



**SEMI-ANNUAL PROGRESS REPORT FOR
UNIVERSITY TRANSPORTATION CENTERS**

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Signature of Submitting Official: 

1. Accomplishments

1.1 What are the major goals of the program?

1.1.1 Research

Safety Research Using Simulation (SAFER-SIM) is a Tier 1 University Transportation Center (UTC) with a research priority of promoting safety. The UTC includes five institutions: University of Iowa (lead), University of Wisconsin Madison, University of Massachusetts Amherst, University of Central Florida, and University of Puerto Rico Mayaguez. SAFER-SIM leverages research from a range of disciplines to study how road users, roadway infrastructure, and new vehicle technologies interact and interface with each other. The center uses microsimulation and state-of-the-art human in the loop driving, bicycling, pedestrian simulators to develop solutions for safer transportation in the US and globally.

SAFER-SIM works to promote safety by addressing these research topic areas:

- Automated Vehicles Technology
- Connected Vehicles Technology
- Vulnerable Road Users
- Roadway Infrastructure Design
- Distributed Simulation Technology

1.1.2 Leadership Development

SAFER-SIM sites are recognized nationally and internationally as leaders in transportation safety research with a distinction in applying simulation to safety problems. Developing the next generation of leaders in safety research and simulation is a key function of our work. Our center will accomplish this using seminars, symposia, web-based discussions, and other opportunities to share our expertise.

1.1.3 Education and Workforce Development

SAFER-SIM will educate the next generation of safety professionals, building the transportation workforce for tomorrow, and fostering a vibrant community of researchers.

1.1.4 Technology Transfer

SAFER-SIM will establish and promote opportunities for research collaboration with industry, state and local governments, and other organizations with an interest in transportation safety. The center will promote commercialization activities and will provide highly trained scientists for the industrial workforce

1.1.5 Collaboration

Strong collaboration efforts will take place across consortium sites, within consortium sites, and with government agencies and industry partners. Collaboration plays an important role in reaching goals in all areas at our center.

1.1.6 Diversity

SAFER-SIM is committed to promoting diversity through student involvement on research projects and to reaching underrepresented populations in community outreach.

1.2 What was accomplished under these goals?

1.2.1 Research

The center has funded ninety-nine (99) projects under the FAST Act. Thirty-nine (39) projects remain active, and sixty (60) projects are complete. Multi-institution collaborative projects are now counted separately for each institution. All project information can be found on the research tab of the [SAFER-SIM website](#) and active projects are listed on the Transportation Research Board's [Research in Progress \(RIP\) Database](#) though information is still being gathered for posting for a few projects.

Year	Funded/Inactive	Projects Active	Projects Complete	Total Projects
Y1	0	0	14	14
Y2	0	0	16	16
Y3	0	2	17	19
Y4	0	5	18	23
Y5	0	15	3	18
Y6	0	8	1	9
Total	0	30	69	99

Five (5) research projects are complete and have submitted reports that are still under review, listed below. These projects are finalizing revisions to reports and datasets, and final submission to TRID will follow completion of review. More description is available in [Section 6.1](#).

Projects Completed this Period
A Co-Simulation Study to Assess the Impacts of Connected and Autonomous Vehicles on Traffic Flow Stability during Hurricane Evacuation
The Gap Effect in Conditionally Automated Driving
Using Augmented Reality to Help Older Adults Make Safe Road-Crossing Decisions
Driver Behavior in the Presence of E-Scooters within Varying Infrastructure
Investigating the Effects of Cooperative Driving for CAVs in Different Driving Scenarios Using Multi-Driver Simulator Experiments

SAFER-SIM and the AAA Foundation for Traffic Safety continue collaboration with the funding of two additional research projects:

- **Identifying outcome measures to evaluate effectiveness of consumer education and training for vehicle automation** (AAAFTS Year 4) – University of Massachusetts, Lead
- **Mapping comprehension of ADAS across different driving and road user populations** (AAAFTS Year 4) – University of Iowa, Lead

Below is a summary of research performance metrics for the current performance period. Full list can be found [here](#).

Performance Metric	Result
Peer-reviewed journal publications (published)	10
Book chapters	0
Edited books	0
Conference papers, posters, and symposia	29
Paper/poster awards	3
External grants related to SAFER-SIM	5

1.2.2 Leadership Development

Researchers and students gained and shared valuable experience through SAFER-SIM work this period.

SAFER-SIM researchers continued representing the center at professional meetings through invited presentations. This work shows the combined expertise of our center along with the wide range of stakeholders interested in our research including state departments and tech companies. Some invited presentation highlights include:

1. Guo, Z. (2023). Pave the Way for Future Mobility Systems with Large-scale Transportation Electrification. Presentation at the UCF College of Engineering and Computer Science Weekly Seminar, Orlando, FL.
2. Guo, Z. (2023). Towards an Electrified Transportation Systems: Planning, Operation, and Market Design. Presentation at the Rosen College Research Colloquium, Orlando, FL.
3. Guo, Z. (2023). Optimal coordination of charging and platooning schedules for electrified freight systems. Presentation at the COTA Winter Symposium, Washington D.C.
4. O’Neal, E.E Child development and road traffic injury risk. 2022 Iowa Safe Routes to School Conferences, Des Moines, January 27, 2022.
5. Kearney, J.K., VR Research in Three Parts. Keynote presentation, University of Iowa Computing Conference, February 24, 2023.
6. “Gap Effect in Shifting Attention in Conditional Automation” International Conference on Traffic and Transport Psychology (ICTTP), Gothenburg, Sweden, 07/2022, Emily Shull
7. Reyes, M.L. (2022). Rear Seat Occupant Belt Use and Motor Vehicle Crash Injury Severity. Traffic and Safety Forum. Nov. 15. Ames, IA
8. Presentation of research findings on the project: Performance Evaluation of the PR-30/PR-189 Diverging Diamond Interchange Phase 2. November2022. 10 participants form PRHTA, FHWA, Constructora Santiago and UPRM.
9. Presentation of SAFERSIM Research using the UPRM Pedestrian Virtual Reality Simulator and the UPRM Driver Simulators. Director of the Engineering Research and Development Center (ERDC) of the US Army Corps of Engineers, and his executive and administrative teams. Mar 28, 2023. 25 participants.
10. Didier Valdés, Benjamín Colucci, Alberto Figueroa-Medina, Yindhira Taveras, and Andrés Chamorro. Use of Driving and Virtual Reality Simulation Technologies to Visualize Transportation Safety Innovations. 100th Annual Meeting of the Transportation Research Board, Visualization Lighting Talks Lectern Session 1420, Standing Committee on Visualization in Transportation (AED-80), January 29, 2021.
11. Alberto Figueroa-Medina. Study of Gap Acceptance and Walking Speed of Pedestrians using Virtual

Reality Simulation. 1st Virtual Congress of Traumatic Brain Injury. Graduate School of Rehabilitation Counseling, University of Puerto Rico at Río Piedras, March 5, 2021.

12. Alberto Figueroa-Medina. Innovative Research Contributing to Safety, Sustainability and Resilience in Transportation Systems. 1st Virtual Summit RIDNAIC. March 16, 2021.
13. Didier Valdés, Benjamín Colucci, and Alberto Figueroa-Medina. Success Stories on Technology Transfer: UPRM Experience. Virtual SAFER-SIM Symposium, March 19, 2021

SAFER-SIM contributed to the advancement of simulation and road safety through other leadership development activities this period. Researchers actively participated on grant review panels, advisory committees, professional organizations, and other scholarly endeavors. SAFER-SIM researchers were honored by an array of awards for impactful achievements in transportation. Some exemplary awards were given to our Co-Directors and are listed below:

1. Zhaomiao Guo, NSF Civil Infrastructure System Panel in 2022 and 2023
2. Zhaomiao Guo, NSF LEAP HI Panel in 2022
3. Shannon Roberts served on an NSF proposal review panel.
4. Shannon Roberts served on an NIH proposal review panel for HCMF (Human Complex Mental Function).
5. Shannon Roberts continues to serve on a BTSCR panel for BTS-01: Guidance for Employer-Based Behavioral Traffic Safety Programs for Drivers in the Workplace. For the panel, she provided guidance for the contractor in terms of how drivers will respond to traffic safety programs.
6. NSF ERC Site Visit Team (Christofa)
7. NSF Cyberphysical Systems (Christofa)
8. Member of Oversight Panel for NCHRP project 07-29: Development of the 8th edition of the AASHTO's A Policy on Geometric Design of Highways and Streets (Green Book). National Cooperative Highway Research Program, Transportation Research Board. (Figueroa-Medina)

Professional awards received this period included 3 received by a University of Iowa graduate student:

1. Emily Shull, SAFER-SIM Excellence Award, 2023
2. Emily Shull, SAFER-SIM UTC Outstanding Student of the Year, 2023
3. Emily Shull, Human Factors and Ergonomics Society (HFES) Student Member with Honors, 2022

Below is a summary of leadership development performance metrics. Full list can be found [here](#).

Leadership Development Performance Metric	Result
Invited presentations	13
Invited papers	0
Invited workshops	1
Grant review panels	8
Advisory committees	25
Journal editing	40
Leadership positions in professional organizations	23
SAFER-SIM webinars (see section 1.1.4)	9
Professional awards	6

1.2.3 Education and Workforce Development

Consortium members continued engaging students of all levels this period in transportation, safety, and STEM (science, technology, engineering, and math).

The University of Iowa actively engaged K-12 students this period through tours, events, and classroom visits with 4403 students participating. The UI team focused on visiting school districts with high percentages of minority students and established relationships with new school districts while continuing existing relationships. School classroom visits present STEM concepts and provide students with information on transportation careers and present science topics supporting physics, math, psychology, and health curricula. Two in-class mini research activities are offered, distracted driving and stopping distance based on the coefficient of friction of different road conditions. Additionally, UI researchers are again involved in the organizing committee for the [Iowa National Transportation Summer Institute \(INTSI\)](#). The INTSI is a STEM Camp for 7-9 grade students focusing on STEM education, careers in transportation, and leadership. The program will provide 16 students with challenges with two weeks of introduction to careers in aviation, maritime, and surface transportation.

K-12 activities include:

- Classroom visits – 954 students
- Project Lead the Way or Class tours – 71 students
- STEAM Institutes – 2010 students
- Career Caravan – 1200 students
- Job Shadows – 7 students
- Workshops – 61 students
- Other – 100 students

Activities with collage-age students include:

- Friendship Force of Cedar Rapids-Iowa City Tour – 7 students
- Iowa State University Transportation Student Group Tour – 15 students
- National Society of Black Engineers - 10

SAFER-SIM developed an [online resource](#) in 2019 for Boy Scouts of America to earn the Traffic Safety merit badge. The goal of the resource is to create greater visibility and access to the merit badge. The Traffic Safety merit badge “gives Scouts crucial tools to stay safer when driving a car on a highway, riding a bike across town, or jogging across a busy street.” By completing the Traffic Safety merit badge, Scouts learn about transportation safety, careers, and research at an opportune time. The online resource continued making nationwide impacts this period with students this period.

In 2020, SAFER-SIM developed a similar [online tool](#) for the Engineering Merit Badge. Whether it is improving personal electronics, developing health care solutions, creating automated vehicles, protecting the environment or sending people to Mars, engineers are using math and science to create a better tomorrow. Earning the Engineering Merit Badge gives Scouts a better understanding of how engineers work and how to apply the engineering process to daily problems. For both badges, some scouts work with the badge material online then obtain completion documentation locally rather than from our personnel.

Traffic Safety Merit Badge		
	This Period	To Date
Started	38	1081
Completed	27	745
Engineering Merit Badge		
	This Period	To Date
Started	8	337
Completed	29	170

Below is a summary of education and workforce development performance metrics. Full list can be found [here](#).

Education and Workforce Development Performance Metric	Result
Peer-reviewed journal publications w/ student authors	9
Book chapters w/ student authors	0
Conference posters and papers w/ student authors	24
Paper/poster awards w/ student authors	1
Graduate students working on and supported by SAFER-SIM related projects	32
Undergraduate students working on and supported by SAFER-SIM related projects	14
Student attendance and presentations at the SAFER-SIM symposium	30
Transportation-related M.A. and PhD theses	7
Curriculum modules developed	2
Student Internships	1
Presentations to student groups or classes	6 33 students
# Schools visited and # students present	9 834 students
# Career fairs visited and # of attendees	10 career fairs 1660 attendees
Summer institutes and programs and # of students participating	0 0 students

1.2.4 Technology Transfer

SAFER-SIM-funded projects work toward technology transfer goals from the beginning through completion. State DOTs, industry partners, and other agencies work with researchers by using their expertise or findings to inform decisions that guide future research and projects.

A main aspect of our technology transfer activities involves webinars. Research projects are required to present webinars about their results which are shared with contacts in academia, industry, and government. The presentations focus on findings, recommendations, specifications, and guidelines. SAFER-SIM now gathers webinars from individual project into online symposia where projects may be grouped by subject matter to allow parties interested in specific topics to interact with several researchers and projects in a single session. Attendance at presentations remain open to all transportation professionals and the public, recorded, and posted on the SAFER-SIM YouTube channel so they are available to anyone who was not able to attend or would like to review. The first project symposium was December 2022. The project presentations were:

- **Enhancing the effectiveness of automated vehicle sensory-based alert systems** - Meng Wang, University of Massachusetts-Amherst
- **Understanding of advanced vehicle technology: The role of system exposure and perceptions of other road users** - Ganesh Pai, University of Massachusetts-Amherst
- **Analyzing the Performance of Remote-Drivers on Transit Shuttle Short Routes** - Kelvin R Santiago-Chaparro, University of Wisconsin-Madison
- **Transportation Data Analysis and Visualization Online Course Modules Development** - Kelvin R Santiago-Chaparro, University of Wisconsin-Madison
- **Dynamically Adapting Driver Assistance Systems Using Driver Monitoring Technology** - Chris Schwarz, University of Iowa
- **A Co-Simulation Study to Assess the Impacts of Connected and Autonomous Vehicles on Traffic Flow Stability during Hurricane Evacuation** - Samiul Hasan, University of Central Florida
- **Investigating the Effects of Cooperative Driving for CAVs in Different Driving Scenarios Using Multi-Driver Simulator Experiments** - Zijin Wang, University of Central Florida
- **Assess Driver Behaviour through Work Zones using Driving Simulation: Comparison between Drivers Sensitized Using Virtual Reality and General Driving Population** - Carla Lopez del Puerto, University of Puerto Rico-Mayaguez

Our center has been successful at receiving media attention from our work. Some highlights of SAFER-SIM sites in the media this period include:

- Fox Weather - Samiul Hasan gave a live interview discussing the challenges in evacuation before Hurricane Ian's landfall in Florida in September 2022.
- Wallet Hub - Shannon Roberts was quoted in a Wallet Hub article about "2023's Best & Worst States to Drive in".

Lab tours included government representatives and their staff, professionals in the transportation industry, corporations, local interest groups, Our center offered 15 facility tours:

- 3/3/2023: Tour of Hank Lab at University of Iowa; Siqi Liu (Iowa Writers' Workshop), number of people unknown
- 11/3/2022: Tour of Hank Lab at University of Iowa; CS:3980 Building Interactive Virtual Environments in Unity – 20 people
- 1/25/2023: Steve Brody, 1 person
- 2/10/2023: National Society of Black Engineers, 10 people

- 2/24/2023: Dr. Ruofei Duo, 1 person
- 7/2/2022: International Students, 8 people
- 10/3/2022: Injury and Violence Prevention Course, 40 people
- 10/5/2022: Friendship Force of Cedar Rapids-Iowa City, 7 people
- 10/11/2022, Discover Your University, 10 people
- 10/14/2022: Urban and Regional Planning Students, 15 people
- 11/2/2022: Discover Your University, 10 people
- 11/11/2022: Iowa State University Transportation Student Group, 15 people
- 11/29/2022: RTL Automotive Toxicology Meeting, 15 people
- 12/28/2022: Engineer for Rolls Royce, 1 person
- Shannon Roberts (along with graduate and undergraduate students) gave a tour of the driving simulator lab to prospective UMass undergraduate students during the Engineering Open House, number of people unknown

Below is a summary of our technology transfer plan performance metrics with the full list accessible [here](#) and more detail provided in [Section 3](#) below.

Technology Transfer Performance Metric	Result
SAFER-SIM webinars	8
Registrations for webinars	64
Views of archived webinar content	Not reported
Press releases for SAFER-SIM related research	0
Media requests	2
Tours of facilities	15
Website traffic	Not reported
Patents filed	0
DOT requests for presentations or proposals related to SAFER-SIM	1
Practitioner attendance at events	3 from industry 6 from government
Number of improved or new simulation technologies, software, methods, or processes	0

1.2.5 Collaboration

Collaboration drives our consortium in all aspects of our work. Our collaboration is described further in [Section 2](#) of this report.

SAFER-SIM and the AAA Foundation for Traffic Safety continue collaboration for the fourth year. Two additional research projects were created and funded this year. Researchers from AAAFTS, the University of Massachusetts-Amherst, and the University of Iowa are collaborating to further understanding of advanced vehicle technologies.

Identifying outcome measures to evaluate effectiveness of consumer education and training for

vehicle automation (AAAFS Year 4) – University of Massachusetts, Lead This project has the primary objective to identify outcome measures that can be used to assess effectiveness of training and education for advanced vehicle technologies. This research will be focused on understanding drivers’ knowledge in the context of vehicle technologies that are currently deployed and available (Level 1 & 2 as per SAE J3016 (SAE, 2018) definitions). Specifically, adaptive cruise control (ACC) and lane keeping assist (LKA) or lane centering technologies will be considered, whether they function independently or in combination. A secondary objective of this proposed research is a discussion of the implications of these identified outcome measures in the context of higher levels of automation.

Mapping comprehension of ADAS across different driving and road user populations (AAAFS Year 4) – University of Iowa, Lead This project will survey drivers and other road users regarding their knowledge of different vehicle technologies, providing significant insight into how understanding varies across populations, defined by age, gender and individual differences. This research will also identify those groups of individuals who are lacking the necessary understanding but who feel confident, nonetheless. The outcomes of this research will (1) inform the development of education and training approaches for specific populations, and (2) characterize those individuals with miscalibrated confidence in their understanding of advanced vehicle technologies.

Below is a summary of collaboration performance metrics. Full list can be found [here](#).

Collaboration Performance Metric	Result
Attendance at the SAFER-SIM symposia	64
Interdisciplinary research projects within and across sites	7
Collaborative research projects across SAFER-SIM or other UTC sites	8
Collaborations with industry partners and government agencies	19
Collaborative peer-reviewed journal publications	0
Collaborative book chapters	0
Student exchanges with other SAFER-SIM sites	0
Students pursuing advanced degrees at other SAFER-SIM sites	0
Programs involving community colleges	0
Graduates hired at other SAFER-SIM or UTC sites	0

1.2.6 Diversity

Diversity continues to play an important part in our research and outreach. The University of Puerto Rico Mayaguez and University of Central Florida are minority serving institutions. Twenty-three (23) students from historically excluded groups were involved in 17 SAFER-SIM projects this period. Individuals from historically excluded groups contribute to SAFER-SIM at all levels including the directors, advisory board, principal investigators, and students.

One student from underrepresented or minority groups graduated this period.

- Angel Mori-Vargas for University of Puerto Rico - Mayaguez

Below is a summary of diversity performance metrics. Full list can be found [here](#).

Diversity Performance Metric	Result
# SAFER-SIM projects involving underrepresented/minority (U/M) students	17
# U/M events attended	3
# U/M students at attended events	37
Graduating U/M student placement	1

1.3 What opportunities for training and professional development have been provided?

SAFER-SIM provides opportunities for training and professional development in numerous ways. Students gain direct training from faculty and research staff from involvement in research projects. Researchers and students are encouraged to attend conferences to share their work and continually develop their professional skills and share their knowledge with others in the transportation industry.

1.4 How have the results been disseminated?

Final reports and datasets are posted on all required repositories after completion. Additionally, research projects are required to submit two-page summaries and prepare online webinar presentations about their results which are shared with contacts in academia, industry, and government. Researchers and students also share their work at meetings, conferences, and with the public.

1.5 What do you plan to do next reporting period to accomplish these goals?

SAFER-SIM funded an additional 3 projects this period. The center will continue progressing toward final reports from projects. Sites and administration teams have been working through a backlog of delays due to COVID-19, and the center expects to see many delayed projects complete next period. Project symposia, education and outreach will continue as normal.

2. Participants & Collaborating Organizations

2.1 What organizations have been involved as partners?

The following organizations have been involved as SAFER-SIM partners during this reporting period:

<i>Organization Name</i>	<i>Location</i>	<i>Contribution</i>
1. AAA Foundation for Traffic Safety	Washington D.C.	Financial support Collaborative research
2. Recreative Association of Sport Buenaventura	Mayagüez, Puerto Rico	Provided facilities at low cost to perform data collection activities for the project.
3. Mayagüez Bureau of Highway Patrol	Mayagüez, Puerto Rico	The Mayaguez Bureau of Highway Patrol provided

		Equipment and experienced police officers to measure BAC during the project data collection.
4. UW-Madison Global Health Institute	Madison, WI	Collaborative research
5. City of Racine	Racine, WI	Financial support to help with the purchase of AV. In-kind support facilities to operate the AV shuttle in Racine.
6. Gateway Technical College	Racine, WI	In-kind support facilities to house and operate the shuttle in Racine.

2.2 Have other collaborators or contacts been involved?

A main focus of SAFER-SIM UTC is collaboration, both within consortium sites and across disciplines. Consortium members engage in regular web conferencing, teleconferences, and email communications, as well as face-to-face interactions via site visits and time set aside during symposia. Site directors participate in a conference call once a month to share information about the progress at each university.

SAFER-SIM researchers have a diverse range of backgrounds that span many colleges throughout the universities. The variety of expertise within the consortium creates a collaborative environment to take a wholistic approach on safety issues. The backgrounds of our researchers include:

- Civil, Environmental, & Construction Engineering
- Mechanical & Industrial Engineering
- Industrial & Systems Engineering
- Computer Science
- Psychology & Brain Sciences
- Public Health
- Management Sciences
- Urban and Regional Planning

Our advisory board currently includes 11 individuals from industry, government, and academia.

William Horrey	AAA Foundation for Traffic Safety
Patrick Hoye	Iowa Governors Traffic Safety Bureau
Rich Romano	University of Leeds

Lisa Schletzbaum	Massachusetts DOT
Gary Huttman	MetroPlan Orlando
Chuck Green	Industry consultant (formerly GM)
Elizabeth Pulver	State Farm
Don Fisher	Volpe
John Corbin	USDOT
Linda Boyle	University of Washington
Rebecca Burkel	Wisconsin DOT

3. Outputs

Below is a summary of our technology transfer plan output performance metrics. Further description can be found in [Section 1.2.4](#) Technology Transfer Accomplishments with the full list accessible [here](#).

During this reporting period SAFER-SIM leadership chose to change our approach to webinars from individual project webinars to online symposia where projects are grouped by subject matter to allow parties interested in specific topics to interact with several researchers and projects in a single session. Attendance at presentations will remain open to all transportation professionals and the public, recorded, and posted on the SAFER-SIM YouTube channel so they are available to anyone who was not able to attend or would like to review. The first project symposium is being planned for December 2022.

Performance Metric	Target	Result	Target Next Period
SAFER-SIM webinars as part of symposia	10	8	10
Registrations for webinars	200	64	100
Views of archived webinar content	200	Not reported	200
Press releases related to SAFER-SIM	1	0	1
Media requests	10	2	5
Tours of facilities	15	15	15
Website traffic	Not reported	Not reported	3,000 users 3,000 sessions 7,000 pageviews
Patents filed	1	0	1
DOT requests for presentations or proposals related to SAFER-SIM	1 per year	1	1 per year
Practitioner attendance at events	100	23	100
Number of improved or	5	0	1

new simulation technologies, software, methods, or processes			
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3.1 Publications, conference papers, and presentations

Journal Publications

1. M. Nour and M.Zaki Towards formalization and monitoring of microscopic traffic parameters using temporal logic, Accepted Journal of Transportation Research Record
2. Afifah, F., Guo, Z., and Abdel-Aty. M. (2023), System-level impacts of en-route information sharing considering adaptive routing. Transportation Research Part C: Emerging Technologies, 149, 104075. (IF: 9.02)
3. Z. Wang, O. Zheng, L. Li, M. Abdel-Aty, C. Cruz-Neira and Z. Islam, "Towards Next Generation of Pedestrian and Connected Vehicle In-the-loop Research: A Digital Twin Co-Simulation Framework," in IEEE Transactions on Intelligent Vehicles, doi: 10.1109/TIV.2023.3250353.
4. Rundus, C. R. M., McGehee, D. V., & Schwarz, C. W. (2022). Analyzing Driver Foot Behavior between Regenerative and Service Braking. SAE International journal of transportation safety, 11(09-11-01-0001).
5. Ryan, A., Hennessy, E., Ai, C., Kwon, W., Fitzpatrick, C., and Knodler, M. (2023). "Driver Performance at Horizontal Curves: Bridging Critical Research Gaps to Increase Safety." Traffic Safety Research. 3, 000014. 10.55329/LMJI8901.
6. Parker, J., Wang, M., Ojuri, B., Roberts, S. C., McDermott, J. M., & Fisher, D. L. (2023). Impact of Level 2 Automation and ADHD Symptomatology on Young Drivers' Attention Maintenance. Transportation Research Part F: Traffic Psychology and Human Behaviour, 94, 504-516.
7. Figueroa-Medina, D. Valdés, B. Colucci, N. Cardona & A. Chamorro. 2022. Analysis of Walking Speeds and Success Rates on Mid-Block Crossings using Virtual Reality Simulation. Accident Analysis and Prevention Journal. Elsevier. February 2023.
8. Song, Y., Chitturi, M. V., & Noyce, D. A. (2023). Impact of event encoding and dissimilarity measures on traffic crash characterization based on sequence of events. Accident Analysis & Prevention, 185, 107016.
9. Song, Y., Chitturi, M. V., & Noyce, D. A. (2022). Intersection two-vehicle crash scenario specification for automated vehicle safety evaluation using sequence analysis and Bayesian networks. Accident Analysis & Prevention, 176, 106814.
10. Song, Y., Chitturi, M. V., & Noyce, D. A. (2021). Automated vehicle crash sequences: Patterns and potential uses in safety testing. Accident Analysis & Prevention, 153, 106017.

Conference papers and presentations

1. Wang, Z., Yue, L*., Abdel-Aty, M., Zhu, J., Zheng, O., & Zaki, M. Investigating the Effects of Human-Machine Interface on Cooperative Driving at Non-Signalized Intersection Using an Integrated Co-Simulation Platform, Presented at 103th Annual Meeting of the Transportation Research Board, Washington, D.C.
2. Wang, Z., Yue, L*., Abdel-Aty, M., Zhu, J., Zheng, O., & Zaki, M. Investigating the Effects of Human-Machine Interface on Cooperative Driving at Non-Signalized Intersection Using an Integrated Co-Simulation Platform, Presented at UTC SAFERSIM Symposium 10 years of

Research.

3. Afifah, F.*, Guo, Z., and Abdel-Aty, M. (2022), Impacts of I2V Infrastructure Placement on CVs Safety in an Interconnected Network. Presentation at the Transportation Research Board 101th Annual Meeting, Washington D.C. and IISE Annual Conference, Seattle, WA.
4. Z. Wang, O. Zheng, L. Li, M. Abdel-Aty, C. Cruz-Neira and Z. Islam, "Towards Next Generation of Pedestrian and Connected Vehicle In-the-loop Research: A Digital Twin Co-Simulation Framework," Presented at UTC SAFERSIM Symposium 10 years of Research.
5. O'Neal, E.E., Kim, N. Y., & Plumert, J.M. (March 2023). Parental scaffolding of children's prospective control in a dynamic perception-action task. Oral presentation at the 2023 biennial meeting of the Society for Research in Child Development, Salt Lake City, UT.
6. O'Neal, E.E., Subramanian, L.D., Noonan, M., Stoffel, J.A., Wang, J., Kim, N.Y., Kearney, J.K., & Plumert, J.M. (April 2023). How do children respond to autonomous vehicle external human-machine interface cues? Oral presentation at the 2023 annual meeting of the Society for Violence and Injury Research, Denver, CO.
7. Malik, J., O'Neal, E.E., Noonan, M., Plumert, J.M., & Kearney, J.K. (February 2023). Can augmented reality help pedestrians safely cross multiple lanes of traffic? Safer-Sim Symposium, University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico February 2023
8. Jiang, Y., Rahimian, P., O'Neal, E.E., Parr, M., Malik, J., Subramanian, L., Kim, A., Plumert, J.M., & Kearney, J.K. (February 2023). Assistive technology for vulnerable road users. Safer-Sim Symposium, University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico February 2023
9. Jiang, Y., Rahimian, P., O'Neal, E.E., Parr, M., Malik, J., Subramanian, L., Kim, A., Plumert, J.M., & Kearney, J.K. (February 2023). Peer influences on risky pedestrian road crossing. Safer-Sim Symposium, University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico February 2023
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Books or other non-periodical, one-time publications
Nothing to report

3.2 Policy Papers

Nothing to report

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

[SAFER-SIM website](#) - contains descriptions of research projects and final reports, news articles about our work, contact information, and other important information related to the center. The website is updated regularly with news stories and outreach events. Traffic measures from the website are below:

Metric	This Period	Lifetime
Total Users	Not reported	27,328
New Users	Not reported	26,698
Sessions	Not reported	50,230
Page Views	Not reported	104,676

[SAFER-SIM YouTube Channel](#) - contains webinars, virtual symposium presentations, simulation boot camp, and online traffic safety merit badge videos. Metrics from those videos are below:

Metric	This Period	Lifetime
Uploaded videos	Not reported	130
Views	Not reported	48,185
Subscribers	Not reported	224

[SAFER-SIM Twitter Account](#) – contains tweets about webinars, news digests, news articles, merit badge opportunities, and YouTube playlists. Metrics from the account are below:

Metric	This Period	Lifetime
Tweets	0	394
Tweet Impressions	0	82,600
Followers	0	170

[SAFER-SIM Dataverse](#) - data repository containing final data from research projects.

Metric	This Period	Lifetime
Datasets	Not reported	44
File Downloads	Not reported	14,176

3.4 New methodologies, technologies, or techniques

Nothing to report

3.5 Inventions, patent, and/or licenses

Nothing to report

3.6 Other products

[Simulation Boot Camp Videos](#) –A webinar series developed by the collective expertise of SAFER-SIM to train researchers on using simulation as a research tool. The boot camp was translated into an in-person workshop at the Road Safety & Simulation conference. The online videos have been viewed 583 times.

[Online Traffic Safety Merit Badge](#) – 1081 Scouts have started the materials and 745 have completed the requirements. More information in [Section 1.2.3](#).

Metric	This Period	Lifetime
Scouts Started	38	1081
Scouts Completed	27	745

[Online Engineering Merit Badge](#) – 331 Scouts have started the materials and 168 have completed the requirements. More information in [Section 1.2.3](#).

Metric	This Period	Lifetime
Scouts Started	8	337
Scouts Completed	29	170

[Two-page Project Summaries](#) – Each research project is required to submit a 2-page summary of the research for a quick overview and takeaways from the work. The summaries focus on recommended practices for transportation professionals providing easier access to key information than the technical report and are available on the “[Research](#)” tab of our website within specific project information.

[Biweekly News Digest](#) – The email campaigns serve to provide information about SAFER-SIM webinars, final reports, conferences, news articles, and job opportunities. Metrics from the news digest are below:

Metric	This Period	Lifetime
Subscribers	Not reported	333
Campaigns Sent	Not reported	155
# Opens	Not reported	11,321

4. Outcomes

SAFER-SIM included three performance measures related to outcomes in our technology transfer plan:

Performance Measure	Target	Result	Target Next Period
Number of improved or new technologies, software, methods, or processes adopted	5	0	1
Stakeholders who adopt, implement or deploy SAFER-SIM research findings or technologies through policy, practice, regulation, rulemaking or legislation	2	0	2
Number of projects that reach adoption, implementation or deployment	1	0	1

Number of improved or new technologies, software, methods, or processes adopted
Nothing to report.

Stakeholders who adopt, implement or deploy SAFER-SIM research findings or technologies through policy, practice, regulation, rulemaking or legislation
Nothing to report.

Number of projects that reach adoption, implementation or deployment
Nothing to report.

4.1 Increased understanding and awareness of transportation issues

SAFER-SIM makes efforts to reach all stakeholders with our research and outreach. Researchers and students share work at conferences, meetings, and with the general public to promote safety and bring awareness to transportation issues.

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

Nothing to report.

4.3 Increases in the body of knowledge

SAFER-SIM research continues to build on the knowledge of transportation safety and simulation through final reports, summaries, journal articles, and presentations at conferences, meetings, and other avenues. Full list [here](#).

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

Highlighted in [Section 1.2.4](#) and in [Section 4](#).

4.5 Enlargement of the pool of trained transportation professionals

Our center supports the development of trained transportation professionals in numerous ways. College students directly involved in research will graduate and join the workforce as members of industry, academia, or government. Outreach efforts focused on middle school and high school students will spark the interest of some to study and join the transportation field. The recorded webinars and presentations from the boot camp continue to draw interest online.

4.6 Adoption of new technologies, techniques or practices

Nothing to report.

5. Impacts

SAFER-SIM included two performance measures related to impacts in our technology transfer plan:

Performance Measure	Target	Result
Expected reductions in crashes from implemented policy, practice, regulation, rulemaking or legislation	Not yet determined	Not yet realized
Expected reductions in congestion and traffic	Not yet	Not yet

conflicts implemented policy, practice, regulation, rulemaking or legislation	determined	realized
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Expected reductions in crashes from implemented policy, practice, regulation, rulemaking or legislation
Not yet realized.

Expected reductions in congestion and traffic conflicts implemented policy, practice, regulation, rulemaking or legislation
Not yet realized.

5.1 Impact on the effectiveness of the transportation system

SAFER-SIM’s approach to understanding the role that humans play in a complex, ever-changing transportation environment will lead to improved safety and effectiveness of the transportation system. Our research will lead to a safer roadway environment that encourages multiple modes of transportation, thereby also reducing traffic congestion and preserving the environment.

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

Nothing to report

5.3 Impact on the body of scientific knowledge

Highlighted in [Section 1](#) and [Section 3](#)

5.4 Impact on transportation workforce development

Highlighted in [Section 1](#)

6. Changes/Problems

6.1 Changes in approach and reasons for change

The center is still affected by COVID-19 although we have returned to normal activities. Research projects have resumed progress toward completion, yet delays caused by the pandemic have resulted in projects completing at later dates than planned when they were funded. While project backlogs are easing, they still exist. Research teams continue to balance multiple active projects with new, overlapping timelines causing delays in finalizing report revisions and datasets. The administrative burden has increased to process these deliverables because the shifted timelines led more projects completing at the same time than originally expected.

We are working with PIs to complete all projects and finalize all deliverables and reporting materials within the grant performance period. We plan to request a 12-month extension to allow continued support of students and completion of projects.

6.2 Actual or anticipated problems or delays and actions or plans to resolve them

No problems or delays are anticipated.

6.3 Changes that have a significant impact on expenditures

No changes have had a significant impact on expenditures.

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

No significant changes in use or care of human subjects, vertebrate animals, and/or biohazards have occurred.

7. Special Reporting Requirements

Nothing to report