Laura Sandt, UNC HSRC; Becky Naumann; UNC IPRC/ Co-Investigators: Kristen Hassmiller Lich, UNC; Jill Kuhlberg, UNC; Steve Marshall, UNC IPRC; Stephen Heiny, UNC HSRC
 - Project completed. Two articles (open source) available now and a third under review. Findings were used to inform Phase 2 system dynamics work (i.e., CSCRS Project 21).
- [Project R21](#) aims to develop a system dynamics simulation model that can be used as a learning tool to explore the pedestrian safety impacts of New York City's congestion pricing policy.
 - PI: Becky Naumann, UNC IPRC / Co-PIs: Kristen Hassmiller Lich, UNC Gillings School of Global Public Health; Laura Sandt, UNC HSRC; and Steve Marshall, UNC IPRC
 - Finalizing article extraction and bibliometric analyses for a scoping review of congestion pricing policies and their safety-related impacts; building the structure of and synthesizing data to parameterize a system dynamics simulation model of potential safety effects of congestion pricing policy implementation on vulnerable road user safety.

- [Project R22](#) aims to use integrated data to examine characteristics related to pedestrian and bicyclist injuries.
 - PI: Katie Harmon, UNC HSRC / Co-Investigator: Laura Sandt, UNC HSRC
 - Integrating crash and emergency department visit data (e.g., vehicle type, rurality, posted speed limit/estimated speed at impact, road classification, lane number, and light condition data) for a better picture of pedestrian and bicyclist injuries (compared with analyzing datasets individually).
- [Project R24](#) aims to develop a framework to quantify the overall protective capability of the system and will be benchmarked against the desired capability of the system, as established by the policy makers.
 - PI: Offer Grembek, UCB
 - Kinetic energy has been selected as the focal variable to represent the magnitude of a crash.
 - The feasibility of creating a small but representative database of crash magnitudes across the U.S., for different modes and conditions has been evaluated.

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

- In its role on the Leadership Council for the Road to Zero Coalition, CSCRS researchers supported a fall webinar series, hosted by CSCRS advisory board members from the Vision Zero Network, Institute of Transportation Engineers and the National Safety Council. The series laid out principles of Safe Systems based on research and practices identified by CSCRS research and other sources. Here are the webinars (must have an account to access):
 - [An Introduction to Safe Systems in the US, a Road to Zero Coalition Webinar](#), November 2019
 - [Safety Culture 101, a Road to Zero Coalition Webinar](#), December 2019
- The CSCRS team was again very visible at the TRB Annual meeting. CSCRS researchers presented in or contributed to [more than 130](#) sessions, workshops, posters, committee meetings at the January event.
- UNC's successful Coffee & Conversation discussion series transformed into a new format in fall 2019. Called Roadways for a Safer Future, this course used seminars, workshops, and field trips to explore the role roadway infrastructure plays in road safety. Speakers, including multiple CSCRS researchers and other local stakeholders, provided a variety of road safety perspectives.
- CSCRS continued extensive planning in preparation for hosting the biennial National Travel Monitoring Exposition and Conference ([NaTMEC](#)) in June 2020, Raleigh, NC. During this period CSCRS coordinated program development, secured vendor support, launched registration. (Unfortunately, due to the COVID-19 pandemic, the event was postponed to June 2021.)

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

- CSCRS work with the Core Learning Community Systems National Peer Learning Team, a working group that meets regularly to explore defining a systems approach to road safety, is moving into a new phase. The group is planning a webinar about incorporating systems tools into injury prevention and is exploring future learning opportunities.

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.

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.

- Continued [Project R9](#) to explore the operational needs and characteristics for an autonomous vehicles dispatch center.
 - PI: Missy Cummings, Duke
 - This project is almost complete. Several concepts of operation were elucidated, and various simulation models were developed for examining dispatcher workload and testing the impact of mixed traffic of autonomous vehicles and human-driven vehicles.
- Continued [Project R10](#) to investigate how machine learning techniques can be used to design countermeasures that improve system safety.
 - PI: Missy Cummings, Duke / Co-Investigator: Michael Clamann, UNC HSRC
 - Project completed; the final project report is under review at CSCRS. Two datasets that include driver and pedestrian traffic fatality predictions have been submitted to CSCRS.
- Continued [Project R11](#) to examine 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
 - The draft final report was submitted and is under review.
- Continued [Project R12](#), which aims to provide a more accurate picture of California traffic injuries by utilizing medical data to fill in where police crash reports may have limited information, and to get a more accurate picture of California emergency medical services response times.
 - PI: David Ragland, UCB / Co-Investigator: Chris Cherry, UTK
 - Project complete; report near complete and data being organized for submission. Project has led to collaborations with California Center for Medical Outcomes (CMOD) on a follow-up project to extend matching collision and hospital data to increase knowledge of under-reporting.
- Continued [Project R13](#), which assesses how technological change embodied by shared mobility services impacts road safety.
 - PI: Noreen McDonald, UNC DCRP / Co-Investigator: Tabitha Combs, UNC DCRP
 - Manuscript completed and sent out for journal article peer review.
- Continued [Project R15](#) 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
 - Final report is in CSCRS review. Developed several important approaches toward understanding how land use and travel demand modeling approaches (e.g., four-step model) can formally integrate safety prediction models into other transportation objectives. An application was developed for Nashville's transit-oriented development scenario.
- Continued [Project R16](#), which 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
 - Final report is in CSCRS review. Developed system maps to identify where opioid use can influence transportation safety. Conducted a dataset and data element inventory of police crash records

across all 50 states and identified linkage potential with state Prescription Drug Monitoring Program databases.

- Continued [Project R18](#), which 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
 - This study provides a detailed analysis of the safety impacts of two recently-developed light rail systems in the U.S.: Orlando SunRail and Charlotte Lynx. This study will examine the frequency and severity of various crash types before and after the introduction of light rail service.
- Continued [Project R20](#), which 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
 - Final report submitted to CSCRS. The project has quantified risk factors associated with injury severity in motorcycle crashes and identified relevant countermeasures. A federal database called Motorcycle Crash Causation Study was analyzed using rigorous statistical methods.
- [Project R25](#) aims to advance crash investigation with connected and automated vehicle data.
 - PI: Michael Clamann, UNC HSRC / Co-Investigator: Asad Khattak, UTK
 - This project is investigating how the potentially rich dataset available to connected and autonomous vehicles (CAVs) can be leveraged to improve crash investigations in the future and overall transportation safety, with a focus on the data needs of law enforcement.
 - A survey was developed and pilot tested with 50 law enforcement officers in North Carolina. It will be distributed nationally in Q2 2020.
 - Interviews have been conducted with several experienced collision reconstructionists to collect subject matter expert opinions on how automated vehicle data could change crash investigations.
 - The project team attended monthly meetings with the SAE ADS Data Logger Task Force to follow SAE efforts on identifying data elements recorded by automated driving systems in collision events.
- [Project R26](#) aims to accelerate shared learning around micromobility safety impacts.
 - PI: Christopher R. Cherry, UTK / Steve Marshall, Becky Naumann, UNC IPRC, and Susan Shaheen, UCB
 - In January 2020, the micromobility ICD-10-CM codes were accepted for inclusion in the FY2021 version of ICD-10-CM.
 - Developed a database of all e-scooter fatalities and a [compilation](#) of published reports and manuscripts related to e-scooter injuries.
 - Worked with Bird scooter company to host five roundtable workshops on scooter safety, attended by more than 200 professionals.
 - Developing model survey instruments for different sampling platforms that draw from best practices from existing pilot tests.
- [Project R27](#) aims to investigate how to effectively test connected and automated vehicles using physical and simulation tests.
 - PI: Subhadeep Chakraborty, UTK / Co-Investigator: Asad J. Khattak, UTK, Co-Investigator: Mary (Missy) Cummings, Duke University
 - The project is getting underway. We have been conducting literature reviews on safety reports on connected and automated vehicles (CAVs) by organization, disengagement of CAVs, driver's license tests, crash statistics, and human monitoring system.
 - Based on the literature reviews, the safety test scenario has been established with edge cases, targets for detection, and Measures of Performance (MoPs). In addition, we have been refining the simulation software to realistically simulate the detection and movements of CAVs for simulation testing.

- During the reporting period, the UTK research team held several meetings with the Duke University research team to discuss collaborative work and progress. An abstract related to the project was accepted by Society of Automotive Engineers (SAE). A simulation framework that both Oak Ridge National Laboratory (ORNL) and UTK team members have coauthored. UTK faculty wrote a software license agreement for working closely with ORNL.
- [Project R28](#) aims to apply evidence-based countermeasures to reduce injuries in motorcycle crashes.
 - Jerry Everett, UTK / Co-PI: Asad Khattak, UTK
 - The project will enable evidence-based practice, shorten the research-to-practice cycle and focus on assisting stakeholders with diverse backgrounds, motorcycle safety practitioners and advocates in applying the outcomes of CSCRS research and information synthesized from the literature.
 - The project involves strong collaboration with the Tennessee Highway Safety Office (THSO). A meeting was scheduled with the Tennessee Highway Safety Office.
- [Project R30](#) evaluates the impacts of urban freight on road safety through detailed spatial and longitudinal analyses.
 - PI: Noreen McDonald, UNC DCRP
 - Developing alternative last mile freight vehicle performance profile to include in future safety analysis. Developing initial state-wide safety inventory of urban freight.
- [Project R31](#) examines crash risk for at-risk population segments and underlying risk factors.
 - PI: Diana Mitsova, FAU / Co-Investigator: Eric Dumbaugh, FAU
 - Data collection is complete and preliminary data analysis is underway.
- [Project R32](#) seeks to develop novel methods for safety education and outreach targeted to lower-income and minority children in Miami.
 - PI: Eric Dumbaugh, FAU
 - The first of three proposed activities, the Cardboard Challenge, occurred in October 2019. The second, Science Saturday, was scheduled for March 2020, but was postponed due to COVID-19

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

- Completed [Project R7](#), which developed and evaluated a prototype Android mobile app that will alert pedestrians when they are near areas of high traffic density.
 - PI: Missy Cummings, Duke University
- Completed [Project R14](#), which created an online, searchable, [centralized data clearinghouse](#) of more than 3,000 existing bicycle and pedestrian safety-related datasets as a national resource for safety researchers.
 - PI: Krista Nordback, UNC HSRC / Co-Investigators: Seth LaJeunesse, UNC HSRC, and Julia Griswold, UCB
 - Development of project plan underway with goals to hire graduate student researchers in next month or so.
- Continued [Project R19](#), which is developing a deeper understanding of human errors that lead to crashes.
 - PI: Asad J. Khattak, UTK / Co-Investigator: Eric Dumbaugh, FAU
 - The project is complete, and the final report has been submitted to the CSCRS. Developed detailed taxonomy of human errors and violations that provides a fundamental understanding of human factors and highlight opportunities to design successful interventions. Analyzed the SHRP2 naturalistic driving study dataset based on instrumented vehicles to understand pre-crash, near-miss and non-event driving.
- R23: Driver impairment detection and safety enhancement through comprehensive volatility analysis
 - PI: Asad Khattak, UTK /Subhadeep Chakraborty, UTK, and Michael Clamann, UNC HSRC

- Researchers are working on simulations to integrate data from drivers' biometrics, vehicle kinematics and roadway environments to explore driving volatility and leading indicators of driver impairments. Data from SHRP2 naturalistic driving study is also being analyzed.

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.

- Continued [Project R8](#), a two-year effort developing tools to assist parents of new drivers.
 - PI: Arthur Goodwin, UNC HSRC
 - This project is nearing completion and resources will be available in the next reporting period.
- Continued [Project R17](#), which 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
 - Completed content for a "Guide for Vision Zero Plans;" revised per expert feedback. Final Guide to be available in Summer 2020.

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

Objective 1.2 covered many efforts to disseminate research, specifically relating to systems-oriented projects and work that CSCRS is producing. [Several presentations covering CSCRS research](#) were featured at the 2020 TRB Annual Meeting. Table 1 highlights additional presentations made in this reporting period to disseminate research findings to diverse groups.

Table 1: Select CSCRS outreach highlights

Duke	Benjamin Bauchwitz, presentation about driver and autonomous vehicle monitoring system, Humans and Autonomy Lab, February 2020.
	Missy Cummings and Dr. Li gave tours to NC Public Safety officials on 3 OCT 2019.
	Missy Cummings discussed some of her work at the MHI logistics conference in Palm Springs, OCT 2019.
	Missy Cummings discussed some of her work at the General Motors Sigma Xi Annual Dinner Keynote speaker, "Man vs. Machine or Man + Machine?" November 2019, Detroit, MI.
	Missy Cummings discussed some of her work as a panelist for "Navigating the (Mis)Perceptions of Autonomous Vehicles", IEEE TechEthics symposium, November, 2019, New York, NY.
	Missy Cummings discussed some of her work as a speaker for the Detroit Chemistry Club, "Where we stand with autonomous technology", November 2019, Detroit, MI.
	Missy Cummings participated as a panelist for NSF Webcast at the British Embassy, "The Future of Transportation." January 2020. Met with IIHS/David Harkey + 5 members of executive team in Feb 2020 to brief on relevant findings
FAU	A paper developed from R11 was accepted for presentation at the Southeastern UTC Conference, which has been postponed due to COVID-19.
	An abstract from R11 has been submitted for presentation at the Association of Collegiate Schools of Planning Annual Conference and is currently under review.
	A product from R3 was presented at the South Florida Safe Streets Summit. "Achieving Vision Zero: Designing Safe Systems for All Road Users." Safe Streets Summit. Fort Lauderdale, FL. February 7, 2020. 65 participants.
UCB	Offer Grembek presented "The Safe System Approach: Considerations for Developing a Multi-Layered System" at the Friday Transportation Seminar, Portland State University TREC, Friday, October 11, 2019.
	Offer Grembek and Pravin Varalya presented "Emerging Safety Issues in Transportation" at the UC ITS Legislative Briefing, Wednesday, November 6, 2019.
	Susan Shaheen presented "Micromobility and TNCs: Leveraging Partnerships for Curbside Management and Data" at the UC ITS Legislative Briefing, Wednesday, November 6, 2019.
	David Ragland presented "Linking Crash and Post-Crash Data" in the CSCRS research call, Wednesday, November 13, 2019.
	Offer Grembek presented the keynote address, "Safe System Approach: Consideration for developing a Multi-layered Safe Transportation System" at the 3rd Center for Human Urban Mobility annual Summit, in San Diego, CA on Monday, November 18, 2019.
	Offer Grembek presented "Vision Zero: Actions Taken and Actions Needed" at the Nordic Future Mobility Summit, at Stanford University, Palo Alto, on Friday, January 17, 2020. Offer Grembek, UCB, presented "Setting Speed Limits" at the Metropolitan Transportation Commission Tech Transfer Seminar, in San Francisco, on Monday, February 3, 2020.

	David Ragland, UCB, did a 30 minute presentation on excess risk for senior road users (drivers, occupant, pedestrians) at meeting of the California Master Plan for Aging (MPA) Research Committee on February 24. About 30 members of the Committee attended and 20 additional participants called in remotely.
UNC	Naumann R. Using systems approaches and building diverse partnerships to prevent leading causes of injury death. Researchers’ Lunch with the Dean. Chapel Hill, NC. February 17, 2020. (About 15 participants)
	Naumann R, Sandt L. Exploring the systems that lead to roadway fatalities. Safe Systems Transportation Research Forum legislative briefing. Chapel Hill, NC. October 10, 2019. (About 10 participants)
	Naumann R. Lecture at UNC School of Global Public Health in EPID 625/MHCH 625/ HBEH 625: Injury as a Public Health Problem. Lecture on: “U.S. Road Safety: Where have we come from and where are we going.” October 29, 2019. (about 15 participants)
	Naumann R. Lecture at UNC Department of City & Regional Planning in PLAN 636: Urban Transportation Planning. Lecture on: “Road Safety in the U.S.: Where have we come from and where are we headed.” October 24, 2019. (about 25 participants)
	McDonald, N. (2020, February). <i>Changing Technology, Changing Travel: Planning Transportation in a Time of Uncertainty</i> . [Presentation]. Hyde Lecture, College of Architecture, University of Nebraska, Lincoln.
	McDonald, N. (2019, November). <i>Health and Transportation: Understanding the Role of Emerging Mobility Options</i> . [Presentation]. The Ohio State University, Center for Urban and Regional Analysis.
	Wen, Y., Cherry, C., Bassett Jr, D. Thorsen, T., Zhang, S., Weinhandl, J., Brakewood, C., Morse, J. (2019). Evaluating the Physical Activity Impacts of Riding Electric Kick Scooters. Conference on Health and Active Transportation. December 3, 2019. Washington D.C.
UTK	Wen, Y., Shah, N., Cherry, C. (2019). Infrastructure Challenges for designing Roads for small Wheel Transportation such as Electric Scooters: A Complete Streets Perspective. International Cycling Safety Conference. November 18-20, 2019. Brisbane, Queensland, Australia.
	N. Shah, M. Azad. Cherry C. (2019). Linking traditional crash data, bikeshare data, and social media to create a new picture of cycling safety. International Cycling Safety Conference. November 18-20, 2019. Brisbane, Queensland, Australia.
	Vehicle Standards for Micromobility. Safe Micromobility International Transport Forum Workshop. Lisbon, Portugal. October 18, 2019 (contributed to Safe Micromobility report released in February 2020)

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:

- UNC Fall 2019 graduate course, Injury as a Public Health Problem. Instructor: Yvonne Golightly. Co-Instructor: Meghan Shanahan (18 students). The course will include content on using systems thinking and science approaches to better understand road safety problems.
- Duke University Spring 2020 undergraduate and graduate course Design of Experiments. Instructor: Mary (Missy) Cummings. 23 students participated.
- UNC DCRP Spring course PLAN 590.001 Roadways for a Safer Future. Instructor Tabitha Combs; co-instructors Seth LaJeunesse and Wesley Kumfer (HSRC). 19 students
- UNC DCRP Spring course PLAN 590.003 Complete, Safe, Equitable Streets. Instructor Tabitha Combs. 29 students
- UNC DCRP Spring course PLAN 672 Urban Data Analytics. Instructor Nikhil Kaza. 20 students
- UNC DCRP Spring course PLAN 738 Transport Policy. Instructor Allie Thomas. 16 students
- FAU Spring 2020 undergraduate course, URP 2051: Designing the City. Instructor: Dr. Eric Dumbaugh. 59 students participated.
- UCB Fall 2019 graduate course Injury Prevention and Control. Instructors: Professor David Ragland, and Dr. Glenn Shor. Topics focused on road user behavior in itself and as impacted by roadway design (8 students).
- UCB Spring 2020 graduate course Traffic Safety and Injury Control. Instructors: Professor David Ragland, and Offer Grembek. Course organized to illustrate principles of a systems approach to safety (12 students).
- UCB Fall 2019 graduate course Sustainable Mobility. Instructor: Daniel A. Rodriguez. Focused on technology, policy, and behavioral changes to increase the environmental, social, and financial sustainability of transportation (35 students).

- UCB Spring 2020 graduate course Transportation Sustainability. Instructor: Susan Shaheen. Focused on sustainable transportation, policy, innovations, and engineering concepts/methods (55 students).
- UTK’s Civil and Environmental Engineering faculty offered 12 transportation courses during Fall 2019 and Spring 2020 covering transportation engineering (I and II), transportation lab, traffic characteristics, geometric design, transportation safety, transportation planning, public transportation, transportation seminar, analysis techniques for transportation systems, intelligent transportation systems.

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

Here are some notable student activities and highlights from this reporting period.

- Several CSCRS students were chosen as [Dwight David Eisenhower Transportation Fellows](#) in fall 2019. Two were UNC’s M. Clay Barnes, whose research covers health/safety outcomes related to e-commerce, and Libby Szufflita, whose research looks at traffic analysis zones. [UCB also had several Eisenhower fellows.](#)
- CSCRS also continues the popular “CSCRS bookshelf” feature of its Crossroads newsletter. This segment invites students to write summaries of transportation related books they’re reading.
- The NaTMEC event incorporates several opportunities to engage students including poster presentations.

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

Table 2: Select CSCRS student engagement activities

UCB	UCB awarded 5 graduate students CSCRS Road Safety Graduate Student Fellowships, providing the opportunity to generate high quality CSCRS research pertaining to road safety topics.
	Offer Grembek and Lisa Peterson, UCB, partnered on a project with UC Berkeley’s Center for Cities + Schools educational initiative, Y-PLAN, to develop resources and educational content on traffic safety and vision zero/safe systems principles to integrate into their curriculum as part of a 10 week program for the Engineering Leadership Academy high school students at Oakland High School, Oakland, CA. They presented, “Safe Systems and Vision Zero: A Fresh Approach for Improving Road Safety in our Communities” to youth on Wednesday, February 26, 2020 and participated in a walk audit of the community on Tuesday, March 3, 2020 (approx. 60 students participated in both events).
	UCB: Stephen Wong, PhD Dissertation (May 2020): Compliance, Congestion, and Social Equity: Tackling Critical Evacuation Challenges through the Sharing Economy, Joint Choice Modeling, and Regret Minimization (Co-Advisors: Susan Shaheen and Joan Walker, Civil and Environmental Engineering)
Duke	For R9, one undergraduate student and one research assistant worked on function analysis for the dispatch center and did the literature review. One postdoctoral associate worked on R9 to analyze two datasets using two machine-learning methods.
	For R27, one Ph.D. student is working on the driver and vehicle monitoring system and designing the experiment protocol. One research assistant and one research associate is helping with the pilot testing of the monitoring system.
	One postdoc and one undergraduate student attended the TRB Annual Meeting 2020 and presented one poster.
FAU	Cardboard Challenge, October 12, 2019. Conducted a safety workshop for K-5 students in the East Little Havana community in Miami. The event was bi-lingual (English/Spanish) and tasked children with developing urban buildings, arranging them into a model city, and then developing safe transportation infrastructure to connect them. Approximately 45 children participated.
	A graduate student, Sibel Body, was employed as a graduate research assistant.
UNC	PhD Injury Epidemiology student Bhavna Singichetti engaged in CSCRS-funded research projects on effective public health policy for road traffic injury prevention, as well as systems science applications to road safety.
	Undergraduate student Madison DeVries supported Project R17, gaining experience and exposure to road safety research. She assisted with the Vision Zero Plan Guide by formatting the resource section and securing copyright permissions for images.
	UNC DCRP named 15 masters students and 2 doctoral students Transportation Leadership Fellows. The fellowship comes with a small stipend to support students’ commitment to pursuing cross-disciplinary partnerships in road safety in their professional training, work, or research.
	UNC DCRP awarded 2 masters students Road Safety MP scholarships to support masters project research with clear implications for road safety
	UNC DCRP masters students conducted research with implications for road safety. Bonnie Guo’s masters project, “Complete Streets Index for Chapel Hill” creates a way for the town of Chapel Hill to identify streets that need better safety design/interventions that may not be seen as problematic using conventional indicators. Tory Gibler’s masters project, “Curbside Management in North Carolina” assesses current and aspirational curbside management practices in six North Carolina cities to help address safety implications as modes mix and conflict with an increasing demand for downtown curb access.
	UNC DCRP named 15 masters students and 2 doctoral students Transportation Leadership Fellows. The fellowship comes with a small stipend to support students’ commitment to pursuing cross-disciplinary partnerships in road safety in their professional training, work, or research.
	UNC DCRP awarded 2 masters students Road Safety MP scholarships to support masters project research with clear implications for road safety
Two DCRP graduate students (Will Curran-Groome & Florence Dwyer) were involved in creating and maintaining the e-scooter fatality database and the e-scooter injury literature repository.	

UTK	<p>Mr. Zachary Jerome, undergraduate Civil Engineering student who works on CSCRS projects has won the competitive National Science Foundation Graduate Research Fellowships. In his NSF application, Jerome has proposed to work on behavioral issues relating to seat-belt use. https://cee.utk.edu/cees-jerome-three-others-in-college-win-nsf-graduate-research-fellowships</p> <ul style="list-style-type: none"> o Zachary William Jerome, an undergraduate member of UTK ITE, was awarded ACEC 2019 a/e ProNet Engineering Scholarship. o Zachary William Jerome, an undergraduate member of UTK ITE, was awarded the John Callaway Academic Achievement Award. o Zachary William Jerome, an undergraduate member of UTK ITE, was awarded ACEC TN Scholarship. o Zachary William Jerome, an undergraduate member of UTK ITE, was awarded ASHE Middle Tennessee Scholarship.
	<p>Ramin Arvin represented the Civil and Environmental Engineering Department in the Graduate Student Senate.</p>
	<p>Jonathan West, an undergraduate member of UTK ITE, won Lawrence S. Barker Jr Award at University of Tennessee. Jonathan West, an undergraduate member of UTK ITE, was awarded the ORNL FCU scholarship at University of Tennessee. Jonathan West, an undergraduate member of UTK ITE, was awarded UT the volunteer scholarship at University of Tennessee. Jonathan West, an undergraduate member of UTK ITE, was awarded the Tennessee society of Professional Engineers scholarship at University of Tennessee.</p>
	<p>The activities of UTK Institute of Transportation Engineers (ITE) Student Chapter is summarized as following:</p> <ul style="list-style-type: none"> o Six (6) UTK-ITE meetings were held in Fall 2019 and Spring 2020 semesters. o Four (4) UTK ITE Student Chapter members (Cassidy Crossland, Kinzee Clark, Wesley Darling, and Zachary Jerome) competed and won the 2nd TSITE (Tennessee Section of the Institute of Transportation Engineers) Traffic Bowl Competition. o UTK ITE Student Chapter won the Best Student Chapter award in Tennessee. o UTK ITE Student Chapter won the 2nd Best Student Chapter in Southern District. o UTK ITE student chapter was awarded a \$3000 fund by UTK Student Engagement Office to help undergraduate students attend the TRB annual meeting. o UTK ITE team (Three of our ITE students) were selected as finalists of Transportation Technology Tournament. This competition is held by National Operation Centre of Excellence (NOCoE). o UTK ITE team attended the ITE international annual meeting 2019 at Austin, TX. o UTK ITE Chapter members took part in the PARK(ing) Day event held in downtown Knoxville. o The UTK ITE student chapter hosted some events and programs for University of Tennessee Engineering day.
	<p>Six UTK graduate students won the Lifesavers Traffic Safety Scholarship to attend the National Lifesavers Traffic Safety Conference in Tampa, Florida.</p>
	<p>Nima Hoseinzadeh and Cassidy Crossland were selected as Tickle College of Engineering Graduate Student Council.</p>
	<p>UTK WTS-Advancing Women in Transportation Student Chapter met 6 times in Fall 2019 and Spring 2020 semesters.</p>

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

- UTK Civil & Environmental Engineering Department held Weekly Graduate Student Researcher meetings with graduate students in order to support mentoring and share best practices for effectively communicating research, making presentations, and utilizing social media.

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

- FAU coordinated with the Urban Impact Lab, Dream in Green, AIA Miami, Miami Center for Architecture & Design, Inc., and the Health Foundation of South Florida to hold the Cardboard Challenge, October 2019 in Miami, FL. The event was targeted toward K-5 schools in the area and focused around creative play, street safety and environmental stewardship.

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

Myriad teaching, training, and learning opportunities have already been showcased in this report. Additionally:

- Weekly traffic safety seminars were held at SafeTREC on Fridays to provide platforms to discuss research happening at the center and beyond. Select topics:
 - o October 1, 2019: Offer Grembek presented: "Safer Speeds: Considerations for Speed Limits and Management: Part 1". 13 staff, students, guests participated.
 - o January 17, 2020: Shane Turner, Abley Technical Director/Safe Systems Specialist Adjunct Senior Fellow, University of Canterbury, presented: "Moving Towards Safe Systems (Vision Zero) on Mixed Use Urban Arterials in New Zealand and Australia." 10 staff, students, guests participated.

- February 14, 2020: Offer Grembek presented: "Vision Zero and Safe System/s for California." 11 staff, students, guests participated.
- March 20, 2020: CSCRS Road Safety Fellow Riya Young presented: "Distracted Driving with Uber/Lyft Drivers, Part 2." 18 staff, students, guests presented.

1.4 How have the results been disseminated?

Results are being disseminated in accordance with the CSCRS [Technology Transfer Plan](#). In addition to the goal-specific activities described above, staff developed and disseminated one issue of *CSCRS Crossroads* newsletter in January 2020 (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 maintained the CSCRS Twitter feed, which now has 447 followers. A recent month's analytics showed 11,200 impressions, an increase of almost 60% over the previous month. Staff also maintained the CSCRS Facebook page.

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?

CSCRS has quickly pivoted energies to focus on evaluating impacts of the COVID-19 pandemic on the transportation system and expects those activities to be a major part of the next reporting period. CSCRS is evaluating research opportunities related to the pandemic, such as "shocks" to the transportation system, sharp reductions in crashes combined with expected increases when stay-at-home orders are lifted.

The following section provides additional examples of what CSCRS plans to complete during the next reporting period (4/1/2020-9/3/20) to accomplish the previously described goals and objectives.

- **Research activities planned:**

- The CSCRS Executive Committee will meet to discuss the Year 5 call for research process, finalize the call, evaluate research proposals received in a peer-review process, and select projects for funding during the next reporting period.
- Project R17 ("Strengthening existing and facilitating new Vision Zero plans") researchers will finalize the Guide for Vision Zero Plans and close-out their project. The Guide will be disseminated to interested parties and housed on the CSCRS website, where it will be publicly available. The study team also intends to have 1-2 manuscripts drafted on project results for peer-review publication and a final report will be submitted. A fact sheet on the project, developed by CSCRS, will be available on the website.
- Project R21 researchers will complete and submit for publication a scoping review on the safety-related impacts of congestion pricing policies. The project will also further development of a system dynamics simulation model designed to examine safety impacts of NYC's congestion pricing policy.

- **Professional development activities planned:**

- Work will continue on rescheduling NaTMEC for June 2021.
- Tabitha Combs will discuss safety measures in traffic impact analyses at a workshop at the ITE conference (August, New Orleans), which may become a virtual/remote session.
- UNC-HSRC staff will continue development of new course modules to offer under the Road Safety Academy, including advanced training on survey design practices to incorporate safety and other topics.

- **Teaching and student enrichment activities planned:**

- Introduce round 4 of the UCB CSCRS Graduate Student fellowship for UC Berkeley graduate students conducting independent research under faculty supervision on relevant to road safety.
- Attend final project presentations for the Y-PLAN Engineering Leadership Academy students at Oakland High School for K-12 education.
- Our consortia will teach several college courses, as well as incorporate CSCRS research findings and opportunities into other/existing courses and seminars.
- UNC Fall 2020 graduate course, Injury as a Public Health Problem. Instructor: Yvonne Golightly. Co-Instructor: Meghan Shanahan. The course will include content on using systems thinking and science approaches to better understand road safety problems.
- NaTMEC 2020 will incorporate activities for students, including opportunities to present and a poster event.

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
AT&T Fleet Complete, Atlanta, GA (Financial Support)
SoftServe, Inc., Austin, TX (Financial and Collaborative Support)
PhD Posters, Durham, NC (Financial Support)
Toyota Motor North America, Saline, MI (Financial Support)
Uber, San Francisco, CA (Financial Support)
VHB, Watertown, MA (Financial Support)
Volkswagen Group of America, Herndon, VA (Collaborative Support)
Foundation
Health Foundation of South Florida, Miami, FL (Collaborative Support)
John D. and Catherine T. MacArthur Foundation, Chicago, IL (Financial Support)
Local Government
Town of Chapel Hill Staff, Chapel Hill, NC (Collaborative Support)
Other Non-Profits
American Institute of Architects, Miami, FL (Collaborative Support)
America Walks, Portland, OR (Collaborative Support)
American Planning Association, Chicago, IL, and Washington, DC (Collaborative Support)
American Public Health Association, Washington, DC (Collaborative Support)
Association of Pedestrian and Bicycle Professionals, Lexington, KY (Collaborative Support)
Broward Metropolitan Planning Organization, Fort Lauderdale, FL (Collaborative Support)
Dream in Green, Miami, FL (Collaborative Support)
Institute of Transportation Engineers, Washington, DC (Collaborative Support)
Insurance Institute for Highway Safety, Vehicle Research Center, Ruckersville, VA
The Miami Center for Architecture and Design, Miami, FL (Collaborative Support)
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)
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)
The Road to Zero Coalition/The National Safety Council, Itasca, IL (Financial and Collaborative Support)
Transportation Research Board Standing Committee on Pedestrians, Washington, DC (Collaborative Support)
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
California Emergency Medical Systems Authority (Collaborative Support, Data Request)
California Center for Medical Outcomes, 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)
*New this period: North Carolina Turnpike Authority, Raleigh, NC (Collaborative 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, Johnson City, TN (Collaborative Support)
North Carolina State University Institute for Transportation Research and Education, Raleigh, NC (Collaborative Support)
Planning Society @ FAU, Boca Raton, FL (Collaborative Support)
Renaissance Computing Institute, Chapel Hill, NC (Collaborative Support)
University of Tennessee Chattanooga, TN (Collaborative Support)
Various Jiaotong Universities in China (Collaborative Support)
North Carolina Central University, Durham, NC (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.

CSCRS is working with FHWA and other partners on planning NaTMEC 2020, originally scheduled to be held in Raleigh, NC, June 2020 (now rescheduled for June 2021 due to COVID-19). 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.

Sections 3.1-3.3 present the significant number of outputs related to CSCRS research and tech transfer.

3.1 Publications, conference papers, and presentations

Key highlights:

- CSCRS researchers recently published the article [“Integrating complex systems science into road safety research and practice, Part 2: applying systems tools to the problem of increasing pedestrian death rates”](#) in the journal *Injury Prevention*. The article aims to provide a specific example of how systems dynamics tools can increase understanding of stakeholder “mental models” and generate robust systems-based hypotheses about the escalating problem of rising pedestrian death rates in the U.S.

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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., M. Kamrani , & A. Khattak, Examining the role of pre-crash driving volatility in contributing to crash intensity, <i>Accident Analysis and Prevention</i> , 132, 2019, 105226.
Arvin, R., Kamrani, M., & Khattak, A. J. (2019). “How instantaneous driving behavior contributes to crashes at intersections: Extracting useful information from connected vehicle message data”. <i>Accident Analysis & Prevention</i> , 127, 118-133.
Azad, M., Hoseinzadeh, N., Brakewood, C., Cherry, C. R., & Han, L. D. (2019). Fully Autonomous Buses: A Literature Review and Future Research Directions. <i>Journal of Advanced Transportation</i> , 2019.
Boggs, A. M., Arvin, R., & Khattak, A. J. (2020). Exploring the who, what, when, where, and why of automated vehicle disengagements. <i>Accident Analysis & Prevention</i> , 136, 105406.
Boggs, A. M., Wali, B., & Khattak, A. J. (2020). Exploratory analysis of automated vehicle crashes in California: a text analytics & hierarchical Bayesian heterogeneity-based approach. <i>Accident Analysis & Prevention</i> , 135, 105354.
Combs, T, McDonald, N, & Leimenstoll, W. (2020). Evolution in Local Traffic Impact Assessment Practices, <i>Journal of Planning Education and Research</i> . Online first.
Dong C., A. Khattak, D. Clarke, K. Xie, Exploring the factors that contribute to the injury severities of vulnerable roadway users involved crashes, <i>International Journal of Injury Control and Safety Promotion (NICS)</i> , 26:3, 2019, pp. 302-314.
Dumbaugh, E, Merlin, L. and Saha, D. (2020, January). Towards Safe Systems: Traffic Safety, Cognition, Cognition, and the Built Environment. <i>Journal of Planning Education and Research</i> .
Hezaveh, A. M., Arvin, R., & Cherry, C. R. (2019). “A geographically weighted regression to estimate the comprehensive cost of traffic crashes at a zonal level”. <i>Accident Analysis & Prevention</i> , 131, 15-24.
Hezaveh, A.M., T. Nordfjærn, J. Everett, C. Cherry (2019) The correlation between education, engineering, enforcement, time of day and self-reported seat belt use; incorporating the spatial effect. <i>Transportation Research Part F</i> .
Hoque, M. A., Rios-Torres, J., Arvin, R., Khattak, A., & Ahmed, S. (2020). The extent of reliability for vehicle-to-vehicle communication in safety critical applications: an experimental study. <i>Journal of Intelligent Transportation Systems</i> , 1-15.
Hoseinzadeh, N., Arvin, R., Khattak, A. J., & Han, L. D. (2020). Integrating safety and mobility for pathfinding using big data generated by connected vehicles. <i>Journal of Intelligent Transportation Systems</i> , 1-17.
Li, T., Hui, F., Liu, C., Zhao, X., & Khattak, A. J. (2020). Analysis of V2V Messages for Car-Following Behavior with the Traffic Jerk Effect. <i>Journal of Advanced Transportation</i> , 2020.
Liu J., A Khattak, L Han, & Q. Yuan. (2019). How much information is lost when sampling driving behavior data? Indicators to quantify the extent of information loss, <i>Journal of Intelligent and Connected Vehicles</i> .
Liu, J., Khattak, A. J., Li, X., & Fu, X. (2019). A spatial analysis of the ownership of alternative fuel and hybrid vehicles. <i>Transportation Research Part D: Transport and Environment</i> , 77, 106-119.
Liu, J., Khattak, A. J., Li, X., Nie, Q., & Ling, Z. (2020). Bicyclist injury severity in traffic crashes: A spatial approach for geo-referenced crash data to uncover non-stationary correlates. <i>Journal of Safety Research</i> .
Merlin, L., C. Cherry, A.M. Hezaveh, E. Dumbaugh (2019) Residential Accessibility’s Relationships with Crash Rates per Capita. <i>Journal of Transport and Land Use</i> .

Naumann, R., K. Shiue, A.M. Hezaveh, S. Marshall, C. Cherry (2019) Connections between opioids and road injury: linkage of prescription monitoring and crash databases. <i>American Journal of Preventive Medicine</i>
Naumann, R.B., Kuhlberg, J., Sandt, L., Heiny, S., Apostolopoulos, Y., Marshall, S.W., & Lich, K.H. (2020). Integrating complex systems science into road safety research and practice, Part 1: Review of formative concepts. <i>Injury Prevention</i> , 26(2), 177-183.
Naumann, R.B., Kuhlberg, J., Sandt, L., Heiny, S., Kumfer, W., Marshall, S.W., & Lich, K.H. (2020). Integrating complex systems science into road safety research and practice, Part 2: Applying systems tools to the problem of increasing pedestrian death rates. <i>Injury Prevention</i> . [Epub ahead of print]. doi: 10.1136/injuryprev-2019-043316.
Naumann, R.B., Shiue, K., Hezaveh, A.M., Marshall, S.W., & Cherry, C.R. (2020). Connections between opioids and road injury: linkage of prescription monitoring and crash databases. <i>American Journal of Preventive Medicine</i> , 58(3), 461-466.
Saha, D. Dumbaugh, E., and Merlin, L. (2020, January). A Theoretical Framework to Understand the Role of Built Environment on Traffic Crashes: Implications for Transportation Planning and Policy Practice. <i>Journal of Safety Research</i> .
University of California Institute of Transportation Studies (2019, December). Research Synthesis for AB 2363 Zero Traffic Fatalities Task Force, California State Transportation Agency.
Wali B., A. Khattak, & N. Ahmed, Examining correlations between motorcyclist’s conspicuity, apparel related factors and injury severity score: Evidence from new motorcycle crash causation study, <i>Accident Analysis & Prevention</i> , 131, 2019, pp. 45-62.
Wali B., A. Khattak, & T. Karnowski, Exploring Microscopic Driving Volatility in Naturalistic Driving Environment Prior to Involvement in Safety Critical Events - Concept of event-based driving volatility, <i>Accident Analysis & Prevention</i> , Volume 132, November 2019, 105277, pp. 1-25.
Wali, B., & Khattak, A. J. (2020). Harnessing ambient sensing & naturalistic driving systems to understand links between driving volatility and crash propensity in school zones—A generalized hierarchical mixed logit framework. <i>Transportation Research Part C: Emerging Technologies</i> , 114, 405-424.
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. <i>Accident Analysis & Prevention</i> , 131, 45-62.
Zhao, X., S. Jing, F. Hui, R. Liu, & A. Khattak, Dedicated Short Range Communication DSRC-based rear-end collision warning system— An error-component safety distance model and field test, <i>Transportation Research Part C: Emerging Technologies</i> , Volume 107, 2019, pp. 92-104.
Presentations
Harmon, K.J. (2019, November). Green devil assembly: e-scooters, safety, & sustainability. [Panel]. Duke University, Durham, NC.
Harmon, K.J. (2020, January). The epidemiology of e-scooter injuries: What we know, what we don’t, and what we are doing about it. [Presentation]. 2020 SAE International Government/Industry Meeting. Washington, DC.
Person-Jones, K., Harmon, K.J., Northam, W.T., Quinsey, C. (2019, December). Children struck by motor vehicles: factors associated with subsequent head injury. [Presentation]. 48th Annual Meeting of the AANS/CNS Section on Pediatric Neurological Surgery. Scottsdale, AZ.
Books or other non-periodical, one-time publications
Cummings, M., & S. Li, (2019) "Machine Learning Tools for Informing Transportation Technology and Policy," HAL2019-02.

3.2 Policy Papers

- Boggs, A.M., Jerome, Z., Khattak, A.J., Shay, E. “Readiness for Automation: A Synthesis and Implications of Automated Vehicle-Related Enacted State Legislation,” in review.
- Cummings, M.L, “Rethinking the maturity of artificial intelligence in safety-critical settings,” AI Magazine, in review.

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

- Duke’s [Simulator of Humans and Automation in Dispatch Operations](#) (SHADO), which allows users to prototype dispatch operations of transportation systems.
- A traffic safety video, [“Where did the rules of the road come from?”](#) was published to the UCB SafeTREC YouTube channel highlighting CSCRS Road Safety Fellow Eva Villaincourt’s research in February 2020. The video was also featured on Streetsblog USA and The Urbanist.
- The [National Pedestrian and Bicycle Safety Data Clearinghouse](#) (a product of [R14](#)) was visited by 417 unique visitors during this period.
- The CSCRS website, www.roadsafety.unc.edu, was regularly updated with new information regarding research, educational and professional development research, resources, and opportunities. The site had around 2,200 unique visitors from all over the U.S. and the world during this period.

3.4 New methodologies, technologies or techniques

CSCRS helped develop the now finalized standard, [J3194, Taxonomy and Classification of Powered Micromobility Vehicles](#).

Other new technologies or techniques are documented in the final reports published by each completed project and highlighted in a “Research 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

As part of [Project R26](#), created a [list of e-scooter fatalities \(2018-2020\)](#).

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 adoptions, use or reference to CSCRS products, or influence on national or state research agendas (see Section 4.6)

4.1 Increased understanding and awareness of transportation issues

CSCRS researcher Michael Clamann, UNC HSRC, was been selected as a 2019 Science Policy Fellow for the Human Factors and Ergonomics Society (HFES).

CSCRS staff engaged with high-profile media outlets. Examples:

- Tabitha Combs, UNC DCRP, was quoted in *Car and Driver* in March 2020. [The article](#) describes a database Combs created to catalog local COVID19 responses to expand access to safe walking and bicycling opportunities while supporting social distancing guidelines.
- Laura Sandt and Katie Harmon, UNC HSRC, were featured in [an article](#) on Medium regarding e-scooter safety in January 2020.
- Laura Sandt was interviewed for ABC11 News in October 2019 regarding [crashes involving pedestrian deaths](#).
- Offer Grembek was interviewed for the *San Diego Union Tribune* in 2019, published on January 21, 2020.
- Julia Griswold, UCB, was interviewed by Phillip Reese of *California Healthline* for “Bike Fatalities Hit 25-Year High in California, Rise Nationwide” published on January 28, 2020.
- Missy Cummings and her team at Duke were featured in a *Mirage News* story on [North Carolina autonomous technologies](#) in October 2019.
- Missy Cumming also participated in these media pieces:
 - November 2019 PBS special, [“Look Who’s Driving,”](#) October 2019
 - *Shift* podcast (sponsored by *Automotive News*), [“AV testing and levels of autonomy \(Episode 18\),”](#) November 2019

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.

4.2 Passage of new policies, regulation, rulemaking or legislation

In October 2019, CSCRS team members held the UNC-Chapel Hill Safe Systems Transportation Research Forum, a day devoted to meeting with U.S. Congressional staffers about important transportation safety research at UNC. CSCRS staff helped coordinate the event, and the staffers will meet with a variety of CSCRS researchers and other related campus departments including computer science faculty. Staffers learned about several CSCRS research areas including ped/bike issues, data evaluation, occupant protection and more. [This video](#) provides an overview of the successful event.

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.

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

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

CSCRS's university programs and student activities continue to attract new students to each campus and enlarge the pool of future professionals that are invested in improving safety. The presentations and other tech transfer activities implemented 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 were integrated into a [national curriculum \(module 19\) related to pedestrian and bicycle planning and design](#), funded by the FHWA Office of Safety. This course has been shared with 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.

CSCRS continues to see a greater uptake in the field of Safe Systems concepts and research emerging from our Center activities. For example, the newly finalized [Washington State Strategic Highway Safety Plan 2019](#) includes references to systems concepts (and images from our researcher presentations from previous webinars) and an entire chapter on Safe Systems. Many other states (including Louisiana, South Carolina, Washington, and Oregon) and regions (including Montgomery County, MD) are soliciting technical assistance in the development of systemic approaches and implementing the guidance developed by CSCRS staff. CSCRS leadership through the Road to Zero Coalition has directly influenced Safe Systems literature developed and shared widely by the Institute of Transportation Engineers, and our research reports are integrated into their Safe Systems [professional development resource hub](#).

As part of [Project R26](#), researchers proposed a new set of standardized e-scooter injury codes to the National Center for Health Statistics, which were officially accepted in early 2020 and will be included in the new International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). These official coding guidelines are used by hospitals around the world and will result in a more standardized method for classifying injuries involving emerging micromobility devices, which will enable safety researchers and health clinicians to develop more comparable assessments of injury frequency and severity across geographies if the codes are used

correctly. The [guidance we issued for coding e-scooter injuries with existing codes](#) has been adopted in several regions, including statewide in North Carolina and in cities in California, Texas, and others.

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 (see Section 5.1).
- 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 (see Section 5.2).

5.1 Impact on the effectiveness of the transportation system

Findings from CSCRS research projects provided insights into Safe Systems practices and evidence of effectiveness around the world. CSCRS continues seeing engagement with decision-makers in the transportation safety realm and adoption of Safe Systems methods and tools developed by our consortium members (described in Section 4.6). The ability to estimate specific impacts of these policy changes will require time and additional resources, but we anticipate positive safety effects based on prior research findings and the experiences in other countries.

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 stakeholders around the country, creating the channels needed for implementation. For example, Becky Naumann, Kristen Hassmiller Lich, and Laura Sandt, all with UNC, provided support and materials, and consulted with planners of a Side Guard Task Force Meeting aimed to convene a diverse range of stakeholders to collaboratively discuss strategies to solve the side underride crash problem. UNC guided the group to utilize a systems lens when considering contributors to underride crashes and potential policy solutions. The in-person meeting was canceled due to social-distancing, but a virtual version was held on April 17, 2020.

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. Evidence of our impact on the body of scientific knowledge can be found through appointments that recognize our expertise and provide opportunities to influence scientific discourse. New appointments this reporting period include:

- Laura Sandt was appointed incoming chair of the TRB Pedestrian Committee (ACH10).
- Asad Khattak, UTK, was elected as a Board Member of TennSMART, a Tennessee-based consortium of transportation CEOs, research institutions and government officials. It is leading transportation research by providing information-sharing platforms for organizations and individuals seeking to advance transportation technology and bring efficient new modules to market. In addition, he is working with Tennessee DOT and other Tennessee university on connected and automated vehicle technologies, and he served on the advisory board of TEMA, the Centre for Mechanical Technology and Automation at University of Aveiro in Portugal.
- Asad Khattak also served as: Editor-in-Chief of Journal of Intelligent Transportation Systems, Associate Editor of International Journal of Sustainable Transportation, Special Advisor to the UT-based and SCI-

indexed Journal of Transportation Safety & Security, and Board member of Analytical Methods in Accident Research.

5.4 Impact on transportation workforce development

CSCRS's continuing 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.

For example, during this reporting period, CSCRS's team launched the NCDOT Center of Excellence in Advanced Transportation Technology, in collaboration with other NC UTCs and state universities. The new Center is leveraging multi-disciplinary skills and knowledge towards a long-term view and cutting-edge approaches in transportation research and implementation, creating opportunities for new projects, partnerships and work focused on Safe Systems approaches to transportation safety. In a related effort, members of the CSCRS team were awarded a grant to manage the 2020 NCDOT Research & Innovation Summit in fall 2020. This annual event contributes to workforce development and brings together different stakeholders to discuss innovative research, technologies, and other issues. We will continue our outreach via webinars, conferences (when safe), and other campus-specific seminars.

6. Changes/Problems

6.1 Changes in approach and reasons for change

The COVID-19 pandemic has impacted CSCRS transportation research and engagement activities due to social distancing, travel restrictions, and other factors. CSCRS has quickly adapted to these changes and all university courses have moved to distance-learning classes, with changes to student assignments and grading.

6.2 Actual or anticipated problems or delays

A key example of a COVID-19 related delay is the postponement of the June 2020 NaTMEC conference. CSCRS staff are currently working on plans to move the meeting to June 2021 and exploring options to offer session content in a webinar series starting fall 2020. Preliminary survey results indicate that moving the meeting to 2021 will likely result in reduced attendance and possible reduced participation from sponsors/exhibitors. Other examples:

- Cancellation or postponement of STEM projects due to school closures.
- Cancellation or postponement of in-person training, conferences, and workshops.
- Delay or cancellation of state or local match-funded projects.
- Participation in CUTC events cancelled/postponed.

6.3 Changes that have a significant impact on expenditures

Nothing to report at this time, though costs associated with the NaTMEC conference postponement are pending.

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

The pandemic has caused temporary freezes on data collection requiring close contact with human subjects, such as simulator-based research and intercept-survey studies, and university requirements for IRB application resubmission/reapproval. In addition, there have been temporary freezes on data collection requiring close contact with research team members, such as in-vehicle experiments and automated vehicle testing.

7. Special Reporting Requirements

Nothing to report. This entire report is available on the [CSCRS website](#).