

Freight Mobility Research Institute

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Project Title	Freight Mobility Research Institute (FMRI) Evangelos I. Kaisar, Ph.D. Director, Freight Mobility Research Institute (FMRI) Associate Professor & Director Geomatics and Transportation Engineering Program
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Name of Submitting Official, Title and Contact Information	-
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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	5/30/2017
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 11/30/2016 – 5/30/2017

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, advance regional planning and setting of transportation priorities that deliver higher practice and economic growth and enhance productivity. These research efforts will (i) support maintenance and improvement of mobility in the face of growing traffic and shrinking resources; (ii) develop methodologies that link the performance of the U.S. freight transportation system; (iii) increase border-crossing efficiency while maintaining security and resilience; and (iv) improve air quality to advance personal health as well as translate into reduced energy consumption, reduce congestion, and cooperative performance improvement.

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.

Research Program themes:

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** - Define most efficient means of communication, data collection, and data mining for performance based freight fluidity network management. In particular, data needed to understand shipper behavior in terms of value of time and shippers' utility function so that modal choice and network flows may be better understood and predicted.
- **Freight Network Modeling and Operations** - Develop the best methods for understanding, operating and modeling multimodal freight transportation networks. Develop a methodology for Freight Fluidity measurement on the national level that can refocus transportation investments targeted to those benefiting local economic development as well as the nation's economy.
- **Intermodal Logistics** - Develop robust tools to identify optimal freight movements, and terminal locations by considering intermodal connections as well as supply and demand constraints.
- **Freight and Supply Chain Sustainability** - There are many tradeoffs in terms of emissions, energy consumptions, and health impacts that can be analyzed at the vehicle level (e.g. electric vs. conventional engines), mode level (e.g. rail vs. highway) and supply chain level (e.g. local food chains vs. international food chains). A major research effort of this center will focus on the development of methods, tools, and performance measures to evaluate sustainability aspects of freight operations and alternatives at the vehicle, mode, and supply chain level.
- **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?

[For this reporting period describe: 1) major activities; 2) specific objectives; 3) significant results, including major findings, developments, or conclusions (both positive and negative); and 4) key outcomes or other achievements. Include a discussion of stated goals not met. As the program progresses, the emphasis in reporting in this section should shift from reporting activities to reporting accomplishments.]

[Generally, the activities and expected outputs, outcomes and impacts should not change from one reporting period to the next. However, if there are changes, please list the revisions and explain the reason(s) for the changes.]

Research Program and Selection

For Year 1 of this grant our research program has two parts. The first is a set of pre-selected Year 1 Launch Projects. These projects will be selected from short proposals submitted and reviewed during the proposal preparation process and allowed us to begin the research as soon as summer 2017. There are some changes from the list submitted in the proposal because of changes in availability of researchers. The second part of our Year 1 research program is the open solicitation for our consortium. The RFP was issued in April 2017, and proposals were due June 30, 2017. The RFP is available at <http://fmri.fau.edu/>. The Associate Director for Research (Dr. John Hourdos) is managing the proposal review process. We anticipate making selection in the summer, with projects to start in the fall 2017 semester.

First year Lunch Projects:

Eco-Driving study on Trucks along a Signalized Arterial with Significant Freight Traffic

Principal Investigator: Yunlong Zhang, Professor, Texas A&M University

Co-Investigator: Bruce Wang, Associate Professor, Texas A&M University

Eco-driving is a concept of reducing fuel consumption and greenhouse gas emissions through changing driving behaviors. Along a signalized arterial, frequent driving mode changes in decelerating, stopping/idling, and accelerating contribute to elevated levels of fuel consumption and emissions. Because of the extra distance and time needed for deceleration and acceleration of heavy trucks, and because of the significantly alleviated fuel consumption rate and emission rates during the acceleration processes of these trucks, the driving decisions of the trucks not only have major impacts on the mobility, but also have significant environmental and economic impacts.

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. Secondly, this study will specifically consider market penetration and compliance rate of eco-driving from truck drivers and other drivers. The market penetration and compliance rates will significantly affect the results of optimization and also call for different modeling approaches; from a deterministic one to one that is probabilistic and considers uncertainties.

Identify Potential Causes of Truck Bottlenecks on Freeways and Develop Mitigation Strategies

Principal Investigator: Chen-Fu Liao, Sr. Systems Engineer, University of Minnesota

Co-Investigator: John Hourdos Research Associate Professor, University of Minnesota

Freight transportation provides significant contribution to our nation's economy. Reliable and accessible freight network enables business in the Twin Cities to be more competitive in the Upper Midwest region. Accurate and reliable freight data on freight activity is essential for freight planning, forecasting and decision making on infrastructure investment. Building on our previous research to measure freight mobility and reliability along key freight corridors in the Twin Cities metro area, this project will leverage our previous development for assessing truck congestions and travel time reliability to identify and investigate potential causes of truck bottlenecks and develop mitigation strategies on major truck highway corridors in the 8-county metro area. In addition, we will also include key freight corridors that connect to the regional freight centers in St. Cloud, Mankato, and Rochester areas. We plan to investigate potential causes of truck bottlenecks for recurring and non-recurring congestion conditions by merging truck volume and congestion information on a GIS framework for spatial analysis. We also propose to develop a systematic reporting tool to rank truck bottlenecks truck highway corridors. This tool will allow agencies to monitor the truck bottlenecks and evaluate the impact of deployed mitigation strategies on a regular basis. The objectives of this project are to: (1) identify truck bottlenecks and assess congestion impact, (2) examine and analyze trucking activity nearby congested areas and investigate

possible causes of recurring congestions, (3) develop and recommend potential mitigation solutions for improve system performance for all users, and (4) develop a systematic reporting tool to rank truck bottlenecks and use the tool to evaluate the impact of deployed mitigation strategies.

Modeling Adoption of Autonomous Vehicle Technologies by Freight Organizations

Principal Investigator: Sabyasachee Mishra, University of Memphis

Co-Investigator: Mihalis Golias, University of Memphis

Co-Investigator: Evangelos Kaisar, Florida Atlantic University

Over the last few years, a rapid explosion of new technologies have created opportunities to address critical freight transportation challenges in urban, suburban and rural areas. Some examples of new technologies include expansion of e-commerce, 3-D printing, deliveries by unmanned aerial vehicles (UAVs or drones), and potential applications of automated and connected vehicles in freight transportation (e.g. truck platooning). These new technologies are also influencing consumer behavior and thereby reshaping freight supply chains at the urban, regional, and international level.

The autonomous vehicle technologies use new features including smartphones, vehicle fleet tracking (GPS, and location-based systems), sensors (V2V, V2I), enhanced imaging technologies, and other sources that arise from broader smart city initiatives. While the fully autonomous vehicle technology is yet to come, some of the new features are already available and some freight organizations are already adopting them. These new technologies and data sources are creating new challenges for freight planners in identifying the potential non-adopters and adopters. In addition, how the adoption will vary over time. Adoption methods available from consumer behavior research are mostly based on individuals, and limited to organizations. The general adoption methods cannot be directly used in modeling adoption of freight organizations.

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.

3. How have the results been disseminated?

[Describe how the results have been disseminated. Include any outreach activities that have been undertaken to reach members of communities who are not usually aware of these program activities, for the purpose of enhancing public understanding and increasing interest in learning and transportation careers.]

“Nothing to Report”

4. What do you plan to do during the next reporting period to accomplish the goals?

[Describe briefly, what you plan to do during the next reporting period to accomplish the goals and objectives.]

Plans are to: 1) Implement the approved Year 1 projects, 2) continue work and complete the Year 1 projects, 3) begin the Year 2 RFP projects, and 4) continue dissemination of research results via our website, other publications, journal 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 **11/30/2016 – 5/30/2017**

1. Journal publications

[List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like. A publication in the proceedings of a one-time conference, not part of a series, should be reported under “Books or other non-periodical, one-time publications.”]

[Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).]

“Nothing to Report”

2. Books or other non-periodical, one-time publications

[Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.]

[Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).]

“Nothing to Report”

3. Other publications, conference papers and presentations

[Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication as noted above.]

“Nothing to Report”

4. Website(s) or other Internet site(s)

[List the URL for any Internet site(s) that disseminates the results of the research and/or program activities. A short description of each site should be provided. It is not necessary to include the publications already specified above in this section.]

The Freight Mobility Research institute (FMRI) has established the center website <http://fmri.fau.edu/>

5. Technologies or techniques

[Identify technologies or techniques that have resulted from the research activities. Describe the technologies or techniques and how they are being shared. Such as Technologies or technology assessments]

“Nothing to Report”

6. Outreach activities

FMRI Seminar Series Spring 2017

MD Sultan Ali, FAU, “Guidance for Identifying Corridor Conditions that Warrant Deploying Transit Signal Priority and Queue Jump”. March 2017.

Richard Michalski, Sirius XM, “Opportunities for Enhancing the Robustness and Functionality of the Dedicated Short Range Communications (DSRC) Infrastructure Through the Use of Satellite DARS”. April 2017.

Somaye Fakharian, WSP/Parsons Brinckerhoff & WTS South Florida “Introduction of Women’s Transportation Seminar (WTS) Area, of Transportation Engineering and the Benefits of WTS”. April 2017.

7. Courses and workshops

New Graduate Courses: One new graduate Transportation Logistic course was introduced in the Department of Civil Environmental and Geomatics Engineering at Florida Atlantic University in the summer 2017 as part of our goal to establish an online transportation program and certificate in the field of freight transportation and logistics. The course was CGN 5935 Advance 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.

8. Inventions, patent applications, and/or licenses

[Identify inventions, patent applications with date, and/or licenses that have resulted from the research. Submission of this information as part of an interim research performance progress report is not a substitute for any other invention reporting required under the terms and conditions of an award; as of the date of this document, UTC Program

inventions may not be submitted to the Federal government's Interagency Edison (iEdison) invention-reporting system, but OST-R is working to make that available and will notify UTCs. For additional requirements pertaining to Patents and Copyrights, refer to General Provisions of Grants for University Transportation Centers, Section III, 14.]

“Nothing to Report”

9. Other products

[Identify any other significant products that were developed under this program. Describe the product and how it is being shared.

Examples of other products are:

- Databases
- Physical collections
- Audio or video products
- Software or NetWare
- Models
- Educational aids or curricula
- Instruments or equipment
- Data & Research Material
- Other]

“Nothing to Report”

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.

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1. What organizations have been involved as partners?

[Describe partner organizations – academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic) – that have been involved with the program. Partner organizations may provide financial or in-kind support, supply facilities or equipment, collaborate in the research, exchange personnel, or otherwise contribute.]

Provide the following information for each partnership:

Organization Name:

- American Transportation Research Institute (ATRI)
- Hampton University
- Portland State University
- Texas A&M University
- University of Florida
- University of Memphis
- University of Minnesota

2. Have other collaborators or contacts been involved?

[Some significant collaborators or contacts within the lead or partner universities may not be covered by “What people have worked on the project?” Likewise, some significant collaborators or contacts outside the UTC may not be covered under “What other organizations have been involved as partners?” For example, describe any significant:

- Collaborations with others within the lead or partner universities; especially
- interdepartmental or interdisciplinary collaborations;
- Collaborations or contact with others outside the UTC; and
- Collaborations or contacts with others outside the United States or with an international organization.
- Country(ies) of collaborations or contacts.]

FMRI has extensive relationships with other universities, public agencies, and private industry. The FMRI UTC has access to these relationships. This section presents our collaborators and their relationship to the FMRI UTC.

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://fmri.fau.edu/> .

Partners and contributors: State Department of Transportation, Florida Chamber of Commerce, Palm Beach North Chamber of Commerce, College of Engineering and Computer Science at FAU, etc.

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

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1. What is the impact on the development of the principal discipline(s) of the project?

[Describe how findings, results, techniques that were developed or extended, or other products from the program made an impact or are likely to make an impact on the base of knowledge, theory, and research and/or pedagogical methods in the principal disciplinary field(s) of the program. Summarize using language that an intelligent lay audience can understand (Scientific American style).]

[How the field or discipline is defined is not as important as covering the impact the work has had on knowledge and technique. Make the best distinction possible, for example, by using a “field” or “discipline”, if appropriate, that corresponds with a single academic department (i.e., physics rather than nuclear physics).]

The FMRIIs serve 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

The projects will still undergo a peer-reviewed process to seek guidance on maximizing their uniqueness, value, and implement ability. 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.

2. What is the impact on other disciplines?

[Describe how the findings, results, or techniques developed or improved, or other products from the program made an impact or are likely to make an impact on other disciplines.]

“Nothing to Report”

3. What is the impact on the development of human resources?

[Describe how the program made an impact or is likely to make an impact on human resources.]

“Nothing to Report”

4. What is the impact on physical, institutional, and information resources at the university or other partner institutions?

[Describe ways, if any, in which the program made an impact, or is likely to make an impact, on physical, institutional, and information resources that form infrastructure, including:

- Physical resources such as facilities, laboratories, or instruments;
- Institutional resources (such as establishment or sustenance of societies or organizations);
or
- Information resources, electronic means for accessing such resources or for scientific communication, or the like.]

“Nothing to Report”

5. What is the impact on technology transfer?

[Describe ways in which the program made an impact, or is likely to make an impact, on commercial technology or public use, including:

- Transfer of results to entities in government or industry;
- Instances where the research has led to the initiation of a start-up company; or
- Adoption of new practices.]

“Nothing to Report”

6. What is the impact on society beyond science and technology?

[Describe how results from the program made an impact, or are likely to make an impact, beyond the bounds of science, engineering, and the academic world on areas such as:

- Improving public knowledge, attitudes, skills, and abilities;
- Changing behavior, practices, decision making, policies (including regulatory policies), or social actions; or
- Improving social, economic, civic, or environmental conditions]

“Nothing to Report”

7. Additional impacts

[NTC encourages to consider identifying program results by outcomes or impacts, as suggested by the examples below. Impacts should be linked to National goals expressed in the Secretary’s Strategic Goals.]

[Outcomes are broader changes that are expected to result from the products, such as:

- Increased understanding and awareness of transportation issues;
- Improved body of knowledge;

- Improved processes, techniques and skills in addressing transportation issues;
- Enlarged pool of trained transportation professionals;
- Greater adoption of new technology;
- Other impacts.

Impacts are the longer-term, fundamental changes intended as a result of your activities, such as:

- Safer driver behavior;
- Increased travel time reliability;
- Increased intermodal transportation operations;
- Reduction in carbon and other harmful emissions from transportation sources;
- Other impacts.]

“Nothing to Report”

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	11/30/2016 – 5/30/2017
1. Changes in approach and reasons for change	<p>[If there is nothing significant to report during this reporting period, state “Nothing to Report.”]</p> <p>[Describe any changes in approach during the reporting period and reasons for these changes. Remember that significant changes in objectives and scope require prior approval of the OST-R grant administrator.]</p> <p>“Nothing to Report”</p>
2. Actual or anticipated problems or delays and actions or plans to resolve them	<p>[If there is nothing significant to report during this reporting period, state “Nothing to Report.”]</p> <p>[Describe problems or delays encountered during the reporting period and actions or plans to resolve them.]</p> <p>“Nothing to Report”</p>
3. Changes that have a significant impact on expenditures	<p>[If there is nothing significant to report during this reporting period, state “Nothing to Report.”]</p> <p>[Describe changes during the reporting period that may have a significant impact on expenditures, for example, delays in hiring staff or favorable developments that enable meeting objectives at less cost than anticipated.]</p> <p>“Nothing to Report”</p>
4. Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards	<p>[If there is nothing significant to report during this reporting period, state “Nothing to Report.”]</p> <p>[Describe significant deviations, unexpected outcomes, or changes in approved protocols for the use or care of human subjects, vertebrate animals, and/or biohazards during the reporting period. If required, were these changes approved by the applicable institution committee and reported to the agency? Also specify the applicable Institutional Review Board/Institutional Animal Care and Use Committee approval dates.]</p> <p>“Nothing to Report”</p>
5. Change of primary performance site	<p>[If there is nothing significant to report during this reporting period, state “Nothing to Report.”]</p>

location from that originally proposed

[Identify any change to the primary performance site location identified in the proposal, as originally submitted.]

“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 **11/30/2016 – 5/30/2017**

“Nothing to Report”