Center for Advanced Multimodal Mobility Solutions and Education

USDOT Tier 1 University Transportation Center
Semi-Annual Progress Report #14

Submitted to:	U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology (OST-R)
Grant Number:	69A3551747133
Project Title:	Center for Advanced Multimodal Mobility Solutions and Education (CAMMSE)
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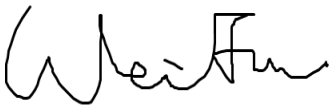
Submission Date:	April 24, 2024
DUNS:	06-630-0096
EIN:	56-0791228
Recipient Organization:	University of North Carolina at Charlotte
Project/Grant Period:	November 30, 2016 - September 30, 2024
Reporting Period Start Date:	October 01, 2023
Reporting Period End Date:	March 31, 2024
Report Term or Frequency:	Semi-annual
Signature of Submitting Official:	

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1. ACCOMPLISHMENTS

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

The major goals and objectives of the program as outlined in the proposal include the following categories.

Research

CAMMSE will address the FAST Act research priority area of "Improving Mobility of People and Goods" by conducting multi-disciplinary, multi-modal research, education and workforce development, and technology transfer. CAMMSE is motivated by the recent advances in computing, smartphones and communication technologies, and ubiquitous data to create sustainable, efficient, and growth-enabling multimodal transportation systems. Cutting edge analytical methods and models will enhance the effectiveness, efficiency, and reliability of these systems accordingly. Recent technological advancements enable new perspectives and holistic approaches to address the well-known challenges in multimodal transportation systems planning, design, operations, and maintenance. In particular, the following research topic areas will be established to maximize synergy and adaptability across multiple modes and jurisdictions:

- Increase access to opportunities that promote equity in connecting regions and communities, including urban and rural communities;
- Generate innovations in multi-modal planning and modeling for high-growth regions;
- Develop data modeling and analytical tools to optimize passenger and freight movements;
- Innovations to improve multi-modal connections, system integration and security; and
- Smart Cities.

Leadership

The CAMMSE team is nationally and internationally recognized for its contributions to the field of transportation research, and for its deployment of successful solutions to critical, real-world transportation challenges. In addition, team members are committed advocates and longstanding leaders within the multimodal transportation community and the UTC system itself. Through this UTC grant, the Consortium plans to build on its demonstrated experience to mentor future leaders in the field of transportation. CAMMSE plans to nurture students through skill building and professional development activities that promote notable research scholarships and successful transportation careers.

Education and Workforce Development

With years of collective education, research, and UTC experience, CAMMSE will provide a transportation education program through its partner universities. The program will promote creative and multidisciplinary problem-solving and exposure to a myriad of educational and workforce development experiences. The program will serve to attract, educate, and train future and existing transportation professionals with the know-how to undertake and implement innovative projects being or to be conducted.

The workforce development program will leverage the existing training skills and delivery resources available within partner universities. On-line webinars will be designed and delivered using available technical resources, which could provide Continuing Education Credits (CEUs) to interested course participants. In addition, UTC funds will be used to support and host the monthly transportation seminar series, particularly while classes are in session. The target audience is current students and the local university community. UTC funds will also enhance our ability to host nationally and internationally

recognized speakers. The target audience is local and regional (onsite), and national when recording and posting talks online.

CAMMSE will support career-building activities that facilitate student transition from school to the workplace by offering enhanced student research opportunities, research seminars, guest speakers, professional conference travel and other professional networking opportunities. In addition, outreach programs at the pre-collegiate level (elementary to high school) will be designed to spark interest in transportation issues and to encourage youth to consider transportation academic programs and careers. The outreach initiatives will particularly focus on recruiting underrepresented minorities into transportation and other STEM fields.

Technology Transfer

The technology transfer program at CAMMSE is designed to support the USDOT in its objective of "expanding technology transfer to partners and stakeholders" by sharing research results quickly and to the widest possible audience. CAMMSE has demonstrated ability to disseminate research results, spur implementations, and conduct continuing education programs. The technology transfer program is a direct extension of the Center's research and education programs; in other words, these activities are designed to increase the scope and effectiveness of research accomplishments and education initiatives. General objectives within the technology transfer area in CAMMSE will be to:

- Increase the national visibility of CAMMSE research and education activities.
- Increase the availability and speed at which CAMMSE research results are disseminated.
- Provide technical assistance based on CAMMSE research and development.

Collaboration

CAMMSE has an extensive history of forming collaborative relationships at a variety of technical, fiscal and administrative levels. Across all its activities, from conducting pooled fund studies to hosting tech transfer events, CAMMSE will seek to work with collaborators from all sectors.

Diversity

In order for the transportation workforce to reflect the diversity of the national workforce pool, CAMMSE will continue to pursue the development of innovative programs to encourage new entrants, particularly those from groups currently underrepresented in the field. CAMMSE will actively participate in a number of committed activities through which the CAMMSE will increase interest in STEM disciplines and raise awareness of transportation-related careers amongst underrepresented groups.

1.2. What was accomplished under these goals?

Research

CAMMSE was funded by USDOT in November 2016 under the FAST act. During this reporting period, CAMMSE research results have been published in multiple journals, including *Engineering Applications of Artificial Intelligence, Future Transportation, International Journal of Engineering Education, Journal of Intelligent Transportation Systems, Physica A: Statistical Mechanics and its Applications,* and *World Electric Vehicle Journal.* CAMMSE research results were also presented at several conferences on different occasions, which include the 12th International Conference on Transportation and Traffic Engineering (ICTTE 2023), the 2023 North Carolina Section of the Institute of Transportation Engineers (NCSITE) Annual Meeting, the 103rd Annual Meeting of the Transportation Research Board, and 2024 TSU research week.

Leadership

Representing the CAMMSE, Center Director Dr. Wei Fan has served as an affiliate faculty in the School of Data Science, UNC Charlotte since August 15, 2020. During this reporting period, CAMMSE Center Director and Associate Directors have been actively serving on many editorial boards (e.g., Editor-in-

Chief of *International Journal of Transportation Science and Technology,* and *Journal of Infrastructure Preservation and Resilience*, Handling Editor of *TRR Inaugural Editorial Board, Transportation Research Record*, Associate Editor *of Accident Analysis and Prevention, ASCE Journal of Transportation Engineering, Part A: Systems*, *International Journal of Transportation Science and Technology, IEEE Transactions on Intelligent Transportation Systems, Transportation Planning and Technology, Current Trends in Civil & Structural Engineering, Journal of Nondestructive Evaluation,* and *Journal of Transportation Safety and Security;* Editorial Board of *Journal of World Review of Intermodal Transportation Research*, *International Journal of Transportation Science and Technology*, *Journal of Transportation Research Part D*, and *Asian Transport Studies*) and many professional committees (e.g., Vice-Chair of World Transport Convention Cross-Cutting Division, General Secretary of Chinese Overseas Transportation Association (COTA), Co-Chair of World Transport Convention Connected Autonomous Vehicles Section, Corresponding Member of ASCE Data Sensing & Analytics Committee, Advisory Board Member of ASCE National Artificial Intelligence (AI) Committee, Member of ASCE Transportation Safety Committee, ASCE National Connected & Autonomous Vehicles Impacts Committee, NCDOT Fully Autonomous Vehicle (FAV) Research Working Group Committee, NCSITE Scholarship Committee, TRB Standing Committees (A0020C, ACP60, AP075, AHB60, AT045, AW010, AW010 (2)(3), AW020), World Transport Convention Shared Logistics and Transportation Systems Committee, Member of Maritime Education, Training, and Outreach Subcommittee of the Lone Star Harbor Safety Committee (LSHSC), as well as several proposal and paper review committees (e.g., NCHRP (17-108, 08-157, 17-102), and the TRB 103rd Annual Meeting).

Education and Workforce Development

CAMMSE has been working with the Institute of Transportation Engineers (ITE) Student Chapter at UNCC in supporting and hosting the bi-weekly transportation seminar series in which guest speakers are invited to UNCC to present their current project activities while classes are in session. The target audience is current students and the local university community. Dr. Fan's transportation research group has also been conducting graduate student seminars on a weekly basis during this reporting period.

CAMMSE Center researchers have been meeting on a regular basis. CAMMSE has provided a medium for sponsored students to develop important soft skills. All these events required that students interact with the local community and think of creative ways to portray complicated concepts in a simple and easy way to understand. CAMMSE has impacted both the local community and the sponsored students by encouraging creativity and enhancing connections.

At UNCC, CAMMSE Center Director Dr. Wei Fan taught the "Discrete Choice Modeling" course in the Fall 2023 semester, "Connected and Autonomous Vehicles" and "Traffic Engineering" courses in the Spring 2024 semester to several undergraduate and graduate students who were in attendance. He also served as a research supervisor for four Ph.D. students, as well as a Committee Member for two Ph.D. candidates. During this reporting period, a total of four students at UNCC have been involved in CAMMSE projects and all of them were directly supported by CAMMSE. During this reporting period, Chengying Hua was awarded the Cyrus Painter Memorial Scholarship in November 2023.

At TSU, six undergraduate-level and nine graduate-level transportation-related courses were taught by CAMMSE personnel (Drs. Yi Qi, Mehdi Azimi, Fengxiang Qiao, and Ms. Keziah Hill). During the reporting period, there were a total of four Workshops and seminars that were hosted by the team.

At UT Austin, there was one female student and one female researcher involved in CAMMSE projects. Faculty members at UT have integrated CAMMSE research into courses taught. Findings from CAMMSE research were presented to junior and senior level as well as graduate level civil engineering students in CE 321 Introduction to Transportation Engineering, CE 367T Traffic Engineering, and CE 392M Public Transportation Engineering.

Technology Transfer

At UNCC, CAMMSE faculty, staff, researchers, and students have been making presentations at different meetings including the 2023 North Carolina Section of the Institute of Transportation Engineers (NCSITE)

Annual Meeting on November 9, 2023, the 12th International Conference on Transportation and Traffic Engineering (ICTTE 2023) from December 29-31, 2023, the 103rd Annual Meeting of the Transportation Research Board, Washington D.C. from January 7-11, 2024.

TSU CAMMSE team shared the research findings with students, transportation professionals, and the public through published journal or conference papers, oral presentations, or student thesis works. During the reporting period, TSU published one peer-reviewed journal paper and gave one presentation.

At UT Austin, there are a total of two active projects sponsoring one Ph.D. student, one principal investigator, and one researcher. One of the best technology transfer tools is the students who work on these CAMMSE research projects. These UT Austin students are key to the technology development as they will carry the knowledge and technology developed through CAMMSE projects to the Transportation Engineering industry. They will carry the new technology with them and use it in their new jobs, teaching peers how to use the technology, thereby implementing the technology. Most importantly, these new techniques will continue to grow and improve as they are used. The professors at UT Austin have also used their classes to teach the new techniques developed through the CAMMSE UTC, therefore planting the new technology in students that are not directly supported by the UTC. In addition, information developed through UT Austin's research is being shared with the City of Austin as the City functions as a partner in the research efforts. The UT graduate student researchers collaborated with the Austin TxDOT District integrating their findings into the district's preparation for a major re-build of IH-35 through Austin.

Collaboration

CAMMSE created a diverse collaboration network with different state and local government agencies, and educational and professional organizations, as well as community practitioners. CAMMSE also worked to build collaborative relations with international transportation centers and universities.

During the reporting period, CAMMSE Center Director Dr. Wei Fan has been actively collaborating with several other universities across the country and abroad (e.g., NC A&T University) in conducting research and co-writing proposals and/or papers.

At TSU, Dr. Yi Qi and Dr. Mehdi Azimi partnered with several universities to develop new UTC proposals, such as Texas State University, Texas A&M University, Oklahoma State University, and the University of Texas at Arlington. In addition, Dr. Yi Qi, Dr. Mehdi Azimi, and their teams also collaborated with the Argonne National Laboratory, the City of Houston, Houston BCycle, Houston METRO, and the Texas District of the Institute of Transportation Engineers (ITE) on various research projects.

UT Austin has partnered with the Women in Transportation Seminar Heart of Texas (WTS-HOT) Student Chapter and the Institute of Transportation Engineers (ITE)/ Intelligent Transportation Systems (ITS) Student Chapter. UT Austin's research is being shared with the City of Austin as the City functions as a partner in the research efforts. Furthermore, paper collaborations with other UT Austin students who specialize in other transportation studies have occurred.

Diversity

Several Ph.D. students from underrepresented groups have been hired to conduct CAMMSE's research during this reporting period. For example, at UNCC, four international graduate students (including Mr. Tianjia Yang, Mr. Chengying Hua, Mr. Zehao Wang, all of whom came from P.R.China, and Mr. Mujeeb Abiola Abdulrazaq came from Nigeria) joined the INES Ph.D. program and they have been working as CAMMSE research assistants.

TSU is one of the nation's largest historically black universities, with most students being minority students. During the reporting period, TSU CAMMSE supports graduate students with different backgrounds, and half of them are female students.

UT Austin currently has two females involved with CAMMSE, including a female Latina.

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

At UNCC, the CAMMSE bi-weekly seminars are open to the general public, particularly to the local and state transportation agencies, as well as industry practitioners. CAMMSE has also been holding the weekly graduate seminar series at UNCC.

At UConn, CAMMSE researchers have organized and participated in a transportation graduate student seminar each week of the past two semesters. In the reporting period, this translates to twelve seminars attended by approximately 300 students, faculty, and visitors in total.

TSU host seminars and workshops to provide more learning opportunities to their students. During the reporting period, four seminars and workshops were organized. In addition, CAMMSE TSU continues to provide research assistantships to both undergraduate and graduate students who are interested in developing their careers in the transportation area. Sponsored students participated in CAMMSE research projects and worked closely with their faculty members to receive extensive hands-on trainings.

UT Austin has provided ample opportunities for students to engage in professional development and networking activities. Sponsored by the university, students had the chance to attend conferences such as the Transportation Research Board (TRB) Conference in Washington, D.C. in January 2024, where they could showcase their research and establish connections for future job opportunities. Additionally, students submitted papers in February 2024 for presentation and publication for the upcoming Canadian Society of Civil Engineering (CSCE) Conference in June 2024. Moreover, UT Austin organized various job-hunting seminars and workshops to support students in their search for post-doc positions. These events aimed to equip students with valuable skills and insights for navigating the job market successfully. Furthermore, students actively participated in the hiring process for a new transportation engineering professor. They had the opportunity to engage with potential candidates by hosting them for lunch and conducting personal meetings to assess their suitability and mentoring approach for graduate students.

1.4. How have the results been disseminated?

News items and information about CAMMSE have been regularly posted on the website at https://cammse.uncc.edu/news.

In particular, as mentioned before, UNCC has published many journal papers and made many presentations both nationally and internationally. The research of WSU has been disseminated through the presentations mentioned earlier. At TSU, CAMMSE research results were published in one peer-reviewed journal. The research results were also disseminated through an invited presentation their faculty member gave. UT Austin has presented the results through published papers, technical reports, and technical presentations. Research results are disseminated through the classroom teaching of the principal investigators and their colleagues. Additionally, various papers were presented at the Transportation Research Board's Annual Meeting in Washington, D.C.

1.5. What do you plan to do during the next reporting period to accomplish the goals and objectives?

The following tasks are planned in order to accomplish the goals and objectives of CAMMSE.

(1) All final project reports to be completed for year 6 (2021-2023) will be provided to the Transportation Research Board (Transport Research International Documentation database), the National Transportation Library, the U.S. DOT's Research Hub, the Transportation Library, the Volpe National Transportation Systems Center, FHWA's Research Library, and the U.S. Department of Commerce as required by OST-R.

(2) UNCC will continue to present papers based on CAMMSE's research on different occasions including the 2024 North Carolina Section Institute of Transportation Engineers (NCSITE) Annual Meeting.
(3) TSU will complete the currently active projects. The research findings will be summarized in technical reports and will also be submitted to peer-reviewed journals for publication. In addition, TSU CAMMSE will continue to provide research assistantships to students to encourage them to pursue careers in the transportation area. Finally, continue hosting transportation-related seminars or workshops for both CAMMSE-supported students and all other students majoring in transportation or interested in pursuing their careers in transportation areas.
(4) UT Austin CAMMSE participants are gearing up for the CSCE Conference in June 2024, where they will have the opportunity to share their research findings on e-scooter safety and engage in discussions with colleagues from various backgrounds. Additionally, the CAMMSE team is actively working on submitting a newly completed paper on the balancing of efficacy and equity in public transit operations to journal publications and potential conferences. At these meetings, CAMMSE researchers will present CAMMSE-work and discuss findings/insights with colleagues from all over the world. UT Austin will also continue submitting any finalized research product to journal publications whenever possible.

2. PARTICIPANTS AND COLLABORATING ORGANIZATIONS

2.1. Who has worked on the program?

The members of CAMMSE UTC include the University of North Carolina at Charlotte (UNCC); the University of Texas at Austin (UT Austin); the University of Connecticut (UConn); Washington State University – Pullman (WSU); and Texas Southern University (TSU). Table 1 lists the leadership team members who have worked on the program during this reporting period.

Table 1. CAMMSE Staff Working on the Program

Name	Wei Fan	Randy Machemehl	Nicholas Lownes	Xianming Shi	Yi Qi
Program/Project Role	Center Director	Associate Director at UT Austin	Associate Director at UConn	Associate Director at WSU	Associate Director at TSU
Contribution to Program/Project	Oversees overall operations of the program. Responsible for coordinating with stakeholders and developing and implementing the CAMMSE strategic plan	Serves as liaison between CAMMSE and UT Austin	Serves as liaison between CAMMSE and UConn	Serves as liaison between CAMMSE and WSU	Serves as liaison between CAMMSE and TSU
Funding Support	UNCC	UT Austin	UConn	WSU	TSU
Collaborated with Individual(s) in Foreign Country(ies)	Yes	No	Yes	Yes	Yes
Country(ies) of Foreign Collaborator(s)	P.R.China	No	Australia	P.R.China	P.R.China
Traveled to Foreign Country(ies)	N/A	N/A	N/A	N/A	N/A
If traveled to foreign country(ies), duration of stay	N/A	N/A	N/A	N/A	N/A

2.2. What organizations have been involved as partners?

Table 2. A List of Organizations Creating Partnerships with CAMMSE

Organization Name	Type / Location	Partners Contribution to Project				
		Financial Support	In-kind Support	Facilities	Collaborative Research	Personal Exchanges
Capital Metro – Austin Public Transit	Government /TX		X	X		
Centralina Council of Governments	MPO /NC		X			

City of Austin	Government /TX				X	
City of Charlotte	Government /NC		X			
City of Houston	Government /TX				X	
Connecticut Transportation Institute	Government /CT				X	
Houston BCycle	Non-profit/ TX				X	
Houston-Galveston Area Council	Non-profit /TX				X	
International Association of Maritime and Port Executives	Non-profit /Intl.				X	
Metropolitan Transit Authority of Harris County (METRO)	Government /TX				X	
North Carolina A&T University	University /NC				X	
North Carolina Department of Transportation	Government /NC		X			
North Carolina Turnpike Authority Automated Vehicle Proving Ground	Government /NC				X	
Texas A&M Transportation Institute	University /TX				X	
Texas Department of Transportation	Government /TX		X	X		
Texas District of the Institute of Transportation Engineers (ITE)	Non-profit /TX				X	
Texas Southern University	University /TX	X	X	X		
Texas State University	University /TX				X	
UConn Human Rights Institute	University /CT					
University of Houston	University /TX				X	
University of Connecticut	University /CT	X	X	X		
University of North Carolina at Charlotte	University /NC	X	X	X		
University of Texas at Austin	University /TX	X	X	X		
US DOT National Center for Sustainable Transportation (NCST)	University /CA				X	
UT's Center for Transportation Research (UT Austin)	University /TX		X	X		
Washington Department of Transportation	Government /WA				X	
Washington State University	University /WA	X	X	X		

Our CAMMSE UTC has successfully established an external advisory board which contains members from universities and government agencies. The detailed information about all five advisory board members is provided below:

- Dr. Michael Accorsi, Professor and Senior Associate Dean, School of Engineering, University of Connecticut.
  Email: michael.accorsi@uconn.edu
- Dr. Amit Bhasin, Director, Center for Transportation Research, Associate Professor, Transportation Engineering, The University of Texas at Austin.
  Email: a-bhasin@mail.utexas.edu
- Elizabeth Robbins, Planning Policy & Partnerships Manager, Multimodal Planning Division, Washington State Department of Transportation.
  Email: robbins@wsdot.wa.gov
- Neil Mastin, Research and Development Manager, North Carolina Department of Transportation.
  Email: jmastin@ncdot.gov
- Wade Odell, Research Engineer, Texas Department of Transportation.
  Email: Wade.Odell@txdot

2.3. Have other collaborators or contacts been involved?

Dr. Wei Fan, CAMMSE Director, has been collaborating and conducting research with faculty and researchers from UNCC and North Carolina A&T University. A collaborative relationship has been successfully developed between them. Dr. Fan has been working with other researchers at UNC Charlotte on a research project entitled “Geo-FRIT: A Web-based Geospatial Analytics Tool for Quantifying Freight Risk and Resilience in Transportation”, which was sponsored by NCDOT. Dr. Fan also served as the lead principal investigator on the funded project entitled “Impact of Connected and Automated Vehicles on Work Zones” sponsored by NC-CAV/NCDOT.

TSU CAMMSE faculty members teamed up with professors from different universities to develop new UTC proposals. Collaborators were from the Texas State University, Texas A&M University, Oklahoma State University, and the University of Texas at Arlington.

UT Austin collaborated with City of Austin Transportation Department and the Austin District of TxDOT.

3. OUTPUTS

3.1. Journal publications, conference papers, and presentations

Journal publications

[1] Gu, J.J., Jiang, Z.B., Fan, W., Qin, W. and Zhang, Z., Short-Term Semantic Trajectory Prediction for Individual Metro Passengers Based on Multi-Level Periodicity Mining, Accepted for Publication, *Engineering Applications of Artificial Intelligence*, February 2024.

[2] Yang, T. and Fan, W., Transit Signal Priority under Connected Vehicle Environment: Deep Reinforcement Learning Approach, Accepted for Publication, *Journal of Intelligent Transportation Systems*, January 2024.

[3] Hua, C. and Fan, W., Safety-Oriented Dynamic Speed Harmonization of Mixed Traffic Flow in Nonrecurrent Congestion, Accepted for Publication, *Physica A: Statistical Mechanics and its Applications*, December 2023.

[4] Liu, K., Wang, J. and Fan, W., Emerging Technologies in the Electrification of Urban Mobility, *World Electric Vehicle Journal*, 14(12), 331, 2023.

[5] Azimi, M., Wali, M. M., and Qi, Y., Studying the Impact of the COVID-19 Pandemic on Bikeshares as a Mode of Shared Micromobility in Major Cities: A Case Study of Houston, *Future Transportation*, 4(1), 270-282, 2024.

Conference papers

[1] Rezwana, S. and N. Lownes, Human-Autonomous Interplay: Evaluating Driver Trust and Behavior in Mixed Traffic Conditions (Accepted ICTD 2024).

Presentations

[1] Hua, C. and Fan, W., Injury Severity Analysis of Time-of-day Fluctuations and Temporal Volatility in Reverse Sideswipe Collisions: a Random Parameter Model with Heterogeneous Means and Heteroscedastic Variances, The 103rd Annual Meeting of the Transportation Research Board, Washington D.C., January 7-11, 2024.

[2] Yang, T. and Fan, W., Enhancing Robustness of DRL-Based Adaptive Traffic Signal Controllers in Mixed Traffic Environments through Data Fusion and Multi-Discrete Actions, The 103rd Annual Meeting of the Transportation Research Board, Washington D.C., January 7-11, 2024.

[3] Yang, T. and Fan, W., Equity-Based Traffic Signal Control under Connected Vehicle Environment: Deep Reinforcement Learning Approach, The 103rd Annual Meeting of the Transportation Research Board, Washington D.C., January 7-11, 2024.

[4] Yang, T. and Fan, W., Evaluation of Transit Signal Priority at Signalized Intersections under Connected Vehicle Environment, The 103rd Annual Meeting of the Transportation Research Board, Washington D.C., January 7-11, 2024.

[5] Fan, W., Equity-Based Traffic Signal Control under Connected Vehicle Environment: Deep Reinforcement Learning Approach, Keynote Presentation, The 12th International Conference on Transportation and Traffic Engineering (ICTTE 2023), Wuhan University of Technology, Wuhan, China, December 29-31, 2023.

[6] Hua, C. and Fan, W., Injury Severity Analysis of The SUV Overturn with Latent Class Clustering and Random Parameter Logit Model, The 2023 North Carolina Section of the Institute of Transportation Engineers (NCSITE) Annual Meeting, Friday Center For Continuing Education, UNC Chapel Hill, NC, November 9, 2023.

[7] Yang, T. and Fan, W., Equity-Based Traffic Signal Control under Connected Vehicle Environment: Deep Reinforcement Learning Approach, The 2023 North Carolina Section of the Institute of Transportation Engineers (NCSITE) Annual Meeting, Friday Center for Continuing Education, UNC Chapel Hill, NC, November 9, 2023.

[8] Otieno V., and Qi, Y., Challenges in Moving Towards Electric Vehicle Era, TSU research week, March 2024.

3.2. Website(s) or other internet site(s)

The CAMMSE website is located at http://cammse.uncc.edu/. This website has been used to disseminate any information related to the program. Other internet sites include: http://sboyles.github.io/, https://sites.utexas.edu/machemehl/ and http://www.mass-lab-ut.com/.

3.3. Technologies or techniques

Nothing to report.

3.4. Inventions, patent applications, and/or licenses

Nothing to report.

3.5. Other outputs

CAMMSE Graduate Seminar Series @ UNCC, Sponsored by CAMMSE

[1] "Spatial-Temporal VSL Using Distributed Multi-Agent Reinforcement Learning", Presented by Mr. Chengying Hua (CAMMSE INES Ph.D. research assistant), October 11, 2023, EPIC CEE Conference Room 3344.

[2] "A Comprehensive Survey on Multi-Agent Reinforcement Learning for Connected and Automated Vehicles", Presented by Mr. Tianjia Yang (CAMMSE INES Ph.D. research assistant), October 18, 2023, EPIC CEE Conference Room 3344.

[3] "Analyzing the Injury Severity in Overturn Crashes Involving Sport Utility Vehicles: Latent Class Clustering and Random Parameter Logit Model", Presented by Mr. Chengying Hua (CAMMSE INES Ph.D. research assistant), November 1, 2023, EPIC CEE Conference Room 3344.

[4] "Equity-Based Traffic Signal Control under Connected Vehicle Environment: Deep Reinforcement Learning Approach", Presented by Mr. Tianjia Yang (CAMMSE INES Ph.D. research assistant), November 8, 2023, EPIC CEE Conference Room 3344.

[5] "Impact of Connected Vehicle on Work Zone Network Safety through Dynamic Route Guidance", Presented by Mr. Mujeeb Abiola Abdulrazaq (CAMMSE INES Ph.D. research assistant), November 29, 2023, EPIC CEE Conference Room 3344.

[6] "Spatial Analysis of CAV Safety Using XAI", Presented by Mr. Chengying Hua (CAMMSE INES Ph.D. research assistant), December 5, 2023, EPIC CEE Conference Room 3344.

[7] "TRB 2024 Summary: Recent Research Progress and Updates on Traffic Signal Systems & Reinforcement Learning", Presented by Mr. Tianjia Yang (CAMMSE INES Ph.D. research assistant), January 19, 2024, EPIC CEE Conference Room 3344.

[8] "Safety Effects of Work Zone Advisory Systems under the Intelligent Connected Vehicle Environment: A Microsimulation Approach", Presented by Mr. Mujeeb Abiola Abdulrazaq (CAMMSE INES Ph.D. research assistant), January 26, 2024, EPIC CEE Conference Room 3344.

[9] "2024 TRB Summary: Lectern Sessions – Part 1", Presented by Mr. Chengying Hua (CAMMSE INES Ph.D. research assistant), February 2, 2024, EPIC CEE Conference Room 3344.

[10] "Road Safety Modeling Based on Historical Data: Machine Learning Methods", Presented by Mr. Zehao Wang (CAMMSE INES Ph.D. research assistant), February 9, 2024, EPIC CEE Conference Room 3344.

[11] "Transit Signal Priority Control with Connected Vehicle Technology: Deep Reinforcement Learning Approach – Corridor Level Preliminary Results", Presented by Mr. Tianjia Yang (CAMMSE INES Ph.D. research assistant), February 16, 2024, EPIC CEE Conference Room 3224.

[12] "Measuring the Safety and Mobility Impacts of Connected Vehicles in A Work Zone Environment: An Agent-Based Modeling", Presented by Mr. Mujeeb Abiola Abdulrazaq (CAMMSE INES Ph.D. research assistant), February 23, 2024, EPIC CEE Conference Room 3344.

[13] "2024 TRB Summary: Lectern Sessions – Part 2", Presented by Mr. Chengying Hua (CAMMSE INES Ph.D. research assistant), March 1, 2024, EPIC CEE Conference Room 3344.
[14] "Spatiotemporal instability of Factors Affecting Active Traveler injury Severity: A Balanced Ensemble Method", Presented by Mr. Zehao Wang (CAMMSE INES Ph.D. research assistant), March 22, 2024, EPIC CEE Conference Room 3344.
[15] "Transit Signal Priority Control with Connected Vehicle Technology: Deep Reinforcement Learning Approach", Presented by Mr. Tianjia Yang (CAMMSE INES Ph.D. research assistant), March 29, 2024, EPIC CEE Conference Room 3344.

ITE Seminar Series @ TSU, Co-organized and sponsored by TSU ITE Student Chapter and CAMMSE

[1] Project Logistics Career Talk, Itoro Ibanga, Project Logistics Specialist, Air Liquide, October 31, 2023.
[2] ITS Technologies in Traffic Signal Control and Traffic Management, Peijia Tang, Senior Traffic Engineer, CUBIC, November 30, 2023.
[3] Blueprint for Success: Navigating the Path to Professional Excellence, Enamul Karim Fayek, Team Lead - Traffic, HNTB, February 1, 2024.
[4] Engineering in the City of Houston, Richard Smith, Managing Engineer, City of Houston, February 29, 2024.

Technical Reports

Nothing to report.

4. OUTCOMES

4.1. Increased understanding and awareness of transportation issues

Project 12 “Investigating the Impact of COVID-19 Pandemic Outbreak on Bike Share Usage and Ridership”, has significantly increased understanding and awareness of transportation issues. By examining bikeshare ridership patterns during the pandemic, the study sheds light on how public transportation behaviors change in response to external factors such as health crises. The findings underscore the resilience and adaptability of alternative transportation modes like bikeshare, particularly in times of disruption, and emphasize the importance of flexible and sustainable transportation solutions for urban communities.

There were more findings in Project 14 “Investigate Age Impacts on Controlled Flight into Terrain (CFIT) Crashes in General Aviation” regarding pilot-related factors on Controlled Flight into Terrain (CFIT) crash. By analyzing the CFIT accidents in General Aviation from 2016-2018, it was found that the majority of flights involved in CFIT accidents were operated by a single pilot. It was also found that pilots in most of the accidents were non-occupational pilots. Note that occupational pilots include commercial airplane pilots and airline transport pilots.

The outcomes of research conducted at UT Austin contribute significantly to our understanding of transportation issues, particularly concerning e-scooters and public transit systems. The e-scooter project sheds light on the dangers posed by excessive speeds and the complex legal landscape governing e-scooter operations, emphasizing the need for further research into e-scooter safety and the implementation of geofencing technologies.

In the realm of public transit, our research delves into the intricate balance between cost, revenue, and the equitable provision of services. While initially applied in a pandemic context, this methodology has demonstrated its robustness for everyday application, offering valuable insights into transit operations.

4.2. Passage of new policies, regulation, rulemaking, or legislation

Nothing to report.

4.3. Increases in the body of knowledge

Project 12 “Investigating the Impact of COVID-19 Pandemic Outbreak on Bike Share Usage and Ridership”, has made a valuable contribution to the body of knowledge on bikeshare systems and their response to external shocks like the COVID-19 pandemic. Through descriptive analysis and regression modeling, the study provides empirical evidence of how ridership dynamics evolve during unprecedented events, offering insights into the factors influencing bikeshare usage patterns. By documenting the increase in ridership during the pandemic and identifying significant variables affecting ridership levels, the research adds to our understanding of the complex interactions between public health emergencies, environmental factors, and transportation choices.

In Project 13 “Countermeasures for Maintaining Safe and Effective Public Transit Service in the Post-COVID-19 Era”, modeling results show that infection risk is highly correlated to the exposure time, and that more strategies aimed at reducing the exposure time should be considered. This finding indicates that the proposed strategy can control the COVID-19 infection risk and has a much lower cost compared with the capacity reduction strategy that has been widely used by the transit agency during the pandemic. Besides, other strategies, such as providing express service to passengers who need to take a long ride to reduce their exposure time, can also be considered.

The research conducted at UT Austin significantly contributes to the field of transportation by introducing advanced analytical methods that address micro-mobility safety issues and help transit authorities navigate the delicate balance between efficacy and equity in public transit. These methods encompass highly predictive machine learning techniques such as ridge regression, established statistical methodologies like causal mediation analysis, and the analytical hierarchy process (AHP).

Machine learning models play a pivotal role in predicting the likelihood of sustaining serious injuries after an e-scooter fall. Causal mediation analysis proves the effectiveness of geofencing in mitigating e-scooter crashes, while AHP facilitates high-level decision-making by prioritizing essential bus routes within the network. These methodologies offer valuable tools for policymakers, city planners, and transportation engineers seeking to establish safer and more sustainable transportation infrastructure.

4.4. Improvement of existing techniques, practices, technologies

The findings of Project 12 “Investigating the Impact of COVID-19 Pandemic Outbreak on Bike Share Usage and Ridership” have the potential to inform and improve existing techniques, practices, and technologies related to bikeshare operations and urban transportation planning. By identifying the positive impact of the COVID-19 pandemic on bikeshare ridership and the factors driving this increase, transportation policymakers and operators can better anticipate and respond to future disruptions. Additionally, the study highlights the importance of integrating bikeshare systems into broader transportation planning frameworks, especially for providing first-mile/last-mile solutions and reducing reliance on private car usage, thus contributing to more sustainable and resilient urban transportation systems.

4.5. Enlargement of the pool of trained transportation professionals

As a direct result of CAMMSE research funding, at least two PhD candidates at UNC Charlotte and two PhD candidates at UT Austin will complete their academic work this spring and summer and enter the work force.

4.6. Incorporation of new techniques, practices, technologies

Nothing to report.

5. IMPACTS

The CAMMSE is currently conducting a variety of research, education and outreach, technology transfer, and diversity activities and as such, the impact of this program cannot be comprehensively measured during this reporting period.

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

In project 13 “Countermeasures for Maintaining Safe and Effective Public Transit Service in the Post-COVID-19 Era”, the developed model can be used for assessing the effectiveness of different countermeasures and operational strategies that aim at reducing the COVID-19 infection risk of riding public transit. Thus, the findings of this study will help public transit agencies maintain safe and effective public transit services during the post-COVID-19 era and future pandemics.

The research conducted at UT Austin revealed that while the parking geofence indirectly influenced a portion of e-scooter crashes reported on campus, the speed reduction geofence did not demonstrate statistical significance in reducing crash rates or injury severity, even though the majority of crashes were caused by excessive speeds. This underscores the need for a more robust data collection system for micro-mobility trips and crash rates.

Furthermore, the research on public transit introduced a holistic method for generating a daily list of essential routes crucial to society. This approach carefully considers the balance between demand and current supply levels, providing valuable insights for transit authorities in their daily operational decision-making processes.

5.2. What is the impact of technology transfer on industry and government entities, on the adoption of new practices, or on research outcomes which have led to initiating a start-up company?

The results of project 14 “Investigate Age Impacts on Controlled Flight into Terrain (CFIT) Crashes in General Aviation” will help determine higher risk factors in general aviation and develop new policies and practices for improving the flight instructors' training and bi-annual flight reviews.

The research is performed by students and faculty supervisors who work closely with industry and government entities. As with the traffic volume estimation project, the working relationship with industry and government enables immediate technology transfer, plus the students who develop the new technology carry that knowledge with them into their eventual transportation sector employment.

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

The research findings from conducting CAMMSE projects increased the body of scientific knowledge. One of the best technology transfer tools is the students who work on these CAMMSE research projects. These UT Austin students are key to the technology development as they will carry the knowledge and technology developed through CAMMSE projects to the Transportation Engineering industry. They will carry the new technology with them and use it in their new jobs, teaching peers how to use the technology, thereby implementing the technology. Most importantly, these new techniques will continue to grow and improve as they are used.

5.4. What is the impact on transportation workforce development?

Engaging in CAMMSE's research initiatives allows students to gain firsthand experience with cutting-edge technologies and innovative methodologies for analyzing transportation-related challenges. This hands-on learning experience, guided by the mentorship of CAMMSE faculty members, equips students with the knowledge and skills that are essential for their future professional endeavors in the field.

Furthermore, CAMMSE's sponsorship of workshops and seminars presents invaluable opportunities for students to engage in dialogue with leading experts from both industry and academic spheres. These interactions not only enhance their understanding of the transportation sector but also significantly contribute to their career development by expanding their professional networks and exposing them to current trends and challenges in the field.

The professors at UT Austin have also used their classes to teach the new techniques developed through the CAMMSE UTC, therefore planting the new technology in students that are not directly supported by the UTC. In addition, information developed through UT Austin’s research is being shared with the City of Austin as a partner in the research efforts.

6. CHANGES AND PROBLEMS

6.1. Changes in approach and reasons for change

Nothing to report.

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

Nothing to report.

6.3. Changes that have a significant impact on expenditures

Nothing to report.

6.4. Significant change in use or care of animals, human subjects, and/or biohazards

Nothing to report.

6.5. Changes of primary performance site location from that originally proposed

Nothing to report.

6.6. Additional information regarding products and impacts

Nothing to report.

7. SPECIAL REPORTING REQUIREMENTS

(1) External Advisory Board: Available on the program website: https://cammse.uncc.edu/directory/external-advisory-board

(2) Financial and Annual Recipient Share Reports: The SF 425 requirements will be met by separate reports.

APPENDIX

CAMMSE @ UNC Charlotte Funded Projects, 2016-2018 (Year 1), All Completed

University	Principle Investigator	Category	Title of the Funded Project
University of North Carolina at Charlotte	Wei Fan	Advanced Research	Estimation of Origin-Destination Matrix and Identification of User Activities Using Public Transit Smart Card Data
	Wei Fan	Applied Research	Improving the Movements of People and Freight: A Case Study of the Piedmont Atlantic Megaregion
University of Texas at Austin	Randy Machemehl	Applied Research	Forecasting Ridership for Commuter Rail in Austin
	Randy Machemehl	Advanced Research	Corridor Level Adaptive Signal Control
University of Connecticut	Nicholas Lownes	Basic Research	Stochastic Multimodal Network Modeling
	Nicholas Lownes	Basic Research	Robust Routing, Assignment, and Simulation of Transit Systems
Washington State University	Xianming Shi	Applied Research	The Use of Connected Vehicle Technology to Facilitate Multimodal Winter Travel
	Jia Yan	Applied Research	The Effect of Competition of Transport Modes on Mobility
Texas Southern University	Mehdi Azimi Yi Qi	Applied Research	Use of Vessel Automatic Information System Data to Improve Multi-modal Transportation in and around the Ports
	Yi Qi	Applied Research	Use of Innovative Intersection Designs for Improving Mobility and Reducing Roadway Traffic Congestion

CAMMSE @ UNC Charlotte Funded Projects, 2017-2019 (Year 2), All Completed

University	Principle Investigator(s)	Category	Title of the Funded Project
University of North Carolina at Charlotte	Wei Fan	Advanced Research	Use of Multisensor Data in Modeling Freeway Travel Time Reliability
	Wei Fan Martin Kane	Applied Research	Using General Transit Feed Specification (GTFS) Data as a Basis for Evaluating and Improving Public Transit Equity
	Wei Fan Yu Wang	Applied Research	Evaluating the Potential Use of Crowdsourced Bicycle Data in North Carolina
	Wei Fan	Advanced Research	Impact of Connected and Automated Vehicles (CAVs) on Freeway Capacity
	Wei Fan	Advanced Research	Optimal Variable Speed Limit Control for the Mixed Traffic Flows in a Connected and Autonomous Vehicle Environment
University of Texas at Austin	Randy Machemehl	Applied Research	Characterization of Bicycle Rider Behavior among Various Street Environments
	Randy Machemehl	Applied Research	Evolution of Advanced Transit Signal Priority with Gap-Based Signal Recovery Strategy
	Stephen Boyles	Applied Research	Assessment of Parcel Delivery Systems Using Unmanned Aerial Vehicles
	Christian Claudel	Advanced Research	Deep-learning Based Trajectory Forecast for Safety of Intersections with Multimodal Traffic
University of Connecticut	Nicholas Lownes Charles Patton Kelly Bertolaccini	Applied Research	Investigating the Linkage between Transit Access to Services and Affordable Housing Availability
	Karthik Charan Konduri	Advanced Research	Development of Continuous Time, Temporally Constrained and Behaviorally Consistent Tour Pattern Generation System for Modeling the Impacts of Autonomous Vehicle Future
	Norman Garrick Carol Atkinson - Palombo	Applied Research	What Do We Want from Autonomous Vehicles (AVs)? Using Participatory Planning and Scenario Analysis of Alternative Futures to Identify Stakeholders' Desired Outcomes from the Strategic Deployment of Emerging Transportation Technology
Washington State University	Xianming Shi	Applied Research	Developing Friction Data to Support the Optimal Use of Pre-wet Deicing Salt for Enhanced Winter Mobility
	Xianming Shi	Applied Research	Modeling the Macroscopic Effects of Winter Maintenance Operations on Traffic Mobility on Washington Highways
Texas Southern University	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	Determination of Freeway Acceleration Lane Length for Smooth ad Safe Truck Merging
	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	Innovative Countermeasures for Reducing the Truck Waiting Time at Marine Terminals

	Mehdi Azimi Yi Qi Qun Zhao	Applied Research	Investigating the Impact of Different Attributes on Bicycling Mode Share as A Multimodal Connectivity Strategy in Large Cities: A Case Study in Houston

CAMMSE @ UNC Charlotte Funded Projects, 2018-2020 (Year 3), All Completed

University	Principle Investigator(s)	Category	Title of the Funded Project
University of North Carolina at Charlotte	Wei Fan	Applied Research	Predicting Travel Time on Freeway Corridors: Machine Learning Approach
	Wei Fan Martin Kane	Applied Research	Optimizing Transit Equity and Accessibility by Integrating Relevant GTFS Data Performance Metrics
	Wei Fan Yu Wang	Applied Research	Analyzing Cycling Behavior during Different Time Periods Using Crowdsourced Bicycle Data
	Wei Fan	Applied Research	Trajectory Optimization of Connected and Autonomous Vehicles (CAVs) at Signalized Intersections
University of Texas at Austin	Randy Machemehl	Applied Research	Forecasting Bicycle Facility Demand to Estimate Societal Impacts
	Randy Machemehl	Applied Research	Corridor Level Adaptive Signal Control (Phase II)
	Stephen Boyles	Applied Research	Assessment of Parcel Delivery Systems Using Unmanned Aerial Vehicles (Phase II)
	Christian Claudel	Advanced Research	Deep-learning Based Trajectory Forecast for Safety of Intersections with Multimodal Traffic (Phase II)
University of Connecticut	Jeffrey Cohen Nicholas Lownes	Applied Research	Highways and Wealth Distribution: A Geospatial Analysis
	Karthik Konduri Nalini Ravishanker	Applied Research	Are Transportation Network Companies Synergistic with Other Shared Ride Mode Offerings? An Exploratory Analysis of Demand Data from NYC Utilizing High Resolution Spatiotemporal Models
	Norman Garrick Carol Atkinson - Palombo	Applied Research	Understanding the Surprising and Oversized Use of Ridesourcing Services in Poorer Neighborhoods in NYC
Washington State University	Michelle Akin Xianming Shi	Educational Research	Multimodal Transportation Engineering Curriculum for Middle and High School Students
	Xianming Shi	Applied Research	Effects of Incorporating Connected Vehicle Technologies into No-Notice Emergency Evacuation during Winter Weather
	Ali Hajbabaie	Applied Research	Dynamic Speed Harmonization in Connected Urban Street Networks: Improving Mobility
Texas Southern University	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	Development of Guidelines for Implementation of Contraflow Left-Turn Lanes at Signalized Intersections
	Yi Qi Qun Zhao Mehdi Azimi	Applied Research	Signal Timing Strategy for Displaced Left Turn Intersections
	Mehdi Azimi Yi Qi	Applied Research	Impacts of Bicycling Corridor Improvements on Users' Behaviors in Large Cities

CAMMSE @ UNC Charlotte Funded Projects, 2019-2021 (Year 4), All Completed

University	Principle Investigator(s)	Category	Title of the Funded Project
University of North Carolina at Charlotte	Wei Fan	Applied Research	Travel Time Forecasting on a Freeway Corridor: a Dynamic Information Fusion Model Based on the Random Forests Approach
	Wei Fan Martin Kane	Applied Research	Optimization of Long-Term Highway Work Zone Scheduling
	Wei Fan	Applied Research	Impact of Connected and Autonomous Vehicles on Nontraditional Intersection Design: Superstreets
	Wei Fan	Applied Research	Machine Learning-based Trajectory Optimization of Connected and Autonomous Vehicles
University of Texas at Austin	Randy Machemehl	Applied Research	Quantification of Societal Bicycle Impacts (Phase III)
	Randy Machemehl	Applied Research	Corridor Level Adaptive Signal Control (Phase III)
	Stephen Boyles	Applied Research	Assessment of Parcel Delivery Systems Using Unmanned Aerial Vehicles (Phase III)
	Christian Claudel	Advanced Research	Deep-learning Based Trajectory Forecast for Safety of Intersections with Multimodal Traffic (Phase III)
University of Connecticut	Nicholas Lownes	Advanced Research	Prioritizing People - Mixed Equilibrium Assignment for AV Based on Occupancy
	Nicholas Lownes Timothy Becker	Advanced Research	Using Computational Biology to Mitigate Path Overlap in Transit Assignment
	Jin Zhu	Applied Research	Disaster Resilience through Diverse Evacuation and Emergency Transportation Systems
	John Ivan Amy Burnicki	Applied Research	Estimation of Pedestrian Volume Using Geospatial and Traffic Conflict Data
Washington State University	Xianming Shi	Applied Research	Multimodal Connected Vehicle Pilot for Winter Travel
Texas Southern University	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	A New Method for Estimating Truck Queue Length at Marine Terminal Gates
	Mehdi Azimi Yi Qi	Applied Research	Analysis of Intermodal Vessel-to-Rail Connectivity
	Mehdi Azimi Yi Qi	Applied Research	Bicycle Network Connectivity and Accessibility: A Study on the Effects of Bike Infrastructures on Bicycle Sharing System Demand

CAMMSE @ UNC Charlotte Funded Projects, 2020-2022 (Year 5), All Completed

University	Principle Investigator(s)	Category	Title of the Funded Project
University of Texas at Austin	Randy Machemehl	Applied Research	Impacts of Speed on Dockless Electric Scooter Crashes
	Randy Machemehl	Applied Research	Optimizing Type and Location of Pedestrian Crossing Signs at Non-signalized Intersections
	Christian Claudel	Advanced Research	Predicting Paths of Controlled Pedestrians at Intersections Using Deep Learning Models
University of Connecticut	John Ivan Amy Burnicki	Applied Research	Estimation of Pedestrian Compliance at Signalized Intersections Considering Demographic and Geographic Factors
	Carol Atkinson Palombo Norman Garrick	Applied Research	An Evaluation of the Transportation Equity Impacts of Uber and Lyft Usage in Chicago
	Nicholas Lownes	Applied Research	Pedestrian Behavior and Interaction with Autonomous Vehicles
Washington State University	Ji Yun Lee	Advanced Research	Effect of Connected and Autonomous Vehicles on Supply Chain Performance
Texas Southern University	Mehdi Azimi Yi Qi	Applied Research	Studying the Impact of Pandemic Outbreaks on Maritime Transportation and Port Operation
	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	Short Term Intersection Traffic Flow Forecasting
	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	The Impacts of COVID-19 on Public Transit

CAMMSE @ UNC Charlotte Funded Projects, 2021-2023 (Year 6), Some Completed, Some Ongoing

University	Principle Investigator(s)	Category	Title of the Funded Project
University of North Carolina at Charlotte	Wei Fan	Applied Research	Evaluating and Comparing the Impact of Connected and Autonomous Vehicles on Conventional Intersections and Superstreets (completed)
	Wei Fan	Advanced Research	Real-time Traffic Flow Prediction based on Spatiotemporal Patterns in Connected and Autonomous Vehicles Environment (completed)
	Wei Fan	Advanced Research	Online Cooperative Lane-changing Model of Connected and Autonomous Vehicles (completed)
	Wei Fan	Applied Research	Impact of Connected and Autonomous Vehicles on Signalized Intersections with Transit Signal Priority (completed)
	Wei Fan	Advanced Research	Dynamic Coordinated Speed Control and Synergistic Performance Evaluation in Connected and Automated Vehicle Environment (ongoing)
	Wei Fan	Advanced Research	Transit Signal Priority Control with Connected Vehicle Technology: Deep Reinforcement Learning Approach (ongoing)
University of Texas at Austin	Randy Machemehl	Applied Research	Impacts of Speed on Dockless Electric Scooter Crashes (Phase II) (ongoing)
	Randy Machemehl	Applied Research	Optimizing Type and Location of Pedestrian Crossing Signs at Non-signalized Intersections (Phase II) (ongoing)
	Randy Machemehl	Applied Research	Developing Robust Smart Traffic Signal Control (completed)
University of Connecticut	Nicholas Lownes	Advanced Research	Prioritizing People - Mixed Equilibrium Assignment for AV Based on Occupancy (Phase II) (completed)
	Nicholas Lownes	Advanced Research	Pedestrian Behavior and Interaction with Autonomous Vehicles (Phase II) (completed)
	Jin Zhu	Applied Research	Disaster Resilience through Diverse Evacuation and Emergency Transportation Systems (Phase II) (completed)
	John Ivan Amy Burnicki	Applied Research	Estimation of Pedestrian Compliance at Signalized Intersections Considering Demographic and Geographic Factors (Phase II) (completed)
Washington State University	Xianming Shi	Applied Research	Prediction of Traffic Mobility Based on Historical Data and Machine Learning Approaches (completed)
Texas Southern University	Mehdi Azimi Yi Qi	Applied Research	Investigating the Impact of COVID-19 Pandemic Outbreak on Bike Share Usage and Ridership: A Case Study in Houston (ongoing)

	Yi Qi Mehdi Azimi Qun Zhao	Applied Research	Countermeasures for Maintaining Safe and Effective Public Transit Service in the Post-COVID-19 Era (ongoing)
	Yi Qi Qun Zhao Mehdi Azimi	Applied Research	Investigate Age Impacts on Controlled Flight into Terrain (CFIT) Crashes in General Aviation (ongoing)

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