



**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 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

SAFER-SIM issued a Request for Proposals in the Fall of 2020 and received twenty-six (26) proposals. Eighteen (18) projects were selected for funding in April 2021, including the third year of a collaborative research program with the AAA Foundation for Traffic Safety. These funded projects will be posted on [Research in Progress \(RIP\) Database](#) in May and will begin work in the summer or fall of 2021.

The center has funded seventy-eight (78) projects total – fifty-nine (77) research and (1) outreach – under the FAST Act. Thirty-four (34) projects remain active and twenty-six (26) projects are complete. All project information can be found on 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	10	8	18
Y4	0	17	0	17
Y5	18	0	0	18
Total	18	27	33	78

SAFER-SIM completed seven (7) research projects this period. These projects have completed final reports, but we are still waiting to finalize on TRID. The reports were submitted on TRID but weren’t archived. A librarian cataloger from the National Transportation Library asked us to include a technical documentation page on the reports moving forward. We’ve already included all information in the report as required by the grant including federal grant number and ORCID, and we are working on adding the technical documentation page to comply with the National Transportation Library requirements. The projects below completed this period and will be listed on TRID next period once the technical documentation page is added.

Projects Completed this Period	TRID
The Impact of Driver’s Mental Models of Advanced Vehicle Technologies on Safety and Performance (UMass)	TBD
Minimum time to situational awareness during transfer of control under varying levels of task load	TBD
Extended Evaluation of Training Programs to Accelerate Hazard Anticipation Skills in Novice Teen Drivers	TBD
Training to Improve Situational Awareness Regarding Operational Design Domain in Driving Automation Systems	TBD
Study of Gap Acceptance and Walking Speeds of Pedestrians using Virtual Reality Simulation	TBD

Driver's Safety Assessment in Two-Lane Rural Road Work Zones	TBD
Assessing a Two-Step Posted Speed Reduction as a Potential Countermeasure to Improve Safety in School Zones Using Driving Simulation	TBD

Kyle Rector from the University of Iowa earned the prestigious [National Science Foundation's CAREER grant](#) building off SAFER-SIM work. Dr. Rector is an Assistant Professor in the Department of Computer Science and her research specialty is human-computer interaction (HCI) and accessibility, with the goal of using computing technology to enhance quality of life for people with disabilities:

1. CAREER: Dynamic Virtual Reality Experiences for People with Visual Impairments
 Funding Agency: National Science Foundation
 Kyle Rector (PI), University of Iowa
 Amount: \$550,000
 Duration: August 2021-July 2026.

SAFER-SIM had two teams of researchers win awards on their SAFER-SIM-related work this period.

1. Martin Bruening Award - Any member of the Wisconsin Section of the Institute of Transportation Engineers or its student chapters may submit a candidate technical paper. The paper must result from a study or design project in the field of transportation or traffic engineering in which the author(s) served as a principal participant.
 Paper title: "Impact of Geometry and Operations on Left Turn Gap Acceptance at Signalized Intersections with Permissive Indication" stemming from [this project](#).
2. Best paper award from [this UCF project](#), "Impacts of Privately Owned Electrical Vehicles on Power Distribution System Resilience", Energy Systems Track, Institute of Industrial and Systems Engineers Annual Conference

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	24
Paper/poster awards	2
External grants related to SAFER-SIM	1

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:

- Mohamed Abdel-Aty presented on Safety Management and Visualization: Real-Time data, Safety Analytics and AI at the Metropolitan Transport Commission 2020 On-Line International Seminar on

December 15, 2020.

- Chao Wang from the University of Iowa presented on the Gaussian Process based modeling, monitoring and knowledge transfer in engineering applications at the online INFORMS annual meeting.
- Shannon Roberts from the University of Massachusetts Amherst gave a presentation entitled “Using Text Mining to Uncover Drivers’ Perception of Baseline Driver Assistance Systems” during the SAE Government/Industry Digital Summit on February 2, 2021.
- University of Wisconsin Madison researchers provided an update at the Wisconsin Automated Vehicle External Committee meeting

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. Mohamed Abdel-Aty received the [2020 Roy W. Crum Distinguished Service Award](#) from the National Academies Transportation Research Board. Dr. Aty is recognized for his distinguished achievements in the development of immediate practical applications of his fundamental and developmental research results as well as for contributing broadly to the science of transportation safety. His work and accomplishments will leave an enduring legacy, which will undoubtedly continue to improve transportation safety research, methods, and practice.
- Dr. Mohamed Abdel-Aty: Publons Web-of-Science, Highly Cited Researcher, Clarivate™ identifies the world’s most influential researchers — the select few who have been most frequently cited by their peers over the last decade. In 2020, fewer than 6,200, or about 0.1%, of the world's researchers, in 21 research fields and across multiple fields, have earned this exclusive distinction, November 2020.
- Benjamín Colucci Ríos received the [2021 Wilbur S. Smith Award](#): Given by the American Society of Civil Engineers (ASCE) and its Transportation Development Institute for "unending leadership and dedication to action for the improvement of road safety in Puerto Rico and around the world".

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

Leadership Development Performance Metric	Result
Invited presentations	8
Invited papers	0
Invited workshops	0
Grant review panels	3
Advisory committees	80
Journal editing	36
Leadership positions in professional organizations	20
SAFER-SIM webinars	5
Professional awards	16

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).

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 67 scouts started the resource this period with 60 more scouts successfully completing all requirements. In total 864 scouts have used this resource and 538 have completed all requirements.

Following the success of the Traffic Safety Merit Badge, 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. An additional 39 scouts started the resource this period with 30 more scouts successfully completing all requirements. In total 239 scouts have used this resource and 125 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	23
Paper/poster awards w/ student authors	0
Graduate students working on and supported by SAFER-SIM related projects	41
Undergraduate students working on and supported by SAFER-SIM related projects	14
Student attendance and presentations at the SAFER-SIMposium	33 students
Transportation-related M.A. and PhD theses	0
Curriculum modules developed	9
Student Internships	2
Presentations to student groups or classes	10 presentations 175 students
# Schools visited and # students present	0
# Career fairs visited and # of attendees	0

Summer institutes and programs and # of students participating	0
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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 5 webinars this period with 174 registrants – 126 from academia, 18 from industry, and 16 from government.

Webinar	Date	Registrants	Archived Views
The Impact of Driver’s Mental Models of Advanced Vehicle Technologies on Safety and Performance	10/27/2020	30	32
Using Simulation to Assess Right-Hook Conflicts Between Bicycles and Cars at Protected and Unprotected Intersections	11/10/2020	43	33
Assessing a Two-Step Posted Speed Reduction as a Potential Countermeasure to Improve Safety in School Zones Using Driving Simulation	2/23/2021	22	18
Study of Gap Acceptance and Walking Speeds of Pedestrians using Virtual Reality Simulation	3/9/2021	58	68
Drivers’ Safety Assessment in Two Lane Rural Road Work Zones	3/24/2021	21	19
		174	170

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

- [NADS pulls in nearly \\$1.5M funding to further study transition of control in automated vehicles](#) – Iowa Technology Institute
- [National Advanced Driving Simulator awarded \\$1.45 million to further research on automated vehicles](#) – The Daily Iowan
- [Iowa City driving simulator awarded \\$1.45 million to research automated vehicles](#) – Clay and Milk
- [Iowa City bolsters bike safety with new road markings](#) – The Daily Iowan
- [New driving behavior a concern heading into winter](#) – CBS 2 Iowa
- [The Road to the Future Runs Through Iowa](#) – Iowa Magazine
- [Creating an Automated Shuttle for America’s Backroads](#) - Adapt
- [Autonomous Lingo in the Repair Space](#) – Adapt

- [Garrett Morris and Kyle Rector of Computer Science earn prestigious NSF CAREER awards](#) – College of Liberal Arts and Sciences
- [Jaydeep Radadiya: UMass Amherst Rising Researcher](#) – University of Massachusetts-Amherst
- [MIE Junior Sarah Widrow Wins Two Noteworthy Transportation Awards](#) – University of Massachusetts-Amherst

Usual lab tours were slowed this period due to COVID-19. Our center still reached stakeholders from government, academia, and industry through online efforts. Individuals from the following organizations attended webinars this period:

- AAA Foundation for Traffic Safety
- Federal Highway Administration
- Hyundai American Technical Center, Inc.
- State Farm
- National Highway Traffic Safety Administration
- U.S. Department of Transportation
- New York City Department of Transportation
- Massachusetts Department of Transportation
- Wisconsin Department of Transportation
- Northern Arizona University
- Hanyang University
- San Diego State University
- Oregon State University
- University of California Davis
- Texas A&M Transportation Institute
- CMA Architects & Engineers, LLC
- US Federal Government
- Wisconsin State Patrol
- First Tennessee Development District

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	5
Registrations for webinars	174
Views of archived webinar content	241
Press releases for SAFER-SIM related research	0
Media requests	14
Tours of facilities	1
Website traffic	1,908 users 3,253 sessions 6,620 pageviews
Patents filed	0

DOT requests for presentations or proposals related to SAFER-SIM	1
Practitioner attendance at events	41
Number of improved or new simulation technologies, software, methods, or processes	1

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 biennial SAFER-SIMposium was virtual this year due to COVID-19 but was very successful. The symposium consisted of four sessions focusing on the theme of “research to implementation.” 78 total attendees participated in the sessions.

- The symposium kicked off on March 11th with a presentation by David Yang and Bill Horrey from the AAA Foundation for Traffic Safety about “What Makes A Successful UTC”. Afterwards, we utilized the platform “Gather” to network and socialize virtually. 42 individuals attended this session.
- 50 people attended the second session featuring a panel of industry and government professionals sharing their perspective on implementing research: Eric Hill (MetroPlan Orlando), Rachel James (Federal Highway Administration), Lily Oliver (Massachusetts DOT), Charles Green (General Motors), and Bob Najduk (Trek Bicycle) on March 12th.
- The following week on March 18th, a panel of researchers from the SAFER-SIM sites gave presentations about their success stories on technology transfer. 46 individuals attended this session.
- The final day, March 19th consisted of student hybrid poster sessions that took place on “Gather”. 15 students gave a one-minute hybrid presentation about their projects to around 40 people. A poster session followed where students could discuss their projects in more depth.

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

Collaboration Performance Metric	Result
Attendance at the SAFER-SIMposium	78
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	15
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 (24) students from historically underrepresented groups were involved in twenty (20) SAFER-SIM projects this period.

A diversity highlight from this period is:

- Shannon Roberts sat on a panel for students from Roosevelt University (in Chicago IL) after they viewed the documentary ‘Picture a Scientist’ on March 18. There were approximately 35 students, mostly women and many underrepresented, in attendance.

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	20
# U/M events attended	1
# U/M students at attended events	35
Graduating U/M student placement	0

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 slowly resuming, and projects will move 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:

<i>Organization Name</i>	<i>Location</i>	<i>Contribution</i>
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 New this period	Madison, WI	Collaborative Research

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 Hoyer	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	6	5	10
Registrations for webinars	200	174	200
Views of archived webinar content	150	170	200
Press releases related to SAFER-SIM	1	0	1
Media requests	10	7	10
Tours of facilities	10	0	5
Website traffic	3,000 users 5,000 sessions 8,500 pageviews	1,908 users 3,253 sessions 6,620 pageviews	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	1	1 per year
Practitioner attendance at events	100	41	100
Number of improved or new simulation technologies, software, methods, or processes	5	1	5

3.1 Publications, conference papers, and presentations

Journal Publications

1. H. Nassereddine, K. R. Santiago-Chaparro, and D. A. Noyce, “Modeling Vehicle Pedestrian Interactions Using a Non-Probabilistic Regression Approach,” *Transportation Research Record*, 2020. <https://doi.org/10.1177%2F0361198120962799>
2. Yingxue Zhang, Yanhua Li, Xun Zhou Xiangnan Kong, Jun Luo. Off-Deployment Traffic Estimation --- A Traffic Generative Adversarial Networks Approach. *IEEE Transactions on Big Data* <https://doi.ieeecomputersociety.org/10.1109/TBDATA.2020.3014511>
3. Rahman, M. H., Abdel-Aty, M. Application of Connected and Automated Vehicles in a Large-Scale Network by Considering V2V and V2I Technology’ accepted at *Transportation Research Record (TRR)*, 2020. <https://doi.org/10.1177%2F0361198120963105>
4. Elmquist, R. Serban, D. Negrut, “A Sensor Simulation Framework for Training and Testing Robots and Autonomous Vehicles,” *ASME Journal of Autonomous Vehicles*, 2021. <https://doi.org/10.1115/1.4050080>.
5. K. Liu, D. Negrut, “The role of physics-based simulators in robotics,” *Annual Review of Control, Robotics, and Autonomous Systems*, Vol. 4, 2021, <https://doi.org/10.1146/annurev-control-072220-093055>.
6. H. Choi, C. A. Crump, C. Duriez, A. Elmquist, G. D. Hager, D. Han, F. J. Hearl, J. Hodgins, A. Jain, F. A. Leve, C. Li, F. Meier, D. Negrut, L. Righetti, A. Rodriguez, J. Tan, J. Trinkle, “On the use of modeling and simulation in robotics: opportunities and challenges,” *Proceeding of the National Academy of Sciences*, 2021 <https://doi.org/10.1073/pnas.1907856118>.
7. Song, Y., Chitturi, M.V. and Noyce, D.A., 2021. “Automated vehicle crash sequences: Patterns and potential uses in safety testing.” *Accident Analysis & Prevention*, 153, p.106017. <https://doi.org/10.1016/j.aap.2021.106017>
8. Benjamín Colucci, Didier Valdés, and Alberto M. Figueroa-Medina. 2021. “Innovative Research that Contributes to Safety, Sustainability, and Resilience in Transportation Systems.” Paper published *International Journal of Natural Disasters, Accidents, and Civil Infrastructure (Revista Internacional de Desastres Naturales, Accidentes e Infraestructura Civil, RIDNAIC)*, Vol. 19-20, #13, pp. 211-229. https://www.scipedia.com/public/Colucci_et_al_2021a
9. Pradhan, A. K., Pai, G., Radadiya, J., Knodler Jr, M. A., Fitzpatrick, C., & Horrey, W. J. (2020). Proposed Framework for Identifying and Predicting Operator Errors When using Advanced Vehicle Technologies. *Transportation Research Record: Journal of the Transportation Research Board*. <https://doi.org/10.1177%2F0361198120938778>
10. Jiang, Y., O’Neal, E. E., Zhou, S., Plumert, J. M., & Kearney, J. K. (2020). Crossing Roads with a Computer-generated Agent: Persistent Effects on Perception–Action Tuning. *ACM Transactions on Applied Perception (TAP)*, 18(1), 1-16. <https://doi.org/10.1145/3431923>

Conference papers and presentations

1. Baghali, S.* and Guo, Z. (2021, Best Paper Award) Investigating the Effects of Privately Owned Electrical Vehicles on Distribution System Resilience. Presentation at the IISE Annual Conference, Online
2. Siddique, N., Afifah, F.*, Guo, Z. and Zhou, Y. (2021) Predictive Modeling for PEV Charging

Behavior using Large-scale Charging Data. Presentation at the Transportation Research Board 100th Annual Meeting, Online

3. Guo, Z., Afifah, F.*, and Qi, J. (2021) A Decomposition-based Approach for Transportation and Power Systems Interdependence with Renewable Generators and Electric Vehicles. Presentation at the Transportation Research Board 100th Annual Meeting, Online.
4. Chuang, H*, Guo, Z., Aeschliman, S., Zhou, Y., Afifah, F.*, and Huang, J.(2021). Energy Impact Analyses of Electrified Ride-sourcing Services without Trip-chain Data. Presentation at the Transportation Research Board 100th Annual Meeting, Online
5. Rahman, R., Bhowmik, T., Eluru, N., and Hasan, S. (2021) Assessing the Crash Risks of Evacuation: A Matched Case-Control Approach Applied over Data Collected during Hurricane Irma, TRB Annual Meeting 2021, D.C. Washington.
6. Malik, J., Di Napoli Parr, M., Flathau, J., Tang, H., Kearney, J.K., Plumert, J.M., Rector, K.K. (in press). Determining the Effect of Smartphone Alerts and Warnings on Street-Crossing Behavior in Non-Mobility-Impaired Older and Younger Adults. ACM CHI: Conference on Human Factors in Computing Systems, 2021.
7. 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? Oral presentation accepted for presentation at the 2021 biennial meeting of the Society for Research in Child Development, Virtual Conference.
8. 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 accepted for presentation at the 2021 biennial meeting of the Society for Research in Child Development, Virtual Conference.
9. 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 accepted for presentation at the 2021 biennial meeting of the Society for Research in Child Development, Virtual Conference.
10. Subramanian, L. D., O’Neal, E.E., Plumert, J. M., & Kearney, J. K. (March 19, 2021) A Study of Pedestrian Road Crossing in the Presence of eHMI using an Immersive Virtual Environment, Poster Presentation, SAFER-SIM UTC Symposium.
11. 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 accepted for presentation at the 2021 annual meeting of the Society for Violence and Injury Research , Virtual Conference.
12. Saisubramanian, S., Roberts, S. C., Zilberstein, Z. (in press). Understanding User Attitudes Towards Negative Side Effects of AI Systems. In CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI ’21 Extended Abstracts). ACM Press.
13. J. Taves, A. Young, S. Benatti, A. Elmquist, R. Serban, A. Tasora, D. Negrut, “SynChrono: An MPI-Based, Scalable Physics-Based Simulation Framework for Autonomous Vehicles Operating in Off-Road Conditions,” International Conference for High Performance Computing, Networking, Storage, and Analysis, 2020. Poster can be found [here](#).

14. J. Taves, A. Young, S. Benatti, A. Elmquist, R. Serban, D. Negrut, “A Scalable Physics-Based Simulation Framework for Autonomous Vehicles in Chrono,” SAFER-SIM Symposium, 2021
15. J. Taves, A. Elmquist, A. Young, R. Serban and D. Negrut, “SynChrono: A Scalable, Physics-Based Simulation Platform For Testing Groups of Autonomous Vehicles and/or Robots,” International Conference on Intelligent Robotic Systems, 2021. Paper can be found [here](#).
16. B. Claros. “Impact of Geometry and Operations on Left Turn Gap Acceptance at Signalized Intersections with Permissive Indication” Transportation Research Board Annual Meeting, 2021.
17. 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.
18. 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.
19. Alberto Figueroa-Medina. Innovative Research Contributing to Safety, Sustainability and Resilience in Transportation Systems. 1st Virtual Summit RIDNAIC. March 16, 2021.
20. Didier Valdés, Benjamín Colucci, Alberto Figueroa-Medina, Yindhira Taveras, María Rojas, Rocío Sotomayor-Irizarry, C. Lorena Sierra. January 2021. Safety Enhancements to Reduce Speeding in School Zones using Driving Simulation. Transportation Research Board 100th Annual Meeting. Washington, D.C..
21. Alberto Figueroa-Medina, Didier Valdés, Benjamín Colucci, Natacha Cardona, and Andrés Chamorro. March 2021. Study of Gap Acceptance and Walking Speeds of Pedestrians using Virtual Reality Simulation. Poster at SAFER-SIM Symposium 2021.
22. Alberto Figueroa-Medina, Didier Valdés, Benjamín Colucci, Natacha Cardona, and Andrés Chamorro. March 2021. Impact of Road Information Assistive Systems on Pedestrian Crossing Safety. Poster at SAFER-SIM Symposium 2021.
23. Saisubramanian, S., Roberts, S. C., Zilberstein, Z. (in press). Understanding User Attitudes Towards Negative Side Effects of AI Systems. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '21 Extended Abstracts)*. ACM Press.
24. Radadiya, Pai, Pradhan (2020) Are Limitations of Advanced Vehicle Technologies Described Consistently for Different Vehicle Models: An Examination for Adaptive Cruise Control, Annual Meeting of the Association for the Advancement of Automotive Medicine.
25. Ryan, A., Hennessy, E., Fitzpatrick, C., Knodler, M., and Ai, C. (2021) Driver performance at horizontal curves: A review of current simulation literature and research gaps. Poster. Safety Research Using Simulation (SAFER-SIM) Conference, 11–12 & 18–19 March, online format.

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	1,908	20,297
New Users	1,845	19,824
Sessions	3,253	39,366
Page Views	6,620	83,042

[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	5	110
Views	5,600	32,496
Subscribers	31	152

[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	18	385
Tweet Impressions	12,100	76,700
Followers	12	163

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

Metric	This Period	Lifetime
Datasets	1	25
File Downloads	2	11,239

3.4 New methodologies, technologies or techniques

Projects funded by SAFER-SIM developed or improved on the following technologies this period:

1. UM - Through [this project](#), we developed a training program that better informs drivers of the limitations of automated vehicle technology. In comparison to no training and reading a user manual, the training system, which was delivered via PowerPoint, yielded optimal performance (i.e., drivers took back control of the vehicle quickly and efficiently).

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 518 times.

[Online Traffic Safety Merit Badge](#) – 864 Scouts have started the materials and 538 have completed the requirements. More information in [Section 1.2.3](#).

Metric	This Period	Lifetime
Scouts Started	67	864
Scouts Completed	60	538
# of Scouting Councils	48	230
# of Scouting Districts	53	337
# of Scouting Troops	65	402

[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	39	239
Scouts Completed	30	125
# of Scouting Councils	37	89
# of Scouting Districts	38	103
# of Scouting Troops	44	140

[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	18	399
Campaigns Sent	15	113
# Opens	1,380	7,185

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	1	2
Number of projects that reach adoption, implementation or deployment	1	2	1

Number of improved or new technologies, software, methods, or processes adopted

1. Chrono::Sensor provided for public use within Chrono: <https://github.com/projectchrono/chrono>, directly developed under “Physics-Based Sensor Models for Virtual Simulation of Connected and Autonomous Vehicles”
2. SynChrono provided for public use within Chrono: <https://github.com/projectchrono/chrono>, directly developed under “Physics-Based Sensor Models for Virtual Simulation of Connected and Autonomous Vehicles”

Stakeholders who adopt, implement or deploy SAFER-SIM research findings or technologies through policy, practice, regulation, rulemaking or legislation

1. The Chrono::Vehicle and Chrono dynamics engine have been embedded in the CARLA autonomous vehicle simulator by the CARLA team. A CARLA simulation that uses Chrono can be seen [here](#).

Number of projects that reach adoption, implementation or deployment

1. The Chrono::Sensor simulation infrastructure has been deployed for public use.
2. The SynChrono simulation infrastructure has been deployed for public use.

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.

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. If the advanced dashboard interface from [this project](#) were implemented on a larger scale, more drivers would be aware of automated vehicle functionality and would more closely monitor the technology when it is activated. This would in turn lead to fewer instances of unexpected vehicle behavior (e.g., the vehicle doesn't stop for a pedestrian at an intersection) and fewer crashes.
2. If the training program from [this project](#) were implemented on a larger scale, more drivers would be aware of automated vehicle functionality and would more closely monitor the technology when it is activated. This would in turn lead to fewer instances of unexpected vehicle behavior (e.g., the vehicle swerves erratically near a merge) and fewer crashes.
3. The developed convoluted Gaussian process from [this project](#) can accurately predict the baseline performance of driving performance measures at various driving conditions. These predictions can save thousands level of lab simulation hours. The quantified uncertainties of the driving performance measures can also provide information for the behavior variations under different driving conditions, which reveals information for future experiment design.

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

Nothing to report

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 working diligently to return to normal activities. Research projects have resumed progress toward completion, but there have been some additional delays due to a backlog of competing projects at sites that were also affected from COVID-19. These and all projects have plans to ensure completion before the main award end date.

Additionally, we have experienced delays in archiving final research reports on TRID. As described in [Section 1.2.1](#), a librarian cataloger from the National Transportation Library is requiring us to include a technical documentation page on final reports moving forward. The reports already include all information in as required by the grant including federal grant number and ORCIDs, and we are working on adding the technical documentation page to comply with the National Transportation Library requirements.

Normal in-person outreach and attendance at meetings and conferences is still on-hold due to COVID-19. Sites are complying with their university's travel and community engagement guidelines, and our center will resume these important activities once it is safe to do so.

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