FAU

FREIGHT MOBILITY RESEARCH INSTITUTE

A Tier 1 USDOT University Transportation Center

Annual Report
2019 - 2020

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GOALS & OBJECTIVES

The ultimate goal of the Freight Mobility Research Institute's (FMRI) is to optimize freight movements for improving the overall freight transportation efficiency. The main contribution of the FMRI research focuses on promoting smart cities, improving multimodal connections, system integrations and security, data modeling, and advanced analytical tools.

The FMRI's mission is 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. 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 the USDOT's strategic priorities, the FMRI members focus their research on improving freight mobility through information technology, freight network modelling and operations, intermodal logistics, as well as freight and supply chain sustainability. The researcher's efforts (i) support maintaining and developing mobility in the face of growing traffic and shrinking resources; (ii) develop methodologies for improving the performance of the U.S. freight transportation system; (iii) increase border-crossing efficiency while maintaining security and resilience; and (iv) improve air quality for better public health, reduce energy consumption for sustainability, and reduce the overall congestion.

The FMRI assembled top experts on freight transportation, network modeling, sustainability, and ITS, representing leading universities across the nation with deep connections to local, state, and regional communities. Each university has an established transportation research center/lab where leading-edge research can be conducted. All the FMRI partners are motivated to embrace innovative research projects, train current and future transportation leaders and workforce, and engage with the industry to enhance collaborations between agencies by improving efficiency and safety, sustainability, reduced traffic congestion, and develop standards to ensure interoperability today and in the future. At the same time, the center has a significant educational impact. The consortium members have a successful history of enhancing interdisciplinary learning opportunities and engaging underrepresented groups. This commitment will be continued and improved via integrated education and outreach components that leverage ongoing activities.
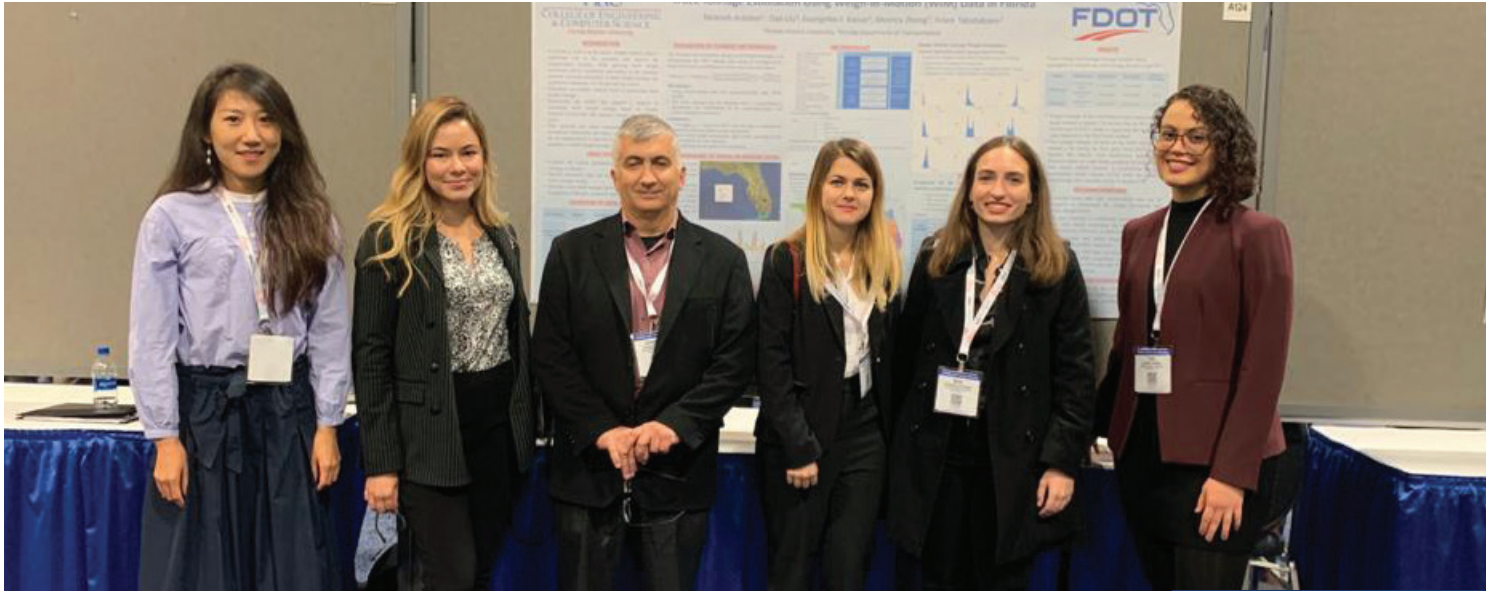
MESSAGE FROM THE DIRECTOR

I am very pleased to provide this annual report for the Freight Mobility Research Institute (FMRI) activities from 2019-2020. It is my pleasure and honor to direct the FMRI, a Tier 1 University Transportation Center housed in the Department of Civil, Environmental and Geomatics Engineering within FAU's College of Engineering and Computer Science. Our Institute was one of only 20 institutes selected for funding from the United States Department of Transportation (USDOT) in 2016. The FMRI partners is a collaboration of faculty, researchers, and students from Florida Atlantic University (lead), Hampton University, Portland State University, Texas A&M University (College Station), University of Florida, University of Memphis, and University of Minnesota (Minneapolis).

Our highly skilled group of individuals have the expertise and experience required to address the critical issues affecting planning, design, operation, and safety of the nation's intermodal freight transportation systems. The FMRI's research goals are to improve freight mobility through information technology, freight network modeling, and operations, intermodal logistics, as well as freight and supply chain sustainability. This collaborative research aims to promote smart cities, improve multi-modal connections, system integration and security, data modeling, and analytical tools for optimizing freight movements. The Institute also will have a significant educational impact through integrated education and outreach components. The FMRI's mission is to strengthen our nation's economic competitiveness by embracing innovative research projects in order to create efficient and safe freight systems, train current and future transportation leaders and workforce, and to engage with industry to enhance collaboration between agencies.
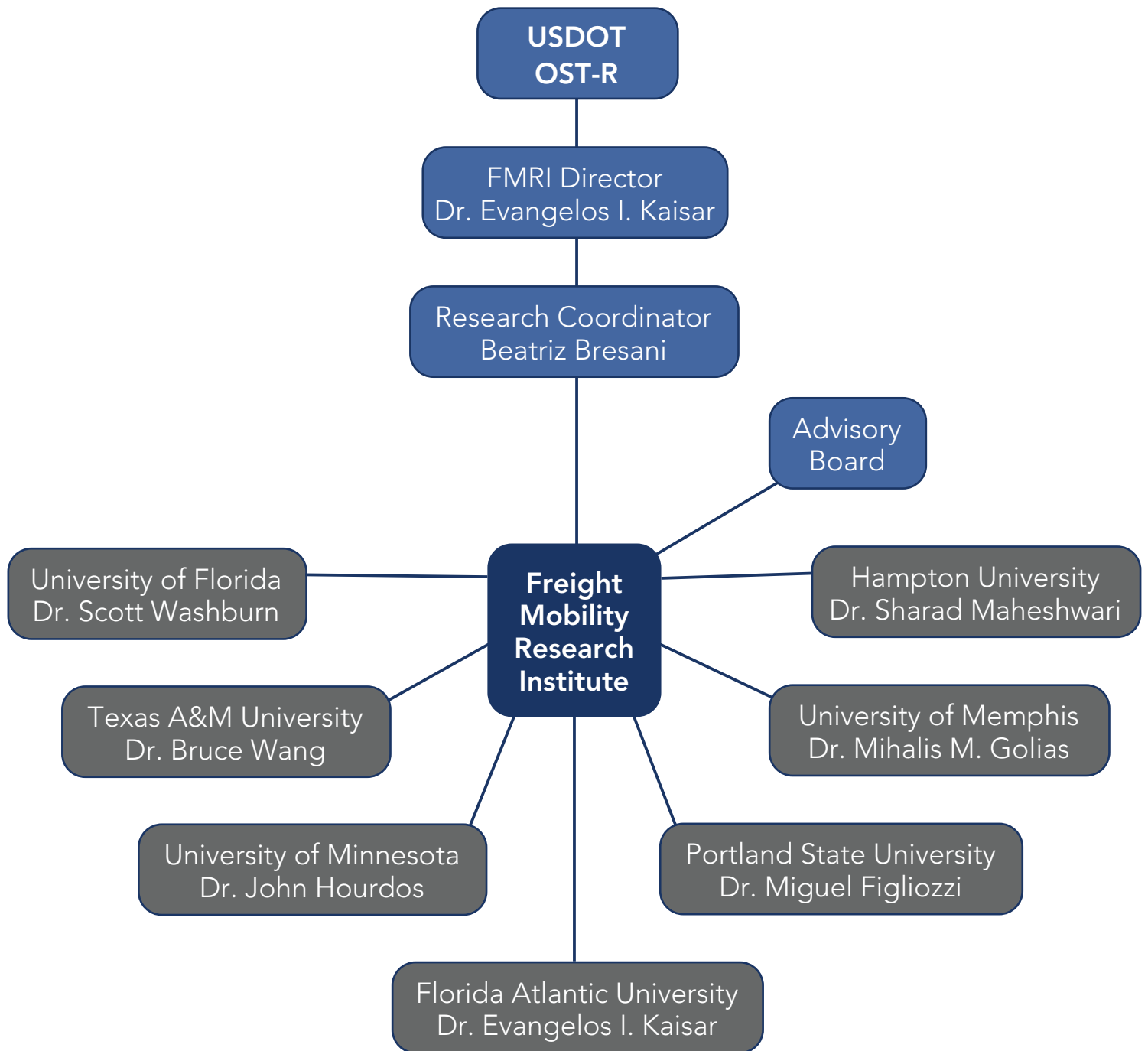
Dr. Evangelos I. Kaisar

Professor, Florida Atlantic University
Director, Freight Mobility Research Institute
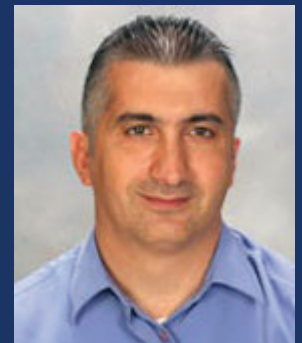
ORGANIZATIONAL CHART

The Freight Mobility Research Institute (FMRI) consists of seven university partners, led by Florida Atlantic University (FAU). Dr. Evangelos Kaisar, Institute Director, and the Research Coordinator reports directly to the U.S. Department of Transportation (USDOT) and the Office of the Assistant Secretary for Research and Technology (OST-R). The FMRI's Advisory Board collaborates and oversees the FMRI projects from each university.

USDOT
OST-R

FMRI Director
Dr. Evangelos I. Kaisar

Research Coordinator
Beatriz Bresani

Advisory Board

Freight Mobility Research Institute

University of Florida
Dr. Scott Washburn

Hampton University
Dr. Sharad Maheshwari

Texas A&M University
Dr. Bruce Wang

University of Memphis
Dr. Mihalis M. Golias

University of Minnesota
Dr. John Hourdos

Portland State University
Dr. Miguel Figliozzi

Florida Atlantic University
Dr. Evangelos I. Kaisar

FMRI TEAM & ADVISORY BOARD

FMRI Executive Committee

Evangelos I. Kaisar, Ph.D.
Director
Florida Atlantic University

Mihalis M. Golias, Ph.D.
Associate Director
University of Memphis

John Hourdos, Ph.D.
Associate Director of Research
University of Minnesota

Sharad K. Maheshwari, Ph.D.
Associate Director of Education
Hampton University

FMRI Faculty Researchers

Evangelos I. Kaisar, Ph.D.
Professor & Director
Florida Atlantic University

Sharad Maheshwari, Ph.D.
Professor
Hampton University

Miguel Figliozzi, Ph.D.
Professor
Portland State University

Sabyasachee Mishra, Ph.D.
Assistant Professor
University of Memphis

Mihalis M. Golias, Ph.D.
Professor
University of Memphis

Bruce Wang, Ph.D.
Associate Professor
Texas A&M University

John Hourdos, Ph.D.
Research Associate Professor
University of Minnesota

Scott Washburn, Ph.D., P.E.
Professor
University of Florida

Alireza Khani, Ph.D.
Assistant Professor
University of Minnesota

Yunlong Zhang, Ph.D.
Professor
Texas A&M University

FMRI Staff

Evangelos I. Kaisar, Ph.D.
Director
Florida Atlantic University

Beatriz Bresani
Coordinator, Research Programs/Services
Florida Atlantic University

Aline Machado
Assistant Research Coordinator
Florida Atlantic University

FMRI Advisory Board

Charles Edwards
Director, Strategic Planning/Logistics
North Carolina Department of Transportation

Rickey Fitzgerald
Rail and Motor Carrier Manager
Florida Department of Transportation

Bob Hillier
Transportation Planning/Freight Coordinator
City of Portland, Bureau of Tranportation

Caitlin Hughes
*Director, Office of Freight Management
and Operations*
Federal Highway Administration
United States Department of Tranportation

Nicole Blackwell Katsikides
*Associate Research Scientist,
Freight Mobility Analysis*
Texas A&M Transportation Institute

Beth R. Kigel
*Vice President, Director of Smart
and Connected Solutions*
HNTB Corporation

Cynthia Borrum Matthews
Manager, Operations Planing and Engineering
FedEx Corporation

Dan Murray
Vice President
American Transportation Research Institute

Daniel Pallme
*Assistant Chief of Environment and
Planning/Freight and Logistics Director*
Tennessee Department of Transportation

Bill Rogers
Senior Program Officer
National Cooperative Freight
Research Program

FMRI PARTNERS

Dr. John Hourdos is the Director of the Minnesota Traffic Observatory and a Research Associate Professor in the Department of Civil, Environmental, and Geo-Engineering at the University of Minnesota. Dr. Hourdos has extensive experience with the theoretical and practical aspects of traffic flow theory and modeling, as well as traffic safety. His current research focuses on Traffic Operations optimization, evaluation of Active Traffic Management systems, and Macro-Meso-Micro hybrid simulation modeling and applications.

Dr. Alireza Khani is Assistant Professor in the Department of Civil, Environmental, and Geo-Engineering at the University of Minnesota. His research focus is on modeling the impacts of emerging technologies on public transit systems, and optimization of the system for more efficient and reliable service. Dr. Khani uses network modeling and optimization techniques to integrate public transit systems with autonomous mobility-on-demand services and electric fleet with renewable energy.

UNIVERSITY OF MINNESOTA
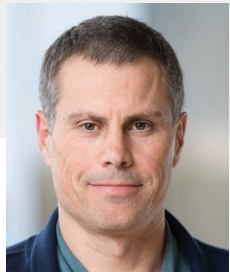
Dr. Miguel Andres Figliozzi is a Professor in the Civil and Environmental Department at Portland State University. Dr. Figliozzi directs the multidisciplinary Transportation Technology and People (TTP) lab and has published extensively in the area of innovative freight vehicle technologies, urban deliveries, city logistics, routing-logistics optimization, and emissions and transportation sustainability. Dr. Figliozzi is a member of the Transportation Research Board (TRB) Network Modeling Committee, Freight and Logistics, and Intermodal Terminal Design Committees.

Portland State UNIVERSITY

OREGON

TEXAS

TEXAS A&M UNIVERSITY.

Dr. Bruce Wang is an Associate Professor at Texas A&M University. His research insterests are stochastic modeling and network optimization with applications in multimodal transportation, freight logistics, intelligent transportation systems, vehicle routing and scheduling, revenue management, and other areas. He is active member with TRB and other transportation organizations.

Dr. Yunlong Zhang is a Professor at Texas A&M University. His expertise include modeling and simulation, traffic operations, transportation modeling and simulation, intelligent transportation systems, computer applications in transportation, operation research, and signal optimization. He is active member of TRB and other transportation organizations.

Dr. Sharad K. Maheshwari is a Professor in the Department Business Administration at the Hampton University. His main area of teaching and research interests are supply chain management, transportation management, distracted driving, quality management, project management and business education. He has worked on several grants from the US Department of Transportation. He was associate director of education and technology transfer of the Hampton University's UTC.
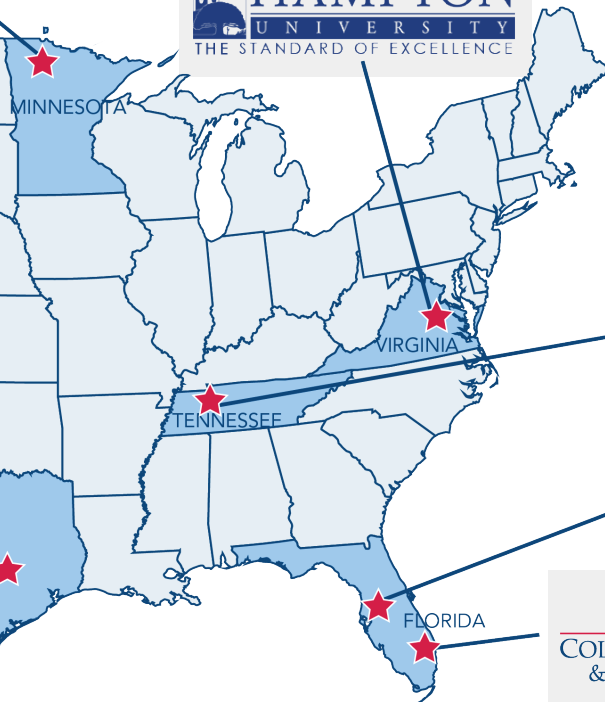
Dr. Mihalis M. Golias is an Associate Professor with the Department of Civil Engineering at the University of Memphis. He is the chair of the Standing Committee on Ports and Channels of the Transportation Research Board, the co-Director of the Biologistics Cluster in the FexEx Institute of Technology at the University of Memphis, and the Associate Director of the Freight Mobility Research Institute at Florida Atlantic University. His teaching and research covers the areas of maritime and freight transportation; physical network vulnerability; capital/operational resource allocation for network improvements; and multi-level multi-criteria decision making.

Dr. Sabyasachee Mishra is an Assistant Professor of Civil Engineering and the co-director of FedEx Institute of Technology at the University of Memphis. His expertise includes travel demand modeling, network investment decision making, transportation planning, economics, and impact of disruptive technological innovations on transportation. He is involved with a number of national and state Transportation projects from U.S. Department of Transportation, Federal Highway Administration, Tennessee DOT, Maryland State Highway Administration, Maryland DOT, and Michigan DOT.

Dr. Scott Washburn is a Professor in the Department of Civil and Coastal Engineering at the University of Florida. Dr. Washburn's areas of expertise include traffic flow theory, traffic operations analysis, traffic simulation model development and testing, development of traffic analysis and level of service computational methodologies and complementary software tools. Dr. Washburn's primary research efforts are aimed at improving and enhancing traffic analysis methods, particularly those in the Highway Capacity Manual.

Dr. Evangelos I. Kaisar is a Professor in the Department of Civil, Environmental & Geomatics Engineering at Florida Atlantic University. In addition, Dr. Kaisar is the Director of the FMRI. Prior to joining FAU, he was a project manager for the Maryland Transportation Authority. Dr. Kaisar is an expert in transportation systems analysis, large scale mathematical modeling, traffic management, logistics, and preparedness catastrophic management. Dr. Kaisar has over 15 years of experience in research and education and vast experience in managing research programs and administrative expertise.
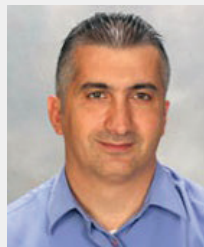
Dr. Lili Du is an associate professor in the Department of Civil and Coastal Engineering at the University of Florida. She has been working on several research projects in in the University of Florida Transportation Institute (UFTI).

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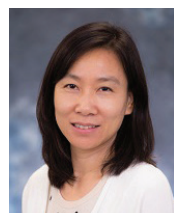
FMRI PERFORMANCE MEASURES

25
of professional or
peer presentations

16
of journal
publications

9
of workshops,
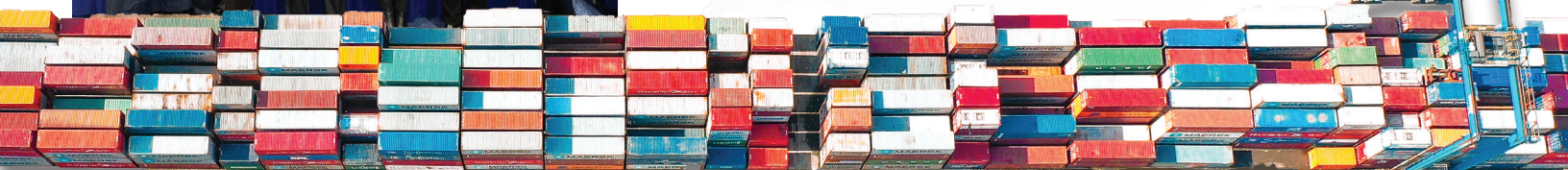seminars, and
webinars

8
of educational
initiatives

8
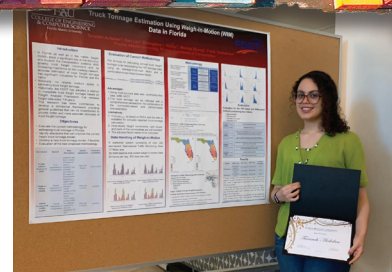# of FMRI
projects funded

4
of adopted
models

17
of
partnerships

13
of students participations
in seminars/conferences

20
of graduate research
assistant students

Our research activities are multimodal/intermodal and multidisciplinary in scope. The FMRI team is well-poised to address a variety of issues directly applicable to the USDOT strategic goal of economic competitiveness. The 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 and Resilience

TIMELINE AND MILESTONES

Jan 2020
FMRI at TRB, Advisory Board meeting

Sep 2019
Year 3 projects established

May 2019
FMRI and USDOT partner meeting at the University of Memphis

Jan 2019
FMRI goes to the 98th TRB Annual Meeting, Advisory Board Meeting

Jun 2018
CUTC Annual Summer Meeting in Minneapolis, MN
Year 2 projects established

Jan 2018
FMRI participated in the 97th TRB Annual Meeting,
CUTC Meeting, and FMRI partner meeting in Washington, DC

Nov 2017
FMRI co-sponsored the 5th Annual UTC Southeastern Regional Conference

Jul 2017
Year 1 projects established

Jun 2017
First FMRI and USDOT partner meeting at FAU
2017 CUTC Annual Summer Meeting in Buffalo, NY

Feb 2017
FMRI website launched - **fmri.fau.edu**

Jan 2017
CUTC Meeting in Washington, DC
1st FMRI partner meeting at FAU

Dec 2016
FMRI received
USDOT award

FMRI FUNDED PROJECTS | YEAR 3

Analysis of Freight Movement Within Regional Evacuations
Dr. Evangelos Kaisar

Florida is a state that frequently suffers from natural disasters, 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 shipments 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.

Identification and Evaluation of Critical Urban Freight Corridors
Dr. Evangelos Kaisar

Efficient movement of freight is vital to the rivaling economies of cities and metropolitan areas. 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 ability to entirely understand and accurately designate freight vehicle route choices is essential in helping to inform regional and state decisions. 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. Specific criteria and requirements exist for identifying and designating 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. 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.

Optimal and Robust Control of Vehicle Platooning on Signalized Arterial with Significant Freight Traffic
Dr. Yunlong 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 and bottleneck appear more easily at a segment where freight traffic is significant. Previous project from FMRI found 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.

Significant truck traffic presents the opportunities for truck platooning. The safety should be ensured in these dynamic process 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 research, a stability analysis between dynamic trajectories of different vehicles under different scenarios will be investigated. The 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.

Fathoming the Maximum Potential for Freight Sensitive Intersection Control
Dr. Bruce Wang

TEXAS A&M
UNIVERSITY.

Freight vehicles have significantly different attributes in kinetic movement, economic values (e.g. value of time) and environmental effect. Along with another project, also by TAMU, the objective is to increase the understanding of the point and network benefits of intersections, respectively. At a general intersection, it seeks to understand how to appropriately and optimally consider freight and passenger vehicles is a problem that has not been previously well addressed. 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, it enables signal control by considering relevant factors such as economic values.

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.

Integrate Autonomous Delivery Vehicle into Sustainable Urban Logistics Planning and Optimization
Dr. Evangelos Kaisar

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. Sustainable urban distribution system is one of the most recent trends, where 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 areas, where ground and road-based robots will dominate. Autonomous delivery vehicles (ADV) are a new element of ground-based delivery services. They are a more practical solution in cities, which has the potential of last mile delivery to customers to reduce the urban road traffic and emissions. In this research we discuss the ADV combined with truck transportation regarding the urban sustainable freight delivery network. 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.

Managing the Growth of Last-Mile Deliveries and Curb Space Demand
Dr. Miguel Figliozzi

According to the United States Census Bureau's Quarterly E-Commerce Report, E-Commerce sales in the United States 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 to manage parking and allocate curb space, currently utilized for the most part in urban areas across the US, 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 1) model the allocation and benefits of new delivery systems (such as shared lockers) to improve last-mile efficiency, 2) 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, and therefore are within the scope of this research.

Identifying Critical and Vulnerable Freight Routes in Roadway Networks: A Game Theory Framework and Application in the State of Florida
Dr. Mihalis Golias

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. This also includes make decisions on investments 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 Golias et al. (2018) to identify critical and vulnerable links and/or paths with a focus on freight movements.

Incorporating Freight Regional Land Use Planning Models
Dr. Sabyasachee Mishra

Forecasting of freight demand in land use models has been a challenge over many years in transportation planning. 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, pricing, and dynamic factors, such as seasonal variations in demand and changes in customers' preferences.

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. 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.

FMRI RESEARCH PROJECT HIGHLIGHT

Next Generation of Freight Planning and Operation Models To Incorporate Emerging Innovative Technologies

Grantee: Florida Atlantic University
Portland State University
University of Memphis
Research Priority: Improving Mobility of People and Goods
Funding: $209,984
Project End Date: June 30, 2020

Project Description: Recent rapid explosion of new technologies has 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 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. First, the project will develop diffusion of innovation-based models to predict how the adoption of autonomous trucks will be in the future by freight organizations. Second, we will address how truck platooning will be incorporated in transporta-tion planning models such as how many trucks will be allowed in a platoon, platoon speed, platooning hours, freeway platooning zones, etc. Third, we will model the potential emissions impacts of last mile delivery robots. Fourth, assess the role and feasi-bility of technological innovations in intermodal transportation.

The outputs of the research will include 1) adoption behavior of highly automated trucks by freight organizations, (2) truck platooning analysis in transportation planning and operation models, (3) the impacts of last mile deliveries by delivery robots, and (4) study how disruptive technologies are affecting intermodal transportation.

The impacts of multi-university research will produce the following outcomes: 1) impact of highly automated truck technology in the trucking industry, 2) process in which state departments of transportation and local agencies promote truck platooning by assessing their performance in plan-ning and operational models, 3) emission and other performance impacts of delivery robots for last mile deliveries, and 4) impact of technological innova-tions in intermodal freight transportation opera-tions.
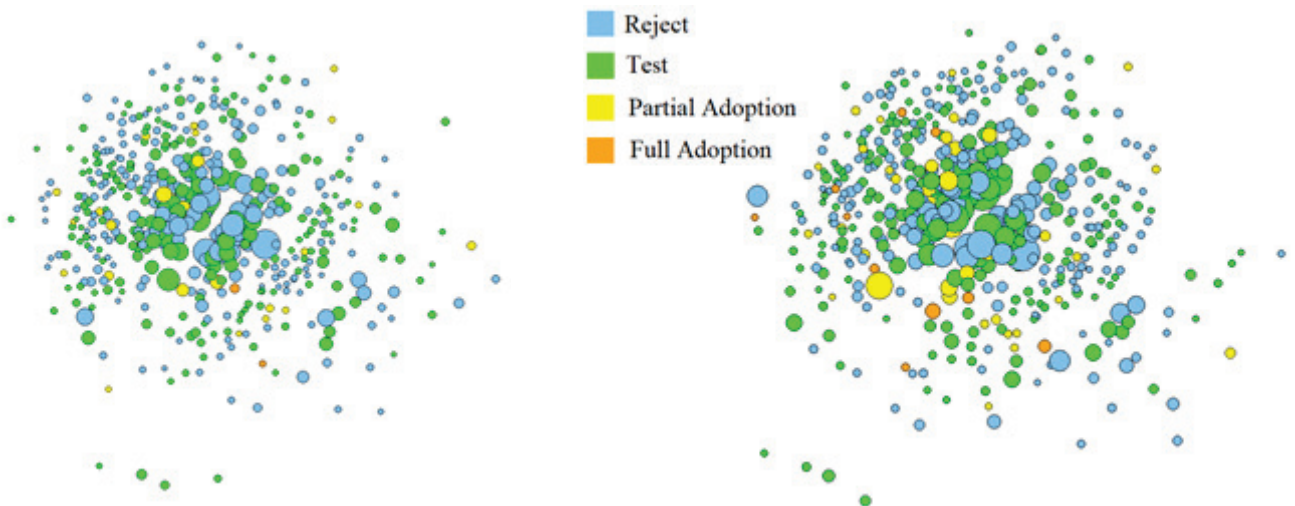

Figure 1: Trucking firms without (left) and with (right) peer effects on automated technology adoption

FMRI CO-SPONSORED WORKSHOPS

Smart Initiatives and Intelligent Freight Transportation
IEEE Intelligent Transportation Systems Conference
Auckland, New Zealand

Creating smart mobility for freight systems can make a powerful influence on the whole transportation network. It can improve the transportation efficiency in real time by reducing the overall delay and travel time, fuel consumption, noise, emissions, etc. Smart mobility freight system comprises a variety of Intelligent Transportation Systems (ITS) applications, such as Freight Advanced Traveler Information System, Freight Dynamic Route Guidance, and Drayage Optimization. Potential applications are automated and connected vehicles in freight transportation, deliveries by unmanned aerial vehicles (or drones), Freight Signal Priority, development.

This workshop addressed 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 focused on existing applications worldwide, current research in this area, and discussed guidelines for future development. Break-out sessions introduced 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

Living in a fast-developing consumer society requires that advances in freight operations are going to be sustainable solutions for the future. The workshop addressed the "last-mile" critical issues affecting freight industry. Topics included fulfillment location optimization, shared delivery options, dynamic routing employing big data and smart active freight mobility.

The involvement of speakers and participants from academia, federal and state agencies, and industry engaged in a multidimensional discussion on urban freight topics by actively discussing research needs. In the end of the workshop, a facilitated prioritization was conducted to identify the most urgent needs in freight transportation related to the strategies and technology developed for "last 50 feet" deliveries and logistics terminals. Finally, this workshop had a wrap-up and question session on the next steps for getting highest-priority projects into the research pipeline.
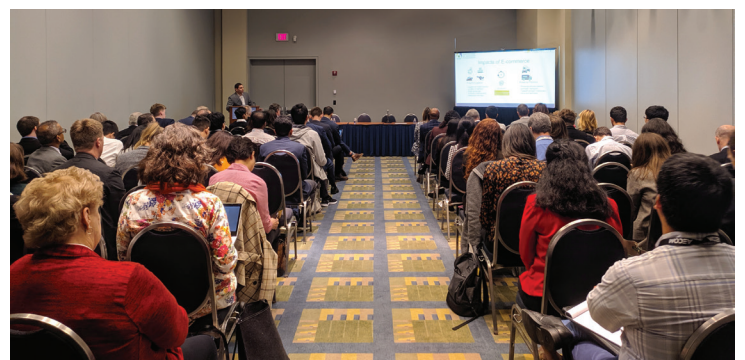
FMRI EDUCATIONAL INITIATIVES

FMRI & ITE FAU Student Chapter Lecture Series
Planning for Freight Flows: From the Perspective of the City and Regional Planners
Mr. Charles Edwards, Director of the NCDOT Office of Logistics and Freight, exposed on the impacts and challenges associated with e-Commerce shipments on predicting traffic flows and designing appropriate urban infrastructure.

Application of Automated Sensor Data for Estimation Models for Real Time Traffic Management
Dr. Anusha S.P, Assistant Professor at the APJ Abdul Kalam Technological University, presented about the application of automated sensor data for development of estimation models for various traffic variables in different traffic conditions, with case studies.

A Career in Transportation: Solving Transportation Problems to Improve People's Lives
Benazir Portal and **Jessica Josselyn**, both Transportation Engineers at Kittelson & Associates, discussed on how a career in transportation can to impact and improve people's lives in a positive way.

Port Planning Under Deep Uncertainty
Dr. Rodrigo Mesa-Arango, from the Florida Institute of Technology, covered the motivation, challenges, and framework of a maritime port planning model for the Latin American and the Caribbean (LAC) region.

From Mobility to Accessibility: Transforming Urban Transportation and Land-Use Planning
Dr. Louis Merlin, from Florida Atlantic University, contrasted the concepts of accessibility and mobility and demonstrated how an accessibility-based analysis may yield different recommendations than a mobility-based analysis through a case study in the San Antonio region.

Freight Research at the Rensselaer Polytechnic Institute
Dr. José Holguín-Veras presented on how he and his team have conducted research on the development of freight demand models that reduces data collection efforts. He also discussed the application of these techniques to the estimation of the Freight Demand Model for Bangladesh.

FAU Transportation Certificate Program
Transportation, Logistics, and Supply Chain Management
The Department of Civil, Environmental and Geomatics Engineering and the Department of Information Technology and Operations Management started offering a jointly designed certificate in Transportation, Logistics and Supply Chain Management. This 12-credit certificate allows graduate students to expand their knowledge on the technical skills of transportation engineering and the analytical business decision-making skills of supply chain management.

2019 Summer Transportation Camps
The Freight Mobility Research Institute holds Summer Transportation Camps at Florida Atlantic University for high-achieving students entering grades 7 to 9 in fall 2019. The courses introduce students to traffic simulation games and GIS, and freight transportation, supply chain and logistics games. The activities were in the FAU Boca Raton Campus. The Traffic Simulation Games & GIS occured on June 17-21, 2019, and the Freight Transportation and Logistics on June 24-28, 2019.

FMRI Webinar Series

Development of Guidelines for Implementation of Freight and Transit Signal Priorities in Urban Corridors

Presented by FMRI Graduate Research Assistant **Taraneh Ardalan** presented about this FDOT project. The primary objective is to establish guidelines for the application of signal priorities by traffic agencies focusing on defined decision factors on the considered corridors. In addition, this analysis assesses the efficacy of FSP and TSP in enhancing freight and transit network efficiency. This research laid out recommendations for different scenarios. The developed guideline relates to corridors where freight delay plays a critical role in determining the performance of the corridors.

## A Discussion on Transportation Post COVID-19

Presented by **Mr. Jeffrey Paniati**, Executive Director and CEO of the Institute of Transportation Engineers. This session engaged the participants in a discussion of the impacts of COVID-19 on the transportation sector and explored the short-term and long-term implications. About the longer-term implications, many questions arise, such as funding, the impacts in demand, options and employment, and the overall transportation scenario after this major disruption.

Supply Chain Disruptions: Lessons Learned From Previous Natural Disasters

Presented by **Dr. Sharad K. Maheshwari**, which is a professor in the Department Business Administration at the Hampton University, and Associate Director (education) at FMRI. This webinar explored previously identified supply chain problems and proposed solutions. It also investigated actions that were taken on these proposed solutions after 2009 and 2011 natural disasters.

Last-Mile Delivery Innovations

Presented by **Dr. Miguel Figliozzi**, Professor in the Civil and Environmental Department at Portland State University. This webinar presented a survey of last mile innovations, focusing on the cost competitiveness of autonomous, air, and ground delivery vehicles and the analysis of their last mile CO_2 emissions. Additionally, the potential impacts of the COVID-19 pandemic on last-mile delivery innovations were discussed.
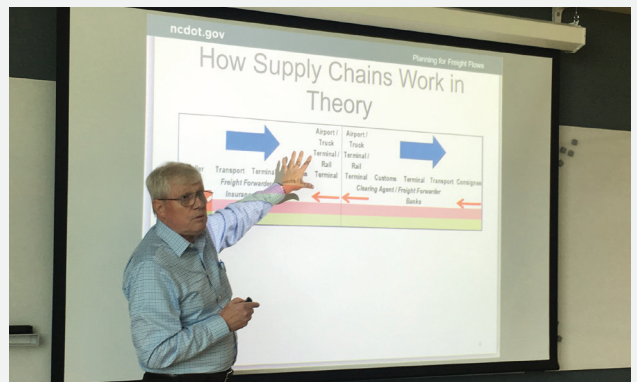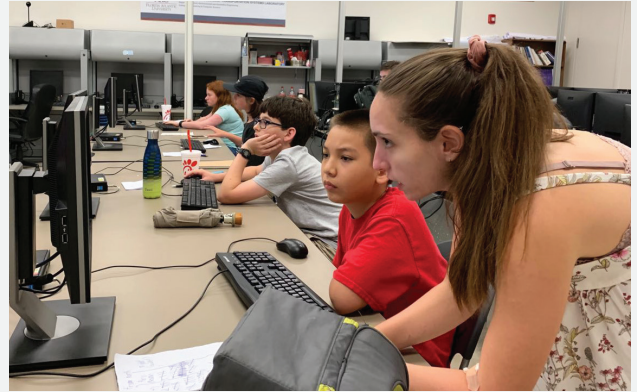
STUDENT ACTIVITY HIGHLIGHTS

Student Chapters

Women's Transportation Seminar FAU Student Chapter

2019-2020 Board
President: Taraneh Ardalan
Vice President: Panagiota Goulianou

The Women's Transportation Seminar (WTS) at Florida Atlantic University (FAU) started officially as a student organization in Spring 2020. This student chapter has the goal of establishing a college-based student community focusing on advancing women in transportation through professional development workshops, networking, and social events. As an active student and young professionals group, either women and men can work together and benefit each other in their careers. The hope of the WTS FAU Student Chapter to facilitate students towards their success.

Advancing Women in Transportation
FAU Owls Student Chapter

The WTS @ FAU will facilitate numerous networking and mentoring opportunities for students at FAU. Members organized two lecture series in January and February of 2020. After the university moved to fully online in the Spring 2020 semester, the chapter started hosting online webinars as a bridge between students, professors, and professionals in the transportation area to keep sharing knowledge and progress of ongoing research. The activities of this student organization can be found on their LinkedIn page **@wts-fau-student-chapter**

Institute of Transportation Engineers FAU Student Chapter

2019-2020 Board
President: Panagiota Goulianou
Vice-president: Taraneh Ardalan

The Institute of Transportation Engineers (ITE) at Florida Atlantic University (FAU) Student Chapter is one of the student chapters in the Florida Puerto Rico District. This is a group of undergraduate and graduate students who are passionate about transportation engineering and planning. The ITE FAU Student Chapter provide students with opportunities to network with industry professionals and academic faculty to learn about transportation engineering and planning in the southeast region. The main objective of this group is to attract students to the profession of transportation engineering and keep its members updated about the existing opportunities in both industry and academia through seminars and webinars series.

INSTITUTE OF TRANSPORTATION ENGINEERS

The chapter is proud of its continued energetic activities over the years that enhance students' knowledge in the field of transportation engineering. In a partnership with the FMRI, this student organization regularly hosts seminars and webinars throughout the semester called FMRI & ITE FAU Student Chapter Lecture Series. Whether you are a student, industry member, professor, or simply someone interested in transportation engineering and/or planning, connect with the chapter to take advantage of the networking and educational opportunities provided by the ITE FAU Student Chapter. The activities of this student organization can be found on their LinkedIn page **@fau-ite-student-chapter**

FMRI Students Awards

Jesse Simpson: CUTC's Outstanding Student of the Year

The FMRI transportation engineering doctoral student Mr. Jesse Simpson, from the University of Memphis, was honored as the FMRI's Outstanding Student of the Year at the CUTC's Annual Awards ceremony. Mr. Simpson is expected to complete his Doctoral Degree in the Fall of 2020. Criteria for this award include technical merit, research accomplishments, academic performance, professionalism, and leadership.

Travis Glick: Elmaghraby PhD Student Competition

The paper "A Case Study of the reliability of Time Sensitive Drone Deliveries" by Travis Glick received the Elmaghraby PhD Student Competition award during the ILS 2020. Mr. Glick is a doctoral student in the Portland State University. His research focuses on transportation modeling utilizing high-resolution data with applications in transit and drone modeling.

Taraneh Ardalan: FAU's 3 Minute Thesis Competition

The FMRI graduate researcher Taraneh Ardalan received two awards in the 4th-Annual Three Minute Thesis (3MT®) Competition at Florida Atlantic University. She won the first place within the College of Engineering and Computer Science in the Preliminary Round. In the Championship, she got the third place in the entire university.

Workforce Development

Curriculum Development for Highway Freight Transportation

Scott Washburn, Lili Du, University of Florida, Evangelos Kaisar, Florida Atlantic University
The objective of this project is to develop curriculum content that for a 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.

Transportation and Workforce Development Project

Sharad. Maheshwari, Hampton University
The overall goal of this 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. Programs will be expanded based on first and second year connections.

SELECTED FMRI PRESENTATIONS

Transportation Research Board
99th Annual Meeting (2020)
Presentations
• "A Real-time Algorithm for Network Signal Control", by Chaolun Ma.
• Workshop: "Improving Last-mile and 50 Feet Logistics with Smart Initiatives to Improve Freight Mobility", by Evangelos Kaisar and Charles Edwards.
• "A Study of Road Autonomous Delivery Robots and their Potential Impacts on Freight Efficiency and Travel", by Miguel Figliozzi and Dylan Jennings.
• "Do Bicycles Reduce Passenger Car Travel Speeds on Urban Roads without Bicycle Lanes? Evidence from Roadways in Portland", by Jaclyn Schaefer, Miguel Figliozzi, and Avinash Unnikrishnan.
• "Robust Maximum Coverage Facility Problem with Drones Considering Uncertainties in Battery Availability and Consumption", by Miguel Figliozi, Darshan Rajesh Chauhan, Avinash Unnikrishnan, and Stephen Boyles.
• "A Ranked Ordered Logit Model to Analyze Relative Crash Risk by Number of Vehicles Involved", by Mohamed Osman, Rajesh Paleti, and Sabyasachee Mishra.
• "Freight Systems and Marine Transportation Work in Progress", by Evangelos Kaisar.
• "Can Autonomous Delivery Robots Reduce Last Mile Energy Consumption and CO2 Emissions?", by Miguel Figliozi and Dylan Jennings.
• "E-Grocery Home Delivery Impacts on Food Access and Equity: a Portland Case Study", by Miguel Figliozzi and Katherine Keeling.
• "Cluster-based Methodology for Scheduling a University Shuttle System", by Ahmadreza Mahmoudzadeh and Xiubin Wang.

Posters
• "Applying an Auction Theory Framework to the Berth Scheduling Problem", by Dimitrios Giampouranis.
• "Container Terminal and Liner Shipping Companies Cooperation and Competition by Means of Capacity Utilization", by Karlis Pujats.
• "User Willingness to Delegate Conventional Driving to Autonomous Driving System Under Different Contexts", by Diwas Thapa, Vit Gabrhel,

Sabyasachee Mishra, Mohames Osman, Dariana Havlíčková, and Petr Zámečník.
• "Truck Tonnage Estimation Using Weigh-In-Motion (WIM) Data in Florida", by Taraneh Ardalan, Dan Liu, Evangelos Kaisar, Monica Zhong, and Frank Tabatabaee.
• "Research on the Dynamic Influence of the Fastener Stiffness of the Non-Ballasted Track", by Dan liu, Trong-vuong Truong, and Chengguang Su.
• "Developing a Methodology to Predict the Adoption Rate of Connected Autonomous Trucks in Transportation Organizations Using Peer Effects", by Jesse Simpson and Sabyasachee Mishra.
• "Intermodal Freight Network Design Model Considering Emission Levels and Time Constraints", by Panagiota Goulianou, Anastasios Charisis, Dan Liu, Evangelos Kaisar, Mihalis Golias.
• "Measuring Consumers' Willingness to Pay Towards Adoption of Connected and Autonomous Vehicles Based on their Social Network", by Ishant Sharma and Sabyasachee Mishra.
• "A Coordinated Routing Mechanism for Connected Vehicles with Information Perturbation Under Mixed-Strategy Congestion Game", by Stephen Spana, Lili Du, Yafeng Yin.
• "Prioritization of Autonomous Public Transit Buses on Urban Roads", by Ishant Sharma, Sabyasachee Mishra, and Mihalis Golias.

The 23nd IEEE International Conference on Intelligent Transportation Systems
Presentations (virtual)
• "Autonomous Delivery Vehicle in Urban E-Grocery Delivery: A Two-Echelon Vehicle Routing Problem", by Dan Liu and Evangelos Kaisar
• "Evaluation of Freight and Transit Signal Priority Strategies in Multi-Modal Corridors: Development of FSP and TSP Guidelines", by Taraneh Ardalan and Evangelos Kaisar.

Other events
• Figliozzi, M., "Last Mile Delivery Innovations," Portland freight Committee, Portland, Oregon, May 6, 2020.
• Figliozzi, M., "Last Mile Modeling Challenges," Oregon Modeling Users Group Meeting, Portland, Oregon, May 16, 2020.

SELECTED FMRI PUBLICATIONS

- Liu, D., Yan P., Deng, Z., Wang Y. and Kaisar, E. I. (2020). *Collaborative Intermodal Freight Transport Network Design and Vehicle Arrangement with Applications in the Oil and Gas Drilling Equipment Industry.* Transportmetrica A: Transport Science, 16, p. 1574-1603.
- Liu, D., Deng, Z., Mao, X., Yang, Y., and Kaisar, E. I. (2020). *Two-echelon Vehicle Routing Problem: Optimization of Autonomous Delivery Vehicle Assisted E-Grocery Distribution.* IEEE ACCESS.
- Figliozzi, M. A. (2020). *Carbon emissions reductions in last mile and grocery deliveries utilizing air and ground autonomous vehicles.* Transportation Research Part D: Transport and Environment, 85, 102443.
- Paleti, R., Mishra, S., Haque, K., and Golias, M. (2020). *Latent class analysis of residential and work location choices.* Transportation Letters. DOI: 10.1080/19427867.2020.1783610
- Sharma, I., Mishra, S., Golias, M., Welch, T., and Cherry, C. (2020). *Equity of transit connectivity in Tennessee cities.* Journal of Transport Geography, 86, 102750.
- Bhattarai, S., Golias, M., Mishra, S., and Talebian, A. (2020). *Multidimensional resource allocation for freight transportation planning.* Transportation Research Part-A: Policy and Practice, 137, p. 95-110.
- Sharma, I., and Mishra, S. (2020). *Modeling consumers' likelihood to adopt autonomous vehicles based on their peer network.* Transportation Research Part D: Transport and Environment, 87, 102509.
- Li, L., Cao, M., Yin, J., Wang, Y., and Mishra, S. (2020). *Observing the Characteristics of Multi-Activity Trip Chain and Its Influencing Mechanism.* KSCE Journal of Civil Engineering, p. 1-14.
- Ngo, H., Kumar, A., and Mishra, S. (2020). *Optimal positioning of dynamic wireless charging infrastructure in a road network for battery electric vehicles.* Transportation Research Part D: Transport and Environment, 85, 102385.
- Simpson, J. R., and Mishra, S. (2020). *Developing a methodology to predict the adoption rate of Connected Autonomous Trucks in transportation organizations using peer effects.* Research in Transportation Economics, 100866.
- Mahmoudzadeh, A. , Khodakarami, M., Ma, C., Mitchell, K., Wang, X., and Zhang, Y. (Under review). *Waterway Maintenance Budget Allocation in A Multimodal Network.* Transportation Research Part E.
- Liu, D., Deng, Z., Pu, Z., Wang, Z., and Kaisar, E. I. (Under review). *Clustering Method for Truck Tonnage Estimation Using Weigh-in-Motion (WIM) Data.* Measurement.
- Liu, D., Yan P., Deng, Z., Wang Y. and Kaisar, E. I. (Under review). *Sustainable Two Echelon Vehicle and Autonomous Delivery Robots Routing for E-Grocery Operations.* Transportation Research Part C: Emerging Technologies.
- Liu, D., Deng, Z., and Kaisar, E. I. (Under review). *Method for Identifying Truck Traffic Site Clustering Using Weigh-in-Motion (WIM) Data.* IEEE ACCESS.
- Liu, D., Deng, Z., Zhang W., Wang Y., and Kaisar, E. I. (Under review). *Design of Sustainable Urban Electronic Grocery Distribution Network.* Alexandria Engineering Journal, 2020, 7.
- Amini, M., Bienstock, C., and Golias, M. (In print). *Management of supply chains with attribute-sensitive products: a comprehensive literature review and future research agenda.* International Journal of Logistics Management.

The Freight Mobility Research Institute is dedicated to the development of student in the spheres of education, research, and professional skills. Our student researchers have a hands-on experience with a plethora of research projects, classroom instruction, and other educational initiatives. The Institute aims to prepare student researchers for real issues plaguing the transportation industry in the improvement of mobility.
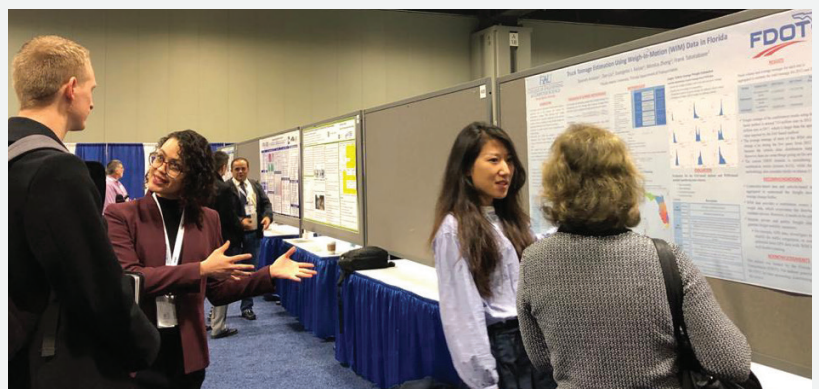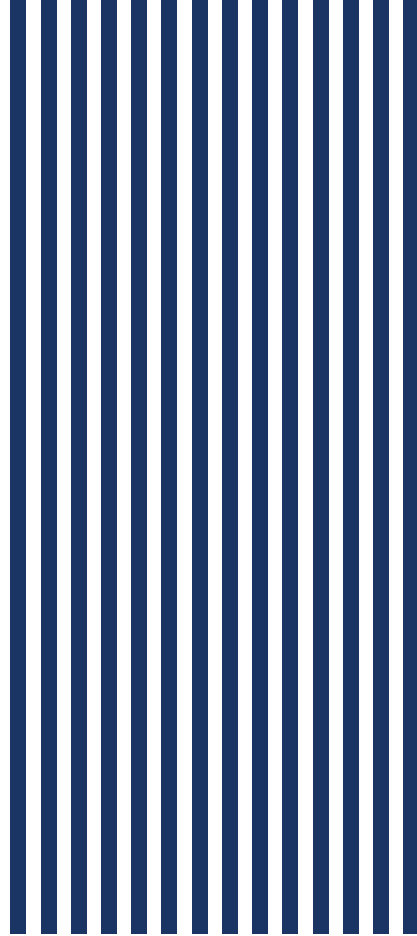
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