



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.

SAPR #2 reporting period: 10/1/20 – 3/31/21

Grant No. 69A3551747113

DUNS: 608195277

EIN: 56-600-1393

Project/grant period: 11/30/16 - 9/30/22

Submitted to:

Robin Kline, Grant Manager
University Transportation Centers Program (RDT-30)
Office of the Assistant Secretary for Research and Technology
U.S. Department of Transportation
1200 New Jersey Avenue, SE, Work Station E33-466
Washington, DC 20590-0001

Submitted by:

Collaborative Sciences Center for Road Safety
Laura Sandt Ph.D., Center Director

sandt@hsrc.unc.edu

919-962-2358

Submission date: April 30, 2021

Table of Contents

1. Accomplishments.....	3
1.1 What are the major goals and objectives of the program?.....	3
1.2 What was accomplished under these goals?.....	3
1.3 What opportunities for training and professional development has the program provided?.....	9
1.4 How have the results been disseminated?.....	9
1.5 What do you plan to do during the next reporting period?.....	9
2. Participants and Collaborating Organizations.....	11
2.1 What organizations have been involved as partners?.....	11
2.2 Have other collaborators or contacts been involved?.....	12
3. Outputs.....	12
3.1 Publications, conference papers, and presentations.....	12
3.2 Policy Papers.....	14
3.3 Website(s) or other Internet site(s).....	14
3.4 New methodologies, technologies, or techniques.....	14
3.5 Inventions, patent applications, and/or licenses.....	14
3.6 Other products.....	14
4. Outcomes.....	14
4.1 Increased understanding and awareness of transportation issues.....	15
4.2 Passage of new policies, regulation, rulemaking, or legislation.....	15
4.3 Increases in the body of knowledge.....	15
4.4 Improved processes, technologies, techniques, and skills in addressing transportation issues.....	16
4.5 Enlargement of the pool of trained transportation professionals.....	16
4.6 Adoption of new technologies, techniques, or practices.....	16
5. Impacts.....	17
5.1 Impact on the effectiveness of the transportation system.....	17
5.2 Impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company.....	17
5.3 Impact on the body of scientific knowledge.....	17
5.4 Impact on transportation workforce development.....	18
6. Changes/Problems.....	19
6.1 Changes in approach and reasons for change.....	19
6.2 Actual or anticipated problems or delays.....	19
6.3 Changes that have a significant impact on expenditures.....	19
6.4 Significant changes in use or care of animals, human subjects, and/or biohazards.....	19
7. Special Reporting Requirements.....	19

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:

- Selected 12 new research projects.
- Presented and/or participated in approximately [105 lectern and poster sessions, panel discussions, and committee meetings](#) as part of the virtual 2021 Transportation Research Board (TRB) Annual Meeting.
- Hosted/managed the virtual fall [2020 North Carolina Department of Transportation \(NCDOT\) Research & Innovation Summit](#), attended by 356 people.
- Continued research and training activities exploring how the COVID-19 pandemic has impacted transportation safety.
- Continued the new [CSCRS webinar series](#).
- Continued significant planning activities for the National Travel Monitoring Exposition and Conference ([NaTMEC](#)) event, as well as for the [NaTMEC webinar series](#) in conjunction with the Institute of Transportation Engineers (ITE).
- Chose the 2020 CSCRS Student of the Year, [Benjamin Bauchwitz of Duke University](#).
- Held a CSCRS Advisory Board meeting in December 2020.
- Concluded several [CSCRS research projects](#), with several more nearing completion.
- Generated almost 30 CSCRS research-related peer-reviewed publications, multiple presentations in addition to those related to the TRB Annual Meeting, a new website, and other new resources including an SAE standard.
- Taught 22 transportation safety-related university courses and engaged hundreds of undergraduate, graduate, and doctoral students in CSCRS research, education, and professional development projects.

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.

The following projects are near completion:

- [R21](#): A systems approach to pedestrian safety, Phase II: Examining congestion pricing policies
 - PI: Becky Naumann, UNC Injury Prevention Research Center (IPRC) / Co-PIs: Kristen Hassmiller Lich, UNC Gillings School of Global Public Health; Laura Sandt, UNC Highway Safety Research Center (HSRC); and Steve Marshall, UNC IPRC
- [R22](#): Using integrated data to examine characteristics related to pedestrian and bicyclist injuries
 - PI: Katie Harmon, UNC HSRC / Co-Investigator: Laura Sandt, UNC HSRC
- [R24](#): Developing a framework to combine the different protective features of a Safe System
 - PI: Offer Grembek, University of California, Berkeley (UCB)

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

- CSCRS continued its [webinar series](#) through this reporting period with 2 new webinars:
 - Strengthening Existing and Facilitating New Vision Zero Plans, Dec. 8, 2020 (64 participants)
 - Crash Risk for Low-Income and Minority Populations: Identifying At-risk Cohorts and Underlying Risk Factors, Feb. 24, 2021 (84 participants)Planning continued for multiple CSCRS webinars to take place in the next reporting period.
- The virtual [NCDOT Research & Innovation Summit](#) was held Oct. 13-14, 2020. The event, managed by CSCRS staff and featuring CSCRS researchers as presenters, provided a platform to bridge UTC research into state and local practice.
- Planning activities for [NaTMEC](#) included program development, building a registration system, website updates, development of sponsorship packages, and more.
- CSCRS also continued the [joint webinar program](#) between NaTMEC and ITE with 3 new webinars:
 - Getting at Pedestrian and Bicyclist Exposure from Three Different Approaches, Nov. 16, 2020 (261 participants)
 - Validating and Leveraging Probe Data to Understand Travel Patterns and Identify Candidate Operations Projects, Jan. 20, 2021 (223 participants)
 - Micromobility Data Collection and Processing – Considerations for Policy Regulation and Data Privacy while Using the Data Meaningfully, Mar. 15, 2021 (approx. 77 participants)

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

- CSCRS members of the [Road to Zero Coalition](#) leadership committee continued their work with that group. CSCRS researcher Wes Kumfer led the Road to Zero working group *Connecting Prioritizing Safety with Transportation Equity*, which met regularly during this period to compile information to be disseminated on the organization’s website.
- CSCRS continued to participate in a Safe Systems Consortium, a working group of CSCRS researchers and advisory board members and other stakeholders that met regularly in February to review the evidence discuss principles of a systems approach to road safety. CSCRS director Laura Sandt was invited to present to the consortium on February 16, 2021.

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

- CSCRS continues to engage with multiple agencies, particularly in consortium member states and cities, to determine the needs of state and local governments in implementing Safe Systems. For specific projects bridging research to local practice, see Objective 2.3.

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.

The following projects are either complete or near completion:

- [R9](#): Concept of operations for an autonomous vehicle dispatch center and [R10](#): Machine learning tools for informing transportation technology design

- PI: Missy Cummings, Duke
- [R11](#): The influence of the built environment on crash risk in lower-income and higher-income communities
 - PI: Yanmei Li, Florida Atlantic University (FAU) / Co-Investigator: Eric Dumbaugh, FAU
- [R12](#): Linking crash and post-crash data
 - PI: David Ragland, UCB / Co-Investigator: Chris Cherry, University of Tennessee, Knoxville (UTK)
- [R13](#): Shared mobility services and their connection to roadway fatalities
 - PI: Noreen McDonald, UNC Department of City & Regional Planning (DCRP) / Co-Investigator: Tabitha Combs, UNC DCRP
- [R15](#): Integrating spatial safety data into transportation planning processes and [R16](#): Opioids at the health and transportation safety nexus
 - PI: Chris Cherry, UTK / Co-Investigator: Louis Merlin, FAU
- [R18](#): Examining potential safety risks associated with the introduction of light rail transit
 - PI: Eric Dumbaugh, FAU / Co-Investigator: Candace Brakewood, UTK
- [R20](#): Investigating the vulnerability of motorcyclists to crashes and injury
 - PI: Asad J. Khattak, UTK / Co-Investigator: Arthur Goodwin, UNC HSRC
- [R25](#): Advancing crash investigation with connected and automated vehicle data
 - PI: Michael Clamann, UNC HSRC / Co-Investigator: Asad Khattak, UTK
- [R30](#): Urban freight and road safety: Trends and innovative strategies
 - PI: Noreen McDonald, UNC DCRP
- [R31](#): Crash risk for low-income and minority populations: An examination of at-risk population segments and underlying risk factors
 - PI: Diana Mitsova, FAU / Co-Investigator: Eric Dumbaugh, FAU
- [R32](#): Applying civic innovation methods to advance safety education: A pilot program
 - PI: Eric Dumbaugh, FAU

Work continued on the following projects:

- [R26](#): Understanding micromobility safety behavior and standardizing safety metrics for transportation system integration
 - PI: Chris Cherry, UTK / Steve Marshall, Becky Naumann, UNC IPRC, and Susan Shaheen, UCB
 - A survey research tool was being developed.
- [R27](#): Safety testing for connected and automated vehicles through physical and digital iterative deployment
 - PI: Subhadeep Chakraborty, UTK / Co-Investigator: Asad J. Khattak, UTK, Co-Investigator: Mary (Missy) Cummings, Duke University
 - Two interim reports were created and posted. A Phase II project has been approved for funding.
- [R28](#): Reducing motorcyclist injuries: Engaging stakeholders to apply evidence-based countermeasures
 - Jerry Everett, UTK / Co-PI: Asad Khattak, UTK
 - The research team is working to update 2015 TN Motorcycle Strategic Safety Plan (MSSP). The effort will translate CSCRS motorcycle research into practice at the state level.
 - Collected and analyzed data on determinants of crash severity for crashes between vulnerable road users and commercial vehicles. Predicted factors contributing to crash severity, analyzed time series, and mapped crashes, comparing to population density and freight-producing employment.

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

The following projects are either complete or near completion:

- [R19](#): Developing a taxonomy of human errors & violations that lead to crashes

- PI: Asad J. Khattak, UTK / Co-Investigator: Eric Dumbaugh, FAU
- [R23](#): Driver impairment detection and safety enhancement through comprehensive volatility analysis
 - PI: Asad Khattak, UTK /Subhadeep Chakraborty, UTK, and Michael Clamann, UNC HSRC

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.

The following projects are either complete or near completion:

- [R8](#): Development of resources to guide parents in helping teens learn to drive
 - PI: Arthur Goodwin, UNC HSRC
- [R17](#): Strengthening 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
- [R22](#): Using integrated data to examine characteristics related to pedestrian and bicyclist injuries
 - PI: Katie Harmon, UNC HSRC / Co-Investigator: Laura Sandt, UNC HSRC

Work continued on the following project:

- [RR2](#): US Vision Zero implementation
 - PI: Kelly Evenson, UNC Gillings School of Public Health / Co-I’s: Seth LaJeunesse, UNC HSRC, and Becky Naumann, UNC IPRC
 - 10 interviews completed, transcription and coding of themes completed, analysis ongoing.

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. CSCRS researchers presented [lectern and poster sessions and panel discussions](#) as part of the virtual 2021 Transportation Research Board (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

Bauchwitz, B. & Cummings, M.L. 2020. Driver Monitoring System Reliability in an Advanced Driving-Assist System Highway Test. 2020 NCDOT Research Summit.
Cummings, M.L. Meaningful human certification instead of meaningful human control. RSIS AI Conference. Mar 2021, Singapore.
Cummings, M.L. The Good, the Bad and the Ugly of Machine Learning. 8th International Conference on Robot Intelligence Technology and Applications. Keynote Address. Dec 2020. United Kingdom.
November 2020, Missy Cummings presented “Balancing Humans & Autonomy in Safety-Critical Systems: Hype vs reality,” Harmel Lecture, Duke University.
November 2020, Missy Cummings presented “The Good, the Bad and the Ugly of Machine Learning.” Understanding the Human Impact of Machine Learning workshop at Northwestern.
December 2020, Missy Cummings presented “Future Pitfalls and Promises of Safety in Autonomous Systems,” for the Mitre speaker series.
January 2021, Missy Cummings presented “Assessing Human-Autonomy Interaction in Driving Assist Settings,” Johns Hopkins Institute for Assured Autonomy.
January 2021, Missy Cummings presented “Tesla Model 3 Reliability in Driver Alerting,” Raytheon workshop on Intelligent Vehicle Dependability & Security.
March 2021, Missy Cummings was a panelist for Virginia Tech’s seminar on Women in Transportation and presented elements of this work.
Dumbaugh, E., Saha, D., and Li, Y. “The Influence of the Built Environment on Crash Risk in Lower-income and Higher-income Communities.” ACSF 60th Annual Conference. November 7, 2020 (with Y. Li, D. Saha, and L. Merlin).
Dumbaugh, E. “A Safe Systems Approach to Addressing Pedestrian and Bicycle Crashes in Lower-Income Areas.” Broward County Bicycle and Pedestrian Advocacy Committee. March 8, 2021.
Dumbaugh, E. “Crash Risk for Low-Income and Minority Populations: Environmental Risk Factors.” Florida Pedestrian and Bicycle Safety Coalition. February 5, 2021.

	Dumbaugh, E. "Crash Risk for Low-Income and Minority Populations: At-risk Population Segments. Florida Pedestrian and Bicyclist Safety Coalition. October 20, 2020.
UCB	On October 21, 2020, Offer Grembek presented in the panel, "Air Quality, Safety & Well-Being Consequences of Transportation Impacts" in the UCLA Lake Arrowhead Symposium.
	On November 12, 2020, Offer Grembek presented in the webinar, "Exploring Pandemic-Era Data Trends and Policy Implications" as part of the Southern California Association of Governments virtual safety series, "Safe, Resilient & Locally Grown: Community-Based Traffic Safety Data & Approaches During a Pandemic."
	Praveen Vayalamkuzhi, Offer Grembek presented the poster, "Impact of Injury-Based Safety Performance Functions on Network Screening" at the Annual Transportation Research Board virtual meeting, January 27, 2021.
	On February 16, 2021 Offer Grembek presented at the Safe System Consortium @ JHU. Presentation title: Reducing Opportunities and Consequences of Errors through a Safe System Approach.
	Jonathan Kupfer, Offer Grembek presented the poster, "Traffic Safety During the COVID-19 Pandemic: A Study of How Incident-Based Traffic Safety Metrics Changed Over Time on State Highways in the San Francisco Bay Area and Los Angeles Regions" at the Annual Transportation Research Board virtual meeting, January 27, 2021.
	On February 25, 2021 David Ragland presented in "COVID-19 Effects on the Mobility of Vulnerable Populations" for a UC Institute of Transportation Studies Webinar. Approximately 80 participants were registered.
UNC	Harmon, K.J. (2020, October 14). Selected characteristics and injury patterns by age group among pedestrians treated in North Carolina emergency departments [Conference session]. Association for the Advancement of Automotive Medicine Annual Conference, Virtual. [Pre-recorded].
	Harmon, K.J. (2021, February 2). Leveraging integrated crash-emergency department visit data to explore pedestrian crash injury characteristics at the population-level [Conference Session]. SAE Government/Industry Meeting, Virtual. [Pre-recorded].
	Harmon K.J. (2021, March 18). A focus on pedestrians. In: Data linkage and motor vehicle crash injury research [Presentation]. Injury and Violence Prevention Branch, NC Division of Public Health Epidemiology Lunch & Learn, Virtual. [~30 attendees].
	Harmon, K.J. (2021, March 10). Using integrated data to examine characteristics related to pedestrian injuries [Presentation]. CSCRS Research Call, Virtual.
	LaJeunesse, S. (2021, December 3). Factors and frames that shape public discourse around road user safety [Presentation]. CSCRS Advisory Board Meeting [~12 attendees].
	LaJeunesse, S. (2021, April 27). Pedestrian distraction: Seldom seen yet loudly heard [Conference session]. 2021 Lifesavers Conference [Pre-recorded].
	Kumfer, W. (2020). Safe Systems: Vision Zero in Action. How can Greater Philadelphia communities implement a Safe Systems Approach with safety culture playing a supporting role into their transportation policies? [Presentation] Panel at Regional Issues and Solutions for Vision Zero in Greater Philadelphia conference.
	Kumfer, W. (2020). Rethinking Traffic Safety Management in the United States. Safe Systems: A Human-Centered Approach to Traffic Safety [Webinar]. 2020 Minnesota TZD Webinar Series.
	Post-doc Olivia Wang guest-lectured in CSCRS-funded PLAN 639 Complete Streets on challenges of integrating urban freight into multimodal streets; this lecture was based on ongoing work supported by R30.
	Naumann, R.B. & Hassmiller Lich, K. A Workshop on Understanding and Operationalizing the 5Rs Framework. An interactive remote workshop. November 16, 2020.
	Naumann, R.B. An introduction to systems science. UNC Injury Epidemiology presentation. March 29, 2021.
Naumann RB, Hassmiller Lich K, Guynn I. A workshop on applying Balance of Petals Mapping to injury and violence prevention. A virtual workshop. March 29, 2021.	
UTK	Shah, N., Aryal, S., Wen, Y., Cherry C. Are scooter-car crashes different from bicycle-car crashes? Accepted to International Cycling Safety Conference 2020. Lund, Sweden.
	Li, X., Hu, Q., Liu, J., Nambisan, S., Khattak, A., Lidbe, A., & Lee, H. (2020, October). Pathway analysis from community development, active travel behavior, to body mass index, and health. In APHA's 2020 VIRTUAL Annual Meeting and Expo (Oct. 24-28). American Public Health Association.

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. (Note: Many of these were transitioned to online formats.) Highlights:

- UCB Fall 2020 – Spring 2021 graduate courses:
 - Injury Prevention and Control. Instructors: David Ragland & Glenn Shor. (5 students)
 - Sustainable Mobility. Instructor: Daniel A. Rodriguez. (32 students)
 - Traffic Safety and Injury Control. Instructors: David Ragland & Offer Grembek. (5 students)
 - Transportation Sustainability. Instructor: Susan Shaheen. (38 students)

- UNC DCRP Fall 2020 – Spring 2021 graduate courses:
 - Transportation planning methods. Instructor: Noreen McDonald. (24 students)
 - Public transit. Instructor: John Tallmadge. (24 students)
 - Urban analytics. Instructor: Nikhil Kaza. (9 students)
 - Complete Streets: Instructor: Tab Combs, with CSCRS guest lecturers Seth LaJeunesse, Michael Clamann, and Wesley Kumfer. (24 students)
 - Transportation Policy. Instructor: Leta Huntsinger. (9 students)
 - Transportation Modeling. Instructor: Leta Huntsinger. (19 students)
- UNC IPRC Fall 2020 graduate course: Injury as a Public Health Problem. Instructor: Steve Marshall; guest lecture on road safety and systems thinking by Becky Naumann and the epidemiology of pedestrian injury by Seth LaJeunesse. (12 students)
- FAU Fall 2020 graduate course: Transportation Planning. Instructor: Louis Merlin. (3 students)
- FAU Fall 2020 undergraduate course: Introduction to Transportation. Instructor: Louis Merlin. (14 students)
- UTK’s Civil and Environmental Engineering faculty offered 11 transportation engineering courses during Fall 2020 – Spring 2021 covering transportation engineering I, transportation engineering II, transportation engineering lab, transportation seminar, traffic engineering: characteristics, intelligent transportation systems, analysis techniques for transportation systems I, transportation engineering I, transportation policy and economics, transportation safety, analysis techniques for transportation systems II. (Enrollment varies)

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

A key highlight of this reporting period was honoring [Benjamin Bauchwitz as the 2020 CSCRS Student of the Year](#). He was recognized during the during the Council of University Transportation Center’s (CUTC’s) virtual 2021 Awards Banquet.

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.
Duke	For R27, 1 PhD student worked on the analysis, experiment design and paper writing and presentation.
FAU	1 master’s student worked on R32.
UNC	1 master’s student from UNC DCRP was involved in R26 for UNC HSRC.
	7 UNC DCRP master’s students and 1 PhD student received funding to attend the TRB annual meeting.
	1 PhD public health epidemiology student worked on R21.
	1 PhD and 4 master’s students in public health epidemiology worked on multiple projects including RR2.
	5 master’s UNC DCRP students received training on assessments for Vision Zero.
UTK	6 graduate students worked with faculty on CSCRS research projects.
	One postdoc worked with Dr. Khattak (faculty in Civil & Env. Eng.) on CSCRS research.
	18 graduate students received funding to attend the TRB (virtual) annual meeting (2021).
	Eight (8) UTK-ITE meetings were held to discuss student activities accompanied with presentation by practicing engineers. Those activities included: <ul style="list-style-type: none"> • Twelve (12) graduate students worked with faculty on CSCRS research projects and prepared research papers for presentation/publication at the 100th Transportation Research Board (TRB) Annual Meeting. • Mr. Nitesh Shah, graduate student at UTK, won TSITE Student Paper Competition First Place. • Mr. Amin Mohammadnazar, graduate student at UTK, won TSITE Student Paper Competition Second Place. • Mr. Iman Mahdinia, graduate student at UTK, won TSITE Student Paper Competition Third Place. • Mr. Nima Hoseinzadeh, Amin Mohammadnazar and Iman Mahdinia represented the Civil and Environmental Engineering Department in the Graduate Student Senate. • Nima Hoseinzadeh and Cassidy Crossland were selected as Tickle College of Engineering Graduate Student Council.

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.

- Seth LaJeunesse mentored (Noreen McDonald advised) DCRP graduate student, Sarah Brown on her CSRS-supported master’s Project, ["Evaluating the Framing of Safety, Equity, and Policing: Responses to the Murder of George Floyd, Black Lives Matter, and Calls to Defund the Police."](#)
- UTK Civil & Environmental Engineering Department held 3 Graduate Student Researcher meetings in the Spring 2021 and Fall 2020 with graduate students to support mentoring and share best practices.
- UCB’s SafeTREC held weekly traffic safety seminars on Fridays including:
 - October 2, 2020, Julia Griswold presented "New Bicycle Level of Service Study at SafeTREC". 19 staff and students participated.
 - December 4, 2020, CSCRS Fellow Guillaume Gojard presented "Evaluating the Best arrangement for Microradars at a sensed crosswalk". 17 staff and students participated.
- CSCRS continued to update its [Jobs Board](#) of student and post-graduation opportunities.

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

- While the continuing impacts of the COVID-19 pandemic made it difficult to engage in K-12 education activities during this period, CSCRS continued to explore new opportunities, with plans to get involved more in the next reporting period. In particular, UTK’s [teen safety program](#) has been successful in impacting young driver safety, particularly the use of the Seat Belt Convincer.

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

Myriad teaching, training, and learning opportunities have been showcased in this report (see Table 1 and 2).

1.4 How have the results been disseminated?

Results are being disseminated in accordance with the CSCRS [Technology Transfer Plan](#). 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 613 followers. A recent month’s analytics showed 5,799 impressions. 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. CSCRS researchers engaged with the Advisory Board. 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 is evaluating research opportunities and needs, including those related to the pandemic, and plans to continue implementation of its strategic research agenda. The following section provides additional examples of what CSCRS plans to complete during the next reporting period (4/1/2021-9/30/21) to accomplish its goals:

- **Research activities planned:**
 - CSCRS will soon announce the funded 2021-2021 research projects. Some of these projects have held kickoffs and are already well underway:
 - [R33](#): US Regional Vision Zero Implementation (led by Kelly Evenson, UNC IPRC)
 - [R34](#): COVID-19 streets: Mobility justice and the rapid rollout of pedestrian and bicyclist improvements (led by Tab Combs, UNC DCRP)
 - [R35](#): Using Safe Systems approach to assess traffic impact and land development (led by Tab Combs, UNC DCRP)
 - [R36](#): Laying the Groundwork for a National Pedestrian Injury Surveillance System (led by Katherine Harmon, UNC HSRC)

- [R37](#): Applying AcciMap to e-Scooter Crashes: A Safe Systems approach to analyzing micromobility (led by Michael Clamann, UNC HSRC)
 - [R38](#): Assessing how private beliefs conflict with public action on Safe Systems (led by Seth LaJeunesse, UNC HSRC)
 - [R39](#): Integrating systems thinking tools into Vision Zero and Safe Systems approaches (led by Becky Naumann, UNC IPRC)
 - [R40](#): A Safe Systems approach to motorcycle safety (led by Eric Dumbaugh, FAU)
 - [R41](#): Bike-sharing as a safety intervention: Evidence from nine large US cities (led by Eric Dumbaugh, FAU)
 - [R42](#): Advancing crash investigation with connected and automated vehicle data – Phase 2 (led by Michael Clamann, UNC HSRC)
 - [R43](#): Applying AI to data sources to improve driver-pedestrian interactions at intersections (led by Subhadeep Chakraborty, UTK)
 - [R44](#): Safety enhancement by detecting driver impairment through analysis of real-time volatilities (led by Asad Khattak, UTK)
- CSCRS is creating a web resource of videos related to Duke’s research on the safety of Tesla’s driver assist functions, as part of [R27](#).
- Completion, posting, and reporting of several current CSCRS research projects will continue.
- **Professional development activities planned:**
 - Continue planning and hold the virtual [NaTMEC](#), June 21-25, 2021, as well as 1 more installment in the NaTMEC ITE/webinar series: Emerging Equipment, Technologies, and Capabilities to Address Travel Monitoring Basics and Beyond, May 17, 2021.
 - Continue planning and hold the third annual/second virtual [NCDOT Research & Innovation Summit](#), October 5-6, 2021.
 - Continuation of the [CSCRS Webinar series](#); the next 2 webinars are:
 - Exploring the National Pedestrian and Bicycle Safety Data Clearinghouse, Apr. 28, 2021
 - Traffic crashes as seen on TV: An opportunity to reshape the dialogue around road user injury, Jul. 1, 2021
 - The [Vision Zero Leadership Team Training Institute](#), to be held in June 2021, will train multidisciplinary teams from 8 NC cities on core Vision Zero principles and coalition building best practices.
 - UNC DCRP is planning an ITE workshop on TIA and an America Walks webinar on the impacts of the COVID-19 pandemic; dates for both are date TBD.
 - UCB is planning to hold workshops on speed management in partnership with ITE and the Vision Zero Network, dates TBD.
 - UTK will expand training and connections with practice through TN Local Technical Assistance Program, housed at UTK Center for Transportation Research.
 - UTK will work on transportation issues with the TennSMART consortium board, which has members from the private sector, public sector, and academia.
- **Teaching and student enrichment activities planned:**
 - NaTMEC 2021 will incorporate activities for students, including opportunities to present.
 - Teach several college courses, as well as incorporate CSCRS research findings and opportunities into other/existing courses and seminars.
 - Participate in the [UNC Morehead Planetarium & Science Center SciMatch program](#), which pairs middle school teachers with scientists for virtual outreach visits.

- Continue work on CSCRS STEM resources page.

In addition to activities specific to the 3 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 3 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 (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)
*New this period: Safe States, Atlanta, GA (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)
Florida Department of Transportation (Collaborative Support)
*New this period: North Carolina Division of Public Health, Raleigh, NC (Collaborative Support)
North Carolina Department of Transportation, Raleigh, NC (Financial Support)
North Carolina Governor’s Highway Safety Program, Raleigh, NC (Collaborative and Financial Support)
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 Aveiro
University of Miami
University of Tennessee Chattanooga, TN (Collaborative Support)
Various Jiaotong Universities in China (Collaborative Support)
North Carolina Central University, Durham, NC (Collaborative Support)
* New this period: Tennessee Technological University, Cookeville, TN

2.2 Have other collaborators or contacts been involved?

Nothing to report beyond the table above.

3. Outputs

CSCRS included 2 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.

As mentioned, we will continue planning for NaTMEC in 2021, and will manage the 2021 NCDOT Research & Innovation Summit. 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

Presentations given during this reporting period (126 including those for TRB) are summarized in Table 1 (page 6-7-8) of this report. Following are select highlights of publications produced by CSCRS team members:

Table 4: Select CSCRS publications

Peer-Reviewed Publications
Ahmad, N., Wali, B., & Khattak, A. (2021). Exploring the effects of rider age and riding experience on motorcycle crash risk: Evidence from a case-control study. [Manuscript in preparation].
Ahmad, N., Wali, B., Khattak, A., & Dumbaugh, E. (2021). Built-environment, driving errors and violations, and crashes in naturalistic driving environment. <i>Accident Analysis & Prevention</i> . [Under review].
Arvin, R., Khattak, A. J., Kamrani, M., & Rio-Torres, J. (2021). Safety evaluation of connected and automated vehicles in mixed traffic with conventional vehicles at intersections. <i>Journal of Intelligent Transportation Systems</i> , 25(2), 170–187. https://doi.org/10.1080/15472450.2020.1834392
Arvin, R., Khattak, A. J., & Qi, H. (2021). Safety critical event prediction through unified analysis of driver and vehicle volatilities: Application of deep learning methods. <i>Accident Analysis & Prevention</i> , 151, 105949. https://doi.org/10.1016/j.aap.2020.105949
Borhani, S., Arvin, R., Khattak, A., Wang, M., & Zhao, X. (2021). Predicting drivers' reaction time in unexpected lane departure situations using brainwave signals: Application of machine learning techniques. [Manuscript in preparation].
Bauchwitz, B. & Cummings, M.L. (2021). Individual vehicle differences dominate variation in ADAS takeover alert behavior. <i>Transportation Research Record</i> . [Under review].
Beck, J. Arvin, R., Khattak, A., & Chakraborty, S. (2021). Using automated vehicle data to assess the dynamics of crashes: New insights from lidar, camera, and radar data. [Manuscript in preparation].
Carvajal, G. A., Sarmiento, O. L., Medaglia, A. L., Cabrales, S., Rodríguez, D. A., Quistberg, D. A., & López, S. (2020). Bicycle safety in Bogotá: A seven-year analysis of bicyclists' collisions and fatalities. <i>Accident Analysis & Prevention</i> , 144, 105596. doi: https://doi.org/10.1016/j.aap.2020.105596
Combs, T. S., & Pardo, C. F. (2021). Shifting streets COVID-19 mobility data: Findings from a global dataset and a research agenda for transport planning and policy. <i>Transportation Research Interdisciplinary Perspectives</i> , 9, 100322. https://doi.org/10.1016/j.trip.2021.100322
Cummings, M.L. & Bauchwitz, B. (2021). Safety implications of variability in autonomous driving assist performance. <i>IEEE Intelligent Transportation Systems</i> . [Under review].
Dannenberg, A. L., Rodriguez, D. A., & Sandt, L. S. (2021). Advancing research in transportation and public health: A selection of twenty project ideas from a U.S. research roadmap. <i>Journal of Transport & Health</i> , 21, 101021. https://doi.org/10.1016/j.jth.2021.101021
Fry, D., Mooney, S. J., Rodriguez, D. A., Caiaffa, W. T., & Lovasi, G. S. (2020). Assessing Google Street View image availability in Latin American cities. <i>Journal of Urban Health</i> , 97(4), 552–560. https://doi.org/10.1007/s11524-019-00408-7
Harmon, K. J., Hancock, K. A., Waller, A. E., & Sandt, L. S. (2020). Selected characteristics and injury patterns by age group among pedestrians treated in North Carolina emergency departments. <i>Traffic Injury Prevention</i> , 1–4. https://doi.org/10.1080/15389588.2020.1829912
Jing, S., Zhao, X., Hui, F., Khattak, A. J., & Yang, L. (2021). Cooperative CAVs optimal trajectory planning for collision avoidance and merging in the weaving section. <i>Transportmetrica B: Transport Dynamics</i> , 9(1), 219–236. https://doi.org/10.1080/21680566.2020.1845852
Khattak, A. J., Ahmad, N., Wali, B., & Dumbaugh, E. (2021). A taxonomy of driving errors and violations: Evidence from the naturalistic driving study. <i>Accident Analysis & Prevention</i> , 151, 105873. https://doi.org/10.1016/j.aap.2020.105873
Kontou, E., & McDonald, N. (2021). Associating ridesourcing with road safety outcomes: Insights from Austin, Texas. <i>PLoS ONE</i> , 16(3), e0248311. https://doi.org/10.1371/journal.pone.0248311
Li, X., Hu, Q., Liu, J., Nambisan, S., Khattak, A. J., Lidbe, A., & Lee, H. Y. (2021). Pathway analysis of relationships among community development, active travel behavior, body mass index, and self-rated health. <i>International Journal of Sustainable Transportation</i> , 1–17. https://doi.org/10.1080/15568318.2021.1872123
Mahdinia, I., Mohammadnazar, A., Arvin, R., & Khattak, A. J. (2021). Integration of automated vehicles in mixed traffic: Evaluating changes in performance of following human-driven vehicles. <i>Accident Analysis & Prevention</i> , 152, 106006. https://doi.org/10.1016/j.aap.2021.106006
McDonald, N., & Yuan, Q. (2021). Freight loading space provision: Evidence from the US. <i>Journal of Urban Planning and Development</i> , 147(2), 04021015. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000688
Mohammadnazar, A., Arvin, R., & Khattak, A. J. (2021). Classifying travelers' driving style using basic safety messages generated by connected vehicles: Application of unsupervised machine learning. <i>Transportation Research Part C: Emerging Technologies</i> , 122, 102917. https://doi.org/10.1016/j.trc.2020.102917
Mohammadnazar, A., Mahdinia, I., Ahmad, N., Khattak, A. J., & Liu, J. (2021). Understanding how relationships between crash frequency and correlates vary for multilane rural highways: Estimating geographically and temporally weighted regression models. <i>Accident Analysis & Prevention</i> . [In press].
Naumann, R. B., Sandt, L., Kumfer, W., LaJeunesse, S., Heiny, S., & Lich, K. H. (2020). Systems thinking in the context of road safety: can systems tools help us realize a true "safe systems" approach? <i>Current Epidemiology Reports</i> , 7(4), 343–351. https://doi.org/10.1007/s40471-020-00248-z
Saha, D., Dumbaugh, E., & Merlin, L. A. (2020). A conceptual framework to understand the role of built environment on traffic safety. <i>Journal of Safety Research</i> , 75, 41–50. https://doi.org/10.1016/j.jsr.2020.07.004
Salem, C., Vayalankuzhi, P., Grembek, O., Medury, A., & Ensch, J. L. (2021). Process mapping of stakeholders in transportation safety management. <i>Journal of Management in Engineering</i> , 37(1), 04020103. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000875
Sandt, L. S., Proescholdbell, S. K., Evenson, K. R., Robinson, W. R., Rodríguez, D. A., Harmon, K. J., & Marshall, S. W. (2020). Comparative analysis of pedestrian injuries using police, emergency department, and death certificate data sources in North Carolina, U.S., 2007–2012. <i>Transportation Research Record: The Journal of the Transportation Research Board</i> , 036119812093150. https://doi.org/10.1177/0361198120931504

<p>Singichetti, B., Naumann, R. B., Sauber-Schatz, E., Proescholdbell, S., & Marshall, S. W. (2020). Potential injuries and costs averted by increased use of evidence-based behavioral road safety policies in North Carolina. <i>Traffic Injury Prevention</i>, 21(8), 545–551. https://doi.org/10.1080/15389588.2020.1824066</p>
<p>Wali, B., Ahmad, N., & Khattak, A. (2021). Towards better measurement of traffic injuries – Comparison of anatomical injury measures in predicting poor clinical outcomes in motorcycle crashes. <i>Journal of Safety Research</i>. [Under review].</p>
<p>Zhang, Z., Liu, J., Li, X., & Khattak, A. J. (2021). Do larger sample sizes increase the reliability of traffic incident duration models? A case study of East Tennessee incidents. <i>Transportation Research Record: The Journal of the Transportation Research Board</i>, 036119812199206. https://doi.org/10.1177/0361198121992063</p>

3.2 Policy Papers

- [Shaping the narrative around traffic injury: A media framing guide for transportation and public health professionals](#). Produced as part of R29 project.

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

- Updated [list of e-scooter fatalities](#) (March 2021); produced as part of R26.
- Continued to update [Vision Zero Plan Guide repository](#).
- Implemented updates and improvements to the [National Pedestrian and Bicycle Safety Data Clearinghouse](#), which saw more than 500 new users during this reporting period.

3.4 New methodologies, technologies, or techniques

These new techniques were utilized this reporting period:

- UTK developed a methodology for localizing safety performance functions.
- UTK also developed an artificial intelligence-based methodology for analysis of streaming data from driver, vehicles, and roadway to enhance safety.

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

- UNC IPRC developed and adapted the following Vision Zero tools:
 - A Community Readiness Assessment Tool that can be utilized by Vision Zero communities to determine current levels of awareness, knowledge, and support for Vision Zero
 - A partnership assessment tool that can be used by Vision Zero communities to assess the sectors represented in their Vision Zero coalitions and strategic partnerships that they should prioritize.
- UTK developed the SAE Standard [J3230 \(WIP\): Kinematic Performance Metrics for Powered Standing Scooters](#).

4. Outcomes

CSCRS included 2 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 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 staff engaged with high-profile and local media outlets. Key examples:

- CSCRS researcher Tabitha Combs' work documenting and evaluating COVID-related changes to street space allocation was cited in the BBC News and Business Insider and was featured in podcasts produced by The Economist and Bike Here. More details:
 - Levin, T. (2020, December 26). [The US wasn't equipped for 2020's cycling boom. Its failures stem from a century of leaving bikes behind.](#) Business Insider.
 - The Economist. [When cities breathe out—how will they change in the post-pandemic world.](#) (Feb 2, 2021). Retrieved Feb 10, 2021. Host: Standage, T.
- Laura Sandt and Missy Cummings were highlighted in a [video](#) showing collaboration between UNC and Duke.
- Noreen McDonald, UNC DCRP, spoke on background to *The New York Times* reporter Michael Corkery about Amazon's impact on cities.
- Eric Dumbaugh, FAU, wrote "[Worst Practices: How Urban Planning Fails Vision Zero.](#)" an opinion article on the relationship between urban planning and Vision Zero efforts for the Vision Zero Cities Conference that was reprinted in Streetsblog.
- Dumbaugh also wrote "[An Urban Planning Problem: Defenses in Depth and the Need to Reconsider the Role of Urban Planning on Vision Zero](#)" for Vision Zero Cities: International Journal of Traffic Safety Innovation.
- On March 7, 2021, Offer Grembek was interviewed for "Safe Street Science" for BikeTalk.org.
- On March 18, 2021, Offer Grembek was interviewed for, "Fewer jobs, more wine: California's deadly COVID year in charts" for the Mercury News. <https://www.mercurynews.com/2021/03/18/fewer-jobs-more-wine-californias-deadly-covid-year-in-9-charts/>
- On November 20, 2020, Offer Grembek was interviewed [for "Pandemic Road Conditions lead to deadly traffic-related collisions"](#) for the Press Enterprise.
- On December 16, 2020, Offer Grembek was interviewed for "[Pandemic Paradox](#)" for BikeTalk.org.
- UTK edited the Special Issue on Cycling Safety in Journal of Transportation Safety and Security. Dozza, M., Schwab, A. L., Pietrantonio, L., & Cherry, C. R. (2020). Cycling Safety.
- UTK published special issue in Journal of Intelligent Transportation Systems, Volume 25, Issue 2 (2021) with Dr. David Yang and Dr. Donald Fisher on "Safety impacts and benefits of connected and automated vehicles: How real are they?"

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

The work coming from the R27 project on safety testing for autonomous vehicles could provide foundational information and a device prototype for the federal and state transportation regulators for policy definition related to autonomous vehicles' qualifications and safety.

4.3 Increases in the body of knowledge

CSCRS researchers supported the increase in transportation safety knowledge in a variety of ways, documented throughout this report. Beyond these, 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, even virtually, 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

As we have previously reported, we continue to see a deepening of Safe Systems and systems thinking principles, literature, and tools that emerged from CSCRS being integrated broadly into policies and practices observed at national, state, and local levels. For example, in addition to the [Washington State Strategic Highway Safety Plan 2019](#), we have observed states or cities/regions in several places—including Louisiana, South Carolina, Washington, Oregon, California, Texas, North Carolina, and Maryland—that are soliciting additional research or technical assistance in the development of systemic approaches that build upon the guidance developed by CSCRS. 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 well as their Safe Systems Action Plan.

Some projects have resulted in specific actions taken in the states in which CSCRS consortium members are performing research in collaboration with state and local partners. For example, the R-12 project designed to improve data integration has involved the California Center for Medical Outcomes (CMOD), which has initiated a follow-up project to extend matching collision and hospital data to increase knowledge of under-reporting based on crash data. CMOD has used the analytic strategy described in the CSCRS report to guide and improve their matching analyses. In project R-28, the research findings have directly supported the update of the Tennessee Motorcycle Strategic Safety Plan. Projects R-17 and RR2 have led to North Carolina GHSP-funded work to strengthen NC Vision Zero coalitions and provide support to local entities, who are utilizing the [Vision Zero Guidebook](#).

As part of [Project R26](#), in 2019 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](#)), which rolled out on October 1, 2020. These official coding guidelines are being used more routinely by hospitals around the US, resulting in a more standardized method for classifying injuries involving emerging micromobility devices and enabling safety researchers and health clinicians to develop more comparable assessments of injury frequency and severity across geographies if the codes are used correctly.

5. Impacts

CSCRS included 2 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

No start-up activities to report. CSCRS is early in the process of being able to measure the impact of the adoption of new practices described in Section 4.6. We continue working with communities to design and put into place evaluation frameworks and data collection efforts needed to estimate impacts in the future.

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:

- Becky Naumann, UNC IPRC, was invited to guest lecture on systems thinking and road safety practice at Clemson University and to consult on best practice systems thinking tools that can be utilized by multidisciplinary teams working to address transportation safety-related problems.
- Clemson University's Master of Transportation Safety and Administration (MTSA) trains road safety professionals from across the US and is using/studying 3 CSCRS-supported papers:
 - Integrating complex systems science into road safety research and practice, Part 1: Review of formative concepts
 - Integrating complex systems science into road safety research and practice, Part 2: Applying systems tools to the problem of increasing pedestrian death rates
 - Systems thinking in the context of road safety: can systems tools help us realize a true "Safe Systems" approach?
- Katherine Harmon & Nancy Pullen-Seufert, both of UNC HSRC, were asked to consult with Dr. Stan Miller at the Jefferson Center for Injury Research & Prevention relating to crash-health data linkage. This conversation was based on R22 results presented during the CSCRS monthly research call.
- Kelly Evenson, Katie Harmon, and Laura Sandt, all of UNC, met with representatives of WalkBoston to discuss safety-related tools to assess the hospital environment as part of Vision Zero efforts.

- CSCRS researcher Wes Kumfer, UNC HSRC, led the Road to Zero working group Connecting Prioritizing Safety with Transportation Equity.
- Eric Dumbaugh, FAU, was invited to provide recommendations to Broward County, FL, on how to leverage the recently adopted 1 cent transportation sales tax to advance traffic safety, and was invited to give 2 lectures to the State of Florida's Pedestrian and Bicyclist Safety Coalition on the safety needs of lower-income and minority populations.
- Offer Grembek, UCB, served as a member of the following organizations:
 - Steering Committee, California Strategic Highway Safety Plan
 - Bay Area Vision Zero Working Group
 - Metropolitan Transportation Commission (MTC)
 - Road to Zero Safe System Implementation Working Group
 - Institute of Transportation Engineers
- Asad Khattak, UTK, continued serving as a Board Member of TennSMART, a Tennessee-based consortium of top transportation CEOs, research institutions, and government officials. It provides information-sharing platforms for organizations and individuals seeking to advance transportation technology and bring efficient new modules to market. Dr. Khattak's leadership activities also include:
 - Matching projects that involve working with the Tennessee Department of Transportation (TDOT) on implementing Highway Safety Manual procedures in Tennessee, providing matching funds.
 - Working with TDOT on connected and automated vehicle technologies; project also involves working collaboratively with faculty from UTK Mechanical Engineering Department, Electrical Engineering Department at University of Tennessee-Chattanooga.
 - Serving as a member of TRB's Standing Committee on User Information Systems and the Standing Committee on Traveler Behavior and Values.
 - Serving as editor-in-chief of the Journal of Intelligent Transportation Systems and associate editor of the International Journal of Sustainable Transportation.
- Chris Cherry, UTK, has chaired or is a member of the following committees:
 - SAE's Powered Micromobility Committee
 - Bird's Global Safety Advisory Board
 - TRB's Emerging Vehicles for Low Speed Transportation joint subcommittee
- Jerry Everett, UTK, served as the coordinator of the Tennessee Travel Demand User's Group, which aims to improve modeling and forecasting capabilities within the state. The group is a collaboration between the universities, TDOT, FHWA, MPOs, consultants, and other organizations.
- Subhadeep Chakraborty, UTK, served as a Member of IEEE.

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.

CSCRS's continuing work with the [NC Transportation Center of Excellence in Advanced Technology Safety and Policy](#), in collaboration with other NC UTCs and state universities, leverages 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, the 2020 NCDOT Research & Innovation Summit involved workforce development and brought together different stakeholders to discuss innovative research, technologies, and other issues. We will continue our outreach via webinars, virtual events, and other campus-specific seminars.

6. Changes/Problems

6.1 Changes in approach and reasons for change

While the COVID-19 pandemic continued to impact CSCRS transportation research and engagement activities due to social distancing, travel restrictions, and other factors, CSCRS continued adapting to these changes throughout this reporting period. CSCRS continued opportunities and partnerships related to COVID research. UNC-HSRC's [COVID-19 Mobility and Health Impacts Study](#), a partnership with UNC's Gillings School of Global Public Health, Cecil G. Sheps Center for Health Services Research, Odum Institute for Research in Social Science, and the NC State University Department of Statistics.

Planning continued for CSCRS-managed virtual events, such as NaTMEC. Plus, CSCRS researchers and staff continued to participate in virtual meetings and events, notably the TRB Annual Meeting, CUTC meetings, and more, that were previously held in-person.

6.2 Actual or anticipated problems or delays

Key examples of COVID-19 related disruptions that occurred during this reporting period include:

- Cancellation or postponement of in-person training, conferences, and workshops.
- Issues related to in-person data collection (see section 6.4).
- International student recruitments have been affected partly due to the closure of U.S. missions abroad. This is envisioned to be offset by greater efforts for recruitment of domestic students.
- Delays in CSCRS communications and processing of final reports due to staff limitations or reduced staff/student hours due to COVID-19 related family or health needs.
- Opportunities for engagement with K-12 continued to be sparse due to cancellation or postponement of STEM projects due to school closures.
- Delay or cancellation of state or local match-funded projects.

6.3 Changes that have a significant impact on expenditures

Costs associated with rescheduling and reformatting the NaTMEC conference to a virtual event in June 2021.

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

The pandemic 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. School-based STEM activities and other community-based events have been rescheduled or put on hold as schools were closed or operate virtually and communities continue social distancing efforts.

7. Special Reporting Requirements

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