Center for
Healthy and Efficient Mobility
CHEM
A USDOT University Transportation Center

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Overview

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). This report represents work performed from October 2024 through March 2025, therefore references both CHEM and CARTEEH.

CARTEEH was originally established under the Fixing America's Surface Transportation (FAST) Act as a Tier 1 UTC in 2016. It was subsequently awarded a second grant under the Bipartisan Infrastructure Law (BIL) in 2023. Over the years, CARTEEH maintained a strong track record of being an innovative UTC, constantly aligning its scope and mission to serve the research, education, and technology transfer needs of our stakeholders. CARTEEH's original scope of work and activities were designed to align with priorities outlined in the Notice of Funding Opportunity (NOFO) for the University Transportation Center program issued in 2022. CARTEEH center leadership reviewed the changes in USDOT priorities announced in 2025, including those outlined by Secretary Duffy in the Secretarial Memorandum, "Implementation of Executive Orders Addressing Energy, Climate Change, Diversity, and Gender" and DOT Order, "Ensuring Reliance Upon Sound Economic Analysis in Department of Transportation Policies, Programs, and Activities".

Moving forward as the **Center for Healthy and Efficient Mobility (CHEM),** the center is working to realign ongoing activities as necessary to remove emphasis on programs and topics no longer relevant under current USDOT directives.

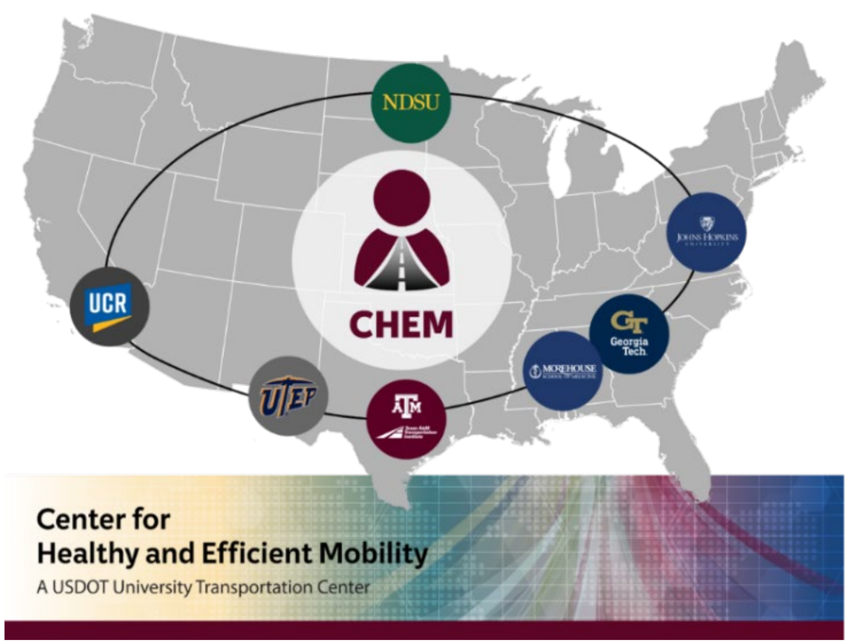

Figure 1. CHEM Consortium Members.

1. Accomplishments

Major Goals of the Program

CHEM's mission will now focus on advancing healthy and efficient mobility, with a focus on improving transportation efficiency, promoting health, reducing adverse impacts of transportation on families and communities and promoting opportunities for access and economic benefit. 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.

CHEM Goal #1: Research Program

Ongoing Collaborative Research Projects

In this reporting period, the center's Year 1 projects were well underway, with several nearing completion over the summer of 2025. The Year 1 project focused on large collaborative projects, with each consortium member leading one project. These projects have been realigned to the extent feasible to reflect the center's changed priorities. The list of these projects, and amended titles, where applicable, are shown in Table 1, and these changes will also be reflected in the Research in Progress (RiP) database and in project materials moving forward.

Table 1. Revision of Year 1 Projects

Project	Institution	Title	Revised Title
01-01-TTI	Texas A&M Transportation Institute	Electric versus Internal Combustion: What are the Actual Emissions and Health Impacts?	Evaluating Efficiencies and Impacts of Electric versus Diesel School Buses
01-02-GT	Georgia Institute of Technology	Integrated Transportation-Health Modeling Platform for Decision-Support	
01-03-UCR	University of California, Riverside	Mitigating Freight Emissions in EJ Communities in and Around Ports	Impact of Freight Activity in and Around Ports
01-04-JHU	Johns Hopkins University	Health Risks for Vulnerable Transit Users	Health Risk for Student Transit Users
01-05-UTEP	University of Texas at El Paso	Air Quality Monitoring for Vulnerable Communities	Air Quality Monitoring in Border Communities
01-06-MSM	Morehouse School of Medicine	Transportation and Health Equity: Tools for Community Engagement	Transportation and Health: Tools for Community Engagement

01-07-NDSU	North Dakota State University	Low-Emissions Technologies for Tribal and Rural Communities	Emerging Vehicle Technologies and Operating Strategies for Tribal and Rural Communities

Some highlights of progress on each research project are as follows:

- **Evaluating Efficiencies and Impacts of Electric versus Diesel School Buses –** Researchers at TTI conducted school bus in-cabin air quality measurement. A total of twelve days were collected from three electric school buses (one electric school bus and two diesel school buses) from the Austin Independent School District (AISD) fleet. The research team also obtained route information from AISD that matches the subject school buses.
- **Transportation and Health: Tools for Community Engagement –** The research team worked to identify new community partners and residents to review and assist with the CHEM curriculum adaptation. They worked with neighborhood planning unit (NPU) presidents to identify current mobility and health issues in each NPU.
- **Emerging Vehicle Technologies and Operating Strategies for Tribal and Rural Communities –** In this reporting period, the research team at North Dakota State University conducted additional literature review on the use of propane transit buses. A survey was conducted by rural and tribal transit agencies regarding their use of alternative fuels, hybrid vehicles, and electric vehicles. A paper was written, submitted, and accepted for presentation at Transportation Research Board Annual Meeting summarizing the results of the survey.
- **Health Risks for Student Transit Users –** In this period, the JHU team established the technical field team including the mechanics at the school bus depot and the sampling team from JHU and developed the sampling set-up and conducted pilot tests of the equipment.
- **Integrated Transportation-Health Modeling Platform for Decision-Support -** In addition to the simulation modeling activities, the research team at Georgia Tech coupled on-road vehicle activity data, with MOVES5 outputs, and with the AERMOD microscale dispersion modeling to predict regional pollutant concentration fields. This work formed the basis for a student's dissertation work that shows how person movement, predicted by activity-based model, through these hourly fields affects exposure.
- **Air Quality Monitoring in Border Communities –** The research team at the University of Texas at El Paso completed a literature review of available software using U.S. EPA's mapping and screening tool for identifying and ranking communities. Field testing measurement equipment was procured, and preliminary data collection was conducted.

- **Impact of Freight Activity in and Around Ports –** The study team at University of California-Riverside developed a modeling suite for estimating truck travel demand, activities, and emissions. This modeling suite allows for an understanding of the impact of freight transportation on communities in and around ports but also those near any freight facilities (e.g., railyards, warehouses, distribution centers) in the region.

Initiation of Year 2 Research Projects

CARTEEH had issued a call for proposals in Fall 2024 that were in the process of being awarded prior to the release of new USDOT directives and the subsequent renaming and realigning of the center as CHEM. Therefore, individual projects are being initiated after realigning them as necessary to address new priorities and directives. Table 2 below provides a summary of projects that are being initiated for Year 2. As these projects are rescoped to appropriately reflect current USDOT directives, they will be entered into the RiP database and work will commence.

Table 2. Year 2 Project Portfolio (Projects in Process of Being Negotiated/Setup).

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
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

Project	Institution	PI	Title
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
02-13-TTI	Texas A&M Transportation Institute	Haneen Khreis	Integrated Transportation and Health Impact Modeling Tool for U.S. Cities
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
02-16-MSM	Morehouse School of Medicine	Fengxia Yan	A Data Framework: Factors Influencing Transportation and Health at the Atlanta Neighborhood Planning Unit (NPU) Level
02-17-GT	Georgia Institute of Technology	Ziming Liu	Real-Time Corridor Modeling and Health Impact Assessment using Dynamic Vehicle Fleet Composition Data

Research Results Disseminated

As outlined in the technology transfer section and in the research updates, as projects have progressed, research results have been presented at events such as the Transportation Research Board Annual Meeting and other conferences.

Plans for Next Reporting Period to Accomplish Research Goal

In the next reporting period, the ongoing and newly initiated projects will be continued, and preliminary steps to initiate Year 3 projects will be undertaken at the start of the third year of the grant (June 1, 2025).

CHEM Goal #2: Education and Workforce Development

Under education and workforce development, CHEM 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. Some notable initiatives during this reporting period include:

Summer Internship Program

CHEM's fifth annual Summer Internship program will kick off May 27, 2025, and conclude on August 1, 2025. This program will be held jointly with the internship program for the National Center for Infrastructure Transformation (NCIT) and Southern Plains Transportation Center (SPTC), two other UTCs with a presence at TTI. Four upper-level undergraduates have been selected to spend 10 weeks in the CHEM offices this summer. They will participate in professional development activities, technical tours, and research presentations throughout the summer. Each intern will take on a chosen research topic under the guidance of a TTI researcher serving as their mentor and prepare a final paper and presentation on their research to be presented at the end of the summer.

Student of the Year Award

Leonardo D. Vazquez-Raygoza, a Ph.D. candidate in Civil Engineering at the University of Texas at El Paso (UTEP) was selected as CARTEEH's 2024 Student of the Year. The 34th Annual UTC Outstanding Student of the Year Awards ceremony was held on January 4, 2025, in Washington, D.C. as part of the Council of University Transportation Centers (CUTC) annual banquet. Leonardo has worked as a student research associate on CARTEEH research projects in transportation and air quality. He is currently working on a CARTEEH project focused on air quality monitoring to assess pollution impacts with Dr. Wen-Whai Li (University Lead, UTEP).

Figure 1. UTC Student of the Year Awardee (Leonardo D. Vazquez-Raygoza) with TTI Agency Director Gregory D. Winfree, Esq and Dr. Joe Zietsman (Center Director) at the 34th Annual UTC Outstanding Student of the Year Awards ceremony in Washington, D.C. on January 4, 2025.

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 three undergraduate students, three master's students, and sixteen doctoral students, from different majors as shown in Table 3.

Table 3. Students involved in CARTEEH Activities in this Reporting Period (Outside of Summer Internship Program)

Academic Level	Number of Students	Program of Study/Major
Bachelor's	2	Civil Engineering
Bachelor's	1	Education
Master's	1	Civil Engineering
Master's	1	Master of Public Health
Master's	1	City and Regional Planning & Transportation Systems
Ph.D.	2	Curriculum and Instruction
Ph.D.	2	Education
Ph.D.	6	Civil Engineering/Civil and Environmental Engineering
Ph.D.	2	Electrical and Computer Engineering
Ph.D.	3	Transportation and Supply Chain
Ph.D.	1	Environmental Health and Engineering/Industrial Hygiene

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 expand on the involvement of students in center activities and continuing our collaborative efforts with Texas A&M University's College of Education and Human Development.

CHEM Goal #3: Technology Transfer and Collaboration

In this reporting period, several activities related to technology transfer and collaboration were initiated and continued by members of the consortium. Consortium leadership also held periodic meetings to monitor progress and ensure collaboration and discussion of center activities.

USDOT Site Visit

On October 9, Dr. Firas Ibrahim (Director, Office of Research, Development, and Technology, Chief Scientific Integrity Officer, Deputy Chief Science Officer), Mr. Caesar Singh (Director, University Grants Programs) and Mr. Thomas Saad (Senior Advisor, Special Programs and Projects) visited Texas A&M Transportation Institute (TTI) Headquarters to meet with the CARTEEH team. The day-long visit included lab tours, a student poster session, a roundtable lunch with affiliated faculty members and briefings from all consortium partners. The meeting was highly successful and productive in describing our ongoing activities and plans to the UTC program leadership.

Figure 2. Pictures from October 9, 2024 USDOT Site Visit

Advisory Board

In this reporting period, an advisory board was assembled for the CARTEEH Center representing leaders from several related fields who could provide independent strategic advice on the center's scientific activities and research programs, discuss emerging transportation and health issues and trends in national and global contexts and support partnerships and leveraging opportunities for the center. With the realignment of the center, the advisory board membership and recruitment is being realigned as needed to meet the new CHEM center goals, and the final advisory board will be formally established in the next reporting period.

Data Hub Updates

The CHEM Data Hub has been moved to a new platform, and several improvements have been made to the system. Activities undertaken as part of the revamp included data processing, missing data, duplicate files removal, data cleaning and standardization, and optimized storage management. To uphold the integrity and accessibility of research data, all datasets were aligned with the CARTEEH Data Management Plan (DMP).

Technology Transfer and Collaboration Results Disseminated

The center's website has been changed to https://chem.tti.tamu.edu/ , with the previous carteeh.org URL now redirecting to this website. The logo, branding, and other materials have also been updated for the Center to use moving forward. The website continues to be actively updated to disseminate information on ongoing center activities and other updates.

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

In the next reporting period, we will continue on several technology transfer activities. Some of the plans include symposium planning, continuing webinars, seminars, and other activities and events.

2. Participants and Collaborating Organizations

Organizations Involved as Partners

The CHEM consortium is a seven-member consortium led by the Texas A&M Transportation Institute (TTI)—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

The tables below provide a list of organizations (Table 5) and individuals (Table 6) 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 CARTEEH Related Activities

Organization Name	Location	Contribution
City of Dallas	Dallas, TX	Air monitoring collaboration
Austin Independent School District	Austin, TX	School bus electrification collaboration
Texas Department of Transportation	Austin, TX	Collaboration
Health Effects Institute	Boston, MA	Collaboration
UT Health School of Public Health	El Paso and Houston, Texas	Community engagement and outreach
City of Atlanta Neighborhood Planning Unit	Atlanta, GA	NPU partner
City of Atlanta Department of Transportation	Atlanta, GA	City Transportation planning and data source
Highland Fleets	Beverly, Massachusetts	Collaboration
Atlanta Regional Commission	Atlanta, GA	Data support
International Center for Food Ontology Operability Data and Semantics (IC-FOODS)	Davis, CA	Collaboration

El Paso City	El Paso, Texas/TXDOT	Low-cost air monitoring at POEs
California Air Resources Board	Sacramento, CA	Share truck telemetry data for use in the CARTEEH collaborative research project

Table 6. Individuals Interacted with During the Reporting Period on CARTEEH Related Activities

Name	Affiliation (institution & location)	Contribution
Jayajit Chakraborty	University of California Santa Babara	Identification of Vulnerable Community
Leah Whigham	UT Health School of Public Health	Community outreach
Juan Aguilera	UT Health School of Public Health	Community outreach
Yun Hang	UT Health School of Public Health	Air quality data analysis
Joanna Pi-Sunyer	Baltimore City Public Schools	Collaboration (ongoing)
Richard Baldauf	USEPA	Collaboration
Nigel Clark	West Virginia University (Emeritus Appointment)	Collaboration
Karl Ropkins	University of Leeds	Development of future research ideas
Timothy Shepherd	Maryland Department of the Environment	In-kind support
Prof. Will Porter	Department of Environmental Science, UCR	Contribute expertise in chemical transport model towards the integrated air quality modeling developed in the CARTEEH research project
Imad Khalek	Southwest Research Institute	Collaboration
Musharraf Zaman	University of Oklahoma	Collaboration on climate and other related topics
Lisa Losada Rojas	University of New Mexico	Collaboration on safety related topics
Heng Wei	University of Cincinnati	Collaboration on GHG emission related topics
Qi Ying	Texas A&M University	Collaboration – modeling topics
Johnathan Snodgrass	Texas A&M University	Collaboration – Electric vehicles and smart charging
Kris Hazafizadeh	Austin ISD	Collaboration on Electric School Bus Project
Chris Klaus	North Central Texas Council of Governments	Discussed potential research projects
Seungju Yoon	California Air Resources Board	Collaboration
Mohamed Idris	MSM, Atlanta, GA	Collaboration

Ramachandra Sivakumar	GA Tech, Atlanta, GA	Pilot Project Collaboration
Jacinta Hughes	BCPS, Baltimore, MD	Data
Omar Martinez	City of El Paso	Low-cost air monitoring at POEs
Louis Hamilton	BCPS, Baltimore, MD	Access to facilities
Lafayette Dorsey	BCPS, Baltimore, MD	Access to facilities
Donald Bowen	BCPS, Baltimore, MD	Access to facilities
Matt Stanbury	Highland Fleets, Beverly, MA	Collaboration
Omar Martinez	City of El Paso	Air Quality Monitoring and Analysis
Harry Williams	University of Cambridge, UK	critical appraisal of exposure-response functions - personnel

3. Outputs

The CHEM website (https://chem.tti.tamu.edu) has been updated to differentiate products and outputs from the CARTEEH center under the FAST Act Grant and BIL Grant as well as the new CHEM activities.

Journal Publications

Fan, H., Lyu, G., Lu, H., Guin, A., & Guensler, R. (2025). Transit Rider Heat Stress and Health: Potential Impacts of Current and Future Extreme Heat Exposure in Atlanta, GA. Environmental Research Letters.

Chavez, M., Li, W.W., 2025. Evaluating Community Exposure to PM2.5 and NO2 using Mobile and Stationary Monitoring, paper submitted to the Journal of Air, 2025.

Aguilera J, Jeon S, Chavez M, Ibarra-Mejia G, Ferreira-Pinto J, Whigham L, Li W-W, Short-Term Associations of Traffic-Related Air Pollution with Cardiorespiratory Outcomes Among Low-Income Residents from a US–Mexico Border Community, Atmosphere 2025, 16(2), 153; https://doi.org/10.3390/atmos16020153.

S. Lee, K. Kim, J. Lee, Y. Kim, J. Cho*, S. Oh*, K. Min, "NOx Reduction in Hydrogen-Fueled Direct-Injected Spark Ignition (DISI) Engines Using Post-Injection Strategy: Experimental and Kinetic Insights," Energy, 2025. (in press)

Khreis, H., Abbas, A., Gil-Sanchez, D., Tatah, L., Schroeder, A., Goel, R., Brand, C., Johnson, R. and Woodcock, J., 2024. Description, Development and Application of the Integrated Transport and Health Impact Modelling Tool for Global Cities (ITHIM-Global). medRxiv, pp.2024-12.

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

Nothing to report.

Other Publications, Conference Papers, and Presentations

Presenters Name(s): Mayra Chavez
Presentation Title: Updates on the UTEP-Paso del Norte Community Foundation's community-based proposal to the EPA's Community Change Grants Program
Event: 90th Joint Advisory Committee meeting, October 27, 2024
Location: Cd. Juarez, Chihuahuha, Mexico

Presenters Name(s): Wen-Whai Li
Presentation Title: Improving data quality for low-cost $PM_{2.5}$ sensor network using calibration data continuously generated at a reference station (accepted for presentation)
Event: 2025 Air Sensors International Conference, Southeast Asia, May 19-22, 2025
Location: Bangkok, Thailand

Presenters Name(s): Bright Quayson, Jeremy Mattson, Ranjit Godavarthy
Presentation Title: Low Emission Technologies for Rural and Tribal Transit
Event: Transportation Research Board Annual Meeting, January 5-9, 2025
Location: Washington, DC

Presenters Name(s): Mary Fox
Presentation Title: Exploring a Community Adjustment Factor: Epidemiological Data for Cumulative Impact and Risk Assessment (Invited)
Event: Michigan Toxics Steering Group Speaker Series
Location: Lansing, MI

Presenters Name(s): Kirsten Koehler
Presentation Title: Low-cost sensors for Environmental Health Applications (Invited)
Event: Columbia University NIEHS P30 Center for Environmental Health and Justice Speaker Series
Location: New York, NY

Presenters Name(s): Liao, Y., Xu, L., Hao, P., Barth, M., and Boriboonsomsin, K.
Presentation Title: Comprehensive Framework for Community Exposure Assessment by Fusing Activity-based Freight Model with Weather Forecasting Model
Event: Proceeding of the Annual Meeting of the Transportation Research Board, January 5-9, 2025
Location: Washington, DC

Presenters Name(s): Bumsik Kim
Presentation Title: Electric vs. Diesel School Buses: Lifetime Greenhouse Gas Emission Comparison
Event: Transportation Research Board Annual Meeting, January 5-9, 2025
Location: Washington, DC

Technologies or Techniques

Nothing to report.

Inventions, Patent Applications and/or Licenses

Nothing to report.

4. Outcomes

Nothing to report.

5. Impacts

Nothing to report.

6. Changes/Problems

Nothing to report.

7. Special Reporting Requirements

Nothing to report.