

Semi-Annual Progress Report for REPS

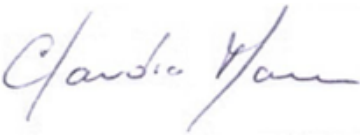
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1. ACCOMPLISHMENTS

1.1 What are the major goals and objectives of the program?

The Research and Education for Promoting Safety (REPS) Tier 1 University Transportation Center is a collaborative initiative aimed at enhancing transportation safety through multidisciplinary research. This center integrates cutting-edge research from civil engineering and computer science to tackle challenges related to infrastructure, traffic operations, and cybersecurity. The REPS team is composed of prominent researchers from four universities in the U.S.: Howard University (HU-Lead), San Jose State University (SJSU), the University of Maryland (UMD), and the University of Nevada, Las Vegas (UNLV).

1.1.1 Research Goals

The goal of REPS is to develop integrative solutions that improve safety by eliminating traffic-related fatalities, reducing transportation infrastructure failures, and enhancing public transit efficiency. Through research, education, and technology transfer, our team is dedicated to preparing safety professionals with the skills needed to tackle evolving technological and safety challenges. The research aligns with USDOT's strategic goals of Safety and Transformation, focusing on preserving transportation systems, reducing cybersecurity risks, and implementing technology transfer activities.

REPS is organized around three key thrust areas, each addressing critical aspects of transportation safety:

- **Thrust Area 1: Safe Design and Systems to Increase Transportation Safety**

This thrust projects aimed at improving transportation safety by designing and implementing innovative systems. The research area explores topics such as the impact of enforcement and education on reducing impaired driving, integrating Adjudication Citation and Enforcement (ACE) data, and the role of mental states on driver safety. It also examines the potential of big data analytics to develop smart cities and prevent accidents.

- **Thrust Area 2: Critical Infrastructure Cybersecurity**

This thrust projects aimed at enhancing cybersecurity in critical transportation infrastructure as systems become increasingly digitized. This research area explores the use of Blockchain and AI technologies to improve data collection, processing, and security, particularly in railways.

- **Thrust Area 3: Safe Public – Protecting Communities from Safety Risks**

This thrust projects aimed at protecting communities from transportation-related risks by advancing traffic safety research. The aim is to reduce road fatalities through the development of advanced tools, monitoring traffic, and improving safety models. By using local data, Crash Modification Factors (CMFs) will be updated for better safety outcomes. The research area also includes testing various technologies to improve road network performance and infrastructure reliability.

1.1.2 Education, Technology Transfer, and Workforce Development Goals

REPS supports national transportation innovation by engaging communities, educational institutions, and organizations through research, technical training, workforce development, and technology transfer. REPS works to strengthen transportation systems, improve infrastructure efficiency, and expand opportunities for American workers and businesses.

Through its partnerships with local and state Departments of Transportation, industry leaders, and federal agencies, REPS promotes safety, innovation, and long-term economic growth. Its programs focus on advancing emerging technologies, supporting career preparation in science and engineering, and developing a skilled workforce that enhances mobility, resilience, and productivity across the nation's transportation network.

1.2 What was accomplished under these goals?

1.2.1 Research

Eleven research projects (06/01/2023 – present) are in progress involving multiple partners. The table below shows the projects status.

Project Status for 04/01/2025–09/30/2025

Project Title	% Completed	Milestones Achieved	Obstacles/Constraints
<u>Investigating the Impact of Enforcement and Education on Reducing Drug-Impaired Driving</u>	95%	Paper Status <ul style="list-style-type: none"> • Paper 1 (Causal analysis) accepted for TRB 2026 • Paper 2 (Combined law enforcement data) seeking journal 	
<u>Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions</u>	100%	Published Link Here	
<u>Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA</u>	100%	Published Link Here	
<u>Smart AI-Technology Employment for Crash Data Analysis</u>	90%	Team continued efforts to develop a natural language processing methodology to automatically analyze large datasets containing crash narratives. These include analyses of 1,166 crash narratives from the Massachusetts DOT. The analyses used AI and Technologies to Improve Safety approaches and tools such as the Llama-3B language model, Multiple Correspondence Analysis (MCA), These efforts resulted in 2 peer-reviewed conference publications (i3CE 2025)	Obtaining detailed crash data is challenging due to limited access to narrative reports and inconsistencies in how law enforcement officers describe incidents. This research addresses these issues by applying AI tools to improve data interpretation and analysis.
<u>Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory Data</u>	95%	The team produced two peer-reviewed conference papers from this project. After Wejo ceased operations and vehicle trajectory data became unavailable, efforts shifted to alternative sources such as Compass, Derq, and StreetLight.	The cost of data and associated tools from the vendors exceeded the project's budget. A limited subset of data was obtained for pilot analyses.
<u>Enhancing Road Safety for All Road Users</u>	95%	The team continued using safety data to guide decision-making aimed at reducing crashes, particularly those resulting in fatal or severe outcomes. They collaborated with community groups and organizations.	As in previous years, recruiting volunteers and securing contributions for gifts and prizes associated with these activities remained a challenge.

Project Title	% Completed	Milestones Achieved	Obstacles/Constraints
<u>Effective Practices to Integrate Traffic Citation and Adjudication (TCA) Data</u>	85%	The team refined the draft Nevada Judicial Primer by incorporating court system data and analyzing case volumes across different court levels in relation to population-based indicators of demand. Additional datasets were obtained from the Nevada DMV, FHWA, and Nevada DOT to support broader evaluations of judicial and law enforcement activity. Efforts continued to establish an Advisory Committee with representatives from key stakeholder agencies statewide. Team members also participated in collaborative activities and meetings with the Nevada Traffic Records Coordinating Committee, Nevada SHSP Key Area groups, Safe Streets in Clark County, and the ATSIP Traffic Records Forum planning committee for the 2025 TRF.	Engaging key stakeholders remains challenging, especially among judicial, legal, and law enforcement groups, whose members are often reluctant to participate in official project discussions due to concerns about being formally documented. Despite these challenges, the team has obtained useful informal feedback and is actively seeking alternative strategies to encourage more meaningful and open stakeholder involvement.
<u>Quantum Machine Learning and Railway Deterioration and Operations</u>	95%	Manuscript accepted for presentation at TRB 2026	
<u>Machine Learning and Railway Track Deterioration Part 1: Degree of Railroad Ballast Fouling Using Gaussian Process Regression</u>	90%	Manuscript submitted for publication. Currently under review	
<u>Machine Learning and Railway Track Deterioration Part 2: Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions</u>	95%	Preparation of final project report	

Project Title	% Completed	Milestones Achieved	Obstacles/Constraints
<p><u>Enhancing Transportation Safety for At-Risk Road Users through Behavioral Monitoring and Smart Infrastructure</u></p>	<p>50%</p>	<p>Initiative 1: Development and Implementation of Smart Infrastructure System and smartphone applications for Real-Time Pedestrian Distraction Prevention</p> <ul style="list-style-type: none"> • Designed and developed PedAlert, a mobile software infrastructure system to detect and reduce pedestrian distraction near intersections. • Presented the project during Howard University Research Month and the abstract was accepted for presentation in the District of Columbia Quality Initiative (DCQI) conference. • The open-access PedAlert codebase repository is hosted on GitHub to support knowledge sharing within the research and practitioner community. Access the published repository at GitHub. <p>Initiative 2: Design and Evaluation of Multi-Modal Behavioral Interventions</p> <ul style="list-style-type: none"> • Finalized protocol; IRB revised and resubmitted. • Developed smartwatch app UI prototypes in Figma. • Implemented working prototype in Android Studio for data collection. • Designed three-day diary study with real-time and end-of-day surveys. • Created onboarding process, consent materials, and participant script. • Built presentation materials for workshop with undergraduates. 	<p>Initiative 1</p> <ul style="list-style-type: none"> • Testing application in real-world environments under diverse conditions and at a large scale remains a challenge due to variations in GPS accuracy, user behavior, and environmental factors. <p>Initiative 2</p> <ul style="list-style-type: none"> • Delays in identifying and onboarding student developers for summer phase. • Hardware selection and compatibility testing for smartwatch deployment. • Logistical challenges for participant device return & safe onboarding. • Need to balance real-time interaction safety with meaningful survey input. • Limited preliminary data for early conference submissions.

Project Title	% Completed	Milestones Achieved	Obstacles/Constraints
		<p>Initiative 3: Distraction and Enforcement Strategies</p> <ul style="list-style-type: none"> • <i>Literature review on distraction regulations:</i> A review of regulations on pedestrian distraction, especially smartphone use at signalized intersections, found successful results with education-based interventions, while highlighting the limited effectiveness of punitive enforcement approaches. • <i>Survey Instrument Developed and Pilot-Tested:</i> Designed and implemented a pilot student survey assessing perceptions of distracted walking, awareness of existing regulations, and support for potential enforcement and education strategies. The instrument served as a model for broader stakeholder engagement • <i>Workshop Executed and Analyzed:</i> In April 2025, a pedestrian distraction and safety workshop was held for engineering students, integrating behavioral science perspectives. Post-workshop evaluations showed an increased understanding of the relevance of policies and a greater support for educational and technology-assisted safety interventions. • <i>Prevention distraction framework:</i> Drawing on literature and workshop feedback, developed a framework with three main components: (1) education and awareness campaigns, (2) non-punitive warning systems, and (3) targeted enforcement escalation for repeated distractions. 	<p>Initiative 3</p> <ul style="list-style-type: none"> • Institutional review and approval requirements delayed the expansion of the stakeholder survey to a broader audience, impacting project planning and outreach. • Additional institutional permissions and partnership agreements needed for external professional recruitment could not be completed within the reporting period. • The integration of multi-stakeholder perspectives into the framework remains pending and will be addressed in the next project phase.

1.2.2 Education & Workforce Development

During this reporting period, the REPS program provided comprehensive education, training, and professional development opportunities across its partner institutions HU, UNLV, SJSU, and UMD. Some activities are included below, and some others are described in detail in section 4.5.

- At HU, education workforce development efforts integrated classroom learning with hands-on research and community engagement to build a robust talent pipeline in transportation. Undergraduate students were trained in mobile technology development, core programming languages, and interdisciplinary collaboration while designing and implementing a smart-infrastructure system and smartphone applications for real-time pedestrian-distraction prevention; they then honed communication skills by preparing posters, presenting at conferences, and organizing a peer workshop on pedestrian distraction for engineering students. These activities were reinforced through targeted coursework in 2025 in CIEG 416 (Transportation Engineering, 22 students), CIEG 445-05 (UG Research Transportation, 5 students), CIEG 544-01 (Transportation Engineering Research, 1 student), and CIEG 638-01 (Advanced Research in Transportation Engineering I, 1 student) in Spring 2025; and CIEG 465 (Traffic Engineering, 20 students), CIEG 579-01 (Advanced Traffic Engineering, 1 student), and CIEG 639-01 (Advanced Research in Transportation Engineering II, 1 student) in Fall 2025—totaling 51 enrollments that scaffolded progression

from foundational concepts to advanced topics. Complementing these university-based efforts, the DDOT–REPS Tech Fair in June 2025 featured drone and robot workshops, earthquake and tsunami activities, and high-school student presentations, drawing roughly 80 participants from Calvin Coolidge, H.D. Woodson, and Jackson-Reed High Schools. Together, these aligned initiatives advanced technical competencies (app development, sensor/data integration, safety analytics), professional capacities (technical writing and presentation, teamwork, leadership), and technology transfer, while strengthening a pipeline into transportation engineering careers.

- At UNLV, faculty led education and mentorship activities spanning undergraduate and graduate programs. Faculty taught CEE 362: Transportation Engineering in Fall 2025, the introductory transportation engineering course at UNLV with 70 students enrolled, supported by a graduate teaching assistant. Faculty also led CEE 725: Freight Transportation, a graduate course with eight students that included service learning-oriented class projects addressing real-world freight transportation problems and safety challenges. Graduate student mentorship included guiding doctoral students on Civil Engineering dissertations on topics such as "Data Analytics for Road Safety" and "Developing AI-Based Approaches to Extract Knowledge from Crash Report Narratives" during Spring and Fall 2025. A master's student was guided on an MSE Thesis on "Analysis of Safety Implications of Flashing Yellow Arrow for Left Turn Traffic Signal Operations" during the same period. In Spring 2025, faculty mentored master's students on CEE 798 projects titled "Scooter Sharing at UNLV: A Practical Approach to Campus Transportation" and "Evaluating Accessibility and Mobility Impacts of Urban Transport Modes: A Case Study of the Vegas Loop," both as part of MSCE degree program requirements. Additionally, REPS staff actively participated in traffic safety outreach activities and events connecting with students, teachers, counselors, and administrators at K-12 schools in Clark County, Nevada, where the Las Vegas metropolitan area is located.
- At SJSU, graduate students actively engaged in applied research projects through faculty-led research initiatives. These opportunities provided hands-on experience that allowed students to contribute to real-world transportation research, develop technical and analytical skills, and prepare for professional careers in the field.
- At UMD, faculty and students advanced research in quantum machine learning applications for transportation infrastructure through active participation in major conferences. The team presented at the AREMA conference in Baltimore, MD in June 2025 on "Quantum Machine Learning and Track Geometry Modelling," at the IBM Quantum Simulation Conference in New York in August 2025 on applying quantum machine learning to transportation infrastructure, and at IEEE Quantum Week (QCE25) in Albuquerque, New Mexico in September 2025 on quantum machine learning methods for rail infrastructure condition assessment.

1.3 How have the results been disseminated?

The results of REPS's research projects have been disseminated through multiple channels, including scientific publications, presentations at major conferences, various professional forums, broadcast media coverage, and community engagement activities. Across the REPS consortium institutions, research outputs were shared through key publications and professional societies, as well as through specific outreach activities at partnering institutions as described in detail in section 3.

1.3.1 Press & media coverage

At UNLV, transportation safety research received extensive coverage through broadcast and print media in the Las Vegas, NV metropolitan area. REPS staff participated in 25 media engagements throughout the reporting period as part of collaborative activities with the Nevada Office of Traffic Safety and other partners. Coverage included television news segments across multiple local channels (Channels 3, 5, 8, 13, and 33) and Spanish-language outlets (Telemundo, Entravision, and Univision), as well as features in the Las Vegas Review Journal. Media appearances addressed critical road user safety topics including overall traffic fatalities, fatal pedestrian crashes, DUI legislation and enforcement, the "100 Deadliest Days" safety campaign, pedestrian-specific data and Justice 40 initiatives, teen driver safety, back-to-school safety tips and enforcement, booster seat giveaways, crossing guard and middle school pedestrian safety, and pedestrian safety month initiatives. These media engagements helped raise public awareness of transportation safety issues and promoted evidence-based safety programs throughout Southern Nevada.

1.3.2 Outreach & Engagement

Across the REPS consortium institutions, comprehensive outreach and engagement activities connected research findings with diverse stakeholders, including students, educators, community members, industry professionals, and policymakers. Institutions disseminated research through academic presentations, community workshops, public events, and professional conferences spanning local, regional, national, and international venues. Activities

emphasized knowledge transfer, capacity building, and public engagement in transportation safety and emerging technologies.

- At HU, the research team actively participated and presented a poster during the Howard University Research Month on April 24th, 2025. A Pedestrian Distraction and Safety Workshop was held on April 14th, 2025, engaging undergraduate students in civil and environmental engineering. The workshop increased student awareness of behavioral and policy aspects of pedestrian safety and promoted experiential learning in applied policy research. Workshop findings and student policy recommendations were posted on faculty webpages to expand public and academic access to project outcomes.
- At UNLV, outreach and engagement activities connected with diverse audiences through community events, safety campaigns, educational programs, and professional conferences. REPS staff participated in numerous traffic safety events in partnership with the Nevada Office of Traffic Safety and other partners throughout the reporting period. Community engagement activities included the "Save A Life, Win A MacBook" safety campaign with poster unveilings and recognition events, such as the "100 Deadliest Days" press conference at UMC Trauma, the Pedestrian Forum 2025, recognition events with County Commissioners for campaign participants, the National Summer Transportation Institute featuring daily tours and community professional presentations, Teen Driver Safety Day with comprehensive education and victim stories, back-to-school high visibility enforcement and booster seat giveaway events. International and national conference presentations included multiple papers at the 2025 Traffic Records Forum in Boston, MA; an invited chief guest role and keynote address at the 11th International Conference on Transportation Systems Engineering and Management in Bhopal, India; presentations on crash narratives and language models at the ASCE International Conference on Computing in Civil Engineering in New Orleans, LA; and an invited foreign expert role leading lectures and tutorials at the Global Initiative on Academic Network Short Course at IIT Guwahati, India. Regional, state, and local engagement included presentations at the Nevada Traffic Records Coordinating Committee meetings, the Institute of Transportation Engineers Mountain District Annual Meeting in Santa Fe, NM, media interviews on HOV lane policy, an invited featured speaker presentation at the Green Valley Rotary Club, and weekly events hosted in partnership with the ITE UNLV student chapter including seminars, webinars, field trips, site visits, and resume review sessions featuring thought leaders from academia, public and private sectors, and non-profit organizations.
- At SJSU, research findings from the "Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions" project were published in the Proceedings of the Human Factors and Ergonomics Society (HFES) Annual Meeting, with plans to present results at the 69th HFES International Annual Meeting in October 2025 in Chicago, IL. The final report "Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA," was highlighted in the Transportation Research Board (TRB) Weekly Newsletter Research Roundup on September 30, 2025, reaching a wide audience of TRB members and other researchers.
- At UMD, the research team actively participated in a variety of conferences, including IEEE Quantum Week (QCE25), IBM Quantum Simulation 2025 (QSIM2025), AREMA Baltimore Conference, and the Transportation Research Board Annual Meeting 2026, disseminating research findings on quantum machine learning applications in transportation infrastructure to diverse professional audiences.

1.4 What Do You Plan to Do During the Next Reporting Period to Accomplish The Goals And Objectives?

1.4.1 General Plan and Actions for the Upcoming Reporting Period

The REPS consortium institutions have developed plans for the next reporting period that focus on advancing transportation safety research, education, workforce development, and stakeholder collaboration. Most of the projects that began in year one are now approaching their final stages, and preparation for final project reports is underway. For year two, research proposals of the consortium universities have been submitted for approval. Howard University will issue a call for new research proposals for the upcoming period to continue fostering innovation and collaboration in transportation safety. For existing projects HU will finalize journal submissions, optimize the PedAlert app for real-world deployment, and disseminate findings through conference presentations. UNLV will launch intersection safety analysis using computer vision with workforce development components, advancing crash narrative research focused on drug-involved crashes, expanding traffic citation and adjudication process studies through stakeholder engagement, and maintaining active participation in safety committees and working groups. UMD will finalize current research projects while actively participating in conferences to disseminate findings. More

details are below.

1.4.2 Research

During April 1–September 30, 2025, the program will prioritize closing out Year 1 research by finalizing the projects listed in Section 1.2 that remain in progress. A summary table will present each Year 1 project’s outstanding milestones alongside proposed completion dates. In parallel, Year 2 research will be initiated and advanced, enabled by the budget approval on August 22, 2025.

Pending milestones of Year 1 research projects

Project Title	Pending Milestones	Timeline to Complete
<u>Investigating the Impact of Enforcement and Education on Reducing Drug-Impaired Driving</u>	<ul style="list-style-type: none"> • Present results of Paper 1 (causal effect analysis) at Transportation Research Board Annual Meeting, 2026 • Publish Paper 2 (Combined law enforcement data). 	4 months
<u>Smart AI-Technology Employment for Crash Data Analysis</u>	Prepare draft final and final reports, related manuscripts for peer-reviewed publication / presentations.	4 months
<u>Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory Data</u>	Prepare draft final and final reports, related manuscripts for peer-reviewed publication / presentations.	4 months
<u>Enhancing Road Safety for All Road Users(Community Engagement, Tech Transfer)</u>	Prepare draft final and final reports, related manuscripts for peer-reviewed publication / presentations.	4 months
<u>Effective Practices to Integrate Traffic Citation and Adjudication (TCA) Data</u>	Prepare draft final and final reports, related manuscripts for peer-reviewed publication / presentations.	4 months
<u>Quantum Machine Learning and Railway Deterioration and Operations</u>	Present results at Transportation Research Board Annual Meeting, 2026	3 months
<u>Machine Learning and Railway Track Deterioration Part 1: Degree of Railroad Ballast Fouling Using Gaussian Process Regression</u>	Revised manuscript based on reviewers’ comments	3 months

(continued on next page)

Project Title	Pending Milestones	Timeline to Complete
<u>Machine Learning and Railway Track Deterioration Part 2: Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions</u>	Preparation of final report	1 month
<u>Enhancing Transportation Safety for At-Risk Road Users through Behavioral Monitoring and Smart Infrastructure</u>	<ul style="list-style-type: none"> ● initiative 1: Development and Implementation of Smart Infrastructure System and smart-phone applications for Real-Time Pedestrian Distraction Prevention: Continue the development and pilot smart infrastructure + smart-phone apps for real-time pedestrian distraction prevention; run controlled field tests; evaluate alert timing, reliability, and user responsiveness; define a scaling strategy; establish agency partnerships for pilots; prepare conference/journal submissions ● initiative 2: Design and Evaluation of Multi-Modal Behavioral Interventions for Distracted Pedestrians: recruit testers; run 2-3 usability test rounds with iterative feedback; refine interaction design and notification logic; analyze feedback for improvements; prepare poster/presentation materials; draft manuscript. ● initiative 3: Development of Framework and Enforcement Strategies: obtaining IRB clearance and launching a large-scale stakeholder survey. Survey data will be analyzed to detect behavioral patterns and preferences for distracted-pedestrian interventions. Findings will be synthesized into a draft journal manuscript presenting a practical intervention framework. 	<ul style="list-style-type: none"> ● initiative 1 – 7 months ● initiative 2 – 7 months ● initiative 3 – 7 months

1.4.3 Education Workforce Development

All REPS institutions will continue to engage undergraduate and graduate students in transportation education, research and mentoring, providing hands-on experience, opportunities to co-author reports and publications, and direct exposure to industry in transportation and state DOT partners.

- At HU we will:
 - Mentor and train undergraduate students in behavioral data interpretation, and applied transportation research methods.
 - Provide professional development through hands-on experience in survey design, stakeholder engagement, and interdisciplinary teamwork.
 - Enhance student skills in research communication, including technical writing, poster preparation, and presentation.
 - Support student participation in Howard University Research Week to foster professional exposure and presentation experience.

- At UNLV we will:
 - Engaging graduate and undergraduate students in Grant Year 2 research projects, incorporating key learnings into instructional and mentoring activities.
 - Integrating methodological advances from ongoing research—including emerging technologies in civil and transportation engineering and deeper insights from transportation crash analysis—into educational modules and coursework.
 - Continuing regular REPS UTC activities in partnership with the Institute of Transportation Engineers (ITE) UNLV student chapter, the Department of Civil and Environmental Engineering and Construction (CEEC), and PSR UTC, including weekly seminars/webinars (2-3 per month), field trips, site visits, and resume review sessions featuring thought leaders from academia, public and private sectors, and non-profit organizations.
 - Delivering key courses: CEE 362: Transportation Engineering (Fall 2025) with 70 students; and CEE 725: Freight Transportation (Fall 2025), a graduate course with eight students including service learning-oriented class projects addressing real-world freight transportation problems and safety challenges.
 - Mentoring doctoral students on dissertation research topics including "Data Analytics for Road Safety" and "Developing AI Based Approaches to Extract Knowledge from Crash Report Narratives" during Fall 2025 and Spring 2026 semesters.
 - Guiding a master’s student on MSE Thesis research on "Analysis of Safety Implications of Flashing Yellow Arrow for Left Turn Traffic Signal Operations" during Fall 2025 and likely Spring 2026 semesters.
- At SJSU we will:
 - Implement Mineta K-12 Workforce Development Programs, with various programs to be completed pending approval from USDOT and Howard University.

2. PARTICIPANTS & COLLABORATING ORGANIZATIONS

Several state governments and industrial partners are in the process of partnering with REPS to provide financial and in-kind support and facilities to the Center:

Organization Contributions to REPS

Name of Organization/Entity	Location	Contribution to Project	Contribution type(s)
National Science Foundation	Alexandria, VA	UNLV projects make use of equipment obtained through an NSF Major Research Instrumentation (MRI) award # 2216489 which supported the build of a self-driving car platform and advanced intersection monitoring locations around campus with cameras and vehicle-to-everything (V2X) capabilities	Financial support
Nevada Office of Traffic Safety	Carson City, NV	Synergistic funding and support to garner access to relevant data	Financial support; in-kind support; collaborative research; personnel exchanges (facilitate guest speakers)

Name of Organization/Entity	Location	Contribution to Project	Contribution type(s)
Nevada Dept of Transportation	Carson City, NV	Provide access to relevant data	in-kind support; collaborative research; personnel exchanges (access to data and resources; facilitate guest speakers, site visits, and field trips)
Clark County Office of Traffic Safety	Las Vegas, NV	Facilitate access to relevant data and subject matter experts	in-kind support; collaborative research; personnel exchanges (access to data and resources; facilitate guest speakers)
Various state and local agencies and organizations (e.g., RTC of Southern Nevada, City of Henderson, City of Las Vegas)	Las Vegas, Henderson, Reno, Carson City (all in Nevada)	Facilitate access to relevant data and subject matter experts	in-kind support; collaborative research; personnel exchanges (access to data and resources; facilitate guest speakers, site visits, and field trips)
Print and broadcast media outlets	Las Vegas, NV	Disseminate information through broadcasts and print coverage	In-kind support
The District Department of Transportation (DDOT)	Washington, DC	Provide access to relevant data	In-kind support

3. OUTPUTS

3.1 Publications, conference papers, and presentations

Metadata for each publication

Citation	Publication status	Federal support acknowledged (Y/N)	DOI	Open-access URL
W. H. Lo, A. Chu, Y. Luo, E. E. Etu, N. Attar, and G. Huang, “Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions,” Tech. Rep. REPS-HU-25-01, Research and Education in Promoting Safety (REPS) Tier-1 University Transportation Center (UTC), 2025.	Published (SJSU)	Y		https://rosap.ntl.bts.gov/view/dot/86331

Citation	Publication status	Federal support acknowledged (Y/N)	DOI	Open-access URL
X. Ren, B. Yang, A. Zandiatashbar, “Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA,” Tech. Rep. REPS-HU-25-02, Research and Education in Promoting Safety (REPS) Tier-1 University Transportation Center (UTC), 2025.	Published (SJSU)	Y		https://rosap.ntl.bts.gov/view/dot/86328
W. H. Lo, A. Chu, Y. Luo, E. E. Etu, N. Attar, G. Liu, and G. Huang, “The Impact of Mental States, Scenarios, and Modalities on Informative Takeover Requests in Automated Driving,” <i>Proc. Hum. Factors Ergon. Soc. Annu. Meet.</i> , vol. 69, 2025.	Published (SJSU)	Y	10.1177/1071181325136008	https://doi.org/10.1177/1071181325136008
L. Zeng and C. Marin, “Public Perceptions and Behavioral Intentions Regarding Impaired Driving: Analysis of Educational and Enforcement Strategies,” <i>International Conference on Transportation and Development 2025</i> , pp. 262–272, Jun. 2025	Published (HU)	Y	https://doi.org/10.1061/9780784486191.023	https://ascelibrary.org/doi/abs/10.1061/9780784486191.023

3.1.1 Peer-Reviewed Journal Publications

1. W. H. Lo, A. Chu, Y. Luo, E. E. Etu, N. Attar, and G. Huang, “Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions,” Tech. Rep. REPS-HU-25-01, Research and Education in Promoting Safety (REPS) Tier-1 University Transportation Center (UTC), 2025.
2. X. Ren, B. Yang, A. Zandiatashbar, “Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA,” Tech. Rep. REPS-HU-25-02, Research and Education in Promoting Safety (REPS) Tier-1 University Transportation Center (UTC), 2025.
3. W. H. Lo, A. Chu, Y. Luo, E. E. Etu, N. Attar, G. Liu, and G. Huang, “The Impact of Mental States, Scenarios, and Modalities on Informative Takeover Requests in Automated Driving,” *Proc. Hum. Factors Ergon. Soc. Annu. Meet.*, vol. 69, 2025.

3.1.2 Conference Papers (Proceedings)

1. P. Subedi, A. Mohammed, A. N. Saleem, and S. Sharma, “PedAlert: A smart app to combat pedestrian distraction at intersections,” presented at *Howard University Research Month*, Washington, DC, USA, Apr. 2025.
2. L. Zeng and C. Marin, “Public Perceptions and Behavioral Intentions Regarding Impaired Driving: Analysis of Educational and Enforcement Strategies,” *International Conference on Transportation and Development 2025*, pp. 262–272, Jun. 2025
3. N. Das, J. Park, and T. Barua, “Benefits and challenges: Using language models in crash narratives including ambiguous statements,” in *Proc. ASCE Int. Conf. Computing in Civil Engineering (i3CE)*, New Orleans, LA, USA, May 2025.

4. T. Barua, N. Das, and J. Park, "Understanding contributing factors to pedestrian related crashes of Massachusetts using factor map analysis," in *Proc. ASCE Int. Conf. Computing in Civil Engineering (i3CE)*, New Orleans, LA, USA, May 2025.
5. K. A. Islam and S. Nambisan, "Understanding rural crash risks in Nevada: A study of fatalities and crash characteristics (2015–2020)," in *Proc. 11th Int. Conf. Transportation Systems Engineering and Management (CTSEM)*, Bhopal, India, Jul. 2025, Paper No. 177.

3.1.3 Conference Presentations

1. P. Subedi, A. Mohammed, A. N. Saleem, and S. Sharma, "PedAlert: A smart app to combat pedestrian distraction at intersections," presented at *Howard University Research Month*, Washington, DC, USA, Apr. 2025.
2. L. Zeng and C. Marin, "Educational and enforcement approaches to impaired driving: A mixed-methods analysis of community response and behavioral change," presented at the *66th Int. Meeting of the Transportation Research Forum*, Saint Charles, MO, USA, Apr. 2025.
3. L. Zeng and C. Marin, "Analyzing public perceptions and behavioral intentions to impaired driving education and enforcement," presented at the *Int. Conf. on Transportation & Development*, Glendale, AZ, USA, Jun. 2025.
4. L. Zeng and C. Marin, "What Really Drives Behavior Change? A Causal Analysis of Impaired Driving Prevention Factors Using Machine Learning and Survey Data," *Transportation Research Board (TRB) Annu. Meeting*, Washington, DC, USA, Jan. 2026.(Accepted for presentation).
5. K. A. Islam and S. Nambisan, "Examining the impact of demographic, geographic and roadway factors on crash severity: A Nevada-based analysis," presented at the *Traffic Records Forum, ATSIP*, Boston, MA, USA, Aug. 2025.
6. S. Nambisan, "Chief guest, valedictory ceremony," presented at the *11th Int. Conf. Transportation Systems Engineering and Management (CTSEM)*, Bhopal, India, Jul. 2025. (Invited)
7. S. Nambisan, "Evolving societal needs, challenges, and opportunities in the transportation domain," presented at the *11th Int. Conf. Transportation Systems Engineering and Management (CTSEM)*, Bhopal, India, Jul. 2025. (Invited Keynote)
8. S. Nambisan, C. Stream, K. Farmer, and J. Byzyka, "Nevada traffic citations and adjudication (TCA) data study: Q3 update," presented at the *Nevada Traffic Records Coordinating Committee Meeting*, Nevada, USA, Sep. 2025.
9. S. Nambisan, S. Nellutla, and S. Koneti, "A comparative analysis of accessible travel options for the Vegas Loop vis-à-vis key existing modes in Las Vegas," presented at the *Institute of Transportation Engineers (ITE) Mountain District Annu. Meeting*, Santa Fe, NM, USA, Jun. 2025.
10. S. Nambisan, C. Stream, K. Farmer, and J. Byzyka, "Nevada traffic citations and adjudication (TCA) data study: An update," presented at the *Nevada Traffic Records Coordinating Committee Meeting*, Nevada, USA, Jun. 2025.
11. K. A. Islam and S. Nambisan, "Nevada's road safety: Comparing urban and rural areas," presented at the *Institute of Transportation Engineers (ITE) Mountain District Annu. Meeting*, Santa Fe, NM, USA, Jun. 2025.
12. S. Nambisan, "Transportation needs, challenges, and opportunities," presented at the *Green Valley Rotary Club*, Henderson, NV, USA, Apr. 2025. (Invited)
13. W. H. Lo, A. Chu, Y. Luo, E. E. Etu, N. Attar, G. Liu, and G. Huang, "The Impact of Mental States, Scenarios, and Modalities on Informative Takeover Requests in Automated Driving," presented at the *69th Int. Annu. Meeting Hum. Factors Ergon. Soc. (HFES)*, Chicago, IL, USA, Oct. 2025, oral presentation.
14. D. D. Alabintei and N. Attoh-Okine, "Quantum machine learning for railway safety," to be presented at the *Transportation Research Board (TRB) Annu. Meeting*, Washington, DC, USA, Jan. 2026.(Accepted for presentation)
15. D. D. Alabintei and N. Attoh-Okine, "Quantum machine learning and track geometry modelling," presented at the *AREMA Conf.*, Baltimore, MD, USA, Jun. 2025.
16. D. D. Alabintei and N. Attoh-Okine, "Hybrid quantum neural network and Shapely additive explanations in rail track geometry defect prediction," presented at the *IBM Quantum Simulation Conf.*, New York, NY,

USA, Aug. 2025.

17. D. D. Alabintei and N. Attoh-Okine, “Quantum Bayesian networks for rail infrastructure condition assessment,” presented at *IEEE Quantum Week (QCE25)*, Albuquerque, NM, USA, Sep. 2025.

3.2 Policy Papers

Nothing to report.

3.3 Websites or Internet Sites

1. Website for HU Initiative 2: [Link](#)
2. Causal Effect Analysis Framework for Transportation Safety Research: [Link](#)
3. Website for UNLV: [Link](#)

3.4 New Methodologies, Technologies, or Techniques

1. Developed an open-source mobile software infrastructure system integrating smartphone sensors, geospatial data, and real-time alerts to reduce pedestrian distraction near intersections, featuring hardware-independent geofencing using GPS and motion APIs for distracted walking detection. (HU)
2. Implemented a modular system architecture comprising user device management, location tracking, distraction detection, and alert delivery modules to enhance scalability and interoperability, with open-access development practices through a public GitHub repository. [GitHub](#). (HU)
3. Developed an interdisciplinary research approach integrating literature review, behavioral assessment, and participatory workshop methods to evaluate perceptions of pedestrian distraction and potential enforcement strategies. (HU)
4. Advanced knowledge extraction from emerging data sets and sensor systems with focus on connected vehicles and infrastructure systems. (UNLV)
5. Developed novel methods to combine and analyze traffic safety data from disparate sources including court system records, traffic crash data, vehicle registration, Census Bureau demographics, and traffic demand metrics. (UNLV)
6. Developed innovative approach leveraging AI and Natural Language Processing (NLP) to analyze crash narratives, deepening understanding of traffic incidents. (UNLV)
7. Application of quantum machine learning in rail engineering. (UMD)

3.5 Inventions, Patents, and/or Licenses

Nothing to report.

3.6 Other Products

Nothing to report.

4. OUTCOMES

4.1 Increased understanding and awareness of transportation issues

The REPS team at HU has advanced understanding and awareness of transportation issues by applying multidisciplinary research, combining civil engineering and computer science to address complex safety challenges such as impaired driving. Through innovative projects, robust data analysis, and collaboration with public agencies, REPS demonstrates how evidence-based approaches and advanced causal inference methods reveal what truly works to reduce risks and improve safety, supporting real-world problem solving. Further, through the Design and Evaluation of Multi-Modal Behavioral Interventions for Distracted Pedestrians project, the REPS team at HU has significantly increased understanding and awareness of transportation issues. This work brought new attention to the challenges of group-level distraction at pedestrian intersections, both through targeted research presentations and interactive workshops. Undergraduate researchers gained advanced skills in human-centered design, including user experience prototyping, behavioral study methods, and the development of wearable technology for safety interventions. The project also prepared the groundwork for innovative practices, like implementing real-time behavioral nudges to

improve pedestrian safety techniques that could shape future intervention and design strategies, especially on urban campuses.

The REPS team at UNLV has played a vital role in increasing understanding and public awareness of transportation issues among policymakers, the media, and the general public. Their research contributions are reflected in peer-reviewed presentations and publications, which have significantly added to the body of knowledge in transportation safety. Through ongoing innovation, the team has improved the processes, technologies, and skills used to address transportation challenges. Educational initiatives at UNLV have expanded the pipeline of trained transportation professionals, reaching students from K-12 to university levels, and have provided valuable continuing education for those already working in the field

The REPS team at UMD has supported an understanding of transportation issues by leveraging quantum machine learning methods, like quantum support vector machines and quantum neural networks to achieve more accurate predictions of rail track geometry defects and enhance railway safety assessment. This pioneering approach gives researchers and transportation professionals deeper insights into safety-critical problems and powerful tools for future system improvements

4.2 Passage of new policies, regulations, rule making, or legislation

Preliminary findings from the pedestrian distraction infraction framework developed by the REPS team at HU are intended to inform future campus and community-level recommendations on distracted walking and pedestrian safety. This research provides evidence to guide the development and passage of new policies, regulations, or safety initiatives aimed at reducing pedestrian risks in both university and broader community settings.

The REPS team at UNLV has made a meaningful impact on the passage of new traffic safety legislation in Nevada. Through active involvement with the Nevada Advisory Committee on Traffic Safety, the REPS team worked to provide expert research and recommendations to state lawmakers, leading to the drafting of several bills. Their efforts were instrumental in the eventual passage of Assembly Bill No. 527, which authorizes the installation and use of school bus infraction detection systems on school buses throughout the state. This new law empowers Nevada school districts and law enforcement to use automated cameras to identify and deter illegal passing of stopped school buses, protecting students and improving overall road safety for communities statewide. [Assembly Bill No. 527 NC AB527](#)

4.3 Increases in the body of knowledge

The REPS outputs have contributed to expanding the body of knowledge

The REPS team at HU has contributed new knowledge to transportation safety research by applying advanced causal inference methods to understand the true impact of educational campaigns on impaired driving behavior. By using tools such as LiNGAM-based causal discovery and the DoWhy analytical framework, the team was able to identify genuine causal drivers of behavioral change, distinguishing them from factors that are merely associated with change. Their findings highlight that credible, locally relevant campaigns and beliefs in intervention effectiveness have the greatest positive influence, while traditional awareness-based strategies may be ineffective or even counterproductive. This work goes beyond prior approaches and sets a new standard for evidence-based policy evaluation, providing actionable insights for policymakers and advancing the methodological toolkit for transportation safety research.

The REPS team at UNLV has actively advanced the body of knowledge in the traffic safety domain, but also on related technology transfer activities.

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

By developing and refining PedAlert—a system that leverages smartphone sensors and geospatial data to flag pedestrian distraction at intersections—the REPS team strengthened its processes and advanced transportation safety. The teams further expanded research methods with a smartwatch-based diary study focused on group pedestrian behavior, and advanced the design, testing, and iteration of a custom smartwatch app using Android Studio. Students improved their abilities in behavioral data collection, and interdisciplinary collaboration, while the project championed an integrated approach combining engineering, behavioral science, to tackle pedestrian distraction in urban environments.

The REPS teams at UNLV have made advances in improving processes, technologies, and techniques to address transportation challenges. Their efforts include extracting actionable information from new data sets and sensor systems focused on connected vehicles and modern infrastructure. They have integrated a wide range of data, court records, crash data, vehicle registration, Census demographics, and travel demand statistics to develop novel analytical frameworks for a more complete understanding of traffic safety. Further, by leveraging AI and natural language processing, the teams have also developed innovative tools to automatically analyze crash narratives, deepening the analysis of roadway incidents and supporting more effective interventions. These improvements in data integration, analytics, and applied research have directly enhanced the capacity of transportation professionals and agencies to make informed, timely decisions for safer and more efficient roadway systems.

The REPS team at UMD is working on the development and application of quantum machine learning models have improved techniques for assessing transportation safety, advancing analytical skills, and technological approaches in the field.

4.5 Enlargement of the pool of trained transportation professionals

The REPS team at HU has helped enlarge the pool of trained transportation professionals by co-hosting the 2025 Transportation Tech Fair in partnership with the District Department of Transportation. This event brought together about 80 high school students from Calvin Coolidge, H.D. Woodson, and Jackson-Reed for a day of hands-on learning and exposure to transportation technologies and engineering. The agenda included interactive drone and robotics workshops, earthquake and tsunami activities, and student presentations promoting STEM education, workforce development, and cultivating the next generation of transportation professionals. The REPS team at HU has expanded the pool of trained transportation professionals with a combination of hands-on outreach and structured multidisciplinary training. In recent efforts, 12 undergraduate students and two graduate students have participated in transportation safety research and professional development activities, specializing in areas such as pedestrian distraction and data-driven problem solving. Workshops focused on pedestrian safety have provided Civil Engineering students with experiential learning, practical skills in application development, and interdisciplinary approaches that connect engineering and behavioral science.

The REPS team at UNLV is actively expanding the pool of trained transportation professionals. Their activities span formal education in transportation engineering and safety, as well as co-curricular and extra-curricular programs that engage students and current professionals at every level—from K-12 outreach, undergraduate and graduate study, to those already working in transportation. These efforts provide real-world experience, mentorship, and specialized skills development, helping grow a diverse and capable workforce prepared for the future needs of the industry.

4.6 Adoption of new technologies, techniques or practices

The REPS teams at UNLV have driven the adoption of new technologies and practices in transportation safety by analyzing data from connected vehicles and sensor-equipped infrastructure, enabling real-time monitoring and improved operational decisions. They have pioneered methods for integrating traffic-related data from diverse sources such as court records, crash statistics, vehicle registration, Census demographics, and travel demand to produce actionable insights for roadway safety. Additionally, by leveraging AI and natural language processing for detailed analysis of crash narratives, the teams have advanced both the efficiency and the quality of transportation safety assessments across the region.

5. IMPACTS

5.1 The effectiveness of the transportation system

The REPS' projects introduce advanced technologies and data-driven solutions across various domains. Specifically:

At UNLV, current efforts focus on extracting knowledge from new datasets and sensor systems related to connected vehicles and infrastructure, aiming to improve both safety and operational efficiency of street networks. The project combines traffic safety data from varied sources and is developing new methods for analyzing this information, which will help identify individuals at higher risk of traffic violations.

Additionally, the team is creating software to automate the analysis of crash narratives, especially for incidents involving drugs. This tool will benefit practitioners who would otherwise spend up to 15 minutes manually reviewing each crash narrative, offering faster, more consistent, and reliable insights.

UNLV researchers also remain closely involved in policy development, actively engaging with officials in Nevada. These efforts are highlighted by successful legislative action, such as the recent passage of Assembly Bill No. 527, which authorizes the installation of infraction detection systems on school buses to improve safety. [Assembly Bill No. 527 NC AB527](#)

5.2 Technology transfer (include transfer results to entities in government or industry, adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company)

At HU, technology transfer has been actively demonstrated through several initiatives aimed at public safety and research impact. The REPS team has developed and implemented a Smart Infrastructure System and accompanying smartphone application for real-time pedestrian distraction prevention. Notably, the PedAlert software infrastructure has been made publicly accessible as an open-source repository on GitHub, encouraging continuous development, collaborative innovation, and broader applications within the pedestrian safety and smart city domains. Access the published repository at [GitHub](#).

In the area of drug-impaired driving research, the REPS team has advanced technology transfer via the development of an AI-driven, automation-enabled framework for causal effect analysis in transportation safety. This framework is specifically designed for researchers, policy analysts, and agency leaders to rigorously evaluate the impact of safety interventions and policies on driver behavior. at [Link](#). Additionally, the pilot phase of the CROSS AWARE project—a smartwatch-based diary system—is underway. [Link](#).

The UNLV REPS team has actively promoted its research initiatives and results through presentations, publications, and collaborations at local, regional, national, and international outlets. These widespread dissemination activities highlight the team’s commitment to sharing knowledge and fostering dialogue within and beyond academic circles. Although the current outcomes have not yet resulted in intellectual property filings, such as patent disclosures or formal licensing, the team anticipates that as their research reaches full maturity, there will be strong potential for innovation leading to IP development and subsequent licensing opportunities.

5.3 The increase in the body of scientific knowledge

The REPS team at HU, working on the design and evaluation of multi-modal behavioral interventions for distracted pedestrians initiated a novel smartwatch-based diary protocol to examine how real-time behavioral nudges can influence group decisions and attention at signalized intersections. By extending traditional safety research methods, the team integrated ecological momentary assessment to capture group behaviors in the moment, a critical yet understudied aspect of pedestrian distraction. This research has provided new information on designing mobile interfaces and wearable interventions tailored to dynamic group contexts within transportation systems. Scholarly dissemination is underway, with outputs including a conference poster and a full paper submission to TEI 2025, both highlighting strategies for group-based behavioral safety interventions.

The REPS team at SJSU’s completed research that expands the body of scientific knowledge by advancing understanding of driver engagement in automated vehicles and demonstrating the application of AI and machine learning to enhance transportation safety in station areas. The resulting methodologies and findings provide actionable insights that can inform transportation planning, operations, and safety practices. By bridging academic research and real-world implementation, this work supports the development of more effective technologies, policies, and professional practices in the transportation sector.

The REPS team at UMD works on quantum-based models, has contributed new methodological perspectives for tackling complexity and uncertainty in transportation systems.

5.4 Transportation workforce development

The REPS team at HU offered students hands-on experience in the creation and evaluation of safety technologies. Central to these efforts is the original idea behind the design and evaluation of multi-modal behavioral interventions for distracted pedestrians, which introduces pioneering approaches to studying and improving pedestrian safety. This project leverages both infrastructure and digital solutions, including the deployment Smart Infrastructure System and a companion smartphone application for real-time distraction prevention. Students are immersed in multi-disciplinary learning through exposure to core human-computer interaction concepts, behavioral science, and hands-on development of wearable and mobile technologies. The team’s behavioral intervention research uniquely examines group-level pedestrian decision-making at intersections, using methods like ecological momentary assessment and

smartwatch-based diaries to capture real-time behaviors. By engaging in every stage of research, including IRB submission, study design, and user testing, Howard students acquire not only technical expertise but also research communication skills, preparing posters, workshops, and manuscripts for scholarly dissemination.

The REPS team at UNLV is working to extract information from new sensor systems and connected vehicle data, develop integrated methods to analyze combined traffic safety sources, and create advanced tools using AI for the analysis of crash narratives. These efforts are streamlining the identification of high-risk traffic violators and improving both the effectiveness of law enforcement and the operational efficiency of the judicial system. UNLV's REPS projects extend beyond technical innovation; they are embedded within graduate and undergraduate coursework, providing students with real-world experience in data analytics, transportation safety, and software development. The team's work is regularly shared at national and international conferences and integrated into professional development programs for students.

The REPS team at SJSU's contributes directly to transportation workforce development by engaging college students in applied research projects that address real-world transportation challenges. Through active participation in data collection, analysis, and dissemination, students gain valuable technical, analytical, and professional skills that prepare them for careers in transportation. This hands-on experience fosters the next generation of transportation professionals equipped to apply innovative methods and evidence-based practices in the field.

The REPS team at UMD provided opportunities for civil engineers and other experts to understand how quantum machine learning can be deployed as a tool to address key challenges in civil infrastructure.

6. CHANGES/PROBLEM

6.1 Changes in approach and reasons for change

Nothing to Report

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

Delays in subaward amendments and administrative processing have slowed the project. Going forward, the consortium universities will submit NCE requests and other authorizations promptly, and Howard University leadership is tightening coordination with research offices and streamlining approvals to avoid further delays.

6.3 Changes that have a significant impact on expenditure

Grant activities have been limited due to delays in authorization to use Year 2 funds. These administrative setbacks have restricted progress during this period.

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

Nothing to Report

6.5 Change of primary performance site location from that originally proposed

Nothing to Report

7. SPECIAL REPORTING REQUIREMENTS

Nothing to Report