



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

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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 seventy-eight (78) projects under the FAST Act – seventy-six (76) research and two (2) outreach. Thirty-two (32) projects remain active and forty-six (46) projects are complete. All project information can be found on the research tab of the [SAFER-SIM website](#). Active projects are listed on the Transportation Research Board's [Research in Progress \(RIP\) Database](#).

Year	Funded/Inactive	Projects Active	Projects Complete	Total Projects
Y1	0	0	9	9
Y2	0	0	16	16
Y3	0	4	14	18
Y4	0	10	7	17
Y5	0	18	0	18
Total	0	34	44	78

SAFER-SIM funded eighteen (18) projects this period, including seventeen (17) research projects and one (1) outreach project. One (1) of the research projects was funded as part of the third year of a collaborative research program with the AAA Foundation for Traffic Safety. All projects started in the summer or fall of 2021, and the new research projects are posted on [Research in Progress \(RIP\) Database](#):

Projects Funded this Period	RiP
Investigating the Effects of Cooperative Driving for CAVs in Different Driving Scenarios Using Multi-Driver Simulator Experiments	1772189
Evaluating the Effects of Cooperative Perception on Avoiding Pedestrian Crashes for Connected and Automated Vehicles	1772188
Forecasting Impact of Connected, Automated, Shared and Electric Vehicles on Florida's Highway Network's Safety between 2020 & 2045 using Simulation & Artificial Intelligence	1772186
Distributed Reinforcement Learning for Optimal Speed Limit Control Over Network with Partial Observability	1778677
Children's Use of eHMI Displays to Guide Road-Crossing Decisions	1772187
Effects of Cognitive Load on Takeover Requests in Conditionally Automated Driving	1773417
Enhancing the effectiveness of automated vehicle sensory-based alert systems	1772185
Virtual Reality Simulation to Evaluate Drivers' Mental Models of Advanced Vehicle Technologies	1772184
Remote and Virtual Air Traffic Control Tower (RVT): Safety Issues and Human Factors Considerations	1772183
Driver Attitudes and Behavior in the Presence of E-Scooters versus Bicyclists	1773375
Impact of Turning Radius on Vehicle Speeds and Pedestrian Crossing Safety on Urban Unsignalized Intersections Using Virtual Reality	1772182

Assessing the Effect of Drivers' Behavior in Rural Roads with Advanced Driver Assistance Systems Using a Driving Simulator	1772181
Assessment of Drivers' Behavior and Workload while Interacting with E-scooters Using a Driving Simulator	1772180
Driver and Pedestrian Behavior at Crosswalks in Modern Roundabouts using Virtual Reality	1772171
Field-Based Evaluation of Left Turn Behavior Variations at the Individual Driver/Vehicle Level	1772170
Quantifying Autonomous Vehicle Pedestrian Interactions at Intersections	1772169
Evolution of User Trust in Autonomous Vehicles and Characteristics of Disengagements	1772168
Transportation Data Analysis and Visualization Online Course Modules Development (Curriculum Development Project)	NA

SAFER-SIM completed thirteen (13) research projects this period listed below. These projects are finalizing revisions to reports and datasets, and final submission to TRID will happen early next period. The delays due to COVID created a backlog of work on the research and administrative sides, yet our center is working diligently through these delays to return to normal operating procedures. More description is available in [Section 6.1](#).

Projects Completed this Period	TRID
Assess Highway Construction Workers Behavior while Driving through Work Zones in Comparison to General Drivers Sensitized Using Virtual Reality and a Driving Simulator	In Progress
Convolved Gaussian Process (CGP): An Alternative to Facilitate Analysis and Predictions of Multiple DPMs under Several Driving Conditions Using Driving Simulators	In Progress
Defining Safety-Critical Scenarios for Simulation-Based Automated Vehicle Evaluation	In Progress
Detailed Analysis of Roadway Users Interactions at Intersections with Flashing Yellow Arrows	In Progress
Effect of Large Vehicles on Left Turn Gap Acceptance at Signalized Intersections	In Progress
Impact of Road Information Assistive Systems on Pedestrian Crossing Safety	In Progress
Interfacing Synchrono and NADS for Virtual Simulation of Conventional & Connected and Autonomous Vehicles	In Progress
Investigate the effects of V2X technologies for automated vehicles using virtual simulation and driving simulator experiments	In Progress
Investigating the Effects of Smartphone-based P2V Warning using Driving Simulator Experiments	In Progress
Investigation of Driving Behavior at Alternative Intersection Designs and Safety Improvement: A Driver Simulator Study	In Progress
Quantifying the Impacts of Situational Visual Clutter on Driving Performance Using Video Analysis and Eye Tracking	In Progress

Shared Connectivity for Safer Shared Space Facilities: Improving mobility for non-motorized and vulnerable Road-Users	In Progress
V2I Infrastructure Placement and Safety Implications of CAVs in an Interconnected Network	In Progress

Samiul Hasan from the University of Central Florida received an external grant from the National Science Foundation. Crash data analysis done under [the SAFER-SIM project](#) significantly helped to write the proposal for this project which will extend the analysis for a rapidly intensifying hurricane.

- Title: EAGER-SAI: Exploring Pathways of Adaptive Infrastructure Management with Rapidly Intensifying Hurricanes
- PI: Samiul Hasan, University of Central Florida
- Sponsor: National Science Foundation
- Amount: \$140,000
- Duration: September 1, 2021-August 31, 2022

Shannon Roberts and Anuj Pradhan from the University of Massachusetts Amherst received an external grant from the Toyota Collaborative Safety Research Center. The objective of this grant is to conduct an experimental evaluation of a hazard anticipation training program for novice teen drivers. The new proposal is very similar to [this SaferSim work](#) as they both focus on developing and evaluating a driver training program that relies on active training and the 3M approach – mistake, mitigation, and mastery.

- Title: A Pilot Usability & Efficacy Evaluation of Hazard Anticipation-Attention Maintenance (HAAM) Training
- PIs: Shannon Roberts and Anuj Pradhan, University of Massachusetts Amherst
- Sponsor: Toyota Collaborative Safety Research Center
- Amount: \$140,000
- Duration: September 1, 2021-August 31, 2022

Elizabeth O’Neal from the University of Iowa receive a K99/R00 Award from the National Institute of Child Health and Human Development. This award provides independent NIH research support during the transition that will help individuals launch competitive, independent research careers. This project is a direct follow-up of [this collaborative AAA Foundation for Traffic Safety \(AAAFTS\) and SAFER-SIM project](#). This project examined the efficacy of the PALM and the Accelerated Curriculum to Create Effective Learning (ACCEL) driver training programs.

- Title: Improving Novice Driver Roadway Hazard Identification Through a Parent-Focused Intervention
- PI: Elizabeth O’Neal, University of Iowa
- Sponsor: National Institute of Child Health and Human Development

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

Performance Metric	Result
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Peer-reviewed journal publications (published)	10
Book chapters	1
Edited books	0
Conference papers, posters, and symposia	14
Paper/poster awards	0
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. Some invited presentation highlights include:

- Dr. Mohamed Abdel-Aty: Delivering the Next Generation Roads Using Active Traffic Management Technology, Keynote, Road to Tomorrow R2T Virtual Conference, International Road Federation, July 2021.
- Dr. Samiul Hasan: Assessing the Safety Impacts of Evacuation Traffic: A Case Study of Hurricane Irma. Central Northeast Florida ITE Webinar, August 18, 2021.
- Mohamed H. Zaki: Proactive Diagnosis of Traffic Safety: From Data to Formalization CICM 2021: 14TH CONFERENCE ON INTELLIGENT COMPUTER MATHEMATICS. July 26, 2021
- John Gaspar and Anuj Pradhan: Panel Discussion - Understanding and Perception of Vehicle Automation. 2021 AAA Forum. September 15, 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 are listed below:

- Dr. Didier M. Valdés from the University of Puerto Rico Mayaguez earned the distinction of the 2019-2020 Outstanding Professor from the Civil Engineering and Surveying Department (Previously not reported)
- Dr. Benjamin Colucci-Rios from the University of Puerto Rico Mayaguez was selected as the 2021 American Society of Civil Engineers (ASCE) Region 5 Wall of Fame Award recipient. This award is a designation to honor Civil Engineers that have made a substantial contribution to ASCE, Region 5, and the Civil Engineering community.
- Dr. Benjamin Colucci-Rios from the University of Puerto Rico Mayaguez was selected as the 2021 American Society of Civil Engineers (ASCE) Region 5 Wall of Fame Award recipient. This award is a designation to honor Civil Engineers that have made a substantial contribution to ASCE, Region 5, and the Civil Engineering community.
- Dr. Elizabeth O'Neal received a [K99 Award](#) from the National Institute of Child Health and Human Development (NICHD). This award provides independent NIH research support during the transition that will help individuals launch competitive, independent research careers.

- Ganesh Pai Mangalore from the University of Massachusetts-Amherst on receiving a [\\$32,500 Link Foundation Fellowship](#) in Modeling, Simulation, and Training. His research project during the span of his Link Fellowship will address the continuing issue of uniformed drivers using ADAS technologies inappropriately, thus nullifying their effectiveness.

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

Leadership Development Performance Metric	Result
Invited presentations	29
Invited papers	0
Invited workshops	2
Grant review panels	6
Advisory committees	75
Journal editing	51
Leadership positions in professional organizations	30
SAFER-SIM webinars	8
Professional awards	11

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).

Jacob Heiden with the University of Iowa participated on the organizing committee for the [Iowa National Transportation Summer Institute \(INTSI\)](#). The INTSI was a virtual STEM Camp for 7-9 grade students focusing on STEM education, careers in transportation, and leadership. Fifteen (15) students completed the camp, which featured virtual learning activities from a wide-variety of transportation-focused organizations below. More INSTI information describe in the diversity [Section 1.2.6](#).

- National Advanced Driving Simulator (SAFER-SIM affiliate)
- Hank Virtual Environments Lab (SAFER-SIM affiliate)
- Iowa Department of Transportation
- Johnson County Engineer
- Iowa City Transit

[STEM Innovator](#) equips high school students with innovation and entrepreneurship skills. Dawn Marshall and Timothy Brown are currently working with two student teams on transportation safety topics related to bicycle safety on roadways. Student teams identify a problem they are passionate about, identify stakeholders, do market research, and develop a solution.

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 at home from COVID-19. An additional 101 scouts started the resource this period with 74 more scouts successfully completing all requirements. In total 965 scouts have used this resource and 612 have completed all requirements.

In 2020, SAFER-SIM then 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. An additional 33 scouts started the resource this period with 17 more scouts successfully completing all requirements. In total 273 scouts have used this resource and 142 have completed all requirements.

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	8
Book chapters w/ student authors	0
Conference posters and papers w/ student authors	12
Paper/poster awards w/ student authors	0
Graduate students working on and supported by SAFER-SIM related projects	43
Undergraduate students working on and supported by SAFER-SIM related projects	18
Student attendance and presentations at the SAFER-SIMposium	NA
Transportation-related M.A. and PhD theses	12
Curriculum modules developed	1
Student Internships	15
Presentations to student groups or classes	2 presentations 35 students
# Schools visited and # students present	0
# Career fairs visited and # of attendees	0
Summer institutes and programs and # of students participating	3 institutes 45 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. The center hosted eight (8) webinars this period with 303 registrants – 188 from academia, 68 from industry, and 46 from government. The tables below include complete webinar information and highlights of the various organizations from all sectors that registered for webinars this period:

Webinar	Date	Registrants	Archived Views
Minimum Time to Situational Awareness During Transfer of Control Under Varying Levels of Task Load	4/20/2021	30	45
Extended Evaluation of Training Programs to Accelerate Hazard Anticipation Skills in Novice Teens	5/18/2021	26	29
Investigating the Effects of Smartphone based P2V Warning using Driving Simulator Experiments	6/1/2021	15	25
Quantifying the Impacts of Situational Visual Clutter on Driving Performance	6/22/2021	15	18
V2I Infrastructure Placement and Safety Implications of CAVs in an interconnected Network	6/29/2021	12	30
Expectations and Understanding of Advanced Driver Assistance Systems among Drivers, Pedestrians, Bicyclists, and Public Transit Riders	8/24/2021	134	57
Data Collection Methods for Detailed Analysis of Roadway Users Interactions at Intersections with Flashing Yellow Arrows	9/7/2021	26	27
Shared Connectivity for Safer Shared Space Facilities: Improving mobility for non-motorized and VRUs	9/22/2021	45	36

Federal	State	Local	Industry	Nonprofit	Academia
Federal Highway Administration	Virginia Department of Transportation	City of Madison	State Farm	AAA Foundation for Traffic Safety	Hayang University
National Highway Traffic Safety Administration	Iowa Department of Transportation	City of Huntsville, AL	Hyundai America Technical Center, INC.	Iowa Bicycle Coalition	Massachusetts Institute of Technology
US Department of	Massachusetts Department of	Metropolitan Washington	AECOM	AAA Northeast	University of Michigan

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

- [Expert says driver distraction is becoming more dangerous in Iowa](#) – KWVL
- [Iowa State Patrol focus on bad driving habits with enforcement project, say distracted driving plays a role](#) – KCRG
- [Preventing child pedestrian injuries: Q & A with Dr. Elizabeth O’Neal](#) – UI IPRC
- [Elizabeth O’Neal wins K99 Award from NICHD to Study Teen Safety](#) - UI CLAS
- [Ganesh Pai Mangalore Wins Prestigious Link Foundation Fellowship](#) - UMass COE
- [Best & Worst States for Teen Drivers](#) - WalletHub
- [Study: Marijuana’s Impact on Driving Is Strain-Specific](#) – Forbes

Usual lab tours continued to be slow this period due to COVID-19, but our center offered 4 facility tours to the following stakeholders from industry, government, and our local community:

- Rivian – electric vehicle automaker
- Iowa Lt. Governor Adam Gregg
- Iowa State Legislators
- Trail Trekkers – local biking-focused summer camp

The University of Iowa virtually hosted the [11th International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design](#) on June 21-23, 2021 with 100 attendees. The Virtual Driving Assessment Conference featured:

- A keynote presentation from Dr. Trent Victor of Waymo
- A keynote presentation Professor Marieke Martens of Eindhoven University of Technology
- A Honda Student Session showcasing research from the next generation of transportation leaders
- Dedicated networking time to connect with colleagues

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	303
Views of archived webinar content	267
Press releases for SAFER-SIM related research	0
Media requests	8
Tours of facilities	4
Website traffic	2,090 users 3,371 sessions 7,426 page views

Patents filed	0
DOT requests for presentations or proposals related to SAFER-SIM	1
Practitioner attendance at events	181
Number of improved or new simulation technologies, software, methods, or processes	2

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.

The center is organizing another virtual symposium next period in October 2021 to encourage collaboration across sites and across disciplines within our center and from external organizations. The symposium will focus on emerging themes in transportation safety and consist of the following sessions:

- Keynote Address from Lisandra Garay-Vega PhD of the National Transportation Safety Board
- Panel Discussion on Emerging Transportation Safety Themes; panelists include
 - Dan McGehee – National Advanced Driving Simulator, University of Iowa
 - Adam Shell – Iowa Department of Transportation
 - Tammy Trimble – Virginia Tech Transportation Institute
 - Josh Domeyer – Toyota Collaborative Safety Research Center
 - Laura Sandt – Highway Safety Research Center, University of North Carolina
- Brainstorming Session on how SAFER-SIM can address emerging topics
- Year 5 Project Introductions

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

Collaboration Performance Metric	Result
Attendance at the SAFER-SIMposium	0
Interdisciplinary research projects within and across sites	6
Collaborative research projects across SAFER-SIM or other UTC sites	8
Collaborations with industry partners and government agencies	17
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	1
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 twenty (22) 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.

Jacob Heiden with the University of Iowa participated on the organizing committee for the [Iowa National Transportation Summer Institute \(INTSI\)](#) designed for minority, young women, and youth with and without disabilities. The INTSI was a virtual STEM Camp for 7-9 grade students on June 21-July 2 focusing on STEM education, careers in transportation, and leadership. INSTI is hosted by Iowa’s University Center for Excellence in Developmental Disabilities. It is offered in collaboration with the Civil Rights Bureau of the Iowa Department of Transportation and funded through the US Department of Transportation, Federal Highway Administration. Fifteen (15) students completed the camp, which featured virtual learning activities from a wide-variety of transportation-focused organizations including two SAFER-SIM affiliated labs.

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	22
# U/M events attended	2
# U/M students at attended events	30
Graduating U/M student placement	2

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?

New projects as well as some ongoing projects funded by SAFER-SIM have been delayed due to COVID-19. Data collection is resuming, and projects are moving forward through adapted protocols and procedures. The center will continue progressing toward final reports from projects. Online webinars and online outreach will continue. Expanded discussion on COVID-19 effects in [Section 6](#).

2. Participants & Collaborating Organizations

2.1 What organizations have been involved as partners?

The following organizations have been involved as SAFER-SIM partners:

Organization Name	Location	Contribution
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Aisin Technical Center of America	Northville, MI	Financial support
AAA Foundation for Traffic Safety	Washington D.C.	Financial support Collaborative research
InSight Learning Technologies	Pacific Palisades, CA	Personnel exchange
Mandli Communications Inc.	Madison, WI	In-kind support Facilities Collaborative Research
Continental Mapping Consultants Inc	Madison, WI	In-kind support Facilities Collaborative Research
Council of University Transportation Centers	Washington D.C	Financial support
Hyundai America Technical Center Inc.	Superior Township, MI	Financial support
City of Orlando	Orlando, FL	Collaborative Research
Recreative Association of Sport Buenaventura	Mayaguez, PR	Facilities
Mayaguez Bureau of Highway Patrol	Mayaguez, PR	Facilities Personnel Exchange
Club de Oficinistas de Mayagüez	Mayaguez, PR	Facilities
Puerto Rico LTAP Center, University of Puerto Rico at Mayaguez	Mayaguez, PR	Facilities
VHB	Washington D.C.	In-kind support
Lee Engineering	Phoenix, AZ	In-kind support
UW-Madison Global Health Institute	Madison, WI	Collaborative Research
City of Racine New this period	Racine, WI	Financial support
Gateway Technical College New this period	Racine, WI	In-kind support

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 10 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](#).

Performance Metric	Target	Result	Target Next Period
SAFER-SIM webinars	10	8	10
Registrations for webinars	200	303	200
Views of archived webinar content	200	267	200
Press releases related to SAFER-SIM	1	0	1
Media requests	10	8	10
Tours of facilities	5	4	5
Website traffic	3,000 users 5,000 sessions 8,500 pageviews	2,090 users 3,371 sessions 7,426 page views	3,000 users 5,000 sessions 8,500 pageviews
Patents filed	1	0	1
DOT requests for presentations or proposals related to SAFER-SIM	1 per year	0	1 per year

Practitioner attendance at events	100	181	100
Number of improved or new simulation technologies, software, methods, or processes	5	2	5

3.1 Publications, conference papers, and presentations

Journal Publications

1. B. Claros. "Impact of Geometry and Operations on Left Turn Gap Acceptance at Signalized Intersections with Permissive Indication" Transportation Research Record. May 2021. <http://dx.doi.org/10.1177/03611981211011476>
2. Guo, Z., Afifah, F.*, Qi, J, and Baghali, S., A Stochastic Multi-Agent Optimization Framework for Interdependent Transportation and Power System Analyses. IEEE Transactions on Transportation Electrification. September 2021. <https://doi.org/10.1109/TTE.2021.3049127>
3. Rahman, R., Hasan, S. and Zaki, M. H. Towards reducing the number of crashes during hurricane evacuation: Assessing the potential safety impact of adaptive cruise control systems. Transportation Research Part C: Emerging Technologies, 128, 103188. July 2021. <https://doi.org/10.1016/j.trc.2021.103188>
4. Rahman, R., Bhowmik, T., Eluru, N., and Hasan, S. Assessing the crash risks of evacuation: A matched case-control approach applied over data collected during Hurricane Irma. Accident Analysis and Prevention, 159, 106260. September 2021. <https://doi.org/10.1016/j.aap.2021.106260>
5. Gaspar, J., Carney, C., Shull, E., and Horrey, W. Mapping drivers' mental models of adaptive cruise control to performance. Transportation Research Part F: Traffic Psychology and Behaviour. August 2021. <https://doi.org/10.1016/j.trf.2021.07.012>
6. Subramanian, L. D., O'Neal, E. E., Roman, A., Sherony, R., Plumert, J. M., & Kearney, J. K. (in press). How do pedestrians respond to adaptive headlamp systems in vehicles? A road-crossing study in a virtual environment. Accident Analysis and Prevention. September 2021. <https://doi.org/10.1016/j.aap.2021.106298>
7. A. Fallahdizchek and C. Wang, "Profile monitoring based on transfer learning of multi-profile with incomplete samples," IISE Transactions, May 2021. <https://doi.org/10.1080/24725854.2021.1912439>
8. Deliali, K., Christofa, E., & Knodler Jr, M. (2021). The role of protected intersections in improving bicycle safety and driver right-turning behavior. Accident Analysis & Prevention, 159, 106295. September 2021. <https://doi.org/10.1016/j.aap.2021.106295>
9. Roberts, S. C., Zhang, F., Fisher, D., & Vaca, F. E. (2021). The effect of hazard awareness training on teen drivers of varying socioeconomic status. Traffic Injury Prevention, 22(6), 455-459. July 2021. <https://doi.org/10.1080/15389588.2021.1940984>
10. B. Colucci, A. Medina and D. Díaz, INNOVATIVE RESEARCH THAT CONTRIBUTES TO SAFETY, SUSTAINABILITY AND RESILIENCE IN TRANSPORTATION SYSTEMS, RIDNAIC (2021). Vol. 19-20, 13 URL https://www.scipedia.com/public/Colucci_et_al_2021a

Conference papers and presentations

1. Alberto Figueroa-Medina, Didier Valdés, Benjamín Colucci, Natacha Cardona, and Andrés Chamorro. September 2021. Pedestrian Walking speeds and Success Rates on Mid-Block Crossing Using Virtual Reality Simulation. Road Safety and Simulation Conference 2021.
2. Carla Lopez, Didier Valdés, Alberto Figueroa, and Benjamín Colucci. Driver's Compliance in Work Zones: Two-Lane Rural Roads -vs.- Freeways. 2021 International LADR Workshop. 2021.
3. Ryan, A., Ai, C., Fitzpatrick, C., and Knodler, M. Identifying safety-critical road segments and potential countermeasures: A geospatial approach using horizontal curve data. To present at the Institute of Transportation Engineers Annual Meeting, 18–21 July, Portland, OR.
4. Ryan, A., Hennessy, E., Ai, C., Fitzpatrick, C., and Knodler, M. Driver performance at horizontal curves: Bridging critical research gaps to increase safety. Paper Number 7. Road Safety & Simulation International Conference, 22–24 September, Athens, Greece.
5. Horrey, W. J., Benson, A., Guo, Z., Afifah, F., Hamann, C. J., & Santiago, K. R. (2021). Expectations and Understanding of Advanced Driver Assistance Systems Among Drivers, Pedestrians, Bicyclists, and Public Transit Riders. Proceedings of the Road Safety and Simulation International Conference. Vol 16, p.19. 06/2021
6. Gaspar, J., Carney, C., Shull, E., and Horrey, W. Mapping mental model accuracy and system exposure to driver behavior. Human Factors and Ergonomics Society Annual Meeting 2021.
7. Malik, J., Kim, N. Y., Parr, M. D. N., Kearney, J. K., Plumert, J. M., & Rector, K. (2021). Do simulated augmented reality overlays influence street-crossing decisions in non-mobility-impaired older and younger adults? Submitted for publication.
8. Malik, J., Parr, M. D. N., Flathau, J., Tang, H., Kearney, J. K., Plumert, J. M., & Rector, K. (2021). Determining the effect of smartphone alerts and warnings on the street-crossing behavior of non-mobility-impaired older and younger adults. In CHI Conference on Human Factors in Computing Systems (CHI '21), May 08–13, 2021, Yokohama, Japan. ACM, New York, NY, USA, 12 pages. <https://doi.org/10.1145/3411764.3445234>
9. O'Neal, E.E., Tang, H., Flathau, J., & Plumert, J.M. (April, 2021). How does parent gender impact the socialization of safety values in sons and daughters? Poster presented at the 2021 biennial meeting of the Society for Research in Child Development (online).
10. Parr, M., Zhou, S., O'Neal, E.E., Kearney, J.K., & Plumert, J.M. (April, 2021). How do Children Perceive and Act on Affordances When Walking vs Bicycling Across Roads? Poster presented at the 2021 biennial meeting of the Society for Research in Child Development (online).
11. Kim, A., O'Neal, E.E., Flathau, J., Tang, H., Kearney, J.K., & Plumert, J.M. (April, 2021). A parent-based intervention program for training prospective control skills in children. Poster presented at the 2021 biennial meeting of the Society for Research in Child Development (online).
12. O'Neal, E.E., Tang, H., Flathau, J., & Plumert, J.M. (April, 2021). Socialization of safety values in children: The role of parent and child gender. Oral presentation at the 2021 annual meeting of the Society for Violence and Injury Research (online).
13. Ryan, A., Christofa, E., Barchers, C., and Knodler, M. (2021). Towards equitable road safety: Socio-demographic divides in municipal highway investments. Conference on Advancing Transportation Equity (CATE), September 2021.
14. Benjamín Colucci. Technical Poster entitled Lessons Learned and Future of the Decade of Action for Road Safety 2011-2020, Strategic Highway Safety Plans and Vision Zero Initiatives presented with Eng. Lynnette Alicea from CSA Group during the ITE 2021 Virtual Annual Meeting. August 13, 2021.

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	2,090	22,387
New Users	2,051	21,875
Sessions	3,371	42,737
Page Views	7,426	90,468

[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	8	118
Views	5,800	34,000
Subscribers	24	177

[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	9	394
Tweet Impressions	5,900	82,600
Followers	6	170

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

Metric	This Period	Lifetime
Datasets	11	36
File Downloads	2,937	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 539 times.

[Online Traffic Safety Merit Badge](#) – 965 Scouts have started the materials and 612 have completed the requirements. More information in [Section 1.2.3](#).

Metric	This Period	Lifetime
Scouts Started	101	965
Scouts Completed	74	612

[Online Engineering Merit Badge](#) – 239 Scouts have started the materials and 125 have completed the requirements. More information in [Section 1.2.3](#).

Metric	This Period	Lifetime
Scouts Started	33	273
Scouts Completed	17	142

[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	0	399
Campaigns Sent	19	132
# Opens	1,773	8,958

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	2	5
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

1. A simulation platform for pedestrian behavior and interaction in shared spaces was improved from

[this SAFER-SIM project](#). The simulation considers the microscopic behavior through the modeling of the gait parameters, group behavior and obstacle avoidance. A stable connectivity network in MANET comprising of active mobile traffic agents and their walking behavior. The network will be used for data dissemination for safety events

2. A novel method to capture the interactions among different driving performance measures so that the prediction performance was improved from [this SAFER-SIM study](#). The method was validated in NADS-1 and mini-SIM under various driving conditions, and the results demonstrated that 15%-20% improvement of driving performance measures prediction accuracy can be achieved.

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 conflicts implemented policy, practice, regulation, rulemaking or legislation	Not yet determined	Not yet realized

Expected reductions in crashes from implemented policy, practice, regulation, rulemaking or legislation

1. The developed simulation [this SAFER-SIM project](#) will provide a means to understand the behavior of pedestrians under mixed traffic conditions. The developed framework aids in investigating urban mobility and peer to peer communication scenarios which will foster next generations shared transportation systems. A robust communication network will share information reliably to all the participating nodes in a network and therefore can be used to address challenging times of disaster evacuation, emergency evacuation. Better communication will help to maintain the safety of non-motorized traffic agents and micro-mobility agents against motorized traffic in shared space.
2. By supporting the safety evaluation of automated vehicles, [this SAFER-SIM research](#) can hasten the development and deployment of AVs and turn the widely expected societal benefits of AV into reality.
3. The results of this [SAFER-SIM study](#) indicate that drivers' visual environment could have significant impacts on traffic safety. The findings could provide a cost-effective method to evaluate road safety and identify important features to reduce crash occurrence and severity if implemented.

Expected reductions in congestion and traffic conflicts implemented policy, practice, regulation, rulemaking or legislation

1. The direct impact of [this SAFER-SIM project](#) is to provide an accurate prediction of the Driving Performance Measures (DPMs) under unobserved driving conditions, which can reduce simulation costs and time. The long-term impact of the project is to reveal the interaction mechanism among different DPMs, which can provide guidance for the DPM design and collection process. A 30%-40% deduction of simulation costs and time can be expected by using the proposed DPM prediction method. The thorough understanding of the DPM interactions can contribute to accurate control and feedback of autonomous driving.

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 are beginning to return to normal activities. Research projects have resumed progress toward completion, but there have been some additional delays due to a backlog of projects at sites. This backlog has led to delays on research and administrative sides. Research teams are balancing 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 finalize these materials from completed projects early next period, and we expect these COVID-related submission delays to not be as prominent moving forward through the remainder of the grant performance period once we are caught up. All funded SAFER-SIM projects have plans to ensure completion before the main award end date.

Following COVID-19, researchers in our center are slowly returning to normal in-person outreach events and attending professional meetings and conferences. Sites are still complying with their university's travel and community engagement guidelines, and our center already has plans to share our work at in-person conferences, schools, and community events next period.

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

Described in [Section 6.1](#)

6.3 Changes that have a significant impact on expenditures

Described in [Section 6.1](#)

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

Described in [Section 6.1](#)

7. Special Reporting Requirements

Nothing to report