Federal Agency	U.S. Department of Transportation
Federal Grant Number	Grant No: 69A3551747120
Project Title	Freight Mobility Research Institute (FMRI)
Program Director Name, Tittle, Contact Information	Evangelos I. Kaisar Director, Freight Mobility Research Institute (FMRI) Associate Professor & Director Geomatics and Transportation Engineering Program 777 Glades Rd. Bldg. #36, Rm. 214 Boca Raton, FL 33431 Tel: 561 297 4084 ekaisar@fau.edu
Name of Submitting Official, Title and Contact Information	Heather Thompson Research Coordinator Freight Mobility Research Institute Hthomp10@fau.edu
Submission Date	April 30, 2017
DUNS/EIN Numbers	004147534/ 65-0385507
Recipient Organization (Name and Address)	Florida Atlantic University 777 Glades Rd. Boca Raton, FL 33431
Recipient Identifying Number (if any)	
Project/grant Period end Date	11/30/2016 - 9/30/2022
Reporting Period End Date	06/01/2017 – 03/31/2018
Report Term or Frequency	PPPR for FMRI – UTC. This report covers the period from November 30, 2016 to June 30, 2017, per Exhibit B, Grant Deliverables and Requirements for UTC Grants (November 2016)
Signature of Submitting Official	

Part I – Accomplishments: What was done? What was learned?	
The information provided in this section allows the OST-R grants official to assess whether satisfactory progress has been made during the reporting period.	
Reporting Period	**06/01/2017 – 03/31/2018**
1. 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 and 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 expertise on freight transportation, network modeling, sustainability, and 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 leading 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 efficiency

	and safety, sustainably reduce traffic congestion, and develop standards 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, on our first years of operation we 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. 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.
2. What was accomplished under these goals?	FMRI is a partnership of the Florida Atlantic University, Portland State University, Texas A&M University, University of Florida, University of Memphis, University of Minnesota, and Hampton University. Its purpose is to conduct a multidisciplinary program of research, education, and technology transfer aimed at increasing the economic competitiveness of urban metropolitan areas through improved freight mobility and transportation system performance across all surface transportation modes. Freight often share the same infrastructure with passengers and compete for the same capacity. The research challenge is how all urban functions can best be managed together. By developing strategies that promote productivity and better integrate modes and users, FMRI contributes to more efficient, sustainable transportation. In the first year we developed procedures and documents for inviting proposals. The submitted proposals conducted external reviews and the final projects selected for funding are listed in the next page. **First Year Research Accomplishments:**

	FMRI research program aims to generate a body of knowledge that makes a significant contribution to solving first- and last-mile transportation problems. Year 1 endeavors were a set of pre-selected launch projects from short proposals submitted and reviewed during the proposal preparation process, which has allowed us to begin the research during Fall 2017. **<u>Year 1 Launch Projects Progress</u>** **FMRI YR-P1: Modeling the Sustainability of Commercial Vehicle Technologies (PI: Figliozzi, PSU)** Unmanned aerial vehicles have the potential to disrupt last mile deliveries and supply chains. UAVs are not constrained by road infrastructure and/or congested roadways. UAVs can increase significantly in last-mile freight mobility for packages and small payloads. UAVs are likely to have a nationwide impact, in both urban and rural areas. Models that can estimate UAVs cost and sustainability impacts are necessary to account properly for the potential UAV mobility and sustainability gains. The main goal of this project is to develop robust tools and models to analyze UAVs environmental, logistical, and cost tradeoffs. More specifically, the research project will: (1) review and analyze key UAV characteristics, limitations, and capabilities, (2) model and compare UAV and conventional ground vehicle lifecycle emissions and sustainability aspects, (3) model and compare UAV operational and long-term costs, and (4) analyze the potential impacts of widespread UAV adoption on freight planning models and tools. This was the first study to model the potential effectiveness of Unmanned Aerial Vehicles (UAVs) or drones to reduce CO2e lifecycle (including both utilization and vehicle phase) emissions when compared to conventional diesel vans, electric trucks, electric vans, and tricycles. Different route and customer configurations are modeled analytically and utilizing real-word data, tradeoffs and comparative advantages of UAVs are discussed. Breakeven points for operational emissions are obtained and the results clearly indicate that UAVs are more CO2e efficient, for small payloads, than conventional diesel vans in a per-distance basis. Drastically different results are obtained when customers can be grouped in a delivery route. UAV deliveries are not more CO2e efficient than tricycle or electric van delivery services if a few customers can be grouped in a route. Vehicle phase CO2e emissions for UAVs are significant and must be taken into account. Ground vehicles are more efficient when comparing vehicles production and disposal emissions per delivery.

	FMRI YR-P2: Eco-Driving Study on Trucks along Signalized Arterial with Significant Freight Traffic. (PI: Zhang, TAMU) The objective of this research is to develop eco-driving strategies by optimizing the speed profiles of the trucks along a signalized arterial to minimize fuel consumption and emission while maintaining good mobility of the corridor. Two significant differences exist between this proposed study and prior studies. Firstly, the study has a focus on trucks which have distinct characteristics in acceleration, deceleration, and speed. These characters will have significant impacts on traffic operations as well as fuel consumption and emissions for an arterial with significant freight traffic. This research aims to accomplish the following specific components: • An optimization model for truck speed profiles • A signal coordination model specifically considering heavy traffic • Integrated modeling of signal control and truck driving decisions in a connected environment A simulation platform was established by VISSIM for the purpose of evaluation. The aggregated influence of truck speed and its Market Penetration Rate (MPR) on the performance of signalized arterial are tested for an isolated intersection and a coordinated signalized corridor. The results show that for a signalized arterial, the exiting coordination fails when the demand is composed of a large portion of trucks. The modelling of the truck dynamics and a new control strategy is developed. **FMRI YR-P2: Truck Parking study: unveiling the parking space density and truck volume relationship. (PI: Wang, TAMU)** The objective is to study the relation between truck volume and parking space density in a simulation environment as phase I. The truck space availability issue is essentially one between volume and density subject to boundary conditions. The intuitive observation is that a higher volume demands more parking space statistically. The boundary condition is that there must be a minimum density no matter how low the volume is. In realistic situations, such as those along the corridors of I-94 in Wisconsin and Minnesota as well as I-35, HW29 in Iowa and Texas, the team believes that there must be an inherent relationship between the space needed and the truck volume. The study means is computer simulation, which allows to flexibly examine all different situations along the interstate highways in terms of volumes and density. The goal is to explore a statistical formula for this relationship in a hope that policy makers may use to examine adequacy of truck parking space within their jurisdiction areas.

FMRI YR-P3: Enhancement of Transportation Network Analysis Tools for Truck-Related Planning and Operations. (PI: Washburn, UF)

This project aims to improve the state-of-the-art for accounting for the impact of trucks at the network level. This will be accomplished in two ways: 1) extending the methodology for multiclass user-equilibrium (UE) traffic assignment to account for flow-dependent PCEs of trucks, and 2) using the HCM freeway facility analysis methodology to calculate travel time in the UE route choice methodology instead of the traditional BPR (Bureau of Public Roads) function. During this period, this study accomplished the following thus far:

- Freeway facility network travel time reliability process
- Network scheme between the traffic assignment software
- UE assignment with HCM FF analysis methodology program and software program that implements the uninterrupted Flow Analysis Methodologies

FMRI YR-P4: Game-Theory Application for Seaport Cooperation, Competition, and Co-opetition. (PI: Gkolias, UM)

Applications of game theory in maritime transportation (ports and liner shipping network in specific) has been in the rise in the last decade (Lee and Song, 2017) and one research direction that has been proposed is the development of models that can capture cooperation/competitions between marine container terminal operators (MCTOs) and liner shipping companies. MCTO and/or port cooperation especially seems like a natural reaction to the rapid changes in the liner shipping industry in the form of new (and perhaps unstable) alliances and demand/supply volatility. In this project, we investigate the applicability of game theory models (e.g., multi-objective, Bertrand/Nash equilibrium problems with or without equilibrium constraints, Nash Bargaining and Equilibrium, Stackelberg etc.) to model cooperation, competition, and co-opetition between marine container terminal operators (MCTOs), seaports, and liner shipping alliances. The objective is to develop a mathematical framework that will maximize port revenues, minimize port costs and increase freight fluidity through our nation's seaports.

FMRI YR-P5: Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations. (PI: Mishra, UM; Kaisar, FAU)

The main objectives of this project are to (1) review rapidly emerging technologies affecting freight planning and operations, (3) survey stakeholders to identify their inclination, and (4) outline future

	research steps necessary to meet future local agencies, MPOs, and state DOTs freight planning and performance evaluation needs. During this reporting period, we completed a literature review of emerging technologies and new datasets resulting out of recent innovations. After completion of literature review, we developed a disaggregate market penetration model for freight transportation organizations adopting connected autonomous vehicle (CAV) technology. Building upon the theory of diffusion of innovation we develop models for various freight transportation innovations, including improved tractor and trailer aerodynamics, anti-idling technologies for trucks, and other organizationally adopted innovations. This study provides valuable insights regarding organizational innovation adoption and a demonstration of the impact of organizational heterogeneity on adoption rates. **FMRI YR-P6: Identify Potential Causes of Truck Bottlenecks on Freeways and Develop Mitigation Strategies. (PI: Liao, UMN)** The objectives of this project are to identify truck bottlenecks and assess congestion impact, examine and analyze trucking activity nearby congested areas and investigate possible causes of recurring congestions, and develop and recommend potential mitigation solutions for improve system performance for all users. With the support from MnDOT, we used NPMRDS to compute monthly truck delay and reliability measures for 2015 and 2016. We developed a systematic ranking tool for truck bottlenecks and used the NCHRP 08-98 report as a guide to identify impediments and bottlenecks. Six potential truck bottlenecks in the study area were identified. We examined and analyzed trucking activities nearby each congested area to understand the potential causes of truck delays. ***Second-Year Projects are currently under review, which include the following:*** **FMRI Y2R1: Interactive web-based platform for analyzing freight data – Phase I.** (PI: Kaisar, Florida Atlantic University, Subcontractors: Edara, University of Missouri) **FMRI Y2R2: Sustainable Urban Freight Mobility through Optimization of Logistics Facility Locations.** (PI: Kaisar, Florida Atlantic University Co-Investigator: Lili Du, PhD, University of Florida) **FMRI Y2R3: Disaggregation of Freight Flows for Tennessee.** (PI: Gkolias, University of Memphis) **Y2R4 - Truck Parking Study: Unveiling the Parking Space Density and Truck Volume Relationship: Phase II.** (PI: Wang, TAMU)

	FMRI Y2R5: Optimization of Winter Maintenance Stations for Safe and Efficient Freight Transportation. (PI: Khani, University of Minnesota) **FMRI Y2R6: Modeling the Impacts of Regulations and Safety Constraints on UAVs Costs and Emissions - Phase 2.** (PI: Figliozzi, Portland State University) **FMRI Y2R7: Next Generation of Freight Planning and Operation Models To Incorporate Emerging Innovative Technologies.** (PI: Figliozzi, PhD, Portland State University, Kaisar, PhD, Florida Atlantic University; Miguel; Mihalis Gkolias, PhD, University of Memphis; Sabyasachee Mishra, PhD, University of Memphis) **FMRI Y2R8: Dynamic Trajectory Control and Signal Coordination for a Signalized Arterial with Significant Freight Traffic.** (PI: Zhang, TAMU) **FMRI Y2R9: Truck Parking Needs in Tennessee.** (PI: Gkolias, University of Memphis, Subcontractors/Co-PIs: Dan Murray, American Transportation Research Institute; Airton Kohls, University of Tennessee, Knoxville; Chris Cherry, University of Tennessee, Knoxville) **FMRI Y2R10: Two-lane Highway Analysis Methodology Enhancements Considering Commercial Trucks.** (PI: Washburn, University of Florida) **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, under this grant we are developing a series of education activities, from K-12 to graduate level. These programs build on the education and training programs available at the consortium universities. In the first year we collaborated with other centers in our region and we planned a joint regional conference for Fall 2017. The conference took place in Gainesville, Florida and was engaged academic institutions in the region as well as public and the private sector. **Transportation Education and Workforce Development Project (PI: Maheshwari, Hampton University)** 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. Students will work alongside faculty researchers on related research projects. The partnerships with the transportation industry will offer students experiential learning through co-ops and internships. During this time, this program accomplished the following thus far: • Lecture Series – Reverse Logistics in Johnson & Johnson Inventory Analysis (September 18, 2017); Reverse Logistics in Johnson & Johnson Procurement and Logistics (April 6, 2018); Port Operations in Virginia (April 23, 2018).K-12 Workshops for high school STEM teachers (December 9, 2017) • Seven internships were awarded during this cycle • Lesson plan development for high school classroom • High school essay student competition • Book creation: A Study of TRANSIT Bus Driver Distraction: A Methodological Approach
3. How have the results been disseminated?	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 conferences. All research projects are expected to result in refereed 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. New graduate courses have been developed for our graduates and non-degree seekers: **CGN 6930 Transportation Operations and Logistics Management.** This course aligns transportation management with a comprehensive overview of intermodal transportation logistics management. We will look at recent trends in the field and its import and stakeholders. Business logistics/supply chain will be viewed from managerial perspectives impacting physical distribution, materials management, transportation management, and logistics and supply chain management. The course covers the planning, organizing, and controlling of these activities including some activities such as transportation basics, inventory and location strategies. The FMRI research seminars serves as a forum for faculty, industry, and graduate students to present their research and work. Seminars and lecture series take place fall and spring semesters, open to public, and are well-attended. A workshop in resilience and in autonomous transportation, co-sponsored by FMRI was offered in Fall 2017 and Spring 2018. In addition, since work under FMRI has begun in September 2017, we do not have many research results. However, results from two FMRI projects will be available via a conference

	marine transportation, which will take place in June 2018, in Washington DC.
4. What do you plan to do during the next reporting period to accomplish the goals?	Currently, the Second-Year Projects are under review. • Finalize subcontracts for the selected projects • PIs begin to work on the selected projects • Continue discussion with StateDOTs for potential collaborations • Develop a FMRI Newsletter • Continuation of K-12 workforce • Finalize the external advisory board for STRIDE We would like to establish a FMRI mentor program that transportation practitioners and DOT staff guide students on research projects to make informed career decisions and to develop into well-educated professionals. The FMRI will continue to disseminate research results to our website, publications, journals and conference papers, professional presentations, and our monthly seminar series.
Part II – Products: What has the program produced?	
Publications are the characteristic product of research projects funded by the UTC Program. OST-R may evaluate what the publications demonstrate about the excellence and significance of the research and the efficacy with which the results are being communicated to colleagues, potential users, and the public, not the number of publications. Many research projects (though not all) develop significant products other than publications. OST-R may assess and report both publications and other products to Congress, communities of interest, and the public.	
Reporting Period	**06/01/2017 – 03/31/2018**
1. Journal publications:	Figliozzi, M. A. (2017) "Lifecycle modeling and assessment of unmanned aerial vehicles (Drones) CO2e emissions" Transportation Research Part D: Transport and Environment, 2017, 57, 251-261 (Federal Support) Figliozzi, M. A. (2018) "A Study of Unmanned Aerial Vehicles Energy and CO2 Emissions Efficiency" Paper Number: 18-05844, presented at the 97th Annual Meeting of the Transportation Research Board, Washington DC, January 2018. (Federal Support) Simpson, J., Mishra, S., Talebian, A., and Golias, M. "Disaggregated Prediction of Adoption Rate of Autonomous Trucks by Freight Organizations" Journal of Advanced Transportation. (Under Review) (Federal Support)

2. Books or other non-periodical, one-time publications	In progress: A Study of TRANSIT Bus Driver Distraction: A Methodological Approach (D'Souza, Hampton University)
3. Other publications, conference papers and presentations	Kaisar, E., Hourdos, J., "Guidance for Identifying Corridor Conditions that Warrant Deploying Transit Signal Priority and Queue Jump" 5th Annual IEEE International Conference, Naples, Italy, June 2017. Kaisar E., and Dhanak M., "A Smart Port Resiliency Assessment and Planning Tool" conference proceeding at 2017 International Urban Freight Conference, Long Beach, CA, October 2017. Petnga L., Austin M., and Kaisar E., "Formal Analysis of Delays in Waterway System Operations With Timed Automata Modeling" 2017 International Urban Freight Conference, Long Beach, CA, October 2017. Pujats* K., Golias M.M., Mishra S., "Marine Container Terminal Cooperation: A Nash Bargaining Approach" 97th Annual Meeting of the TRB. Washington, DC, January 2018. Kaisar E., and Gundersen E., "Data Envelopment Analysis Model for Assessment of Safety and Security of Intermodal Transportation Facilities" conference proceedings at the 97th Transportation Research Board Annual Meeting, Washington DC, January 2018. Simpson, J., Mishra, S., Talebian, A., and Golias, M. "Disaggregated Prediction of Adoption Rate of Autonomous Trucks by Freight Organizations" Journal of Advanced Transportation. Presented at the 5th Annual UTC Conference for the Southeastern Region, Gainesville, Florida, 2018. The paper below titled, "Modeling the Sustainability of Commercial Vehicle Technologies" has been disseminated to the following: • City Logistics Conference, July 2017 • University of Toronto CEE Seminar, September 2017 • METRANS conference, October 2017 • TRB Annual Meeting, January 2018
4. Website(s) or other Internet site(s)	The Freight Mobility Research Institute (FMRI) has established the center website, where you may view center activities related to research goals: http://fmri.fau.edu/

5. Technologies or techniques	The two studies listed below have been presented through seminars, professional presentations to the state and professionals, and implemented in the graduate courses: **Game-Theory Application for Seaport Cooperation, Competition, and Co-opetition**: New modeling technique to foster marine container terminal cooperation and improve profitability. **Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations:** New modeling technique to foster marine container terminal cooperation and improve profitability.
6. Outreach activities	**FMRI Seminar Series Fall 2017 – Spring 2018** These series are designed to facilitate career planning and provide guidance from and connections with practice, these events allow current transportation students to meet and learn from active transportation practitioners. FMRI Fellow: Bratislav Ostojic, "Evaluation of Pedestrian and Bicyclist Performance Measures by Using Crowd Monitoring Technologies in Southeast Florida" Sept., 2017 Dr. Yan Xiao, FIU, "Data-Based Decision Support: A Journey from Data to Information" Oct., 2017 Dr. YU Zhang, USF, "Improve the Level of Service of Free-Floating Bike Sharing-Its Connectivity with Freight Applications" Nov., 2017 Dr. Mihalis Gkolias, UM, "Applications of Game Theory to Containers Terminals" Dec., 2017 Dr. Nikolas Geroliminis, EPFL, "Dynamic Modeling and Perimeter Control in Large-scale Urban Networks" Dec., 2017 Mr. Eric Lindstrom, Kittelson & Associates, " Self-Driving Books-How our standard practices will change in the age of connected vehicles" Feb., 2018 Dr. Tim Schwanen, University of Oxford, Louis Merlin, FAU and Stephen Lockwood, Steve Lockwood LLC "Automation in Transportation" April, 2018

7. Courses and workshops	FMRI: Transportation Education and Workforce Development Project • Lecture Series – Reverse Logistics in Johnson & Johnson Inventory Analysis (September 11, 2017); Reverse Logistics in Johnson & Johnson Procurement and Logistics (April 6, 2018) • K-12 Workshops for high school STEM teachers (December 9, 2017) Summer 2017 - CGN 5935: Advance Transportation Operations & Logistics Management: With a total of 35 students, this new graduate course in the Department of Civil Environmental and Geomatics Engineering at Florida Atlantic University aligns transportation management with a comprehensive overview of intermodal transportation logistics management. We went over recent trends in the field and its import and stakeholders. Business logistics/supply chain was viewed from managerial perspectives impacting physical distribution, materials management, transportation management, and logistics and supply chain management. The course covered the planning, organizing, and controlling of these activities including some activities such as transportation basics, inventory and location strategies. Our goal is to establish an online transportation program and certificate in the field of freight transportation and logistics. Five-Day Engineering and Technology Camp on Freight Transportation of Smart Cities: FMRI sponsored a Summer Engineering and Technology Camp for 16 students moving on to grades 7, 8, and 9 from Crystal Lake Middle School, Carver Middle School, Margate Middle School, and AD Henderson University School. This course covered ArcGIS based spatial analysis of truck traffic in Florida, Port Resilience, Automated and Connected Vehicles, and Public Transportation in Smart Cities. They also visited with the FAU Society of Automotive Engineers Racing Team, assembled a basic soldering kit, and attended a drone flying demonstration. On November 2017 in Fort Lauderdale Florida, the FMRI hosted workshops titled “Lessons from Hurricane IRMA for Increasing Resilience From Practice to Revising Plans and Policy.”
8. Inventions, patent applications, and/or licenses	Nothing to Report
9. Other products	Below are two studies that have developed useful materials for future consumption:

	Game-Theory Application for Seaport Cooperation, Competition, and Co-opetition: • Four mathematical models • A presentation that can be used as part of workshops or as a case study in a classroom environment **Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations:** • Disaggregated model of organizational adoption • Can be applied to innovations other than autonomous trucks
Part III – Participants & Collaborating Organizations: Who has been involved?	
OST-R needs to know who has worked on the project to gauge and report performance in promoting partnerships and collaborations.	
Reporting Period	**06/01/2017 – 03/31/2018**
1. What organizations have been involved as partners?	Organization Names: • American Transportation Research Institute (ATRI) • Hampton University • Portland State University • Texas A&M University • University of Florida • University of Memphis • University of Minnesota • Florida Department of Transportation • The School District of Palm Beach County • Florida Department of Commerce • North Palm Beach Chamber of Commerce
2. Have other collaborators or contacts been involved?	FMRI has extensive relationships with other universities, public agencies, and private industry. This section presents our collaborators and their relationship to the FMRI UTC. Partners and contributors: Florida Department of Transportation, Broward and Palm Beach County Traffic Division, Minnesota Department of Transportation, Tennessee Department of Transportation, Florida Chamber of Commerce, Palm Beach North Chamber of Commerce, College of Engineering and Computer Science at FAU, University of Missouri, and Florida International University.

	Collaborations: The FMRI in Year 1 had one collaborative project between FAU and University of Memphis, titled "Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations." FMRI Advisory Board: The Advisory Board provides overall policy guidance for the Center; it suggests research priorities, identifies funding opportunities, assists in student job placements, and participates in outreach activities. Members are leaders from sponsor agencies, other agencies, and private industry. They serve as liaisons to their agencies and industries, and also contribute funding support. Advisory Board members are appointed by the Director with the advice of the Executive Committee. The Board meets annually. The Advisory Board had a conference call with the consortium members on June 9th, 2017. The purpose of the conference call was to introduce the Tier 1 center, provide an update on all Center activities, and discuss fundraising strategies. A list of Advisory Board members is available at http://eng.fau.edu/research/fmri/advisory-board.php
Part IV – Impact: What is the impact of the program? How has it contributed to transportation education, research and technology transfer?	
DOT uses this information to assess how the research and education programs: • **increase the body of knowledge and techniques;** • **enlarge the pool of people trained to develop that knowledge and techniques or** • **put it to use; and,** • **improve the physical, institutional, and information resources that enable those people to get their training and perform their functions.**	
Reporting Period	**06/01/2017 – 03/31/2018**
1. What is the impact on the development of the principal discipline(s) of the project?	The FMRI serves society by advancing transportation expertise through research and education. FMRI capitalizes on diversity to maximize its impact; academic diversity by way of a multidisciplinary team of faculty and research staff; geographic diversity, uniting academic institutions and their local public and private partners that span the nation; future workforce diversity by ensuring participation of underrepresented groups in STEM education and industry internships. During the first year that the FMRI center has been in operation, its research, education, technology transfer, and workforce development activities impacted the engineering as follows: • Funding has been provided to students affiliated with the FMRI to travel to conferences to present their work to

	network with transportation professionals, academics, and students • Research, and lecture series generated by FMRI is made available on the Center's website for public dissemination • Various workshops have been produced which have been disseminated widely to state DOTs and industry. The projects will still undergo a peer-reviewed process to seek guidance on maximizing their uniqueness, value, and applicability. Our consortium research selection goal is to develop a comprehensive program that focuses on solving high-priority freight mobility 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. *Highlighted below are significant projects from the first year cycle:* **Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations:** Developed disaggregated cellular automata-based approach to model organizational adoption towards innovations. Improved understanding of a specific innovation, i.e., autonomous trucks. **Eco-Driving Study on Trucks along Signalized Arterial with Significant Freight Traffic:** The eco-driving strategies will improve the mobility by saving the travel time of both trucks and passenger cars along a signalized arterial where the truck traffic is significant. The fuel consumptions and pollutions will be reduced, and this will provide citizens living nearby with better air quality. Last but not least, by using better individual truck trajectory control, the strategies will improve the safety at the signalized corridor.
2. What is the impact on other disciplines?	FMRI is a multi-disciplinary research center that includes engineering, computer science, and urban planning and logistics management. Our impact has been on developing interdisciplinary courses and degree programs. At FMRI, most graduate transportation courses are cross-listed between engineering and urban planning. Regarding fields of research, FMRI has contributed to develop a model for adoption of autonomous vehicle technologies by freight organizations. Other disciplines such as computer science, business administration, and economics can take advantage of the models developed. Through our research work, we would like to establish urban freight as a field of research within urban planning/supply chain management.

3. What is the impact on the development of human resources?	FMRI has developed lectures, workshops, and professional opportunities for all levels, including student support, research opportunities, and educational development. Student Support: At FAU, active FMRI UTC research projects fund 8 student positions. Of those hired, two are undergraduates, four are masters, one was a PhD student, and one is a research staff. More positions were made possible by research projects that are planning to start in June, and new students will be hired to fill these positions in the next reporting period. One undergraduate and two master's level students work on outreach activities. There are also additional graduate students that work at FMRI on a variety of projects including research projects, web management, and workforce development-related programs. We also provide financial and administrative support to allow students from all the campuses to participate in transportation conferences and competitions. Opportunities for Research: Student support is an important component of research project selection. Faculty of different research backgrounds and more than ten student researchers participate in these projects. Educational Materials and Programs and Opportunities for Teaching: We began development for the second session of the High School Teacher workshop to be offered June 2018. Several additional courses and programs are under development, and offer teaching opportunities for instructors from industry to share their experiences with our students.
4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?	At FAU, research facilities include staff offices, high capacity computing, state-of-the-art laboratory, secure data servers, and variety of simulation, optimization, and statistical software. • Undergraduate students have been made aware of internship opportunities within the FMRI partner institutions. • Graduate students have been aware of assistantships opportunities via FMRI funded projects. • Through the UTC regional conference and FMRI co-sponsored workshops students and academics have been made aware of different research for future collaboration.
5. What is the impact on technology transfer?	Our technology transfer program will provide information on regional intermodal transportation issues and the Center's research and educational activities to transportation professionals. Our partners have an outstanding track record of success, sharing expertise and

	research results with local, regional, national, and international communities for use in real-world applications that are committed to building on these accomplishments. Information will be disseminated via a Center web page, newsletters, reports, workshops, presentations, and seminars. A primary consideration in the technology transfer program will be the timely distribution of information in a format that is user-friendly and supports government, industry, and academic needs. The use and implementation of the center research results and products by practitioners is critical to improving the transportation system and to ensuring public- and private-sector support for future transportation research. FMRI will continue to focus on outreach to the practitioner community and actively seek partners to move research into practice.
6. What is the impact on society beyond science and technology?	New and improved tools and methods are in progress by FMRI during the first year to enhance mobility, distribution, safety, and security. The educational materials produced by Hampton University, a FMRI partner, have been disseminated and used widely. Collaboration between academia, public, and private sectors remains strong and FMRI continue to assists in collaborative activities. One example of our first-year ongoing projects on technology transfer is the Eco-Driving Study. The strategies developed in this project will assist the truck drivers in their decision making and lead to better (safe/efficient/economical) driving behaviors.
7. Additional impacts	Freight transportation provides significant contribution to our nation's economy. Reliable and accessible freight network enables business in urban areas to be competitive in the nation. Many urban roadways are facing challenges with traffic volumes over capacity during peak periods. As a result, time and money are lost due to traffic congestion. Operational and design constraints such as interchange, steep grade, signalized intersection, work zone, merging, lane drop, and others could contribute additional delays for commercial vehicles. The outcome of the FMRI first-year projects will allow USDOT, local state agencies, and other stakeholders to identify and monitor the performance of freight mobility and to systematically assess the impact of freight operations. The performance measures at any corridor level can provide recommendations on freight mobility specific needs and to help mitigation strategies to reduce delay, and improve reliability and mobility of all users of the system. In addition, with the growth of freight shipments worldwide, the freight

	transportation has grown steadily and has been making greater contributions to the development of the country through our efforts with processes and techniques. As most of these planning applications are highly dependent on the freight flow distribution, it is of critical importance to develop a multiclass assignment model to accurately forecast the distribution. Our main goal is to develop robust tools and models to analyze freight environmental, logistical and cost tradeoffs so we can have better travel time reliability, safety, reduction in emissions, and analyze the potential impacts of widespread new technologies adoption on freight planning models and tools. The impact of our models will improve the county's economic competiveness and make targeted investments to increase freight mobility and fluidity in all the transportation modes.
Part V – Changes/Problems	
If not previously reported in writing to OST-R through other mechanisms, provide the following additional information or state, "Nothing to Report, if applicable:	
Reporting Period	**06/01/2017 – 03/31/2018**
1. Changes in approach and reasons for change	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] "Nothing to Report"
2. Actual or anticipated problems or delays and actions or plans to resolve them	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] "Nothing to Report"
3. Changes that have a significant impact on expenditures	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] "Nothing to Report"
4. Significant changes in use or care of human subjects,	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] "Nothing to Report"

vertebrate animals, and/or biohazards	
5. Change of primary performance site location from that originally proposed	[If there is nothing significant to report during this reporting period, state "Nothing to Report."] "Nothing to Report"
6. Additional Information regarding Products and Impacts	[UTCs are encouraged to consider identifying program results by outputs, outcomes or impacts as suggested by the examples below. Impacts should be linked to National goals expressed in the Secretary's Strategic Goals.] "Nothing to Report"
Part VI– Special Reporting Requirements	
Respond to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements	
Reporting Period	**06/01/2017 – 03/31/2018**
	"Nothing to Report"