Combined Semi-Annual Progress Report for REPS

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Consortium Members	Howard University (Lead Institution), Washington, DC San Jose State University, San Jose, CA University of Nevada, Las Vegas, Las Vegas, NV University of Maryland, College Park, MD
Center Director	John M. Anderson, Ph.D. (2/27/24 – 08/12/2024, Interim PI Dean, College of Engineering and Architecture) Claudia Marin, Interim PI effective 08/13/24 -present
Submitting Official	Claudia Marin, Interim PI
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Signature of Submitting Official (signature must be submitted in accordance with agency-specific instructions).	

The Research and Education for Promoting Safety (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 team 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

REPS goal 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 Innovation, 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 focus area centers on 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. By leveraging data-driven insights, the projects aim to create proactive safety solutions and address high-risk behaviors, ultimately building comprehensive safety systems.

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

This focus area centers on projects aimed at enhancing cybersecurity in critical transportation infrastructure as systems become increasingly digitized. This research area explores the use of Blockchain and Artificial Intelligence (AI) technologies to improve data collection, processing, and security, particularly in railways. Key projects include developing blockchain-based systems for railway track data measurement, creating digital twin-based pipeline safety systems, and incorporating smart AI technologies. These initiatives aim to protect transportation networks from cyber threats while enhancing the security, reliability, and efficiency of data management.

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

This focus area centers on 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. Key projects involve creating bicycle crash modification factors, analyzing freeway and arterial safety, and enhancing safety for pedestrians and vulnerable road users.

1.1.2 Education, technology transfer, and Workforce Development goals

REPS is committed to advancing access to transportation resources by engaging a broad range of communities, institutions, and organizations through research, education, workforce development, and technology transfer. By leveraging emerging technologies, expanding educational pathways, and supporting workforce initiatives, REPS partners with local and state Departments of Transportation, as well as public and private stakeholders, to promote safety, innovation, strategic planning, and the cultivation of a skilled transportation workforce.

1.2 What was accomplished under these goals?

1.2.1 Research

Ten research projects of the REPS (06/01/2023 – present) are in progress involving multiple partners. The research projects are categorized within the three trust areas as follows:

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

1. Investigating the Impact of Enforcement and Education on Reducing Drug-Impaired Driving

   Lead Institution: Howard University

   RIP Database: https://trid.trb.org/View/2430395
2. Effective Practices to Integrate Traffic Citation and Adjudication (TCA) Data

   Lead Institution: University of Nevada las Vegas

   RIP Database: https://rip.trb.org/View/2431642
3. Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions

   Lead Institution: San Jose State University

   RIP Database: https://rip.trb.org/View/2431167

Thrust Area 2: Critical Infrastructure Cybersecurity

1. Smart AI-Technology Employment for Crash Data Analysis

   Lead Institution: University of Nevada Las Vegas

   RIP Database: https://rip.trb.org/View/2431593
2. Quantum Machine Learning and Railway Deterioration and Operations

   Lead Institution: University of Maryland College Park

   RIP Database: https://rip.trb.org/View/2431697
3. Machine Learning and Railway Track Deterioration Part1: Degree of Railroad Ballast Fouling Using Gaussian Process Regression

   Lead Institution: University of Maryland College Park

   RIP Database: https://rip.trb.org/View/2431698
4. Machine Learning and Railway Track Deterioration Part2: Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions

   Lead Institution: University of Maryland College Park

   RIP Database: https://rip.trb.org/View/2431699

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

1. Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory Data

   Lead Institution: University of Nevada Las Vegas

   RIP Database: https://rip.trb.org/View/2431597

- Enhancing Road Safety for All Road Users

  Lead Institution: University of Nevada Las Vegas

  RIP Database: https://rip.trb.org/View/2431646

2. Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA

The Research and Education for Promoting Safety (REPS)

Lead Institution: San Jose State University

RIP Database: https://rip.trb.org/View/2431333

The table below outlines the research projects and summarizes the progress made during the reporting period and constraints.

Projects Status Period: June 1, 2023-September 30, 2024

Project Title	% Completed	Milestones Achieved	Obstacles/Constraints
Investigating the Impact of Enforcement and Education on Reducing Drug-Impaired Driving	50	- Conducted a survey with 882 responses from Howard University students and their networks. - Obtained DUI arrest reports from the Metropolitan Police Department (MPD). - Cleaned and processed survey and arrest data. - Analyzed data using statistical models and machine learning methods.	- Communication issues with the Metropolitan Police Department (MPD) delayed dataset access. - The survey was open for less than a month, targeting Howard University students before final exams, which increased student responses but led to a participant pool primarily consisting of university students, potentially introducing response bias.
Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions	70	- Conducted a literature review on mental states to guide experimental design. - Created specific driving scenarios and compiled associated audio tools. - Established protocols for testing five mental states: distraction, fatigue, mind wandering, emotions, and control.	- Designing experiments with a driving simulator for various mental states presents challenges. - Integrating systems like eye trackers with the driving simulator is complex. - The study's scope typically demands a multi-year effort.
Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA	75	- Developed a network dataset with multi-radius buffers to assess pedestrian accessibility around transportation hubs. - Integrated San Jose walkability data into a model to evaluate the impact on pedestrian access and transportation safety. - Successfully tested the model using a new walkability index, confirming the methodology and providing insights into safety risks near transportation hubs.	- Delays in obtaining crucial, high-resolution spatial data for crime prediction and safety analysis. - Challenges in integrating diverse data sources (crime records, transportation networks, walkability metrics) into the ML algorithm. - Limited computational resources could slow down model processing and validation, affecting large dataset handling.
Smart AI-Technology Employment for Crash Data Analysis	80	- Reviewed literature and performed QA/QC on crash narrative data from Massachusetts. - Applied AI and NLP tools to analyze crash narratives, comparing algorithmic options for accuracy and speed. - Presented project updates at the Nevada Traffic Records Coordinating Committee meetings (June and September).	-Procedural challenges to access crash narrative data beyond what we obtained from the state of Massachusetts
Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory Data	75	- Accessed and performed preliminary analyses of high-resolution vehicle trajectory data (HRVT) streams for the Las Vegas Metropolitan area - Prepared abstracts and draft manuscripts for presentation and publication	Time required to identify, obtain, and clean (QA/QC) data
Enhancing Road Safety for All Road Users	60	- Compiled and geocoded crash data for Clark County, Nevada (2018–2022). - Analyzed data to identify high-risk locations based on injury severity, user type, and crash frequency. - Collaborated with local agencies and media to share findings and support traffic	-Time required to identify, obtain, and clean (QA/QC) data from varied sources -Administrative challenges to access data from the Coroner's office, including concerns regarding Personally Identifiable Information

		safety initiatives. - Featured in multiple media outlets	(PII)
Effective Practices to Integrate Traffic Citation and Adjudication (TCA) Data	60	- Reviewed literature on TCA dataset integration and compiled related practices across U.S. states. - Collected and analyzed Nevada crash data (2015-2021) to identify high-risk areas. - Compiled articles on repeat traffic offenders and mapped judicial agencies involved in citation processes. - Presented findings to state committees and professional conferences.	- Challenges in accessing citation and adjudication data. - Includes concerns about sharing Personally Identifiable Information (PII). - Reluctance from judicial agencies to share case details and adjudication information. - Sensitivity due to upcoming elections in November 2024.
Quantum Machine Learning and Railway Deterioration and Operations	30	-Literature Review Completed -The problem has been formulated -Exploratory Data Analysis Completed	None
Machine Learning and Railway Track Deterioration Part1: Degree of Railroad Ballast Fouling Using Gaussian Process Regression	30	-Literature Review Completed -The problem has been formulated -Exploratory Data Analysis Completed	None
Machine Learning and Railway Track Deterioration Part 2 Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions	30	-Literature Review Completed -The problem has been formulated -Exploratory Data Analysis Completed	None

1.2.2 Education and Workforce Development

During this reporting period, the REPS program provided a comprehensive range of opportunities for education, training, and professional development through various activities across its partner institutions. These included leadership academies, seminars, a workshop, hands-on training sessions, courses, and mentorship programs, contributing significantly to student engagement and workforce development in the transportation field as described in section 4.5 and some described below:

1. At HU, students in the transportation engineering courses were engaged in discussions focused on investigating the impact of enforcement and education on reducing drug-impaired driving. During these sessions, students deepen their understanding of how enforcement and educational measures can influence driver behavior and contribute to enhancing road safety.
2. To assist agencies seeking to revitalize and refocus their leadership talent, the Mineta Transportation Institute developed an intensive Accelerated Leadership Development Academy. The purpose is to provide an accelerated training experience in the essential competencies of leadership for upper and mid-level managers in transportation. The Mineta Transportation Institute has developed a key partnership with the transit agency The Regional Transportation District (RTD), creating a strong collaborative foundation for the implementation of the program.
3. REPS provides funding for research opportunities to students at the Partners institutions. Students have been trained in developing transportation research protocols, participating in hands-on data collection and analysis activities, as well as gaining report writing experience.
4. The REPS team at UNLV, supported by faculty and students, led courses related to the REPS Tier 1 UTC grant, advising students on related projects and research in transportation.
5. The REPS team at UNLV hosted a transportation seminar series weekly during the academic year to engage and motivate students to pursue educational and career opportunities in transportation. The seminars addressed societal needs, current and emerging trends in transportation, and safety-

related topics, while also highlighting the importance of interdisciplinary expertise. The seminar series and outreach activities attracted students from various academic disciplines, encouraging them to explore educational and career paths in transportation beyond engineering. The seminars connected students with internship and research opportunities in transportation, fostering workforce development in this critical field.

6. At UNLV, partnerships with student chapters of professional organizations enrich the students' educational experience and exposure to transportation-related careers.
7. The REPS team at UNLV developed AI-technology tools for improving traffic records data quality, and effective practices were documented for key research areas such as adjudication, citation, and enforcement (ACE) data.
8. UNLV faculty actively participated in regional and international conferences, serving on technical program committees, moderating sessions, making presentations, and submitting abstracts, facilitating knowledge transfer and dissemination.
9. The team at UNLV continued to engage with the community to enhance the safety of low-income road users, combining research and outreach to address transportation safety and mobility challenges.
10. The REPS team at UMD team has been training students in emerging AI technology
11. The REPS team at SJSU led a Summer Transportation Institute (STI) Program focused on promoting diversity, with 84% non-white participants. Students explored transportation careers through a 3-credit college course and shared positive testimonials.

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, and various professional forums. The research outputs are shared through key publications and professional societies, as well as specific outreach through partnering institutions as described in section 3.

1. The research findings were published in journals such as the ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, and the ASCE Journal of Computing in Civil Engineering.
2. Results were shared through papers presented at conferences hosted by organizations such as the Institute of Electrical and Electronics Engineers (IEEE), the American Society of Civil Engineers (ASCE), and the Association of Collegiate Schools of Planning (ACSP). Other venues include the American Association of Geographers (AAG) and various regional and national forums, which serve as platforms for engaging with peers, receiving feedback, and highlighting innovative methodologies developed by the REPS team.
3. The research team actively participated in a variety of conferences, including the Traffic Records Forum hosted by the Association of Transportation Safety Information Professionals (ATSIP), and sessions organized by the Transportation Research Board (TRB). These presentations covered a range of topics, including transportation safety, data analytics, and policy implications.
4. REPS's engagement extended to specialized workshops such as the CyberRail Workshop and the Discussions Advancing Research in Transportation Safety (DARTS) Meeting, where the UMD team presented findings and explored advanced topics in railway engineering, machine learning, and safety data analysis.

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

1.4.1 Plan and Actions for the Upcoming Reporting Period of HU as the lead institution

During the next reporting period, HU as the lead institution will focus on several key initiatives to advance the REPS program goals. The primary objectives include enhancing collaboration, increasing participation,

and successfully implementing research, education, and outreach activities. The specific actions of HU are as follows:

1. Activating the REPS Advisory Board: HU will take the lead in reactivating the advisory board which will include representatives from transportation institutes, academia, industry experts, and stakeholders.
2. Strengthening Partnerships with Consortium Institutions: Coordinate with partner institutions to reactivate the leadership teams for each research thrust area, ensuring a collaborative and cohesive approach to peer review processes and project oversight.
3. Conduct regular meetings with partner institutions to ensure that research activities are on track and aligned with REPS objectives.
4. Enhancing Faculty Participation: Engage more faculty members from Howard University and partner institutions to increase research output, student involvement, and technology transfer initiatives. Expand faculty participation through targeted workshops and collaborative research projects.
5. Enhancing the engagement of undergraduate and graduate students from Howard University and partner institutions in REPS efforts to increase research output, enrich student involvement, and impactful technology transfer initiatives.
6. Expanding Student Involvement in Education and Outreach: Continue to involve HU students in ongoing REPS activities, including research, education, workshops, and community outreach initiatives.
7. Implement student programs to support professional development, such as mentorship opportunities, internships, and hands-on research projects.
8. Implementing Technology Transfer and Community Outreach: Define and execute special activities to promote technology transfer and disseminate research findings to local communities, with a specific focus on addressing transportation safety challenges in the DMV (Washington, Virginia, and Maryland) area.
9. Project Management and Completion: Ensure the timely completion of ongoing research projects and define key activities to support the closure and transfer of research outcomes to relevant stakeholders.
10. Planning for Special Activities in the DMV Area: Initiate region-specific activities to address unique transportation challenges in Washington, Virginia, and Maryland, focusing on promoting equity and safety in underserved communities. Engage local departments of transportation (e.g., DDOT) to try to implement pilot projects and develop a framework for scaling successful initiatives to a broader audience.

1.4.2 Research

During the next reporting period, we plan to continue making progress on the research projects outlined in Section 1.2. The table below outlines the research projects, summarizes the pending milestones, and provides the proposed completion dates.

Projects Pending Milestones

Project Title	Pending Milestones	Timeline to Complete
Investigating the Impact of Enforcement and Education on Reducing Drug-Impaired Driving	- Finalize analysis of response data interpret findings and enhance understanding of drug-impaired driving behaviors and prevention strategies. - Complete the final project report. - Draft a journal or conference paper. - Plan a public presentation to share results with students and the general public.	02/28/2025
Mental States & Machine: Enhancing Driver Engagement in Automated Vehicles for Safer Transitions	- Complete recruitment and data collection by early October. - Approved to use San Jose State University's SONA system. - Plan to recruit 20-30 participants and start experiments in October.	12/31/2024
Building AI and Machine Learning Technologies for Enhancing Transportation Station Area Safety in San Jose, CA	- Finalize the ML prediction process by including walkability around transportation stops as a secondary input. This addition aims to enhance the accuracy of crime and safety predictions in the final model. - Improved predictions will optimize resource allocation for safety enhancements at transportation hubs.	10/30/2024
Smart AI-Technology Employment for Crash Data Analysis	- Wrap up the algorithm development - Complete the analysis - Prepare abstracts, manuscripts, and project report	03/30/2025
Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory Data	- Complete analyses of HRVT data - Prepare abstracts, manuscripts, and project report	12/31/2024
Enhancing Road Safety for All Road Users	- Conducted QA/QC on socio-economic, socio-demographic, and coroner's office data. - Integrated and analyzed crash data with socio-economic and demographic datasets. - Compiled findings into a comprehensive project report.	05/31/2025
Effective Practices to Integrate Traffic Citation and Adjudication (TCA) Data	- Obtain access to citation data and aggregated adjudication data and analyze the data - Consolidate data from varied sources and analyze the data - Prepare abstracts, manuscripts, white papers, and project report	05/31/2025
Quantum Machine Learning and Railway Deterioration and Operations	-Journal paper in preparations - Final Report	12/31/2024
Machine Learning and Railway Track Deterioration Part1: Degree of Railroad Ballast Fouling Using Gaussian Process Regression	-Journal paper in preparations - Final Report	12/31/ 2024
Machine Learning and Railway Track Deterioration Part 2 Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions	-Journal paper in preparations - Final Report	12/31/ 2024

1.4.3 Education and Workforce Development

1. Efforts will be made to enhance collaboration with relevant stakeholders and integrate educational initiatives to promote safety awareness in transportation systems. The team will continue to work diligently to ensure that all REPS milestones are met.
2. Continue with the At UNLV transportation seminar series

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
Nevada Department of Transportation	Carson City & Las Vegas, NV	In-kind (data, information, community engagement)
Nevada Office of Traffic Safety	Carson City & Las Vegas, NV	In-kind (data, information, community engagement)
Clark County Office of Traffic Safety	Las Vegas, NV	In-kind (data, information, community engagement)
Regional Transportation Commission of Southern Nevada	Las Vegas, NV	In-kind (data, information, community engagement)
IEEE	Piscataway, NJ	In-kind: data exploration (NTDAS)
Cambridge Mobile Telematics	Cambridge, MA	In-kind: data exploration (CMT)
District of Columbia Department of Transportation	Washington, DC	In-kind support
Metropolitan Police Department (MPD)	Washington, DC	In-kind support
MPD Headquarters	Washington, DC	In-kind support
Tri Delta Transit	Contra Costa County, CA	Financial: Food, In-kind: 10 participants in a 2-day 16-hour intensive academy, facilities: Used Tri Delta facilities for training
Denver Regional Transportation District (RTD)	Denver, CO	Financial: Food, In-kind: 20 participants in a 2-day 16-hour intensive academy, facilities: Used RTD facilities for training
American Society of Civil Engineers San José Young Members Forum	San José, CA	In-kind support
California High-Speed Rail Authority	San Francisco Bay Area, CA	In-kind support
Contra Costa Transportation Authority	San Francisco Bay Area, CA	In-kind support, facilities
DB Engineering & Consulting USA	San Francisco Bay Area, CA	Financial
East Side Union High School District	San José, CA	In-kind support
Glydways	San Francisco Bay Area, CA	In-kind support, facilities
HNTB	San Francisco Bay Area, CA	In-kind support
May Mobility	San Francisco Bay Area, CA	In-kind support
Nuro	San Francisco Bay Area, CA	In-kind support
San José Department of Transportation & Transportation Incident Management Center	San José, CA	In-kind support, facilities
San José State University (SJSU) Aviation & Technology	San José, CA	In-kind support, facilities
SJSU Environmental Studies	San José, CA	Personnel exchanges
SJSU Library	San José, CA	In-kind support, facilities
SJSU Peer Connections	San José, CA	In-kind support
SJSU Spartan Racing	San José, CA	In-kind support, facilities
SJSU Writing Center	San José, CA	In-kind support
San José Unified School District	San José, CA	In-kind support
Santa Clara Valley Transportation Authority	San José, CA	In-kind support, facilities
Transbay Joint Power Authority	San Francisco, CA	In-kind support, facilities
United Airlines	-	In-kind support
The University of New Mexico	Albuquerque, NM	Collaborative research
MDOT/SHA	Hannover, MD	In-kind support
Duval High School	Lanham, MD	Facilities

3. OUTPUTS

3.1 Publications, conference papers, and presentations

3.1.1 Publications

1. Woldemariam, Petros, and Attoh-Okine, Nii. (Forthcoming). Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions. ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering.
2. Woldemariam, Petros, and Attoh-Okine, Nii. (Forthcoming). Topological Data Analysis for Railway Track Geometry Safety and Maintenance. ASCE Journal of Computing in Civil Engineering.

3.1.2 Conference Papers

1. Zahid, Tarek, and Brendan Morris. Using Deep Traffic Prediction for EMFAC Emission Estimation and Visualization. IEEE Proceedings of the Intelligent Transportation Systems Conference, Edmonton, Canada, September 24-27, 2024.
2. Khandaker Arafin Islam and Shashi Nambisan. Beyond Numbers: Navigating Road Safety Analyses with Integrated Datasets. 2024 Traffic Records Forum, ATSIP, San Diego, CA, August 10-13, 2024.
3. Bo Yang. Presented a speech on the project's progress and methodologies at the International Symposium of Spatiotemporal Data Science 2024, July 24, 2024.
4. Shashi Nambisan, Christopher Stream, and Ryan Cunningham. Traffic Citations and Adjudication Data Linkages and Gaps: An Update. 2024 Traffic Records Forum, ATSIP, San Diego, CA, August 10-13, 2024.
5. Shashi Nambisan, Juliana Byzyka, Shreya Chindepalli, and Khandaker Arafin Islam. Examining Implications of Technological Advancements on Road Safety and Operations. International Conference on Transportation and Development, American Society of Civil Engineers, Atlanta, GA, June 16-19, 2024.
6. Khandaker Arafin Islam and Shashi Nambisan. A Comparative Evaluation of Urban and Rural Road Safety in Nevada. 2024 Lifesaver Conference on Roadway Safety, Denver, CO, April 7-9, 2024.
7. Nambisan, Shashi, Juliana Byzyka, Mehmet Erdem, Billy Bai, and Sushma Koneti. Transportation Needs and Economic Opportunities of Socio-economically Disadvantaged Populations in Las Vegas Hospitality and Tourism Industry. Pacific Southwest Region University Transportation Center 2024 Congress, University of Nevada, Las Vegas, Las Vegas, NV, March 11-12, 2024.
8. Islam, Khandaker Arafin and Shashi Nambisan. Driving Forward: Data-based Strategies for Better Road Safety Equity. Pacific Southwest Region University Transportation Center 2024 Congress, University of Nevada, Las Vegas, Las Vegas, NV, March 11-12, 2024.
9. Zahid, Tarek, and Brendan Morris. Combining Deep Traffic Prediction and Emission Estimation. Pacific Southwest Region University Transportation Center 2024 Congress, University of Nevada, Las Vegas, Las Vegas, NV, March 11-12, 2024.
10. Bo Yang. Traffic restrictions during the 2008 Olympic Games reduced urban heat intensity and extent in Beijing. Association of Collegiate Schools of Planning (ACSP 2023), Chicago.
11. Xiangyu Ren, Bo Yang, Xi Gong, and Yanhong Huang. Street crime prediction using a spatial-temporal cokriging method: a case study of San Jose. American Association of Geography (AAG 2023), Denver.

3.1.3 Conference Presentations

1. Nambisan, Shashi. The Future of Transportation. Panel Member, ConveneNV 2024: Our Sustainable Future Forum, Organized by ImpactNV, Horseshoe Las Vegas Hotel & Casino, Las Vegas, NV, September 26, 2024. (Invited Panelist)
2. Christopher Stream, Shashi Nambisan, and Ryan Cunningham. Nevada Traffic Citations and

Adjudication (TCA) Data Linkages and Gaps: An Update. Nevada Traffic Records Coordinating Committee, Quarterly Meeting (online: Microsoft Teams Meeting), September 10, 2024.

3. Bo Yang. Presented a poster on the project's progress and methodologies at the 7th International Conference on Women and Gender in Transportation, on September 9, 2024.
4. Shashi Nambisan. Session on "Safety Effects and Characteristics of Vehicles & Comparability of Automated Vehicle Crash Databases." 2024 Traffic Records Forum, ATSIP, San Diego, CA, August 10-13, 2024. (Session Moderator Invited)
5. Khandaker Arafin Islam and Shashi Nambisan. Nevada's Road Safety: Comparing Urban and Rural Areas. Nevada Rural Road Safety Summit, Organized by the Nevada Department of Transportation, Elko, NV, July 16-17, 2024.
6. Jay Park, Cristian Arteaga, and Shashi Nambisan. AI Speech Recognition for Crash Reports. Nevada Traffic Records Coordinating Committee, Quarterly Meeting (online: Microsoft Teams Meeting), June 11, 2024.
7. Christopher Stream, Shashi Nambisan, and Ryan Cunningham. Traffic Citations and Adjudication Data Project Update. Nevada Traffic Records Coordinating Committee, Quarterly Meeting (online: Microsoft Teams Meeting), June 11, 2024.
8. Shashi Nambisan. The Challenge of Workforce Development. International Conference on Transportation and Development, American Society of Civil Engineers, Atlanta, GA, June 16-19, 2024. (Session Moderator Invited)
9. Shashi Nambisan. The Role of Policy and Enforcement in Traffic Safety Outcomes. 2024 Lifesaver Conference on Roadway Safety, Denver, CO, April 7-9, 2024. (Session Moderator Invited)
10. Jimoh, Sani, and Attoh-Okine, Nii. (March 2024). Relationship between Track Geometry Parameter and Bayesian Network. CyberRail Workshop.
11. Alabintei, Dengimowei, and Attoh-Okine, Nii. (March 2024). Quantum Machine Learning and Track Geometry Modeling. CyberRail Workshop.
12. Guinn L., Attoh-Okine N. (2024, March 8) Bloc.kchain Technology: A Game Changer in Railway Operations [Conference session] Cyber and Digital Information in Railway Engineering and Operations, College Park, MD, United States.
13. Nambisan, Shashi and Kwaku Boakye. An Analysis of Seat Belt Laws, Seat Belt Use Rates, and Crash Outcomes Across the US. Discussions Advancing Research in Transportation Safety (DARTS) 2024 Meeting, National Highway Traffic Safety Administration, Washington, DC, January 05, 2024. (Invited Keynote Speaker)
14. Nambisan, Shashi. 103rd Annual Meeting, Advanced Vehicle Technologies and Occupant Protection, Panel Discussion. Session 2125, Transportation Research Board of the National Academies, Washington, D.C., January 08, 2024. (Session Moderator Invited)
15. Nambisan, Shashi. Road Safety Goals: Directions to a Destination? 7th Conference of the Transportation Research Group of India (CTRG-2023), Surat, Gujarat, India, December 17-20, 2023. (Invited Keynote Speaker)
16. Khandaker Arafin Islam and Shashi Nambisan. A Comparative Evaluation of Urban and Rural Road Safety in Nevada. 32nd Annual Nevada Fall Transportation Conference 2023. Organized by the Nevada Chapters / Sections of ASCE, ITE, and ITS America. Tuscany Hotel and Casino, Las Vegas, NV, November 1-2, 2023.
17. Nambisan, Shashi and Khandaker "Arafin" Islam. Traditional and Emerging Transportation Safety Data Sources: Challenges, and Opportunities. 2023 Nevada Traffic Safety Summit, Nevada Department of Transportation and Nevada Office of Traffic Safety, Las Vegas, NV, September 2023.
18. Arteaga, Cristian, Jee "Jay" Park, and Shashi Nambisan. Extracting Insights from Crash Narratives: An AI-based Semantic Matching Approach. 2023 Traffic Records Forum, ATSIP, Nashville, TN,

July 9-12, 2023.

19. Nambisan, Shashi, Christopher Stream, and Zohreh Bang Tavakoli. Linkages and Gaps in Traffic Citations and Adjudication Datasets and Processes. 2023 Traffic Records Forum, ATSIP, Nashville, TN, July 9-12, 2023.
20. Nambisan, Shashi, Juliana Byzyka, Mehmet Erdem, Billy Bai, and Pemba Mwepu. An Examination of Transportation for Employees from Socio-economically Disadvantaged Populations in Las Vegas. ITE Mountain District Annual Conference, St. George, UT, June 20-23, 2023.
21. Islam, Khandaker "Arafin" and Shashi Nambisan. Rural Road Safety: A Case Study of Nevada. ITE Mountain District Annual Conference, St. George, UT, June 20-23, 2023.
22. Bo Yang. Poster Presentation at VTA GISDAY 2023 and SJSU GISDAY 2023

3.2 Policy Papers

- Nothing to report yet.

3.3 Websites or Internet Sites

- REPS Interim website: https://cea.howard.edu/reps-tier-1-university-transportation-center

3.4 New Methodologies, Technologies, or Techniques

- AI Speech Recognition for Crash Reports (Discussed by Jay Park, Cristian Arteaga, and Shashi Nambisan)
- Deep Traffic Prediction for EMFAC Emission Estimation (Zahid, Tarek, and Morris, Brendan)

3.5 Inventions, Patents, and/or Licenses

- Nothing to report yet.

3.6 Other Products

1. Nevada Traffic Citations and Adjudication Data Linkages (Christopher Stream, Shashi Nambisan, and Ryan Cunningham)
2. *Leadership Academies*
3. Curriculum for a 2-day intensive was created and customized for Tri Delta specifically.
4. Curriculum for a 2-day intensive was created and customized for RTD specifically.
5. Program newsletter: https://transweb.sjsu.edu/2024-Mineta-Summer-Transportation-Institute
6. Program website: https://transweb.sjsu.edu/workforce-development/summer-transportation-institute
7. MTI staff gave presentations at Abraham Lincoln High School and Pioneer High School in San José to recruit student participants. In addition to sharing the previous year's compilation video, MTI staff discussed the application process and best practices from successful essays.

4. OUTCOMES

4.1 Increased understanding and awareness of transportation issues

1. Ms. Breen, Professor Nambisan, and Professor Stream had dozens of ongoing consultations related to various aspects of this grant and its synergistic activities with local agencies who have jurisdiction of roadways of interest, the MPO (RTC of Southern Nevada), Nevada DOT, Nevada Office of Traffic Safety, Clark County Office of Traffic Safety, law enforcement agencies, and broadcast and print media organizations (television, radio, newspapers)
2. Team members, in particular, MS. Breen, were featured dozens of times by broadcast and print media outlets (television, radio, newspapers) on topics related to this grant and its synergistic

activities such as traffic safety, vulnerable road users, law enforcement, policy, legislation, and regulations.

3. Professor Nambisan continues to serve as a member of the Nevada Advisory Committee on Traffic Safety (NVACTS). The NVACTS is a committee established by the Nevada Legislature.
4. Professor Nambisan continues to chair the Safer Drivers and Passengers committee, which is one of four key (focal) areas of Nevada's Strategic Highway Safety Plan.
5. Professor Nambisan continues to chair the Transportation Research Board's Standing Committee on Occupant Protection.

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

- Nothing to report yet.

4.3 Increases in the body of knowledge

The REPS outputs have contributed to expanding the body of knowledge:

Publications:

Multiway Analytics Applied to Railway Track Geometry and Ballast Conditions by Petros Woldemariam and Nii Attoh-Okine (ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems).

Topological Data Analysis for Railway Track Geometry Safety and Maintenance by Petros Woldemariam and Nii Attoh-Okine (ASCE Journal of Computing in Civil Engineering).

Conference Papers:

A diverse range of conference papers presented, covering topics such as traffic prediction, safety analysis, and distributional safety impacts. Key papers include:

Increased understanding of the pattern in which public transportation patterns and the built environment around transportation hubs and stops affect crime prediction.

Deep Traffic Prediction for EMFAC Emission Estimation.

A Comparative Evaluation of Urban and Rural Road Safety in Nevada.

Examining Implications of Technological Advancements on Road Safety and Operations.

Conference Presentations:

Presentations on varied subjects such as policy impacts, crash report recognition, and digitalization of railway systems:

The Future of Transportation panel discussion.

AI Speech Recognition for Crash Reports.

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

AI Speech Recognition for Crash Reports: Explores the application of AI in automating crash report analysis.

Deep Traffic Prediction for Emission Estimation: Utilizes advanced traffic prediction models to improve emission estimation accuracy.

4.5 Enlargement of the pool of trained transportation professionals

1. *Leadership Academies*

The Mineta Leadership Academy (MTI) Two-Day Intensive Leadership Academy is a specialized program designed to develop the leadership capabilities of transportation professionals. It focuses on enhancing essential leadership competencies and has made a significant impact on transportation agencies in California and Colorado. This structured approach not only enhanced the leadership capabilities of

transportation professionals but also created a positive organizational culture and reinforced career development pathways for those involved, significantly contributing to the enlargement of the pool of trained transportation professionals.

- *MTI Leadership Academy in Contra Costa County, California*

Number of Professionals Trained: 10 RTD professionals.

Program Focus: This training aimed to support agencies by revitalizing leadership talent through an accelerated program in core leadership competencies.

Training Features: The program provided participants with state-of-the-art leadership assessment tools such as Myers-Briggs Type Indicator (MBTI), Belbin Team Roles, Change Style Indicator, and Leadership Styles Survey. These assessments were supplemented with individual review sessions conducted by a board-certified psychologist.

Outcomes: Participants practiced team-building and critical thinking skills, deepened their understanding of management versus leadership, and engaged in collaborative discussions to refine their leadership approaches.

Testimonial: Rashidi Barnes, Tri Delta Transit CEO, mentioned that it was the first formal leadership training the staff had received in the agency's 47-year history, emphasizing its value in fostering leadership growth.

- *MTI Leadership Academy in Denver, Colorado*

Number of Professionals Trained: 20 RTD professionals.

Program Focus: Similar to the California training, this program focused on equipping upper and mid-level managers with the essential 8C's of Leadership Competency Skills.

Training Features: Participants experienced interactive team-building sessions and used leadership assessment tools (e.g., MBTI, Belbin Team Roles) to understand their communication patterns, conflict resolution styles, and leadership capabilities.

Outcomes: This workforce development program provided a boost to employee morale and created clear career advancement pathways for the RTD team.

2. *The Short Course on Cybersecurity and Railway Engineering and Operations* was an educational program scheduled for March 7th, 2024, at UDM, focusing on the critical intersection of cybersecurity and railway engineering. The course addresses the growing digitalization of railway systems and the associated risks, emphasizing cybersecurity frameworks (e.g., NIST 800-53, MITRE ATT&CK), data protection, AI applications, and the use of emerging technologies like Blockchain. The event is structured around expert-led modules, case studies, and interactive discussions, featuring contributions from renowned professionals. The course was offered to 60 participants, including 12 students from UMD.

3. The Enlargement of the Pool of Trained Transportation Professionals was significantly supported through a structured educational program that provided accelerated learning and career exploration opportunities. A total of 16 participants successfully completed a rigorous 3-credit Environmental Studies college course, with an impressive 97% of students achieving a grade of B or better. This strong academic performance indicates the effectiveness of the program in enhancing their knowledge and skills. The program was jointly funded by REPS and MCEEST, and to ensure accurate reporting, participants were allocated equally between both funding sources.

The program's impact extended beyond academic success. According to post-program survey results, 97% of participants expressed satisfaction with their experience, while 72% reported an increased interest in pursuing careers in transportation. These outcomes demonstrate the program's success in sparking curiosity and motivation among students, contributing to a growing and engaged pool of future transportation professionals. By blending academic training with career exposure, this initiative has made a meaningful contribution to expanding the workforce in the transportation sector.

4.6 Adoption of new technologies, techniques or practices.

- Nothing to report yet.

5. IMPACTS

5.1 The effectiveness of the transportation system

The REPS' projects introduce advanced technologies and data-driven solutions across various domains. The integration of AI and high-resolution vehicle trajectory data (HRVT) enables better planning, management, and operation of roadways, allowing for more efficient traffic flow and safety management. Additionally, projects focused on driver engagement in automated vehicles and drug-impaired driving help address human factors in transportation safety. The research into machine learning for railway safety improves predictive maintenance by identifying track failures and deterioration, leading to more reliable railway systems. Furthermore, by addressing equity for low-income road users and developing crime prevention tools for transit hubs, these projects contribute to a safer and more inclusive transportation system, protecting vulnerable populations and enhancing public safety.

1. *How project findings can be used to improve safety*: The research findings from these projects may be applied to reduce traffic accidents caused by distracted or fatigue driving.
2. *Stakeholder engagement and impact*: Ms. Breen and Professor Nambisan collaborated with the Nevada Advisory Committee on Traffic Safety (NVACTS) to involve key stakeholders in the traffic safety domain. This engagement has raised awareness among elected and appointed officials in Nevada about the importance of addressing traffic safety needs and challenges. As a result, NVACTS and other leaders in Nevada have advocated new legislative initiatives aimed at improving traffic safety. Clarify the significance of this stakeholder engagement and how it contributes to long-term policy changes.

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)

1. The findings may inform the design of future automated vehicles, such as the driver state monitoring systems.
2. Quantitative and qualitative analyses based on this grant and other synergistic activities led by Ms. Breen and Professor Nambisan have been integral to the Nevada State Legislature's Joint Interim Standing Committee on Growth and Infrastructure has initiated a "Bill Draft Request" specifically related to authorizing the use by local agencies of automated enforcement tools and technologies to enhance traffic safety.
3. Sheriff Kevin McMahill of the Las Vegas Metropolitan Police Department is advocating for legislative approval to use cameras in the Las Vegas valley for enforcing red-light violations. https://www.reviewjournal.com/local/traffic/is-it-time-for-red-light-cameras-in-las-vegas-the-sheriff-thinks-so-3179003/

5.3 The increase in the body of scientific knowledge

1. Improvement in the walkability around mass transit infrastructures might reduce observed safety disparities. This insights about managing urban planning to support safer, more inclusive public transportation and reduce street crime.
2. The results of efforts led by Dr. Jay Park on the project titled "Smart AI-Technology Employment for Crash Data Analysis" will help augment the existing knowledge base by creating an innovative methodology that harnesses Artificial Intelligence (AI) and Natural Language Processing (NLP) to efficiently delve into narratives included in crash reports filed by law enforcement (police) officers who respond to traffic crashes. The methodological approaches developed in this project will advance the state of the science in this domain.
3. The results of efforts led by Dr. Brendan Morris on the project titled "Freeway and Arterial Performance and Safety Analysis with High-Resolution Vehicle Trajectory (HRVT) Data" have the

potential to leverage emerging traffic data sources such as HRVT to support infrastructure owner operators and practitioners to more effectively plan, operate, and manage their systems and improve safety outcomes on their networks. The methodological approaches developed in this project will advance the stat of the science in this domain.

5.4 Transportation Workforce Development.

The REPS program funds research opportunities for students at partner institutions, providing training in research protocols, data collection, analysis, report writing, and professional communication. These experiences enhance technical skills and prepare students for careers in transportation by developing critical thinking and problem-solving abilities. Students also gain interdisciplinary experience through collaborative projects and are encouraged to present their findings at conferences, boosting their confidence and public speaking skills. Additional training initiatives from the REPS program are highlighted below, showcasing their impact on professional development and inclusivity in transportation education.

1. Leadership Academies Impact:

TriDelta Transit Academy: This academy focused on enhancing the knowledge, skills, and abilities of mid and senior-level managers, including the CEO, at a small transit agency. Participants received training on effective communication strategies, conflict resolution techniques, and understanding their roles within teams. This training aims to equip leaders with the competencies necessary to foster collaboration and drive organizational growth.

RTD Denver Academy: At this leading transit agency, the Leadership Academy strengthened the leadership capacity of mid and senior-level managers. Participants were trained in communication, conflict resolution, and team dynamics, contributing to a more cohesive and high-performing leadership team.

2. Summer Transportation Institute (STI) Program Highlights:

Broadened outreach across schools and regions: The program broadened outreach across schools and regions and removed cost barriers (no-tuition college credit) to expand participation. This inclusive approach promotes equitable access to transportation education and professional development opportunities.

Student Testimonials: MSTI participant Lilia Rodriguez Vargas reflected on her experience, stating, “I learned that there isn’t one fixed pathway of where you want to go and where you want to end up. That is something I worry about all the time. This program helped me realize that I am capable of a lot of things.” Her words highlight the program's success in building student confidence and broadening their career perspectives.

College Course Enrollment: As part of the program, participants were enrolled in a 3-credit college course at San Jose State University, allowing them to experience life as commuter college students without any tuition costs. This opportunity provided them with a firsthand understanding of the academic environment and the rigors of higher education, further preparing them for future academic and career success.

These training programs collectively contribute to the professional development of current and future transportation leaders, supporting a more diverse and well-prepared workforce in the sector.

3. In addition to the “formal” course offerings, the grant partnered with UNLV’s Student Chapter of the Institute of Transportation Engineers on more than 20 events during the academic year. Typically, in each month, these included 2 or 3 seminars by thought leaders from across government, industry, and non-profit organizations and academia who addressed a broad range of topics, with safety often being one of the elements of each seminar. Most of these presentations were webcast and also recorded (based on consent by the presenter). This helped expand the reach of the events. Further, there was one field trip or site visit to a transportation project site/locale. Each event had about 15 to 20 attendees who included undergraduate and graduate students, researchers and faculty members, practitioners, and decision-makers. Collectively, these helped broaden the horizons of students and expand their professional networks.

4. The undergraduate and graduate level educational (curricular and co-curricular) activities alerted

scores of students to challenges and needs in the transportation sector, engaged them in activities to identify opportunities to address these challenges, and encouraged them to continue educational and career opportunities in transportation. These also helped practitioners who attended the events to enhance their knowledge and skills in emerging topics.

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

The project timeline has experienced adjustments due to unforeseen delays associated with the change of PI at the lead institution. Efforts are actively underway to address these challenges and bring the project back on track

6.3 Changes that have a significant impact on expenditure

Nothing to Report

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