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<th><strong>Federal Agency/Organization</strong></th>
<th>U.S. Department of Transportation</th>
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<tr>
<td><strong>Federal Grant Number</strong></td>
<td>Grant No: 69A3551747120</td>
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<td><strong>Project Title</strong></td>
<td>Freight Mobility Research Institute (FMRI)</td>
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| **Report Term or Frequency (e.g. annual, semi-annual, quarterly)** | Semi-Annual report for FMRI – UTC. This report covers the period from July 1, 2019 to March 30, 2020, per Exhibit B, Grant Deliverables and Requirements for UTC Grants (November 2016) |
| **Signature of Submitting Official** |                                 |
Accomplishments

What are the major goals of the program?

The FMRI aims to promote strategic transportation policies, investment, and decisions that bring lasting and equitable economic benefits to the U.S. and its citizens. The Center mission is to address critical issues affecting the planning, design, operation, and safety of the nation’s intermodal freight transportation system, in order to strengthen our nation’s economic competitiveness. Efficient and safe freight movement is inextricably linked to the economic vitality of a local area, state, region, and beyond. In consultation with stakeholders, as well as USDOT’s strategic priorities, as expressed in FAST Act Improving Mobility of People and Goods priority and the known exclusive topic areas established by the Secretary of Transportation, we will focus on research and development that improves freight mobility through information technology, freight network modeling and operations, intermodal logistics, as well as freight and supply chain sustainability to promote smart cities, improve multimodal connections, system integration, and security, data modeling and analytical tools to optimize freight movements and improve efficiency. Also, to advance regional planning and setting of transportation priorities that deliver higher practice, economic growth and enhance productivity.

Major center activities are as following:
Advanced & Applied Research Improving Freight Mobility: Our research activities are multimodal/intermodal and multidisciplinary in scope, with the aims of addressing nationally and regionally significant transportation issues pertinent to economic competitiveness and providing practice-ready solutions. We have assembled top experts on supply chain and logistics freight transportation, network modeling, sustainability, and Intelligent Transportation Systems (ITS), representing leading universities across the nation with deep connections to local, state, and regional communities. Each of these universities has an established transportation research center/lab with top quality faculty conducting cutting-edge research. We are motivated to embrace innovative research projects, train the current and future transportation leaders and workforce, and engage with the industry to enhance collaboration between agencies by improving transport efficiency and safety, first- and last-mile efficiencies, sustainably, traffic congestion reduction, and develop tools and procedures to ensure interoperability today and in the future.

FMRI is well-poised to address a variety of issues directly applicable to the US DOT strategic goal of economic competitiveness. In consultation with our respective state DOTs and metropolitan planning organizations, as well as US DOT strategic priorities, our first years of operation will focus on improving freight fluidity in four major research areas:

- Information Technology
- Freight Network Modeling and Operations
- Intermodal Logistics
- Freight and Supply Chain Sustainability

Education, Workforce Development, Technology Transfer, & Diversity: The consortium is committed to providing high-quality transportation education and workforce development programs for a broad and diverse audience. The Center’s efforts will support the development of a critical transportation knowledge base and a transportation logistics workforce that is prepared to design, deploy, operate, and maintain the complex transportation systems of the future.

FMRI’s effort towards K-12 initiatives include the following:

- Increased minority focus student participation in transportation education.
- Workforce development and increased minorities participation in transportation field.
- Educated High School teachers as well as students in logistics and supply chain management.
What was accomplished under these goals?

In the first and second year, the center developed guidelines and procedures for inviting research and educational proposals. The submitted proposals conducted by external peer reviews and the approved proposals selected for funding. FMRI research program aims to generate a body of knowledge that makes a significant contribution to solving freight transportation problems and improve freight mobility. First- year endeavors were a set of pre-selected launch projects from proposals submitted and reviewed during the proposal preparation process, which has allowed us to begin the research during Fall 2017. As the second-year research projects almost completed, results from the data have been recorded and has been tested and/or deployed by the engaged stakeholders. Also, please find listed below a brief description of the third-year project that have been awarded by the FMRI. The first-year projects have been completed and are currently located on the FMRI website. The second-year projects final report, are going to be published on the FMRI website by summer 2020. Please explore the FMRI website for in-depth project results.

**Second Year Research Projects:**

During the period (April 2018 - September 2018), the center has developed their second-year Request for Proposals (RFP) for research projects through discussion with the advisory board and the stakeholders. These projects were conducted, late Fall 2018 and/or Spring 2019 depending when the project amendment has been signed. For further details, you may find the overview of these projects listed on the FMRI website.

- FMRI Y2R1-18: Interactive web-based Platform for Analyzing Freight Data – Phase I (PI: Dr. E. Kaisar, Florida Atlantic University, Subcontractors: Dr. P. Edara, University of Missouri)
- FMRI Y2R2-18: Sustainable Urban Freight Mobility through Optimization of Logistics Facility Locations (PI: Dr. E. Kaisar, Florida Atlantic University; Co-Investigator: Dr. L. Du, PhD, University of Florida)
- FMRI Y2R3-18: Disaggregation of Freight Flows for Tennessee (PI: Dr. M. Gkolias, University of Memphis)
- FMRI Y2R4-18: Truck Parking Study: Unveiling the Parking Space Density and Truck Volume Relationship: Phase II (PI: Dr. B. Wang, Texas A&M University)
- FMRI Y2R5-18: Optimization of Winter Maintenance Stations for Safe and Efficient Freight Transportation (PI: Dr. A. Khani, University of Minnesota)
- FMRI Y2R6-18: Modeling the Impacts of Regulations and Safety Constraints on UAVs Costs and Emissions - Phase II (PI: Dr. M. Figliozzi, Portland State University)
- FMRI Y2R7-18: Next Generation of Freight Planning and Operation Models to Incorporate Emerging Innovative Technologies (PI: Dr. M. Figliozzi, PhD, Portland State University, Co-PI: Dr. E. Kaisar, Florida Atlantic University; Co-PI: Dr. M. Gkolias, University of Memphis)
- FMRI Y2R8-18: Dynamic Trajectory Control and Signal Coordination for a Signalized Arterial with Significant Freight Traffic (PI: Dr. Y. Zhang, Texas A&M University)
- FMRI Y2R9-18: Truck Parking Needs in Tennessee (PI: Dr. M. Gkolias, University of Memphis, Subcontractors/Co-Pis: D. Murray, American Transportation Research Institute; A. Kohls, University of Tennessee, Knoxville; C. Cherry, University of Tennessee, Knoxville)
- FMRI Y2R10-18: Two-lane Highway Analysis Methodology Enhancements Considering Commercial Trucks (PI: Dr. S. Washburn, University of Florida)

**Third Year Research Projects**

During the period (March 2019 - September 2019), the center has developed their third-year Request for Proposals (RFP) for research project including various discussions held with the advisory board and stakeholders.

- FMRI Y3R1-19: Analysis of Freight Movement Within Regional Evacuations (PI: Dr. E. Kaisar, Florida Atlantic University, Subcontractors: Dr. S. Parr, Embry-Riddle Aeronautical University)

Natural disasters are one of the most common emergency events in the United States. Florida is a state that frequently suffers from such events, specifically hurricanes. As the number of major hurricanes increases, the need to ensure resilient freight movement in the wake of a disaster is ever present. Unfortunately, as a major storm approaches, evacuating traffic represents a significant disruption to freight logistics. At a moment when cargo...
ships are vital to prepare for and recover from a regional national disaster, freight transportation operates at a diminished capacity. The high demand for essential goods, compounded by a hindered ability to move these goods, constitutes a significant vulnerability on a national level. This research seeks to explore freight movements before, during, and after an emergency evacuation in support of identifying lessons learned and best-practices for future planning. The goal of this research is to build upon the prior knowledge and expand the scientific understanding of freight movements on the surface transportation network before, during, and immediately following a regional evacuation and major hurricane. The research goal will be achieved by investigating the movement of goods along Florida’s trucking routes in the weeks leading up to and following the September 10, 2017 landfall of Hurricane Irma. The 2017 evacuation from Hurricane Irma has been referred to as the largest evacuation in the history of the United States. Approximately 6.5 million Floridians were placed under either mandatory or voluntary evacuation orders (Marshall, 2017). This event undoubtedly had a significant impact on the freight movements across the state. The proposed research will take an empirical approach to quantitatively describe the movement of freight during this disrupted period to investigate what happened and what can be learned for future events.

FMRI Y3R2-19: Identification and Evaluation of Critical Urban Freight Corridors (PI: Dr. E. Kaisar, Florida Atlantic University)
There has been a steady increase in demand for goods over the past half-century and therefore there is a continuous need for well-organized freight transportation systems. Optimal use of roadways as the primary and fundamental sector of the freight transportation system is essential. Efficient movement of freight is vital to the rivaling economies of cities and metropolitan areas, and truck highway corridors comprise an essential ingredient of the regional freight transportation system, along with rail and intermodal facilities, river-port barge terminals, and air cargo facilities. To achieve efficient, reliable and robust freight movement, the Fixing America’s Surface Transportation (FAST) Act requires the Federal Highway Administration (FHWA) to establish a National Highway Freight Network (NHFN) to strategically direct Federal resources and policies toward improved performance of the NHFN. The main objectives of FAST are to make the Federal surface transportation more streamlined, performance-based, and multimodal, and to address challenges facing the U.S. transportation system, including improving safety, maintaining infrastructure condition, reducing traffic congestion, improving the efficiency of the system and freight movement, protecting the environment, and reducing delays in project delivery. This network is the focus of funding under The National Highway Freight Program (NHFP), and a significant funding target under the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Grants Program (Nationally Significant Freight and Highway Projects Program) (23 U.S.C. 117). The NHFN consists of the following four subsystems: (1) the Primary Highway Freight System (PHFS); (2) those portions of the Interstate System not part of the PHFS; (3) Critical Rural Freight Corridors (CRFCs); and (4) Critical Urban Freight Corridors (CUFCs). (23 U.S.C. 167(c)). The ability to entirely understand and accurately designate freight vehicle route choices is essential in helping to inform regional and state decisions. Specific criteria and requirements exist for identifying and designating CRFCs and CUFCs according to FHWA. This research will focus on CUFCs and the mobility of goods especially on the first-/last-mile links leading to them. Critical Urban Freight Corridors (CUFC) are public roads in urbanized areas which provide access and connection to the primary highway freight system for ports, public transportation, or other intermodal transportation facilities. After identifying the critical urban corridors, as FHWA encourages when making CUFC designations, it is crucial to consider first or last mile connector routes from high-volume freight corridors to freight-intensive land and key urban freight facilities, including ports, rail terminals, and other industrial-zoned lands. Therefore, investigating the first-/last-mile connectors is necessary to inspect the condition of the route regarding how congested it is and figuring out the necessity of modifying the mobility of the area by innovative and cutting-edge technologies.

FMRI Y3R3-19: Integrate Autonomous Delivery Vehicle into Sustainable Urban Logistics Planning and Optimization (PI: Dr. E. Kaisar, Florida Atlantic University)
The ongoing urbanization presents a challenge both to enterprises who want to adapt to the change and delivery goods more efficient, also the policymakers who can positively impact urban logistics in terms of trade-off decisions on economic and environmental impact. As sustainable urban distribution system becomes one of the most recent trends, hubs are augmented with smaller logistic centers in the city. Nowadays, different technologies and strategies regarding environmental problems appear, which aim to improve the urban logistics in general and the last mile delivery, for example electric cars or cargo bicycles. Current projects suggest that air-based drones are good for rural
and suburban areas for the last mile delivery, but not so ideal for urban centers, especially in dense area, where ground and road-based robots will dominate. Autonomous delivery vehicles (ADV) as a new element of ground-based delivery services are a more practical solution in cities, which has the potential regarding the last mile delivery to customers to reduce the urban road traffic and emissions. We will discuss the ADV combined with truck transportation regarding the urban sustainable freight delivery network. A multi-modal and multi-objective optimization model is proposed to simultaneously minimize the aggregate operating cost and reduce carbon dioxide emission. Also, delivery hubs from alternative hubs are chosen for ADV positioning. A hybrid artificial immune algorithm and genetic algorithm will be used to solve the problem. We would like to apply it to a case study comparing the Economic and Environmental performance in both unimodal delivery method and combined delivery using truck-Autonomous delivery vehicle (TADV). Finally, sensitivity analysis will be used to assess the robustness of the results of the model in the presence of uncertainty. Motivated both by the adoption of new delivering technologies (ADV) in practical transportation industry, and the theoretical gap existing in the present literature, a network planning problem for the cooperated truck and ADV is studied. The primary objective of this study is to develop an urban logistics optimization modal in terms of minimizing the logistics operating cost and carbon emission using TADV from the point of authorities. Simultaneously, the best locations from a set of existing stations are selected for ADV positioning and optimal flow assignment. This research would provide decision support to government authorities, logistics service providers, and other relevant decision makers on sustainable urban logistics planning.

FMRI Y4R4-19: Managing the Growth of Last-mile Deliveries and Curb Space Demand (PI: Dr. M. Figliozzi, Portland State University, Co-PI: Dr. A. Khan, University of Minnesota)

According to the United States Census Bureau’s Quarterly E-Commerce Report (USCB, 2018), E-Commerce sales in the United States (US) have increased at an average annual rate of 16% in the past two decades. This rapid growth of e-commerce and package/service deliveries is creating new challenges in urban areas. Static strategies, currently utilized in for the most part in urban areas across the US, to manage parking and allocate curb space have not kept pace with the rapid change observed on the demand side. There is a lack of conceptual approaches and analytic methods to manage scarce resources and reduce environmental impacts. This project leverages expertise from two universities, Portland State University (PSU) and University of Minnesota (UMN) and attempts to accomplish these objectives: (1) to model the allocation and benefits of new delivery systems (such as shared lockers) to improve last-mile efficiency, (2) to model the utilization of existing parking and curb resources by different delivery environments, vehicle types, and new delivery systems, and (3) to outline best practices and policy guidelines to deal with the growth of e-commerce and package/service deliveries. The growth of ecommerce is blurring traditional definitions and categories. This research addresses both the growth of deliveries for services and packages. For example, Uber Eats and Instacart can be considered both meal and grocery delivery services whereas FedEx and UPS are more traditional package delivery companies. Some companies are fleet based (e.g. UPS) whereas others can be crowdsourced (e.g. Instacart), however, both types of companies utilize parking/curb space are within the scope of this research.

FMRI Y3R5-19: Fathoming the Maximum Potential for Freight Sensitive Intersection Control (PI: Dr. B. Wang, Texas A&M University)

This project parallels the other one submitted at TAMU PI-ed by Professor Zhang that deals with the freight significant corridor traffic control. This one instead fathoms the potential of an individual intersection when freight traffic is present. Freight vehicles have significantly different attributes in kinetic movement, economic values (e.g. value of time) and environmental effect. The two projects enhance each other by deepening understanding of the point and network benefits of intersections, respectively. At a general intersection, how to appropriately and optimally consider freight and passenger vehicles is a problem that has not been addressed well in literature. Current video cameras popularly used for actuated traffic control have the potential to easily differentiate freight vehicles from passenger cars with today’s technology. Video camera can also obtain much real time vehicular information. In such an information driven environment, how to conduct signal control by considering relevant factors such as economic values are an interesting and significant problem. This study will examine the optimal mechanism of the general intersection signal control when a mix of freight and passenger traffic is present. A model and according algorithms will be developed to apply to the general urban intersections. Numerical test via simulation will be
conducted to show the benefits of the developed model and algorithms. Discussion with industry will be taken place for inputs and potential application. We will reach out to the traffic control center of the City of College Station and deliberate with its in-house consultants about potential implementation. The goal of this study is to deepen the understanding of the tradeoffs for right of way between the different groups of vehicles and to provide an according mechanism to optimize the signal control.

**FMRI Y3R6-19: Optimal and Robust Control of vehicle Platooning on Signalized Arterial with Significant Freight Traffic (PI: Dr. Y. Zhang, Texas A&M University)**

Significant freight traffic affects the performance of the whole transportation network in a more sensitive and significant way compared to other traffic in the aspects of mobility, environment, and safety. Trucks need extra distance and time for deceleration and acceleration, and their interactions with other types of vehicles can cause more non-uniformity to the traffic due to their lengths and speeds. Therefore, slowdown or bottleneck appear more easily at a segment where freight traffic is significant. It has been shown in the research of FMRI first-year project that the coordination of signals often fails when the demand is composed of a large portion of trucks. Strategies have been developed in FMRI second-year project to formulate multiple trucks trajectories to pass consecutive signals individually and cooperatively considering mixed traffic conditions. However, a curial problem still remains: significant truck traffic presents the opportunities for truck platooning but since trucks are controlled to formulate platoons to improve mobility, the stability problem exists in the process of platoon evolving when a platoon is approaching a signalized intersection, or when the platoon is merging or splitting. The safety should be ensured in these dynamic processes and the ability to resist disturbance or interruptions should be considered. Thus, a stability analysis is needed for each platooning scenario and a robust control design is applied to ensure the applicability and safety of all those control strategies. This is a necessary and crucial topic for traffic control and operation under significant freight traffic. In the first step of this proposed research, a stability analysis between dynamic trajectories of different vehicles under different scenarios will be investigated. Stability in the process such as truck platooning approaching a signalized intersection, merging and splitting will be analyzed. In the next step, truck platoon evolving strategies over the signalized corridor will be designed with robustness and optimality to ensure the stability of the platooning processes, with signal control for better mobility as part of the consideration. The expected outputs will be suitable control parameters for different platooning scenarios and an optimal and robust controller for the corridor considering truck platooning and signal control.

**FMRI Y3R7-19: Identifying Critical and Vulnerable Freight Routes in Roadway Networks: A Game Theory Frameworks and Application in the State of Florida (PI: Dr. M. Gkolas, University of Memphis; Co-PI: Dr. E. Kaisar, Florida Atlantic University, Co-PI: Dr. J. Hourdos, University of Minnesota)**

Transportation networks are by nature vulnerable to natural and man-made disasters (or incidents). Vulnerabilities of transportation networks have been widely studied in recent years and are gaining even more attention with the growing number of threats (e.g., climate change, man-made attacks). In the US the transportation network is one of the largest and oldest in the world making also one of the most vulnerable. As traffic demand increases (despite the decrease in vehicle miles traveled) decision-makers are faced with the important task of identifying the vulnerable and critical links and routes in the transportation network and make decisions on investment that will protect and fortify the network against attacks. Addressing network vulnerabilities of transportation assets, in general, will minimize impacts of disruption, reduce recovery time and improve on the region’s resilience. In this project, we will improve and implement on a testbed in Florida mathematical models and tools developed by Gkolas et al. (2018) to identify critical and vulnerable links and/or paths with a focus on freight movements.

**FMRI Y3R8-19: Incorporating Freight Regional Land Use Planning Models (PI: Dr. S. Mishra, University of Memphis)**

Forecasting of freight demand in land use models has been a challenge over many years in transportation planning and hence many regional planning agencies face challenges to systematically plan for future infrastructure needs. One of the critical factors in freight and land use is commodity flows. Other factors include location factors, physical factors, operational factors, dynamic factors such as seasonal variations in demand and changes in customers’ preferences, and pricing. Modeling commodity flows with land use is one possible first step; however, it has some limitations as land use data lacks detailed information on economic activities, in particular land use. The commodity flow survey conducted by census every five years captures only three to five percent of observations of the total population and cannot provide the amount and accuracy level required by these models. Further, the propriety
nature of freight data makes it difficult to obtain information on commodity type, value, geographic information etc. This project aims to explore how freight can explicitly be incorporated into classical and next generation land use models. The project will use a case study region (in TN) to demonstrate how freight can be integrated to land use models.

**Fourth Year Research Projects:**

During this period (October 2019 – March 2020), the center has developed their fourth-year Request for Proposals (RFP) for research projects and educational activities that underwent though discussion with the advisory board in the Transportation Research Board Annual meeting, January 2020, and in the follow up FMRI advisory board online meeting on March 2020. Also, FMRI researchers has established round table discussions with the stakeholders on various freight transportation issues regarding potential research ideas for the fourth-year projects. The center is planning to receive the proposals by the middle of May 2020. These proposals will be sent for full external peer review, with each project having at minimum of three external reviewers. Each project will be revised to reflect the comments from each peer reviewer. Once revised by the PI, these projects will be viewed by the Advisory Board and changed accordingly, as needed. The selected projects approved by the FMRI executive committee will be executed by September 2020 depending on COVID-19 pandemic and when the project amendment will be been signed. You may find the overview of these projects listed on the FMRI website, as well as the previous Program Project Progress Report.

**Education and Workforce Development:**

FMRI’s education goal is to foster education and training to contribute to the development of the transportation workforce. Our approach is multi-disciplinary, multimodal, and under this grant we are developing a series of education activities, from K-12 to graduate level. These programs were built on the education and training programs available at the consortium universities. For our second and third-year educational projects, the center developed two educational projects that are almost completed at our consortium locations: Hampton University, University of Florida, and Florida Atlantic University.

**Curriculum Development for Highway Freight Transportation (PI: S. Washburn, University of Florida; Co-PIs: L. Du, University of Florida; and Dr. E. Kaisar, Florida Atlantic University)**

Coverage of freight transportation in a university curriculum is rarely comprehensive and instead usually consists of sprinkling a few related topics throughout a range of courses within the broader curriculum. One challenge to offering a focused and comprehensive course on highway freight transportation is the dearth of curriculum material across the full range of relevant topics. The objective of this project is to develop curriculum content that can be used for an entire 1-semester course focused on highway freight transportation. The focus of the curriculum will be on providing a fairly high-level overview of the transportation of goods via commercial trucking. The focus leans more towards breadth than depth. The primary format of the material will be PowerPoint slides, but a number of example problems and active learning exercises will also be developed.

**Transportation and Workforce Development Project (PI: S. Maheshwari, Hampton University)**

The expanding transportation industry in the U. S. has a growing need for professionals qualified to manage advanced transportation systems. With up to 50% of the current workforce expected to retire in the next ten years, the industry faces a challenge of finding replacements. The overall goal of the proposed Education and Workforce Development Project is to attract and educate the next generation of transportation professionals through well-designed program of coursework, guest lectures, case studies, and experiential learning that reinforces classroom knowledge. The transportation education project will incorporate related programs offered by various departments within the University integrating research results into courses to produce a well-trained, effective, and efficient workforce. The partnerships with the transportation industry will offer students experiential learning through co-
ops and internships. Special focus will be placed on K-12 education. Based on First Year connections, the K-12 programs will be expanded.

Continuing the pursuit of the Transportation and Workforce Development Project, FMRI has accomplished the items listed below:

Major Activities:
1. Lecture Series and Seminars related to Transportation Management and Logistics from FMRI Consortium Partners
2. Student Internships focusing on minorities
3. High School Teachers Workshop on Transportation Planning and Logistics
4. K-12 Student Transportation Essay Competition
   a. Bethel High School, Hampton, VA
   b. Heritage High School, Newport News, VA
5. Expand scholarship opportunities for students
6. K-12, undergraduate and Graduate Students intermodal facilities field trips
7. K-12 Transportation Science Fair program
   a. Bethel High School, Hampton, VA
   b. Heritage High School, Newport News, VA
8. Board of High School curriculum planning
9. Transportation and Logistics Summer Camps

Specific Objectives:
1. Minority student education—2, 4, 5 and 7 above
2. Increase minority participation—1 through 8 above
3. Increase K-12 participation –1 through 8 above

Significant results:
1. Minority student education—Lectures, Seminars, Workshops
2. Increase minority participation and interest in the field—Internship, scholarships and field trips
3. Increase K-12 participation –Lectures, Workshops, Field Trips, Essay and Science Fair

The development and implementation of graduate courses in our consortium continues, as an example CGN 5935 Advance Transportation and Logistics management has played a key role in education and workforce development for the summer 2020 semester at Florida Atlantic University. The course is going to be offered virtually with many benefits to the consortium members. Transportation system management and operations strategies provide multimodal solution that relieve congestion, optimize infrastructure investments, promote travel options, and reduce greenhouse gas emissions. Modeling of complex interactions and causal relationships among current issues. Transportation modes and technologies, vehicle dynamics, basic facility design, capacity analysis, transportation planning, evaluation and choice, network analysis, logistics, and ITS. Transportation risk assessment and computation; evacuation modeling; reliability analysis; infrastructure interdependency analysis; network impact assessment. In addition, in Spring 2020 an undergraduate course offered, TTE 4005 Transportation Planning and Logistics, focusing in air, rail and marine transportation. Designed and delivered to meet the needs of working professionals. This online course has the opportunity for interaction between a group of students and faculty consisted by six modules and was presented in an integrated, indiscipline and industry relevant approach. We were planning with the FMRI Research Associate, to visit the state-of-the-art transportation management center, in South East Florida, to discuss transportation management techniques and how to improve logistics through transportation.

The established certificate in Transportation, Logistics and Supply Chain Management curriculum provided from FMRI and has been approved by the University Senate. The certificate was established by the Department of Information Technology and Operations Management (ITOM) in the College of Business and the Department of Civil, Environmental and Geomatics Engineering (CEGE) in the College of Engineering and Computer Science at Florida Atlantic University. This 12-credit certificate permits graduate students to expand their knowledge on technical skills
The Freight Mobility Research Institute (FMRI) in collaboration with the College of Engineering at FAU, will sponsor two or three Summer Engineering and Technology Camps for students from middle schools across Palm Beach and Broward counties in South East Florida. The camps are scheduled to take place face to face or virtually in June and/or July 2020. Also, the FMRI had offered two Summer Engineering and Technology camps at the main FAU campus, Summer 2019, as part of college annual STEM education initiative directed by Jessica Hibberd and George Edmonds of the FAU College of Engineering and Computer Science. With help from Dr. Sharad K Maheshwari, Professor in the Department of Business Administration in Hampton University and Dr. Dan Liu, Postdoctoral Researcher in FMRI, as well as the minority students Ms. Taranee Ardalan and Ms. Panagiota Goulianou, graduate research assistants at the FMRI FAU, a five-day Transportation Engineering Camps were facilitated. The transportation camps covered the basics of transportation engineering, SPSS based data analysis, freight operations and logistics, intelligent transportation systems (ITS), connected vehicles, origin destination calculation, and traffic count observations. The FMRI faculty visit and presented in High Schools and demonstrate our research findings. In addition, high school students have been invited to visit the state of the art FMRI facilities. During these visits, the students engaged in undergraduate research process by contacting small transportation studies on the FMRI facilities and the surrounding area. Also, the FMRI faculty and engineering staff served as judges for STEM completions. Additionally, other consortium members were involved with their universities educational summer activities such as Hampton University, University of Florida, University of Minnesota and Texas A&M University.

FAU ITE Student Chapter Lecture Series at Florida Atlantic University

The FMRI aims to contribute to the life-long learning of transportation engineering. Along with classroom experiences, educational initiatives sponsored by the FMRI would provide opportunities to students to become familiar with numerous fields of transportation engineering and gain practical experience and knowledge. The center is a proud affiliate of the Institute of Transportation Engineering (ITE), the recently established Advancing Women in transportation (WTS) at FAU, and other ITE student chapters from the consortium members. The FAU ITE Student Chapters is actively collaborating with the FMRI to organize an educational lecture series. Below are the listed lectures from this reporting period.

October 9, 2019 – Charles Edwards, Director, NCDOT Office of Logistics and Freight. “Planning for Freight Flows-From the Perspective of the City and regional Planners”.

October 14, 2019 – Dr. Anusha S.P., Assistant Professor, APJ Abdul Kalam Technological University, Kerala, India. “Application of Automated Sensor Data for Development of Estimation Models for Real Time Traffic Management”.


November 14, 2019 – Dr. Rodrigo Mesa-Arrange, Florida Institute of Technology. “Port Planning Under Deep Uncertainty”.

January 22, 2020 – Dr. Louis Merlin, Florida Atlantic University. “From Mobility to Accessibility: Transforming Urban Transportation and Land-Use Planning”.


March 6, 2020 – Ms. Panagiota Goulianou, Florida Atlantic University, “A Mathematical Modeling Approach Using Time Constraints: The Case Study of Economics of Scale and Sustainability in Intermodal Facilities”.

of transportation engineering and the analytical business decision-making skills of supply chain management. This certificate program has strong connections with logistics industry of Southeast Florida.
How have the results been disseminated?

The project reports are published to the FMRI website and presented at FMRI lecture series, which are open to the public. Preliminary results are often presented at peer review conferences and stakeholders’ meetings, such as Brown Bag meeting with the local state agencies, and the metropolitan planning organizations (MPO). All research projects are expected to result in refereed journal publications. In addition, dissemination is via new graduate courses and developed certificate programs, internship assistance, employment opportunities, professional development seminars and distinguish lecture series, and our website.

Furthermore, the FMRI research seminars and webinars serve as a forum for faculty, industry, and graduate students to present their research and work. Seminars and lecture series take place during Fall and Spring semesters, open to public, and are well-attended. Facebook and Twitter have been used to share our news, events, workshops, and other content. The center is using social media to drive more traffic to the website. Also, the center established webinars that was placed in Fall 2019. In October 2019, Dr. Anusha S.P., Assistant Professor, APJ Abdul Kalam Technological University, Kerala, India. She presented in FMRI/ITE FAU student Chapter lecture series her work in Application of Automated Sensor Data for Development of Estimation Models for Real Time Traffic Management. This was our first webinar that we broadcasted in collaboration with the Nebraska Transportation Center.

The FMRI was working to organize the seventh regional UTC conference in March 26th-27th in Boca Raton, Florida. This annual conference was established in 2013 by a consortium of University Transportation Centers (UTCs) to bring together transportation professionals from both the private and public sectors, faculty, and students from all over the Southeastern region. The theme of the seventh regional UTC Conference was on Connected Vehicles in Smart Cities: The Future of Transportation and Logistics. We were hoping that this conference would provide an opportunity to convey the most recent autonomous transportation research innovation and focus how connected and autonomous vehicle technologies play a role on the smart city concept and to advance its development even further. However, in view of the great global concerns about COVID-19 the conference has been postponed to Fall 2020.

The FMRI has established quarterly newsletters sent through the email distribution platform to update stakeholder’s, state and federal agencies, and other interested parties on the progress of the center. In addition, the FMRI published monthly newsletter with focus on the presentation of research findings and educational activities. Through peer review conferences, the center has held workshops and co-sponsorship throughout this period. The purposes of these workshops were to disseminate our research findings and to encourage collaboration between different agencies and institutions:

_Smart Initiatives and Intelligent Freight Transportation – Current Applications and Guidelines for Future Development, IEEE Intelligent Transportation Systems Conference- ITSC 2019, Auckland, NZ – October 2019._ This workshop, aims to address critical issues affecting planning, design, operation, and safety of the nation’s intermodal freight transportation systems, in order to strengthen nation’s economic competitiveness through efficient freight mobility. In addition, this workshop will focus on current developed and deployed applications worldwide, and current research in this area as well discuss the guidelines for future development. Break-out sessions will introduce participants with the whole concept of Smart Freight Mobility as well serve for information exchange of the research accomplishments.

_Improving Last-mile and 50 Feet Logistics with Smart Initiatives to Improve Freight Mobility. Transportation research Board Annual Meeting, Washington DC, – January 2020._ The workshop objectives are to one) identify innovative strategies and technologies which are being employed / developed to facilitate ‘last mile’ / ‘last 50 feet’ delivery challenges from around the world, and two) to establish a process to evaluate operational changes or technology applications which support the timely flow of freight movements through the transportation system. Additionally, it will deal with various newly emerged initiatives in the area of logistics and supply chain, such as sustainable logistics systems, methods for last mile deliveries and logistics terminals siting and operations. The workshop break-out sessions will engage participants and facilitate research-oriented discussions.
What do you plan to do during the next reporting period to accomplish the goals?

FMRI second-year projects are all almost complete and research findings will be disseminated as needed. FMRI third-year Research RFP projects were awarded in Fall 2019. The center’s Advisory Board oversaw the review process and we were planning to have a quarterly conference calls to discuss the progress of the year three projects. Our consortium research selection goal is to develop a comprehensive program that focuses on solving high-priority freight transportation, logistics and sustainability of supply chain problems. In subsequent years, the center will establish an annual request for proposals focusing on the stated theme as well as high priority needs expressed by our public and private sector partners. For example, these days our nation has major issues in regards to COVID-19 that has popularized the term supply chain management due to the unprecedented, rapid and devastating effects that such a pandemic may cause for supply chains that literally keep society functioning. Many US companies have reported significant disruption to their supply’s chains due to the coronavirus pandemic.

The center will continue their relationship with their stakeholders and State DOTs on cost-share projects and other collaborative efforts in order for the FMRI to successfully deploy their technology transfer to the community. The center will also explore collaborative opportunities with local private and public sector entities in order to develop needed freight related research.

The FMRI will also develop local community educational and technology transfer efforts to advance the knowledge on transportation supply chain, management, logistics, and operations, especially the challenges we’re all facing as the result of COVID-19. For the educational initiative, FMRI plans are to:

1. Implement the approved third-year projects, --More K-12 involvement
   a. An additional workshop for K-12 teachers;
   b. Workshops on preventing supply chain disruption during pandemic crisis
   c. Essay Competitions;
   d. Transportation & Logistics Science Fair;
   e. Participating in ITS America’s for technology;
   f. Logistics & Summer Camps Summer Camps & Invited practitioners;
   g. High School Presentations and Volunteer Participation as Judges in STEM competition;
   h. Internship for minority students with local stakeholders;
   i. Curriculum planning

2. Begin the third-year RFP educational projects, to build on the continuing educational project;

3. Continue dissemination of research results via our website, professional presentations to stakeholders, technical workshops and our seminar and webinar series

In addition, the FMRI has a new pre-collegiate effort that we are preparing to launch this fall. FMRI is planning to work with select high schools that have comprehensive Engineering/STEM Programs. We will reach out to these teachers to engage their students through a unique project that they would work on throughout the Fall semester. Then, in February 2021-during Engineers Weeks, we would bring these students to the consortium members campuses and engage them in a full day where these students present their projects in front of a panel of industry partners, stakeholders and consortium members, and FMRI alumni. We plan to incorporate facility tours, hands on activities and experiments that can be related to FMRI theme.

Participants & Collaborating Organizations

What organizations have been involved as partners?

The FMRI works with multiple partners on main projects, as well as cost-share projects to help further economic development. The center has developed multiple research collaborations for the second and third-year initiatives. Please find below the collaborative projects for the second and third-year.
In addition, the FMRI works closely with the Florida Department of Transportation in a common internship program that offers students an exciting opportunity to work with professionals on real life projects. This is a great opportunity for our students to develop the necessary skills and techniques directly applicable to their professional development.

Education also plays a crucial role in collaborative efforts. Hampton University, the center’s educational partner, works with multiple agencies, companies, and academia to develop and implement workshops, lecture series, internships, and field trips. These partners include Newport News School District (K-12 logistics education), Hampton School District (K-12 logistics education, Hampton School District Logistics Academy member), Hampton University (workshops, lecture series, internships, and administration), Canon, Inc. (field trips and internships), Norfolk Southern Corp. (internships), Hampton Roads Transits (internships), Virginia Department of Transportation (field trips and internships), Virginia Port Authority (field trips and internships), Unilever (internships), and Massimo Zanetti Beverage USA (internships), and US Maritime Administration (MARAD). FAU works with local port authorities for student filed trips and internships.

In addition, the FMRI works with State DOTs and other entities, including the Florida Department of Transportation, Portland Bureau of Urban Transportation Research at University of South Florida, and Tennessee Department of Transportation for their cost-share efforts towards freight mobility.

Portland State University is currently working with the Portland Bureau of Transportation towards research collaboration, discussion of research gaps and contributions to the new Portland Freight Master Plan. University of Florida is working in conjunction with the University of South Florida on a Florida Department of Transportation project, providing matching funds through the project “Commercial Heavy Vehicle Impacts on Signalized Arterial Corridor Performance.” Project #: BDV25 TWO 977-50.

Florida Atlantic University is working with the Florida Department of Transportation on the following projects:

- Florida Department of Transportation. “Evaluation of Freight and Transit Signal Priority Strategies in Multimodal Corridor for Improving Transit Service Reliability and Efficiency” Subcontractor Florida International University. Monthly meetings take place for discussion on progress. Project #: BDV27 TWO 977-14
- Florida Department of Transportation. “Evaluation of Truck Tonnage Estimation Methodologies.” Project #: BDV27 TWO 977-15
- City of Dania Beach. “City of Dania Beach- Mobility Study.”
University of Memphis currently is working with the Tennessee Department of Transportation on the following projects:

- Tennessee Department of Transportation. “Impact and Adoption of Connected and Autonomous Vehicles.”

Have other collaborators or contacts been involved?

The American Transportation Research Institute is involved in the FMRI Y2R9-18: “Truck Parking Needs in Tennessee”

### Outputs

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Target</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td># of proposals/projects with collaborative efforts</td>
<td>5 collaborative proposals/projects</td>
<td>4 projects in Year 2, 3 Projects in Year 3</td>
</tr>
<tr>
<td># of website page views</td>
<td>2,500 page views</td>
<td>2,680 pages views</td>
</tr>
<tr>
<td># of conference presentations</td>
<td>10 conference presentations</td>
<td>23 conference presentations</td>
</tr>
<tr>
<td># of peer-reviewed papers</td>
<td>6 peer-reviewed papers</td>
<td>9 peer-reviewed journal papers, 6 under review, in preparation</td>
</tr>
</tbody>
</table>

### Publications, conference papers, and presentations

#### Journal publications


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

Nothing to Report
Identify for each one-time publication

Nothing to Report

Other publications, conference papers and presentations


Website(s) or other Internet site(s)

The Freight Mobility Research Institute’s official website is fmri.fau.edu. Please find below other websites pertaining to technology transfer and research:

- FMRI Y1R3-17: Enhancement of Transportation Network Analysis Tools for Truck-Related Planning and Operations - Part B (PI: Washburn, UF). Software and user guide will be published at: https://github.com/swash17

Technologies or techniques

Florida Atlantic University, once offered summer camps material for K-12 students focusing on geographical informational systems and Location theory. One week of educational activities were created and presented for middle school students.

Under Texas A&M University, the creation of optimal control and ACC (adaptive cruise control) technology for vehicles (trucks) approaching and passing multiple signalized intersections under mixed traffic conditions on the multimodal corridors will be shared in a published paper.

Under University of Minnesota, our consortium partner is part of the Eureka, which is a five-year summer and school program for female students that are focusing on science, technology, engineering and mathematics. This program
has giving the opportunity for female students grades 11 and 12 to experience campus life, while learning more about transportation and logistics and participating in lectures and career panel discussions.

The software product developed through the Enhancement of Transportation Network Analysis Tools for Truck-Related Planning and Operations – Part B of the first-year project will help transportation agencies perform travel time reliability at a network level, which is also sensitive to the vehicle performance of commercial trucks. FMRI Y1R3-17: Enhancement of Transportation Network Analysis Tools for Truck-Related Planning and Operations – Part B (PI: Washburn, UF). Software and user guide will be published at: https://github.com/swash17

Inventions, patent applications, and/or licenses

Nothing to Report

Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Target</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td># of workshops/seminars/webinars developed</td>
<td>8 workshops/webinars/seminars</td>
<td>2 research workshops 4 educational workshops/seminars 8 ITE lecture series events</td>
</tr>
<tr>
<td># of features articles of FMRI research</td>
<td>5 featured articles</td>
<td>8 articles accepted 4 under review</td>
</tr>
<tr>
<td># of organizations participating in consortium activities</td>
<td>4 organizations</td>
<td>6 research-related organizations 5 educational organizations</td>
</tr>
<tr>
<td># of attendees to seminar/webinar/outreach activities</td>
<td>120 attendees</td>
<td>170 research-based attendees 35 education-based attendees 60 ITE attendees</td>
</tr>
</tbody>
</table>

What outcomes has the program produced?

Under the research component, there is an increased understanding of adoption of new technologies and their implications on Freight transportation to improve the nation’s mobility of people and goods. The center focused their study on new technologies that have created opportunities to address critical freight transportation challenges across all modes in urban, suburban and rural areas. Some examples of new technologies include expansion of e-commerce, last mile deliveries by unmanned aerial vehicles (UAVs) or delivery robots, and potential applications of automated and connected vehicles in freight transportation (e.g. truck platooning). These new technologies are also influencing consumer behavior and thereby reshaping freight supply chains at the urban, regional, and international level. The center is developing diffusion of innovation-based models to predict how the adoption of autonomous trucks will be in the future by freight organizations.

Under the educational component, the following outcomes have been achieved:

- Lectures on High Schools campuses and FAU High School FMRI Facilities, Fall 2019.
- Summer camps with focus on traffic simulation and logistics for middle school students
- More than ten female and minority students were placed in industry as interns. Canon, Inc.; Norfolk Southern Corp., Hampton Roads Transit, VA Port Authority, Unilever, MZB-USA, Kimley-Horn, State Department of Transportation, and VA Port Authority.
- An essay competition among high school student has been organized for two high schools.
- K-12 Transportation Science Fair has been planned for fall of 2019. Participation flyer has been distributed to two high schools.
The FMRI held and sponsored workshops, conferences, and other events during this period. The FMRI, with the Standing committees of Freight Transportation Planning and Logistics, and Urban Freight Transportation, held a Workshop on Improving last-mile and 50 Fett Logistics with Smart Initiatives to Improve Freight Mobility. The workshop objectives are to one) identify innovative strategies and technologies which are being employed / developed to facilitate ‘last mile’ / ‘last 50 feet’ delivery challenges from around the world, and two) to establish a process to evaluate operational changes or technology applications which support the timely flow of freight movements through the transportation system. Also, the FMRI with conjunction with IEEE Intelligent transportation Systems conference, held a workshop on Smart Initiatives and Intelligent Freight Transportation. This workshop, aims to address critical issues affecting planning, design, operation, and safety of the nation’s intermodal freight transportation systems, in order to strengthen nation’s economic competitiveness through efficient freight mobility. In addition, this workshop will focus on current developed and deployed applications worldwide, and current research in this area as well discuss the guidelines for future development. Break-out sessions will introduce participants with the whole concept of Smart Freight Mobility as well serve for information exchange of the research accomplishments.

How are the research outputs described in section (3) above being used to create outcomes?

The center is actively working with stakeholders and academia to create technology transfer throughout the industry and other entities. Examples below show the first initiatives the center is taking with the first and second-year completed projects. The application of the proposed approach of autonomous vehicles is to be used in many other innovations such as drones, collaborative and shared logistics, truck platooning, etc. in Texas. The technologies used in the dynamic trajectory control and signal coordination are combined and applied in a coordinated way to complete the algorithm.

### Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Target</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td># of methodologies, models, and tools developed</td>
<td>5 models developed</td>
<td>11 methodologies, models, and tools developed</td>
</tr>
<tr>
<td># of partnerships from industry, agencies and academic institutions</td>
<td>8 partnerships</td>
<td>10 partnerships</td>
</tr>
<tr>
<td># of adopted methodologies, models, and tools</td>
<td>2 adopted models</td>
<td>4 adopted models</td>
</tr>
</tbody>
</table>

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

Under the education effort, K-12 students’ exposures to various transportation fields through lecture series, field trips, essay competition, transportation science fair, and high school teacher’s workshop will help move students to a career in transportation engineering and logistics.

Under the research effort, the center, for the project Next Generation of Freight Planning and Operation Models to Incorporate Emerging Innovative Technologies; studying freight planning by developing a hybrid-based approach in modeling truck platooning. The hybrid model will be based on feedback from a micro-simulation and macro-simulation of heavy vehicle route choice. The microsimulation model will be based on analytical formulation of speed-density relation of mixed traffic flow and development of simulation framework for truck platooning in a small to medium freeway network. Multi-regime speed-density relationships will be used to describe the mixed traffic flow consisting of trucks and passenger cars. The speed-density relation will incorporate percentage of Platooned trucks, traffic density and spacing policy of platoons. Various spacing and number of Platooned vehicle performance will be used to assess the total system travel time. Adequate spacing and number of vehicles needed in efficient platooning will be further applied in macroscopic traffic assignment to assess overall efficiency in a larger case study area.
What is the impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company?

The work produced under project Y2R2- 18 Sustainable Urban Freight Mobility through Optimization of Logistics Facility Locations is providing an alternative operating method for urban freight systems that can potentially solve many of the problems encountered in the logistics sector, varying from operational costs, problems in safety and mobility, to the increased risk factors and environmental impacts. The key elements that are bound to experience the largest benefit from this study are labor costs, environmental impacts, and mobility. First, the main objective of the proposed solution will be to minimize the costs associated with the operation of the system, when finding the optimal locations of the city logistics facilities. These costs are comprised of three components: (i) the costs to use the facilities chosen for the unloading and delivering of the products, (ii) the costs associated with the transportation of cargo to the selected facilities and (iii) the costs related to the distances from the mini-hubs chosen and the final destinations, which is referred to as the last-mile problem. A set of candidate locations will be identified (e.g. warehouse facilities, parking lots, etc.) and each of these locations will be linked with a utilization cost. For the project to be cost efficient towards the logistics operators, instead of acquiring the chosen hubs, they will lease the facilities for a predefined daily time-window required to unload and deliver the products. This leasing function also provides long-term flexibility in the system, since it can address potential uncertainty in the demand and cost patterns. The logistics providers will conduct short-term (e.g. six-month, yearly) leasing contracts and after the contracted time expires again use the model developed to identify the new optimal locations for the corresponding product demands or fluctuating facility costs. Additionally, the transportation costs from the main hub to the selected facilities are related to the position of each candidate facility, the load that is assigned to each location and must be delivered, the number and type of trucks used for the transportation of cargo, etc.

Moreover, the last-mile is one of the most important areas of operation for the delivery processes, as allows shippers to get more products to consumers faster and cost-effectively and it has become one of the most significant aspects influencing the logistics operations, since it makes up around twenty-eight percent of shipments total cost. So, the minimization of the distances between the chosen locations and the destination nodes comprises a vital component for the success of the operations. The project intends on promoting environmental-friendly solutions for the last-mile deliveries, like the bicycle logistics initiatives that are constantly gaining ground in the global supply chain market and start being implemented by major logistics companies (e.g. DHL, UPS, FedEx, etc.). Furthermore, the study will help improve mobility and sustainability in urban areas, since the trucks used for the product deliveries will not be traveling between all the downtown destination nodes, increasing the vehicle volumes in roads, but will directly head to the hubs and return to their origin from predefined routes, allowing a controllable vehicle distribution in the network and decreasing emission levels. Lastly, as one of the objectives is to minimize the distance from the chosen facilities to the end destinations, the study also ensures that the hubs are in close proximity and easily accessible to the customers, therefore providing opportunities for deliveries on foot, using handcarts, or self-pickup opportunities and relieving the urban network from unnecessary extra heavy vehicle loads. Overall, the project is offering an alternative, cost-efficient and innovative method of distributing goods in metropolitan areas that will help improve urban freight mobility, alleviate traffic congestion from city centers and assist in the reduction of the environmental impacts caused by the transportation systems.

In the Dynamic Trajectory Control and Signal Coordination for a Signalized Arterial with Significant Freight Traffic project, the developed models and algorithms will have the potential to be implemented in onboard devices for driver assistantship systems, or as a part of the infrastructure (signal) control system prototypes.

The Truck Parking Study: Unveiling the Parking Space Density and Truck Volume Relationship project would allow private sectors to associate truck parking problems along the interstate highways with the supply of parking capacities so that they may propose projects to add parking capacities for truckers. The signal optimization project will allow consulting firms on signal to improve their control algorithms to improve practices.
What is the impact on the body of scientific knowledge?

The impacts on the body of scientific knowledge are listed below:

The proposed freight data analytics platform produces a nationwide integrated data warehouse from the public and private sector to improve freight transportation system. In this ecosystem, decision makers will be able to leverage innovations in big data analytics to evaluate the performance of the state’s freight transportation assets or system and also assess the essential role of freight to the State’s economy. In addition, the platform also provides flexible, easy-to-use, interactive web interface which could be used by state agencies to quickly identify causes or trends, perform impact analyses of decisions. This will enable leaders to easily comprehend and act on valuable information much more quickly.

The development of the methods in this program used knowledge from the fields of optimization and control theory under the Dynamic Trajectory Control and Signal Coordination for a Signalized Arterial with Significant Freight Traffic project. The development of the dynamic system and application of theories have shown the effectiveness to solving the problem using that knowledge. The fastest way is applied by using the knowledge to solve the problems compared to previous research on similar topics.

The work produced under project Next Generation of Freight Planning and Operation Models to Incorporate Emerging Innovative Technologies will inform how newer technologies will affect freight transportation so that the lessons learned from this project can be utilized by state and local planning agencies in their decision making and in facilitating appropriate infrastructure to accommodate upcoming innovations for improved understanding of freight mobility.

The Enhancement of Transportation Network Analysis Tools for Truck Parking project created a new capability to analyze network-level travel time reliability at a macroscopic level. This methodology and tool now give the practice an analysis capability, within reasonable time constraints, that was not previously available. This will ultimately allow agencies to make more information highway network investment decisions.

The Two-lane Highway Analysis Methodology Enhancements Considering Commercial Truck aims to improve the state-of-the-art for accounting for the impact of trucks on two-lane highway operations. The work accomplished by building on the work that was done for NCHRP Project 17-65. The issues examined in this project are ones which are very difficult and/or very expensive to study in the field. Thus, the SwashSim simulation tool was utilized exclusively in this project.

What is the impact on transportation workforce development?

The impact on the transportation workforce development has been greatly influenced by the efforts under the FMRI. Multiple endeavors, including post-doctoral researchers, graduate research assistants, and under student assistants have worked under the various research projects, providing opportunities for research, teaching, and training in transportation and logistics. Currently, there are more than seventeen graduate and undergraduate students who are actively involved in these projects. K-12 initiatives have also exposed many non-engineering college majors to the transportation field. Graduate Courses was developed and will continue to developed based on research findings, as well. These programs have provided opportunities for research and teaching in transportation to graduate and undergraduate students, including the development of a generic framework for consolidation and routing principles in the intermodal transportation network. The research conducted will provide new information for classroom learning, such as sustainability issues related to freight new technologies, and new mathematic models and sound scientific research process on the area of network modeling, routing schedule, and logistics. In order to give students a real-world experience, tours have been given to FMRI students to various logistic facilities in different states.

Transportation Camps and Workshops have been held at multiple universities throughout this period. The Transportation Camps were a highly competitive scholarship program that provides middle school students with a
great chance to investigate careers and educational opportunities in today's freight transportation industry, e-commerce and beyond. Students participated in discussions, hands-on design competitions, and trips to study local and regional transportation hotspots. They also spend time with industry role models and a diverse group of students. The graduate research assistants were heavily involved in teaching the students about ArcGIS based spatial analysis, VISSIM based intersection simulations, basics of transportation engineering, freight operations, logistics, connected and automated vehicles, and traffic count observations. The campers also took part in debates, quizzes, and fun freight transportation-related cards games. Hampton University, held one day transportation camp for middle School Student on transportation logistics. The students also had the opportunity to participate in discussions and fun games related top logistics and supply chain management in Summer 2019.

Changes/Problems

Changes in approach and reasons for change

As the FMRI continues to adjust its operations in response to COVID-19 pandemic, the health and safety of everyone associated with FMRI remains the top priority. To that end, most of the educational activities will be remote learning and will continue until at least the end of Summer 2020. All the lecture series, meeting with stakeholders and probably summer camps will be offered through remote delivery as well.

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

Nothing to Report

Changes that have a significant impact on expenditures

Nothing to Report

Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards

Nothing to Report

Change of primary performance site location from that originally proposed

Nothing to Report

Special Reporting Requirements

This 2018 Annual Report:

- outlines the new technology transfer (T2) plan and reporting requirement to guide and strengthen the University Transportation Centers (UTCs) technology transfer activities;
- discusses the Fixing America’s Surface Transportation Act (FAST Act, 49 U.S.C. §5505 as amended by P.L. 114-94, Sec. 6016) requirement for a Regional Center to address transportation safety, congestion, connected vehicles (CV), connected infrastructure, and autonomous vehicles (AV);
- highlights examples of ongoing or recently completed UTC research projects by each of the 32 Centers; and
- summarizes UTC program-wide performance indicators used to measure productivity at individual UTCs.

Last updated: Tuesday, May 28, 2019