Semi-Annual Progress Report No. 3 – The SMARTER Center

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Sustainable Mobility Accessibility Regional Transportation Equity Research Center at Morgan State University

Semi-Annual Progress Report, October 2024

1. ACCOMPLISHMENTS

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

As a USDOT Regional University Transportation Center, the Sustainable Mobility Accessibility Regional Transportation Equity Research (SMARTER) Center assesses and addresses the multi-modal transportation challenges faced by travelers in the mid-Atlantic. The center's researchers are committed to the guiding principles of the UTC: mobility, accessibility, and equity. SMARTER Center researchers are especially focused on the equitable distribution of transportation-related assets, network resilience in the face of climate change, accessibility, network efficiency and mobility, freight and shipping bottlenecks, and the implementation of emerging technologies like electric and connected vehicles.

Assessing, addressing, and improving the mid-Atlantic region's dynamic transportation landscape is accomplished through a robust research program—guided by researchers working closely with students of all levels—with immediate and near-term implementation capabilities for policy makers, industry, and the public at large. A driving priority for SMARTER researchers is community engagement, ensuring that its research and outcomes are shared with the communities within its region—urban, rural, and in-between—through a wide-ranging program of technology transfer, community engagement, education, and workforce development. SMARTER researchers are also committed to the implementation of technology programs and the development of best practices for transportation professionals.

1.2 What was accomplished under these goals?

In the first SMARTER Center grant year SMARTER researchers have made significant progress in their core research, have begun research in their year one collaborative projects, and are beginning to embark on year two core and year two collaborative research. Researchers and staff at the center's lead institution, Morgan State University, have had an especially productive year with the return of the National Summer Transportation Institute, a the execution of a major SMARTER Center reasearch implementation contract, receipt of numerous awards and patents, and the kick-off of a novel year 2 collaborative resaerch initiative. The SMARTER Center welcomed numerous local, state, and regional leaders to its facilities, building awareness and strong ties to local and regional practitioners and decisionmakers. Overall, year 1 has been a successful first grant period and sets the tone for the SMARTER Center's long-term success.

SMARTER researchers have made meaningful progress in their year 1 core and collaborative projects and have reported notable accomplishments:

- The **Smart, Green, Equitable, Safe, Complete Streets for All** project's SMART Intersection was formally approved by the West North Avenue Development Authority's Board of Directors (September 2024) for installation at five critical intersections along the West North Avenue corridor in Baltimore City. The research implementation is the first example of real-world implementation of SMARTER Center research, and is a key step toward an equitable distribution of transportation resources in Baltimore City.
- Fulfilling its commitment to workforce development at the middle- and high-school levels, the SMARTER Center welcomed the twenty-sixth cohort of the **National Summer Transportation Institute**.
- The University of Delaware has used its participation in the SMARTER Center UTC as a springboard to incorporate SMARTER principles of equity, accessibility, and mobility into curricula for the Biden School of Public Policy and Administration and the College of Engineering, embracing a cross-discipline and cross-sector approach to transportaton research, catalyzing around the impacts of climate change and urbanization on transportation systems.

1.3 What opportunities for training and professional development has the program provided?

Morgan State University was proud to host two professional development events in collaboration with the Maryland Connected and Automated Vehicle (MDCAV) Working Group.

The first event, a meeting of the working group, was attended by 130 transportation professionals from across all sectors: state government, academic research, public safety, law enforcement, and private industry. The second event, **USDOT Foundational V2X Interoperability Training**, provided training from USDOT Intelligent Transportation Systems Joint Program Officers to 75 Maryland-area transportation professionals in September 2025. Both events were well attended by Morgan State students, who demonstrated research outputs and implementations (leading tours of the SMART Intersection and presenting the CAVe in a Box) and benefitted from the V2X training.

Project-based training and professional development opportunities in the first grant year include:

- One of the year 1 collaborative projects, **Development of a Pedestrian Collision Avoidance System for Connected and Autonomous Vehicles with Cooperative Perception** has provided invaluable hands-on training and learning opportunities for students across various fronts. Students have been actively engaged in the testing and development of real-world sensors, offering them practical experience in understanding and constructing the connected vehicles and smart city environment. Students have been extensively trained in the intricacies of the safety of pedestrian safety risk, gaining insights into their functionality and importance in enhancing road safety. Lastly, the project has empowered students to apply their knowledge and skills toward the design and implementation of the integration of connected and autonomous vehicle systems, fostering a real-world understanding of how theoretical concepts translate into practical solutions within the realm of transportation engineering and safety.
- Dr. Dimitra Pyrialakou of West Virginia University, along with her graduate and undergraduate research team, has been working with the regional planning agency and the City of Morgantown as part of **Advancing Equity through Regional Multimodal Planning in Small Urban and Rural Communities**. They have participated in one public workshop, partnering with stakeholders, as part of the ongoing work on the Morgantown Pedestrian Plan.
- Dr. Ardeshir Faghri, University of Delaward PI for **The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility** supervises one graduate student and one undergraduate student from the College of Engineering and one Biden School of Public Policy and Administration graduate student. In addition to their focused research contributions to Dr. Faghri's project, other undergraduate and graduate students in his classes have had the opportunities to share their work with DelDOT and WILMAPCO staff for feedback.

1.4 How have the results been disseminated? If so, in what way(s)?

In addition to research dissemination and output examples outlined in later sections, SMARTER Center researchers and staff have commited significant energy to educating the public on its transportation research. In an effort to make transportation research accessible and engaging to subject-matter experts and novices alike, the SMARTER Center launched the SMARTER Transportation Talks (STT) and the SMARTER Explainer series. The center has produced four STT videos, including SMARTER Director Jeihani's "How to Build SMART, Equitable Cities," which feature deep-dive interviews with PIs discussing their SMARTER research initiatives. STT are first live-cast and then archived on the center's YouTube channel.

To document research outcomes, the SMARTER Center has spearheaded an "explainer" series, in which research projects, pilots, and implementations are documented in short, easy-to-digest videos. The first SMARTER Explainer, "The Autonomous Wheelchair is Making Air Travel More Accessible Than Ever," went live in June 2024, and is currently available on YouTube. The autonomous wheelchair pilot at Baltimore/Washington International Thurgood Marshall Airport has been a pilot of considerable interest in the reporting period, receiving tremendous media interest and coverage. Local ABC affiliate WMAR featured the wheelchair in "Morgan State students test autonomous wheelchair that uses AI," in September 2024.

USDOT and Maryland Leadership Visits SMARTER Center

The SMARTER Center was honored to host USDOT and State of Maryland leadership in May. Dr. Robert Hampshire, Dr. Firas Ibrahim, and Mr. Caesar Singh joined Maryland Lieutenant Governor Aruna Miller on a visit to the SABA lab and a SMART Intersection tour. During his address to students, Dr. Hampshire conferred the inaugural SMARTER Student Fellowship to Ramina Javid, one of the center's brightest graduate students.

Furthering our engagement with national, state, and local agency leaders, the SMARTER Center welcomed Eric Smith, Director of the Tech Hubs Program, as part of his teams visit to the Baltimore Tech Hub. He was accomopanied by representatives of the Greater Baltimore Committee (a non-governmental organization representing the private sector in the Baltimore region, "providing insightful economic and civic leadership to drive collective impact"), who have returned to the SMARTER Center for a more focused meeting in which researchers presented SMARTER research implementations and discussed collaboration opportunities.

The SMARTER Center welcomed Maryland Representative Mark Edelson (vice-chair of the Maryland House of Representatives Transportation & the Environment Subcommittee) and MDOT Assistant Secretary for Transportation Equity and Engagement Tony Bridges to the SABA Lab for demonstrations of the SMART Intersection and Key Bridge research. We have made it a central focus of our UTC program to engage local and state leaders in our research, actively soliciting their input and support of our research topics.

1.5 What do you plan to do in the next reporting period to accomplish goals?

The SMARTER Center will host its first SMARTER Symposium in April 2025. Having hosted USDOT leadership, attended the inaugural USDOT Future of Transportation Summit in August 2024, as well as numerous other UTC-related conferences, the SMARTER Center is ready to host its own symposium. We will convene affiliates, public- and private-sector decisionmakers, and students to present SMARTER research and forge new and stronger relationships for workforce development and research implementation.

Projected accomplishments for SMARTER Center affiliates include:

- University of Pittsburgh PIs Stevanovich and Khazanovich will host a training workshop for PennDOT staff as part of their **Socially Responsible Road Charging for Online Retailers to Support Disadvantaged Urban Communities** project in addition to presenting findings at TRB 2025.
- To further its goals of research implementation, especially in underresourced locations, Morgan State University has collaborated with Baltimore City DOT to include 12 SMART Intersection installations (developed in the **Smart, Green, Equitable, Safe, Complete Streets for All** project) in the in the agency's 2024 Safe Streets for All (SS4A) Grant application. Morgan State researchers are also piloting a mobile SMART Intersection that can be deployed temporarily at problem intersections or in localities that may not have the funding to support permanent infrastructure implementation.

2. PARTICIPANTS AND COLLABORATING ORGANIZATIONS

2.1 What organizations have been involved as partners?

The table below illustrates some of the relationships developed and leveraged by SMARTER researchers through their UTC research projects.

Project	Organization, Location	Agency	Contribution
The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility	DelDOT, Dover, DE	State Agency	Information sharing; site visit support
	WILMAPCO, Wilmington, DE	MPO	Information sharing
	DE Environmental Justice Wilmington, DE	State Agency	Information sharing
	University of Delaware College of Engineering Newark, DE	Educational	Match, in-kind, IT support
	Delaware Dept. of Natural Resources and Environmental Control	State Agency	Data and expertise
Crime Prevention through Environmental Design (CPTED) for Public Transit Stations	SEPTA Philadelphia PA	Transit Agency	Information Sharing Site Support
	DART Wilmington, DE	Transit Agency	Information Sharing
	City of Philadelphia, PA	Local Government	Information Sharing
	MTA Baltimore MD	Transit Agency	Information Sharing
Understanding the Role of Equity in Delaware Department of Transportation Expenditures	DelDOT Dover, DE	Transportation Agency	Information Sharing
	WILMAPCO Wilmington, DE	MPO	Information Sharing
	Dover-Kent Dover, DE	MPO	Information Sharing
Design and evaluation of an Arterial-Friendly Local Ramp Metering System	MDOT State Highway Administration	State Agency	Information Sharing
Smart Rideshare Matching–Feasibility of Utilizing Personalized Preferences	UVA Parking and Transportation, Charlottesville, VA	Educational	Cost-share and in-kind participation
Connected Vehicle Identification System for Cooperative Control of Connected Automated Vehicles	Toyota InfoTech San Francisco, CA	Research & Development	Unrestricted research funding
	Commonwealth Cyber Initiative (UVA) Charlottesville, VA	Research & Development	Commercialization Seed Fund
A Novel Driver Warning System with Hedging to Promote Defensive Driving	Forum 8 Japan	Equipment Provider	Technical Support and Equipment
Use of the Large Language Models to Improve Transportation Services	Pennsylvania DOT	State Agency	Technical Support
	Minnesota DOT	State Agency	Technical Support
Deriving Transit Performance Metrics from GTFS Data	StanRTA	State Agency	Data and feedback
	AC Transit	State Agency	Data and feedback

Project	Organization, Location	Agency	Contribution
Advancing Equity through Regional Multimodal Planning in Small Urban and Rural Communities	The City of Morgantown, WV, Engineering and Public Works Department	Local Government	Collaborator stakeholder
	Mountain Line Transit Authority Monongalia County, WV	Transit Agency	Collaborator stakeholder
	The Morgantown Monongalia Metropolitan Planning Organization Monongalia County, WV	MPO	Collaborator stakeholder
Automated Vehicle-supported Mobility Services for Rural Areas	Mountain Line Transit Authority Monongalia County, WV	Transit agency	Collaborator stakeholder
	The Morgantown Monongalia Metropolitan Planning Organization Monongalia County, WV	MPO	Collaborator stakeholder
Smart, Green, Equitable, Safe, Complete Streets for All (Phase I & II: Development of a CAV Testbed-enhanced Smart Campus at Morgan State University)	West North Avenue Development Authority (WNADA) Baltimore, MD	Development Authority	Collaborator (research implementation)
	Baltimore City (MD) Department of Transportation	Local Agency	Collaborator (implementation and data collection)
	Maryland DOT	State Agency	Matching Support
	Iteris	Equipment Provider	Technical Support and Equipment
	Ouster	Equipment Provider	Technical Support and Equipment
A Framework for Volunteer Integration in Rural and Small Urban Transit	Maryland Transit Authority Baltimore, Maryland	Transit Agency	Collaborator stakeholder
	Transportation Association of Maryland	NPO	Collaborator stakeholder

2.2 Have other collaborators or contacts been involved?

Project	Collaborator/ Contributor	ORCID or Title
Automated Vehicle-supported Mobility Srvices for Rural Areas	Kakan Dey	https://orcid.org/0000-0002-5875-6180
	David Martinelli	https://orcid.org/0000-0002-2706-2303
The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility	Paul Moser	Transportation Planning Engineer, DelDOT
	Rodolfo Gomes	Transportation Safety Engineer, DelDOT

3. OUTPUTS

3.1 Conference papers and presentations

SMARTER Center researchers and staff were busy with conferences in the spring and summer of 2024, with a few notable and exciting opportunities in our home city of Baltimore. The following conference participations are a testament to our commitment to developing relationships with local agencies and organizations.

TRB Second Conference on Advancing Transportation Equity (TRB CATE)

The National Transportation Center, home of the SMARTER Center, was honored to sponsor the TRB Second Conference on Advancing Transportation Equity in July 2024, and to participate in three presentations. SMARTER Center Director, Dr. Mansoureh Jeihani, was a featured speaker in the welcome reception, highlighting the value of CATE's presence in Baltimore and the pressing need to incorporate equity analysis in transportation research. She and SMARTER Center Associate Director, Brandy Savarese, participated in "HBCU's Drive Research and Implementation," a panel session highlighting the role of HBCU's like SMARTER's lead university, Morgan State, in leading transportation research.

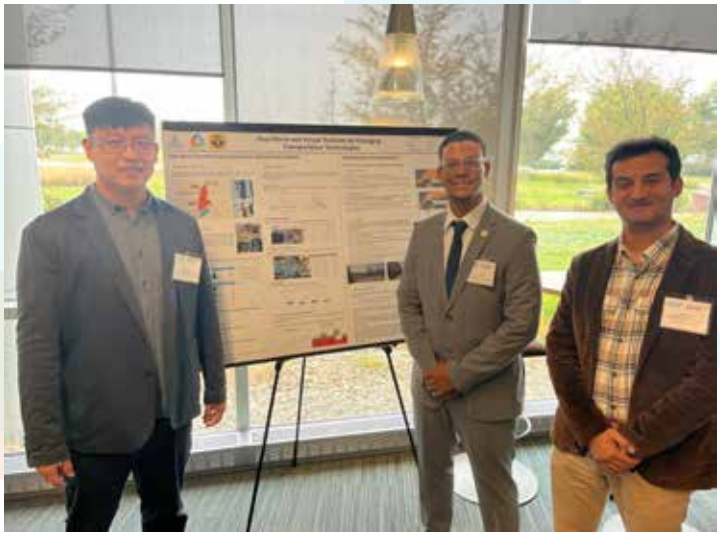
Morgan State graduate student Ramina Javid presented five posters at TRB CATE:

- Javid, R., Sadeghvaziri, E., Jeihani, M., "Micromobility Adoption Patterns: Unveiling Sociodemographic Trends from NHTS 2022."
- Javid, R., Sadeghvaziri, E., Jeihani, M., "Disconnected Mobility: Investigating Public Transit Disconnections in Baltimore City."
- Javid, R., Sadeghvaziri, E., Jeihani, M., "Analyzing Transit Accessibility for Residents with Disabilities in Baltimore City."
- Javid, R., Sadeghvaziri, E., Masoumi, P., Mehryaar, E., Jeihani, M., "A Spatial Analysis of Minority and Women-owned Business Entrepreneurs (MBE/WBE) and Transportation Infrastructure in Baltimore City."
- Javid, R., Sadeghvaziri, E., Masoumi, P., Mehryaar, E., Jeihani, M., "Crash Severity Analysis: Untangling the Impact of Driver Characteristics and Road Conditions in California."

USDOT Future of Transportation Summit

SMARTER Center staff and researchers joined colleagues from the UTC program and USDOT leadership at the inaugural Future of Transportation Summit in Washington, DC. The SMARTER Center was represented by students demonstrating the autonomous wheelchair. In addition to sitting on a workforce development panel, Dr. Jeihani debuted the SMARTER Center's year 2 collaborative research project in her presentation on **Assessing the Aftermath: An In-Depth Analysis of the Regional Impact of the Francis Scott Key Bridge Collapse**. The collapse of the Key Bridge in March 2024 was an event of tremendous regional impacts, particularly for transportation. The SMARTER Center will use its unique role as the Region 3 UTC (with lead institution Morgan State in the site's backyard) to assess transportation impacts and define a path forward for mitigation, management, and equitable rebuilding.

A highlight conference from the reporting period was the Center for Connected and Automated Transportation at Purdue University's Third Annual HBCU Conference. SMARTER undergraduate scholarship recipient Miles Davis and SMARTER Research Assistant Abolfazl Taherpourkomishani accompanied SMARTER PI Dr. Di Yang to present their poster, "Real-world and Virtual Testbeds for Emerging Transportation Technologies."



SMARTER Associate Director Brandy Savarese was invited to define and moderate a panel at the fifteenth annual Baltimore Data Day, organized by the University of Baltimore Jacob France Institute, where residents, community leaders, government representatives, and others "learn how to move from data to stories to action." Her panel, "How Transportation Researchers Can Partner with Local Agencies to Collect, Visualize, and Parse Data in Support of Safety Interventions," which featured Dr. Jeihani and representatives from local development agencies, highlighted SMARTER Center initiatives in promoting access to and use of transportation research in support of community service.

Dr. Jeihani had a busy conference season during the reporting period. In addtion to the participation described, she attending the following conferences:

- MDOT/Maryland Highway Safety Office Toxicology meeting (April 2024)
- TraCR UTC Annual Conference in Greenville, South Carolina: Presenter (May 2024)
- Council of University Transportation Centers Summer Meeting in South Padre Island, Texas (June 2024)
- TRB Automated Road Transport in San Diego, California: Moderator, Beyond Safety Panel (July 2024)
- ITS World Congress in Dubai, Saudi Arabia (September 2024)

Although she was not able to attend the American Road & Transportation Builders Association National Convention in September 2024 due to her participation in the ITS World Congress, Dr. Jeihani remotely accepted the 2024 ARTBA Women Leaders Excellence in Academia Award. Closer to home, Dr. Jeihani was awarded the Morgan State University Excellence in Research and Scholarship Award in August, 2024.

Conference presentations by SMARTER Center affiliates include:

- Aredah, A. and Rakha, H. 2024, "ShipNetSim: A Multi-Ship Simulator for Evaluating Longitudinal Motion, Energy Consumption, and Carbon Footprint." IEEE Smart Mobility Conference.
- Shafik, A. and Rakha, H. "Queue Length Estimation and Optimal Vehicle Trajectory Planning Considering Queue Effects at Actuated Traffic Signal Controlled Intersections," TRB 2024 Annual Meeting.
- Vukojevic. M. "Methodology for "Implementing Multimodal Traffic Systems and CEIS for Vulnerable Road Users in a VR Environment, University of Pittsburgh." Intelligent Transportation Society of Pennsylvania conference (2024).
- Javid, R., Sadeghvaziri, E., Jeihani, M., "Transportation Equity Analysis of Bikeshare Use Among Different Sociodemographic Groups," Poster Presentation with a Paper in the Conference Proceedings at the International Conference on Transportation and Development (ICTD 2024), Atlanta, GA, June 15-18, 2024.
- Javid, R., Sadeghvaziri, E., Kamyab Moghaddam, A., "Using the 2017 NHTS to Investigate the Effect of Household Income on Biking Activities," Poster Presentation with a Paper in the Conference Proceedings at the International Conference on Transportation and Development (ICTD 2024), Atlanta, GA, June 15-18, 2024.
- Yang, D., Zhao, Z., Xie, K., Yang, H., Jeihani, M., Shen, T., "A New Piece-wise Multinomial Logit Model of Crash Severity with Accommodation of Unknown Inflection Points", In: Proceedings of the Road Safety & Simulation International Conference, Lexington, KY, 2024.
- Masumi, P., Taherpour, A., Jeihani, M., Ardeshiri, A., Ahangari, S., "Assessing the Influence of Various No-Right-Turn-on-Red Signs: A Driving Simulator Study," ASCE International Conference on Transportation and Development (ICTD), Atlanta, GA, June 2024, https://doi.org/10.1061/9780784485514.019.
- Masumi, P., Yang, D., Jeihani, M., Swami, M., "Demographic influences on Driving Behaviors: A Comprehensive Study using a Driving Simulator," poster presented at Seventh International TRB Women In Gender Conference, Irvine California, September, 2024.

3.2 Journal publications

- Shafik, A. and Rakha H., "Integrated Back of Queue Estimation and Vehicle Trajectory Optimization Considering Uncertainty in Traffic Signal Timings," IEEE Transactions on ITS Journal, in press, accepted on September 11, 2024.
- Ansariyar, A. and Jeihani, M. Investigating LiDAR Sensor Accuracy for V2V and V2P Conflict Detection at Signalized Intersections. Future Transportation 2024, 4(3), 834-855; https://doi.org/10.3390/futuretransp4030040.

3.3 Books or other non-periodical, one-time publications

SMARTER Center researchers were featured in the following media appearances:

- "Commuting After Bridge Collapse," Scripps News Live, April 5, 2025.
- "Maryland transportation officials consider ramp metering Baltimore area to relieve traffic: State collaborating with National Transportation Center at Morgan State University to conduct feasibility study," WBAL TV 11, July 25, 2025.
- "Morgan State students test autonomous wheelchair that uses AI," WMAR ABC 2, September 24, 2025.

3.4 Websites or other Internet sites

As MDOT's trusted partner in connected vehicle research, SMARTER Center staff were invited to produce a public service video. The Automated Driver Assistance System Resource Video, produced entirely in-house by National Transportation Center staff, familiarizes drivers with automated driver assistance systems and demystifies their application. The first draft of the video was delivered to MDOT in September 2024; staff are currently putting the finishing touches on the final product.

New and ongoing research projects are documented on the National Transportation Center's SMARTER Center subdirectory, detailed project descriptions and investigators' aims and findings. The site also contains a wide array of information about the National Transportation Center's staff, facilities, and workforce development initiatives. We have also launched the SMARTERCenter.org website, which will become a dedicated site for all SMARTER Center UTC updates and outputs.

SMARTER social media has continued to grow during the reporting period, shown in the following metrics:

- LinkedIn: 682 followers
- Twitter (X): 129 followers
- Facebook: 23 followers
- YouTube: 357 views during the recording period; 47 subscribers
- Email newsletter: published quarterly to 581 email subscribers; 3,355 emails sent during reporting period: 1306 opened, 126 clicks
- Zoom webinar registrants in reporting period: 121

SMARTER researchers are disseminating their work on GitHub in the following repositories:

- Connected Vehicle Identification System for Cooperative Control of Connected Automated Vehicles
- Energy consumption Modeling of Ships: towards a Door-to-Door (D2D) Freight Optimization

3.5 Technologies or techniques

The following technologies are currently being developed by researchers in the SMARTER UTC:

- University of Pittsburgh PIs have developed a fuzzy logic-based pay-for-priority system, which allows EDVs to request priority at signalized intersections for a nominal fee. This system not only enhances the efficiency of delivery operations but also provides a flexible mechanism for managing traffic flow in congested urban areas as part of their **Socially Responsible Road Charging for Online Retailers to Support Disadvantaged Urban Communities** project.
- PIs at the University of Delaware have developed geographic information systems predictive models for SLR specifically as they relate to non-motorized transportation facilities as part of **The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility**. Their GIS models are currently being assessed for use by DelDOT.
- Morgan State University PIs in collaboration with University of Maryland PIs are developing a cooperative perception system to leverage the communications between infrastructure and autonomous vehicles to improve traffic safety of pedestrians, as part of their year 1 collaborative research project, **Development of a Pedestrian Collision Avoidance System for Connected and Autonomous Vehicles with Cooperative Perception**.
- PIs at Virginia Tech, working on **Energy Consumption Modeling of Ships: Toward a Door-to-Door (D2D) Freight Optimization** are currently developing a full-scale multi-ship simulator for cargo vessels developed in C++ programing language that will be available to the public as an open-source software.
- Researchers involved in **Smart, Green, Equitable, Safe, Complete Streets for All, Phase II** have written a script for decoding J2735 messages used in CAV systems and algorithms for extracting transportation metrics such as speed, count, and trajectory from real-time data. Due to a problem using the USDOT online tool for traveler information message (TIM) creation, the research team is investigating new ways to create TIMs.

3.6 Inventions, patent applications, and/or licenses

Researchers at Morgan State University have filed a patent for a "Blind Spot Warning with Hedging to Promote Defensive Driving Around Trucks," an outcome of the **Novel Driver Warning System with Hedging to Promote Defensive Driving** project. That patent is currently pending. Dr. Young-Jae Lee of Morgan State University was issued US Patent 11953334, System and Method for Vehicle Routing.

4. OUTCOMES

Several SMARTER projects, including **Crime Prevention through Environmental Design (CPTED) for Public Transit Stations**, **The Mass Transit Dilemma: Streamlining regulatory regimes to address climate change and poverty**, and **Advancing Equity through Regional Multimodal Planning in Small Urban and Rural Communities**, are designed to provide guidance to policymakers and transportation planners in the form of best practices and design frameworks.

5. IMPACTS

5.1 What is the impact on the effectiveness of the transportation system?

As part of the **Smart, Green, Equitable, Safe, Complete Streets for All** project, the Mixed Traffic Connected and Autonomous Vehicle Testbed is actively collecting data on traffic conflicts on the roadways near Morgan State University. Testbed technology will support connected vehicle safety by providing them with static warning messages and traffic signal timing information as they approach specific intersections on the testbed.

In support of SMARTER sustainability goals, University of Delaware's project **The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility** will increase the body of the knowledge related to the planning and designing of the non-motorized transportation facilities in an era of climate change and urbanization.

Researchers at Virginia Tech developed a simulator targeting predictions of ship movements and instantaneous energy consumption and carbon emissions data as part of its project, **Energy Consumption Modeling of Ships: Toward a Door-to-Door (D2D) Freight Optimization.** The simulator can simulate multiple ships in a large-scale environment and is the first to integrate ship dynamics and energy into a simulator.

5.2 What is the impact on the adoption of new practices or policies

Dr. Jennie Saxe at the University of Delaware has created a field checklist for assessing public transit stations for CPTED features. Her **Crime Prevention through Environmental Design (CPTED) for Public Transit Stations** project may also contribute to the adoption of new policies for integration of CPTED principles in public transit stations in order to improve rider sense of safety and ultimately improve access to opportunities accessible by public transit.

Dr. Greg Newmark at Morgan State University intends to produce a web-based data visualization tool to guide transit decision making from his **Deriving Transit Performance Metrics from GTFS Data**.

5.3 What is the impact on the scientific body of knowledge?

Nothing yet to report.

5.4 What is the impact on transportation workforce development?

As illustrated in section 1.3, SMARTER research engages students from middle school through graduate school. By touching students at all levels, the SMARTER Center is creating a pipeline of educated and experienced transportation professionals.

National Summer Transportation Institute at Morgan State University

The National Transportation Center at Morgan State University welcomed the twenty-sixth cohort of the National Summer Transportation Institute (NSTI) on July 1 – 26, 2024. The cohort consisted of twenty middle and high school students from four Maryland counties, Baltimore City, and even a student from Delaware.

NSTI focused on providing students with an overview of transportation engineering and planning, with particular focus on educating students about equitable decision-making and implementa-


tion. Students who participated in the program reported that the program's content was organized in a way that allowed them to fully engage with the material and that the program contributed to their skill and knowledge of STEM and careers in transportation.

Continuing Morgan State's commitment to workforce development, PIs for **Development of a Pedestrian Collision Avoidance System for Connected and Autonomous Vehicles with Cooperative Perception**, are actively engaging in the training of graduate students in two key areas: the development of cooperative perception system in a real-world condition and the design of advanced connected and autonomous vehicle (CAV) systems. Through hands-on participation, students gain invaluable practical experience in constructing and testing CAV technologies. This not only increases their technical skills but also equips them with a deeper understanding of transportation systems and traffic safety. By nurturing a new generation of professionals adept in cutting-edge technologies and methodologies, this project plays a pivotal role in cultivating a skilled workforce capable of driving advancements in transportation safety and efficiency.

PIs at the University of Pittsburgh and the University of Delaware successfully integrate students into their research. Pitt's project, **Ensuring Equity in Pavement Rehabilitation Strategies**, has trained two graduate students in the AI and NLP techniques necessary for the project. Their new expertise will be used in future workforce engagement and disseminated to other students. One of Dr. Saxe's undergraduate students, introduced to transportation research through her project **Crime Prevention through Environmental Design (CPTED) for Public Transit Stations** has now enrolled in graduate studies in transportation at the University of Pennsylvania.

6. CHANGES/PROBLEMS

A few SMARTER Center PIs have adjusted/expanded their approaches or encountered minor issues in their year 1 projects.

6.1 Changes in approach and reasons for change.

- PIs at the University of Delaware have expanded the scope of their research to include rising temperatures and frequent flooding, in addition to the originally outlined analysis of sea-level rise in **The Impacts of Climate Change and Urbanization on Equity Focus Areas, Active Transportation, and Micromobility**. In year 2 research, the UDel team will expand the scope of research further to include: changes in precipitation patterns, urbanization, active transportation, and micromobility.

- Dr. Gregory Newmark has revised his research plan for **Deriving Transit Performance Metrics from GTFS Data** to expand his data sources to include TripUpdate messages as well as the originally planned VehiclePosition messages of the GTFS-RT fields.
- Dr. Pyrialakou at WVU had intended to use surveys to collect data for **Advancing Equity through Regional Multimodal Planning in Small Urban and Rural Communities**, but has decided that a survey will not provide any additional substantial information. Her team will therefore conducting interviews/focus groups exclusively for data collection.

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

The following universities requested no-cost extensions for delivery of their final core research reports; In all but Howard University's case, we expect the approved six-month extension to be sufficient for completion of the work:

- The primary PhD student working on the University of Pittsburgh's **Ensuring Equity in Pavement Rehabilitation Strategies** was granted a medical leave of absence from January 1 to August 31, 2024. She has returned to full time research, and Pitt anticipates project completion by February 2025.
- Dr. Dimitra Pyrialakou has successfully taken on the original West Virginia University PI's research and begun to conduct her own research for the SMARTER Center. She is on-track to complete her year 1 core research by February 2025.
- Dr. Brian Park at the University of Virginia has requested a brief extension for completion of one of his year 1 core projects, **Smart Rideshare Matching – Feasibility of Utilizing Personalized Preferences**. We expect to see his final research report no later than November 30, 2024.
- Dr. Gregory Newmark, a faculty member who joined Morgan State University in 2023, encountered challenges hiring student researchers **Deriving Transit Performance Metrics from GTFS Data** core project, which has created a delay in the data visualization. He has been granted a no-cost extension to February 2025.
- The original SMARTER Associate Director and PI at Howard University is no longer employed there. Howard has appointed a new steward of Howard's role in the SMARTER Center, Dr. Claudia Marin, who has been actively engaged in shepherding the university's core research project, **Near-Real-time Health Monitoring and Assessment of a Railway Track System**, and role in the UTC. Howard and Morgan State have been cooperating with the SMARTER Center program manager to resolve any outstanding financial requests.
- Due to delays in coordinating and receiving documentation from Maryland Transit Administration, Dr Jennie Saxe's MTA-based (document evaluation and site visits) researched will be pushed into year 2 of the project. This has a particular impact on the Baltimore-area components of the project. Engagement with and presentations to community groups are anticipated to take additional time as well (into year 2). Trust-building and relationship development with partners is ongoing.
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6.3 Changes that have a significant impact on expenditures

Howard University's year 2 funding remains on hold due to USDOT review. Morgan State staff is collaborating closely with Howard staff and USDOT to resolve outstanding issues.

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

Completed research projects have been submitted to the following databases: research.hub@dot.gov, NTLDigitalSubmissions@dot.gov, TRIS-TRB@nas.edu, and the Transportation Library at Northwestern University, The Volpe National Transportation Systems Center, the Federal Highway Administration Research Library and the National Technical Information Service.

Appendix A: Key Performance Indicators

UTC Name	SMARTER Center								
University	Morgan State University								
Grant #	69A3552348303								
Reporting Period	April 1, 2024 - September 30, 2024								
	Consortium Total	MSU	UMD	VT	UVA	Pitt	UDel	HU	WVU
RESEARCH OUTPUT									
Number of research articles published in peer reviewed journals	**10**	6	3	1	—	—	2	—	—
Number of conference presentations	**18**	6	2	3	6	1	2	—	—
Number of agencies (or other entities) participating in or collaborating with SMARTER research	**15**	7	—	—	1	2	4	—	5
EDUCATION, TRAINING, WORKFORCE DEVELOPMENT									
Number of SMARTER affiliated students who secured a job in transportation	**13**	2	1	1	2	6	5	—	1
Number of seminars/talks, training events, and workshops	**13**	4	3	—	4	1	7	—	1
Number of K-12 students, 2-year college students, and teachers that have been exposed to transportation	**101**	75	1	—	25	—	4	—	—
TECHNOLOGY TRANSFER									
Number of patents, new technologies, procedures/policies, and standards/design practices	**1**	1	—	—	—	—	2	—	—
Number of newsletters and press releases and social media followers and traffic	**4**	2	1	—	—	—	1	—	1
Number of community outreach events	**12**	10	1	—	—	—	1	—	1
Number of media stories referencing SMARTER research or other activities	**13**	7	—	—	—	2	1	—	4
STUDENT ENROLLMENT									
Undergraduate students	**43**	24	—	—	3	15	60	—	1
Masters students	**20**	16	1	—		1	10	—	2
Doctoral students	**40**	20	3	4	4	8	5	—	1
DEGREES AWARDED									
Undergraduate degrees	**2**	2	—	—	—	—	50	—	—
Masters degrees	**1**	1	—	—	—	—	10	—	—
Doctoral degrees	**3**	1	—	2	—	—	5	—	—
NUMBER OF APPLIED RESEARCH PROJECTS SELECTED FOR FUNDING IN THE REPORTING PERIOD USING UTC FUNDS									
Number of applied research projects	**22**	5	7	2	1	3	3	—	3

Appendix B: SMARTER Center Research Projects

Project Name	Grant Year/ Reseach Type	University	Principal Investigator
A Novel Driver Warning System with Hedging to Promote Defensive Driving	Year 1, Core Research	MSU	Di Yang
Smart, Green, Equitable, Safe, Complete Streets for All, Phase I: Providing a Smart Campus Using a CAV Testbed around Morgan State University	Year 1, Core Research	MSU	Mansoureh Jeihani, Di Yang
Deriving Transit Performance Metrics from GTFS Data	Year 1, Core Research	MSU	Gregory Newmark
The Mass Transit Dilemma: Streamlining Regulatory Regimes to address climate change and poverty	Year 1, Core Research	MSU	Joseph Niehaus
Crime Prevention through Environmental Design (CPTED) for Public Transit Stations	Year 1, Core Research	Udel	Jennie Saxe
Understanding the Role of Equity in Delaware Department of Transportation Expenditures	Year 1, Core Research	UDel	Phillip Barnes
The Impacts of Climate Change and Urbanization on Non-Motorized Transportation Facilities and Negative Consequences on Lower Income Neighborhoods	Year 1, Core Research	UDel	Ardeshir Faghri
Energy consumption modeling of ships: Toward a Door-to-Door (D2D) Freight Optimization	Year 1, Core Research	Virginia Tech	Hesham Rakha
Enabling GLOSA through Domain Knowledge Aware SPAT Prediction and Queue Length Aware Trajectory Optimization	Year 1, Core Research	Virginia Tech	Hesham Rakha
Ensuring Equity in Pavement Rehabilitation Strategies	Year 1, Core Research	Pitt	Lev Khazanovich, Julie Vandenbossche
Socially Responsible Road Charging for Online Retailers to Support Disadvantaged Urban Communities	Year 1, Core Research	Pitt	Aleksandar Stevanovic, Lev Khazanovich
Design and Evaluation of an Arterial-Friendly Local Ramp Metering System	Year 1, Core Research	UMD	Gang-Len Chang
A Comprehensive Analysis of EV Charging Demand Prediction, Infrastructure Planning, and Power Network Resilience in the Era of Electric Mobility	Year 1, Core Research	UMD	Xianfeng Yang
Connected Vehicle Identification System for Cooperative Control of Connected Automated Vehicles	Year 1, Core Research	UVA	B. Brian Park
Measuring Pedestrian Psycho-Physiological Well-Being in the Built Environment	Year 1, Core Research	UVA	T. Donna Chen, Andrew Mondschein
Smart Rideshare Matching – Feasibility of Utilizing Personalized Preferences	Year 1, Core Research	UVA	B. Brian Park
Automated Vehicle-supported Mobility Services for Rural Areas	Year 1, Core Research	WVU	V. Dimitra Pyrialakou
Advancing Equity through Regional Multimodal Planning in Small Urban and Rural Communities	Year 1, Core Research	WVU	V. Dimitra Pyrialakou
Near-Real-time Health Monitoring and Assessment of a Railway Track System	Year 1, Core Research	Howard University	Claudia Marin

Appendix B: SMARTER Center Research Projects, cont.

Project Name	Grant Year/ Research Type	University	Principal Investigator
Implementing and Testing Multimodal Equity through Connected Everything and Traffic Signal Operations in Virtual Reality	Year 1, Collaborative	Pitt, UVA	Aleksandar Stevanovic, B. Brian Park
Development of a Pedestrian Collision Avoidance System for Connected and Autonomous Vehicles with Cooperative Perception	Year 1, Collaborative	MSU, UMD	Di Yang, Xianfeng Yang
Assessing Feasibility of Deploying Transit Signal Priority with Connected Vehicle Technology using MSU Testbed	Year 1, Collaborative	UVA, MSU	B. Brian Park, Young-Jae Lee, Di Yang
A Framework for Volunteer Integration in Rural and Small Urban Transit	Year 1, Collaborative	WVU, MSU	V. Dimitra Pyrialakou, Gregory Newmark
The Impacts of Climate Change and Urbanization on Non-Motorized Transportation Facilities and Low-Income Neighborhoods	Year 2, Core	UDel	Ardeshir Faghri
Crime Prevention through Environmental Design (CPTED) for Public Transit Stations	Year 2, Core	UDel	Jennie Saxe
Smart, Green, Equitable, Safe, Complete Streets for All, Phase II: Development of a CAV Testbed-enhanced Smart Campus at Morgan State University	Year 2, Core	MSU	Mansoureh Jeihani, Di Yang
Impact of Charging Infrastructure on Electric Vehicle Adoption: A Synthetic Population Approach	Year 2, Core	UMD	Cinzia Cirillo
Implementation and Evaluation of Human-in-the-Loop Connected Cruise Control (hCCC)	Year 2, Core	UVA	B. Brian Park
Virtual Reality as a Tool to Enhance Public Involvement Process	Year 2, Core	UVA	T. Donna Chen
Integration of a Real-time Traffic State Estimation and a Decentralized Game-Theoretic Traffic Signal Controller	Year 2, Core	VT	Hesham Rakha
Sustainable Multimodal Planning and Asset Management of Transportation Systems in Small Urban and Rural Communities	Year 2, Core	WVU	V. Dimitra Pyrialakou
Use of the Large Language Models to Improve Transportation Services	Year 2, Core	Pitt	Lev Khazanovich, Aleksandar Stevanovic
Transportation Infrastructure Development Under Uncertainties	Year 2, Core	UMD	Paul Schonfeld
Agent-Based Approaches in Freight Systems: Toward a Door-to-door (D2D) Freight Optimization	Year 2, Core	VT	Hesham Rakha
Assessing the Aftermath: An In-depth Analysis of the Regional Impact of the Francis Scott Key Bridge Collapse	Year 2, Collaborative	All	All