



Center for Efficient Mobility

A USDOT University Transportation Center

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Signature of Submitting Official: 

Overview

As mentioned in the previous reporting period, in March 2025, in compliance with latest United States Department of Transportation directives, The Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH) was renamed as the Center for Healthy and Efficient Mobility (CHEM). In this reporting period, the Center underwent additional changes and realignment, moving forward as the **Center for Efficient Mobility (CEM), addressing the statutory priority area of “Improving the Mobility of People and Goods”**. CEM focuses on advanced transportation sector innovations, with a view to advancing transportation efficiency and delivering economic and social benefits through mobility. The Texas A&M Transportation Institute (TTI) continues to lead this UTC consortium, which includes six partner universities: Johns Hopkins University (JHU), Georgia Institute of Technology (GT), University of Texas at El Paso (UTEP), and the University of California, Riverside (UCR), Morehouse School of Medicine (MSM) and North Dakota State University (NDSU). This semi-annual progress report covers a period of time in which the center continued to refocus and realign its activities to address current USDOT priorities.

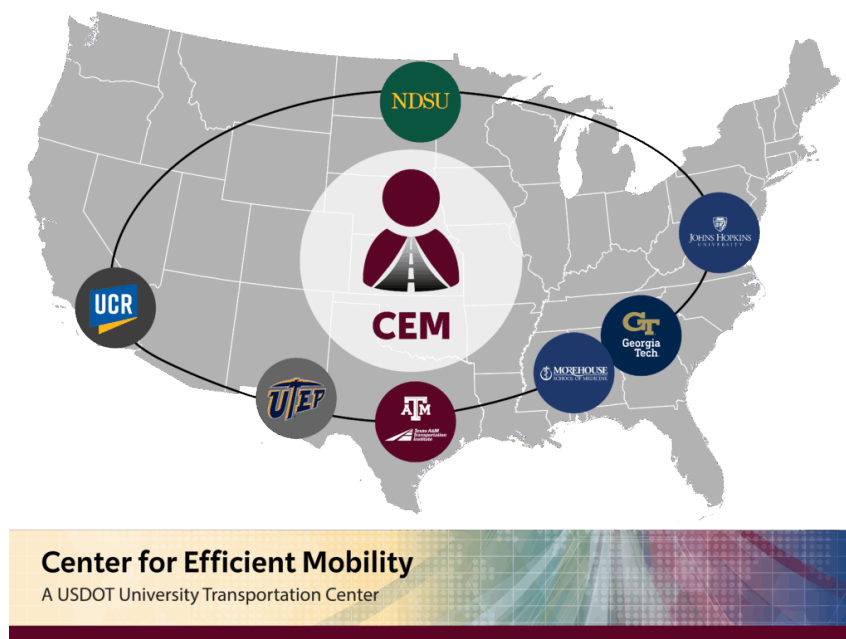


Figure 1. CEM Consortium Members.

1. Accomplishments

Major Goals of the Program

CEM's realigned approach addresses the key issues of efficient mobility and delivering economic and social benefits through transportation. The CEM consortium still prioritizes synergies between the consortium members. Each partner brings a unique role and expertise to the CEM consortium keeping in mind these new focus areas, as summarized below.

Table 1. Consortium Member Expertise

Consortium Member	Key Role/Expertise in Consortium
Texas A&M Transportation Institute (TTI)	TTI serves as the lead institution and brings a broad range of transportation expertise as the nation's largest university-based transportation research center. TTI will focus on bridging research to practice and accelerating innovation and commercialization. TTI will lead data integration and advanced modeling across the consortium.
Johns Hopkins University (JHU)	JHU brings a wealth of safety and public health, human factors, datasets, and engineering expertise which will be leveraged for policy-relevant research outputs.
Georgia Institute of Technology (GT)	GT will focus on advanced modeling, simulation, and data, incorporating AI and emerging methods for technology deployment.
University of Texas at El Paso (UTEP)	UTEP will leverage its expertise on transportation systems and infrastructure to address risk, resilience, and emergency preparedness.
University of California, Riverside (UCR)	UCR will provide freight- and goods-movement focused expertise leveraging their facilities and capabilities that include real-world testing and data collection.
Morehouse School of Medicine (MSM)	As a premier medical institution, MSM will support research on efficient mobility

	with a focus on safety, and community health applied to transportation.
North Dakota State University (NDSU)	NDSU will apply its vast transportation sector experience including advanced air mobility and logistics, as well as expertise in rural and tribal areas with a focus on access, efficient mobility, and safety.

The following sections provide a high-level discussion of activities in-progress and planned during this reporting period under the goal areas of research, education, and technology transfer, which we will continue to build on during future reporting periods of this grant.

CEM Goal #1: Research Program

Previously Funded Research Projects (Year 1 and Year 2 funds)

In this reporting period, progress continued toward completing incomplete projects from Year 1 of the grant and initiating and continuing projects awarded under Year 2 of the grant. As discussed in the previous reporting period, the portfolio of projects for Year 2 were originally selected in late Fall 2024, prior to the issuance of the new federal guidelines and directives in early 2025. The Year 2 projects (summarized in Table 2) were initiated after realigning them as necessary to address new priorities and directives. Principal Investigators (PIs) of these projects were also briefed about the current priorities of the CEM center and requested to align their research activities to the revised center mission. Progress is ongoing on all these projects, and final reporting will be completed as projects move toward completion.

Table 2. Year 2 Project Portfolio

Project	Institution	PI	Title
02-01-UCR	University of California, Riverside	Georgios Karavalakis	Microplastic Air Pollution from the Wear of Vehicle
02-02-JHU	Johns Hopkins University	Johnathon Ehsani	Healthy Micromobility: Moving From Crisis to Opportunity
02-03-UTEP	University of Texas at El Paso	J. Choi	Digital Twin Modeling of NOx Formation from Transient Vehicle Operations in Hilly Terrains
02-04-UTEP	University of Texas at El Paso	Anantaa Kotal	Bridging Data Gaps with Modeled Data from Generative AI: Advancing Health in Transportation Research

Project	Institution	PI	Title
02-05-UTEP	University of Texas at El Paso	Jaeyoon (Jason) Kim	Evaluating the Cumulative Impact of Environmental Conditions on Stress Levels in Micromobility Users: An AI-Driven Multimodal Approach
02-06-JHU	Johns Hopkins University	Allison Barlow	Data Driven Evaluation of the Transportation Barriers to Water Access on the Navajo Nation
02-07-GT	Georgia Institute of Technology	Daniel Hunsaker	Pedestrian Route Choice and Traffic Exposures: A Case Study in Downtown Atlanta
02-08-NDSU	North Dakota State University	Ranjit Godavarthy	Evaluating Efficiency of Rural Transit Systems
02-09-TTI	Texas A&M Transportation Institute	Minjie Xu	Health and Activity Impacts of Student Commute Modes
02-10-TTI	Texas A&M Transportation Institute	Joan Hudson	Transportation and Mental Health in Central Texas Using 211 Call Center Data - An Exploratory Analysis
02-11-TTI	Texas A&M Transportation Institute	Tom Sanchez	Enhancing Rural Public Transportation Through Community Engagement and Technology
02-12-TTI	Texas A&M Transportation Institute	Kunhee (KC) Choi	Pavement-Maintenance-GPT: Optimizing Pavement Maintenance Decisions Using Generative AI
02-14-TTI	Texas A&M Transportation Institute	Deanna Belden	Destination Access and Health - Data Exploration
02-15-UCR	University of California, Riverside	Heejung Jung	Improving Vehicle Cabin Air Quality in Daily Transportation
02-17-GT	Georgia Institute of Technology	Ziming Liu	Real-Time Corridor Modeling and Health Impact Assessment using Dynamic Vehicle Fleet Composition Data

Identification of Projects for Year 3

With the release of Year 3 funds and the changed requirements for DOT approval of research projects prior to commencing work, CEM identified a set of Year 3 projects for DOT approval. These projects focus on leveraging AI for efficiency and developing new technologies and methods. They include projects covering rural areas, addressing the needs of communities, using AI to power infrastructure decisions and efficiency,

advanced modeling, advanced air mobility, and co-optimizing mobility and health. CEM also plans to pursue commercialization opportunities and bring technologies to market to ensure our work has broader impacts. In addition, we will collaborate synergistically with other UTCs undertaking similar efforts to ensure that our projects and efforts are complementary and not duplicative of activities undertaken elsewhere within the UTC program.

The projects shown in Table 3 were approved by USDOT in early 2026. Several of these projects have commenced, and others are in the process of being set up to begin in the next reporting period. The first three projects on the list are flagship projects initiated by TTI to specifically hone in on our new approach and vision by addressing the crucial areas to support our new focus – data for mobility insights, advanced modeling for transportation optimization, and the development of an innovation accelerator to support technologies reaching the market. The remaining research projects all advance our center’s new mission, addressing critical topics in an impactful manner.

Table 3. Year 3 Project Portfolio

Project	Institution	PI	Title
03-01-TTI	Texas A&M Transportation Institute	Joe Zietsman, Tara Ramani, Robert Brydia	Center for Efficient Mobility (CEM) Innovation Accelerator
03-02-TTI	Texas A&M Transportation Institute	Haneen Khreis	Advanced Transportation Optimization and Modeling (ATOM)
03-03-TTI	Texas A&M Transportation Institute	Rodolfo Souza	Data Integration to Support Digital Infrastructure and Efficient Mobility Insights
03-04-TTI	Texas A&M Transportation Institute	Shunhua Bai and Mahin Ramezani	Toward Smarter Mobility: AI-Powered Safety Insights for AVs and Vulnerable Road Users
03-05-TTI	Texas A&M Transportation Institute	Harshit Shukla, Edgar Kraus, Markus Primes	Unmanned Aerial System Automation Using Artificial Intelligence Tools
03-06-TTI	Texas A&M Transportation Institute	Edgar Kraus, Robert Balog	Advancing Rural Mobility through Innovative Charging Solutions
03-07-JHU	Johns Hopkins University	Johnathon Ehsani	Enabling Mobility for Older Adults in the US

Project	Institution	PI	Title
03-08-JHU	Johns Hopkins University	Johnathon Ehsani, Nan Ni	Micromobility Decision-Making Atlas
03-09-GT	Georgia Institute of Technology	Randall Guensler	Real-time Pedestrian Safety and Risk Exposure using Real-time Vehicle Activity and Fleet Composition
03-10-UTEP	University of Texas at El Paso	Yong Je Kim	Advanced InSAR-UAV-LiDAR Flood-Deformation Risk Monitoring for Efficient Mobility
03-11-UTEP	University of Texas at El Paso	Kelvin Cheu	Enabling Mobility of Emergency Medical Service through Connected and Automated Vehicle Preemption
03-12-UTEP	University of Texas at El Paso	Sungmin Youn	Innovative Materials for Improved Roadway Mobility and Drainage Efficiency
03-13-UCR	University of California, Riverside	Peng Hao	Large Multimodal Models-based Undesignated Truck Parking Monitoring System at Rest Areas
03-14-MSM	Morehouse School of Medicine	Dr. Fengxia Yan	Data-Driven Tools for Transportation Efficiency and Community Health
03-15-NDSU	North Dakota State University	Jeremy Mattson	Efficient Mobility for Rural Communities
03-16-NDSU	North Dakota State University	Ranjit Godavarthy	Enhancing Heavy Vehicle Crash Prevention in North Dakota through Machine Learning and Weather Data Integration

Research Results Disseminated

As projects have progressed, several papers have been presented by members of the consortium at venues such as the Transportation Research Board Annual Meeting. However, given the realignment of the center’s priorities and focus, dissemination of research results have been limited.

Plans for Next Reporting Period to Accomplish Research Goal

In the next reporting period, the ongoing and newly initiated projects will be continued. The consortium has scheduled a working session on May 8, 2026 to discuss and strategize new priority research projects for Year 4 of the grant (beginning June 1, 2026).

CEM Goal #2: Education and Workforce Development

Under education and workforce development, CEM will continue to mentor the future transportation workforce and train and inform practitioners. Our programs include research assistantships and summer internships for university students and programs for high schoolers and community health workers.

Project for K-8 Students

A notable education-related project initiated is “Promoting Teachers' and Young Learners' Engagement of Transportation Issues”. In this project, Texas A&M University's Department of Teaching, Learning and Culture initiated a project in which the main goals were to:

- Develop and disseminate K-8 standards aligned science curricula focused on real-world, transportation-related issues that promote students' scientific literacy and STEM interest.
- Offer professional learning opportunities that support K-8 teachers' involvement in curriculum development and implementation of science lessons that tie real world transportation-related issues into science instruction.
- Provide place-based learning opportunities for K-8 and undergraduate students to engage with TTI experts and research as they grapple with real world problems and design solutions.

In this reporting period, Texas A&M faculty worked with two local schools that expressed interest in the curriculum. One of those schools, a local elementary school in Bryan ISD, agreed to pilot components of the elementary curriculum in the spring of 2026. Implementing this material in classrooms may help create a pipeline of students interested in real-world transportation and other STEM related fields.

Summer Internship Program

CEM's sixth annual Summer Internship Program will kick off on May 26, 2026, and will conclude on August 3, 2026. This year's program is a collaborative effort with the National Center for Infrastructure Transformation (NCIT) and the Southern Plains Transportation Center (SPTC), continuing a shared commitment to developing the next generation of transportation professionals.

In this reporting period, the planning for the internship program and student recruitment was conducted. To promote the opportunity, CEM and its partner centers conducted extensive outreach through email campaigns and social media platforms. This broad advertising effort generated strong interest, resulting in more than 20 applications from students across the country. After a competitive selection process, the applicant pool was narrowed to the top four candidates.

The selected interns are upper-level undergraduate students with a strong interest in transportation efficiency and energy systems. They represent four different universities: Texas A&M University, Georgia Institute of Technology, Yale University, and the University of Texas at Dallas. Their diverse academic backgrounds and perspectives will contribute to a dynamic and engaging internship experience.

Over the course of the 10-week program, interns will work in the CEM offices and engage in a wide range of professional development activities, including technical tours, research presentations, and opportunities to interact with experienced professionals in the field. Each intern will pursue a chosen research topic under the guidance of a TTI researcher, who will serve as their mentor throughout the summer.

Additional Education and Workforce Development Activities

UC-Riverside, as part of CEM activities, co-sponsored the Science and Technology Education Partnership Conference (STEPCon) 2025 at the College of Engineering – Center for Environmental Research and Technology (CE-CERT) on 10/14/2025. 80 high school students were welcomed to CE-CERT for immersive lab tours, led by graduate student researchers, as outlined here: <https://www.cert.ucr.edu/news/2025/10/14/ce-cert-hosts-stepcon-and-open-house-2025> . At Johns Hopkins University, a doctoral-level research assistant received practical training in risk communication and science translation for a lay audience.

Student Involvement

In addition to our flagship internship program, several students are engaged as part of ongoing projects. In this reporting period, projects across the member institutions involved several students from different majors as shown in Table 4.

Table 4. Students involved in CEM Activities in this Reporting Period

Academic Level	Number of Students	Program of Study/Major
Bachelor's	28	Civil Engineering, Computer Science, Industrial and Systems Engineering, Environmental Engineering, Materials Science Engineering, Materials Science Engineering, Business Administration, Architecture, Environmental Science, Industrial Design, Aerospace and Mechanical Engineering
Master's	15	Civil Engineering, City Planning, Building Construction and Facilities Management, Urban Design, Urban Analytics, Geographic Information Systems and Technology, Health Sciences, City and Regional Planning (MCRP), Master of Science in Geographic System, Aerospace and Mechanical Engineering
Ph.D.	11	Civil Engineering, Transportation and Supply Chain, Electrical and Computer Engineering, Health Policy and Management/Health and Public Policy, Computer Science

Education and Workforce Development Results Disseminated

Nothing to report.

Plans for Next Reporting Period to Accomplish Education and Workforce Development Goal

For the next reporting period, the team will continue to foster the involvement of students in center activities and conduct the 2026 Summer Internship Program.

CEM Goal #3: Technology Transfer and Collaboration

In this reporting period, most of our usual technology transfer and collaboration activities were paused as we refocused and realigned our centers' activities. The update of the center's website continued with an ongoing review and removal of materials that are no longer compliant with current USDOT guidelines.

Participation in TRB Annual Meeting and UTC Directors Meeting

Several members of the CEM consortium participated in the Transportation Research Board (TRB) Annual Meeting, with presentations featuring CEM's research being delivered by students, researchers and faculty (as summarized in the "outputs" section of the report). CEM was also represented at the UTC Director's meeting, held January 11, 2026 in conjunction with the TRB Annual Meeting. Dr. Tara Ramani, Deputy Director of CEM stepped in to represent the Center Director, Dr. Joe Zietsman, who was unable to attend and provided an overview of center activities to UTC program leadership from USDOT.

Freight Workshop at UCR

UCR hosted a workshop that examined the impacts of freight activity on communities in Inland Southern California at CE-CERT on 12/10/2025. The workshop was attended by more than 50 state, regional, and local agency leaders and policymakers. During the workshop, UCR researchers presented key findings, demonstrated newly developed modeling tools, and facilitated discussions on how these insights can guide future planning and regulatory strategies that protect public health while supporting efficient goods movement.

Plans for Next Reporting Period to Accomplish Technology Transfer and Collaboration Goal

In the next reporting period, we plan to resume several traditional technology transfer activities (e.g., webinars) that were paused while our UTC underwent a realignment. In addition, we plan to initiate targeted technology transfer and commercialization activities to expand our collaboration and technology goals.

2. Participants and Collaborating Organizations

Organizations Involved as Partners

The CEM consortium is a seven-member consortium led by the Texas A&M Transportation Institute, part of The Texas A&M University System. Other members include The University of Texas at El Paso, Johns Hopkins University, Georgia Technology University, University of California at Riverside, Morehouse School of Medicine, and North Dakota State University. The team members from the various partner universities have begun to collaborate on their projects and are refining plans for other CARTEEH activities.

Other Collaborators and Contacts

Table 5 lists organizations our consortium members interacted substantively in the context of center activities during this reporting period.

Table 5. Organizations Interacted with During the Reporting Period on CEM Related Activities

Organization Name	Location	Contribution
AECOM	El Paso	In-kind support, sharing knowledge
Atlanta City Council	Atlanta, GA	City Council Forum
Atlanta Regional Commission (ARC)	Atlanta, GA	2020 Activity-Based Model data outputs, land-use data
Baltimore City Public Schools	Baltimore, MD	Access to facilities
Cities Area Transit	Grand Forks, ND	Project feedback and intent to provide data
City of Atlanta Department of Transportation	Atlanta, GA	City Transportation planning and data source
City of Atlanta Neighborhood Planning Unit	Atlanta, GA	NPU partner
City of El Paso Street & Maintenance Department	El Paso	In-kind support, sharing knowledge
Dekalb County	Atlanta, GA	Safety and Mobility model

El Paso Metropolitan Planning Organization	El Paso	Provided Traffic Demand Model (TDM) shapefiles for El Paso and Ciudad Juárez, including VMT and traffic flow data. The data supports roadway-level emission estimation and integration with physiological stress modeling. In-kind support through data access and technical guidance.
El Paso Fire Department	El Paso	In-kind support, sharing knowledge
El Paso Water Utilities (EPWater)	El Paso, TX	Collaboration; hydrologic data (e.g., flow-gauge records); technical input on flood behavior and drainage conditions
Envision Plastics	Reidsville, North Carolina	Supplies (Recycled plastics)
Georgia Department of Transportation (GDOT)	Atlanta, GA	Roadway and Traffic Signal Controller datasets
Georgia Institute of Technology	Atlanta, GA	Project leadership, machine vision model development, fleet composition analysis
Georgia Tech PACE HPC	Atlanta, GA	High-performance computing support
Marshall University	Huntington, West Virginia	In-kind support
River Cities Public Transit	Pierre, SD	Project feedback access to data
South Coast Air Quality Management District	Diamond Bar, CA	Provide air quality monitoring data for use in the Year 1 collaborative research project
State Road and Tollway Authority (SRTA)	Atlanta, GA	Access to freeway video data and support for data collection
Texas Department of Transportation	Austin, Texas	Collaboration

Texas Department of Transportation (TxDOT), El Paso District	El Paso, TX	Collaboration; in-kind support; data and corridor inventory access; operational feedback on risk products
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3. Outputs

The center website has been updated (<https://cem.tti.tamu.edu/>) to reflect the latest name change and other updates. Other outputs from center activities are listed below.

Journal Publications

E Renck, H Jung; The effect of portable air purifiers and cabin air filters on particulate matter and nitrogen oxides concentrations in vehicle cabins; *Environmental Science: Processes & Impacts*, 27, 2025, 3029-3037; Published on September 4th, 2025.

Faihim Ahmed, Jaeyoung Cho, Song Cheng, S. Scott Goldsborough, Seonah Kim, Compositional effect on the ϕ -sensitivity of ignition delay time in multi-component gasoline, *Combustion and Flame* (accepted)

Chavez M, Vazquez L, Li, W-W, 2025, Queueing-Driven Transportation Emissions and Near-Road Exposure at a Binational Port of Entry, *Air* (accepted)

Other Publications, Conference Papers, and Presentations

Transportation Research Board Annual Meeting, Microtransit Adoption by Rural Communities and Rural Transit Agencies, Ranjit Godavarthy, Jeremy Mattson, Bright Parker Quayson, Washington, DC, January 2026

Minjie Xu, Vainavi Chilukuri, Vainavi Chilukuri, Madhusudhan Venugopal, Tara Ramani, Bumsik Kim; Assessing Student Exposure to In-cabin PM2.5 and Black Carbon in School Buses; Transportation Research Board 105th Annual Meeting, Transportation Research Board, Washington, D.C., January 2026.

Wu, M., Choi, K., Goehl, D., Sammour, F., and Zhang, Z. (2026). "Pavement-Maintenance-GPT: Facilitating Pavement Maintenance Decisions through Multimodal Large Language Model." Transportation Research Board 105th Annual Meeting, Washington, D.C., January 11-15.

Mahmud, Zalish, Anantaa Kotal, and Aritran Piplai. "Impugan: Learning Conditional Generative Models for Robust Data Imputation.", IEEE Big Data 2025, December 8-11, 2025

Liu, Z., H. Lu, A. Guin, and R. Guensler. "A Multi-Stage Machine Vision Framework for Comprehensive Vehicle Attribute Recognition Using Freeway Video Data." 105th Annual Meeting of the Transportation Research Board, Washington, D.C., January 2026

Liu, Z., H. Lu, A. Guin, and R. Guensler. "Can We Use Electric Vehicle Penetration Rates in Project-Level Energy Use and Emission Modeling." 105th Annual Meeting of the Transportation Research Board, Washington, D.C., January 2026

Hunsaker, D., G. Ames, A. Oshri, I. Pathak, A. Guin, and R. Guensler. (2024). "Atlanta Sidewalk Infrastructure Assessment: Methods to Support Impedance-based Routing". GDOT Expo. Poster Session. Atlanta, GA. Sept. 10th, 2025.

Pathak, I., D. Hunsaker, A. Oshri, A. Guin, and R. Guensler. (2024). "Developing an Enhanced Complete Paths Pedestrian Network for Use in Impedance-Based Routing in Downtown Atlanta". GDOT Expo. Poster Session. Atlanta, GA. Sept. 10th, 2025.

Pathak, I., D. Hunsaker, S. Kambli, A. Guin, and R. Guensler. "Mapping Building Entry and Exit Points for Pedestrian Navigation: Workflows and Progress from Downtown Atlanta". Geo Week 2026 Annual Conference. Podium Session. Denver, CO. Feb. 18th, 2026.

Boriboonsomsin, Kanok, Assessing Community Air Quality and Health Benefits of Freight Emission Mitigation Strategies in the South Coast Air Basin, South Coast Air Quality Management District's Clean Fuels Program Advisory Group Meeting, Riverside, CA, January 29, 2026

Bruce Sacks/Robert Mayberry, Safety and Mobility, Atlanta City Council Meeting, Atlanta, GA, January 2026.

Chelsea Kettering, Project Briefing on Benefits to the Navajo Nation Division of Transportation, GIS Day Lightning Talk (Virtual), November 19, 2025.

Books or Other Non-Periodical, One-Time Publications:

Nothing to report.

Technologies or Techniques

Nothing to report.

Inventions, Patent Applications and/or Licenses

Nothing to report.

4. Outcomes

The results of CEM activities have generated several outcomes – one outcome is highlighted from the activities of each consortium member:

- At TTI/TAMU, findings from an ongoing project enhanced reliability, interpretability, and practical utility of automated pavement assessments. It provides transportation agencies with a scalable, cost-effective tool to support reliable maintenance decision-making.
- NDSU's recent activities increased understanding of the challenges and opportunities for electric vehicles, propane vehicles, and microtransit in rural transit agencies. The team developed a spreadsheet user tool that can be used by rural transit agencies to evaluate life cycle energy costs of different fleet configurations.
- GT generated a wealth of data on fleet composition conditions derived from machine vision recognition, and training of undergraduate and graduate students in vehicle image labeling and machine vision model development. This work by GT generated data products and visual analytics for transportation agencies to enhance performance monitoring, planning, and investment prioritization for pedestrian safety.
- The work performed by UCR has improved the understanding of the impacts of goods movement on local communities and resulted in a multi-scale modeling framework for evaluating the effectiveness of mitigation strategies.
- JHU researchers established a robust ethical and technical framework for generating high-quality primary data on U.S. micromobility users, to collectively enhance the project's capacity to produce evidence-based insights that are both scientifically sound and practically relevant for policymakers.
- MSM increased understanding and awareness of safety and mobility issues among local stakeholders in Atlanta including local community health workers and through a briefing to the City Council.
- UTEP's research identified stress-prone roadway segments and environmental conditions, contributing to data-driven transportation planning and policy decisions aimed at improving user safety and comfort.

5. Impacts

The results from the collaborative Year 1 project led by UCR provide critical technical evidence to guide regulatory action, inform freight policy, and support community efforts in Inland Southern California. The research was well received by the South Coast Air Quality Management District (the local air agency). The agency is considering funding a follow-on project that will expand the study area to the entire South Coast Air Basin.

6. Changes/Problems

Nothing to report.

7. Special Reporting Requirements

Nothing to report.