NCTSPM

NATIONAL CENTER FOR TRANSPORTATION SYSTEMS PRODUCTIVITY AND MANAGEMENT

Program Progress Performance Report for University Transportation Centers

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Signature of Submitting Official:

Michael Hunter, Ph.D. **05/30/17**

Date

Accomplishments

What are the major goals of the program?

The National Center for Transportation Systems Productivity and Management (NCTSPM), a Tier I University Transportation Center, was founded to facilitate, coordinate, and conduct research and educational programs toward the following goals:

- Conduct multi-disciplinary research on topics relevant to the relationship among transportation infrastructure (state-of-good-repair), economic competiveness, and safety
- Disseminate research results and other products of the Center to the transportation community
- Promote transportation education and professional development on topics relating to Center research
- Establish a central point of contact and promotion of best practices (e.g., through a web site or list serve) for materials relating to transportation systems performance and management
- Promote diversity in the workforce through active recruitment of women and minority students into degree programs
- Act as a national resource for the debates and discussions that focus on the evolving national transportation program and future directions
- Explore international cooperative activities with research entities in selected countries where similar research interests exist

What was accomplished under these goals?

Accomplishments for the reporting period are discussed below and organized by major center goal.

Conduct multi-disciplinary research on topics relevant to the relationship among transportation infrastructure (state-of-good-repair), economic competiveness and safety

NCTSPM supports multi-disciplinary research. Some projects simultaneously address infrastructure and safety; others deal with state-of-good-repair and economic competitiveness; while still others address all three of our themes. Our researchers represent a variety of disciplines: civil engineering, urban planning, economics, public health, and public policy.

A full listing of NCTSPM-funded research projects can be found at the end of this report.

UAB continued work on seven UTC projects, all of which are collaborations with center universities. Topics include design of sign structures, the safety impacts of electronic billboards, freight modeling, drive-by damage detection of bridges, evaluation of FRP retrofits to bridge structures, and the effects of increased heavy vehicle loadings on bridge life.

UCF established solar-powered image capture systems for determining origin-destination of commercial vehicles. Collected data for freight movements at three locations on I-75 in Florida.

Georgia Tech completed final reports for four projects and continued working on seven projects.

Disseminate research results and other products of the Center to the transportation community

NCTSPM posts research updates to its website on a regular basis. A Project Information Form for each project is posted on the website, as well as related documents, such as pictures, posters, reports, and presentations. Information on NCTPSM's research is also posted to the Georgia Tech Transportation Alumni group on LinkedIn and on the Georgia Tech Civil Engineering website.

During this reporting period, NCTSPM produced over 102 research reports and journal publications, and presented over 55 conference proceedings, invited presentations/lectures on research findings, workshops, seminars, and webinars on a variety of research projects and produced one patent. Research papers were cited over 55 times in the reporting period.

UCF researchers gave two presentations to FDOT District 5 and Freight Leaders in Florida. During the 95th TRB annual meeting, the UCF researchers presented several research papers about safety analysis under low visibility condition. During the 2016 Road Safety on Five Continents (RS5C) conference, one UCF research paper was presented about fog impact on traffic safety.

Equations developed for the research project "Evaluation of Anchor Bold Clearance Discrepancies" will be included in the future AASHTO Standard Specifications for Structural Supports manual.

FIU published 19 research papers in journals and conference proceedings. Made 8 presentations at the Fourth Annual Meeting of the Southeast Region of University Transportation Centers at the University of Tennessee, Knoxville. Completed one final research report. UAB researchers published 8 papers related to NCTSPM projects and made 5 conference presentations during this period.

Promote transportation education and professional development on topics relating to Center research

NCTSPM actively promotes education and professional development.

One UCF Ph.D. student is expected to complete his thesis in a few months. One Ph.D. on-going dissertation is focused on a comprehensive analysis of traffic management, safety, and flow with different weather conditions. Also, one M.S. thesis about the driving behavior and safety under different levels of visibility condition was completed.

For the fourth year in a row the UCF Transportation Systems Engineering program hosted Camp Connect. The week long camp in July brought 13th through 17th graders to campus, where they were presented with an overview of the engineering discipline, describing each field using real world examples. The students also learned about transportation through an interactive board game called Reservation Road Planner where they had to complete a project through the five stages of development, project inventory inclusion, funding, preconstruction, and construction.

FIU held ten seminars with guest speakers from government agencies and consulting companies.

FIU ITE Student Chapter received Best Student Chapter Award from the International Institute of Transportation Engineers (ITE). FIU students recognized for first-place and second-place Best Student Paper Awards at the 15th TRB International Conference on Managed Lanes, May 4-6, 2016 in Miami, Florida.

Establish a central point of contact and promotion of best practices (e.g., through a web site or list serve) for materials relating to transportation systems performance and management

The NCTSPM website remains the main point of contact and promotion of best practices. In the reporting period, the website received more than 12,103 web views and 7,230 unique visits which are illustrated in Figure 1 and Table 1 below.

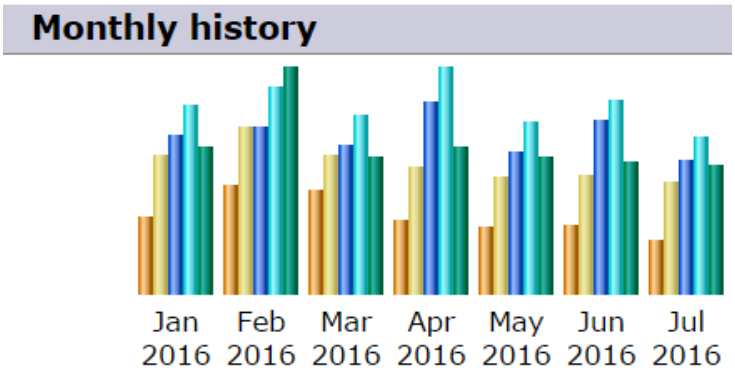


Figure 1. Web traffic during reporting period

Table 1: Web traffic during reporting period

Month	Unique visitors	Number of visits
Jan 2016	1,020	1,847
Feb 2016	1,427	2,197
Mar 2016	1,356	1,849
Apr 2016	964	1,655
May 2016	861	1,537
Jun 2016	899	1,560
Jul 2016	703	1,458

Promote diversity in the workforce through active recruitment of women and minority students into degree programs

During the reporting period, each university took action to recruit women and minority students into their transportation programs and provide them with opportunities for professional development. Activities included:

UAB conducted the fourth annual Summer Enrichment program during June 2016. Six minority students participated in the program this year. The University of Alabama at Birmingham NCTSPM Summer Enrichment Program is a four-week educational development program designed to give additional training and professional exposure to college freshmen or incoming freshmen students enrolled in Alabama's historically black colleges who have an interest in careers related to engineering and transportation. The program is put on by UAB in partnership with Alabama's Historically Black Colleges and Universities (HBCUs) and the UAB Sustainable Smart Cities Research Center, and sponsored by the National Center for Transportation System Productivity and Management (NCTSPM). The program was modeled after a similar program led by the UAB Minority Health and Health Disparities Research Center (MHRC), a comprehensive educational, research, and community outreach center focused on eliminating the health disparities of racial and ethnic minorities. The purpose of the NCTSPM Summer Enrichment Program is to increase the number of well-trained minority researchers and engineers working on transportation-related issues.

This was the fourth year that UAB has offered the NCTSPM Summer Enrichment Program. Dr. Robert Peters, UAB Professor of Environmental Engineering, directed this year's program. Participants heard from experts in topics related to civil engineering and transportation, learned about engineering career options, took classes in scientific writing, worked on research projects under the leadership of a faculty mentor, and developed a comprehensive career roadmap to achieve their future goals. Funding provided through a grant from the NCTSPM paid for four weeks of room and board, curriculum and material costs, and a $250 weekly salary per student participant to offset time away from summer jobs. One of the student participants Marcus Hatcher said, "The program opened my perspective on how sustainability, engineering, and health science all work together."

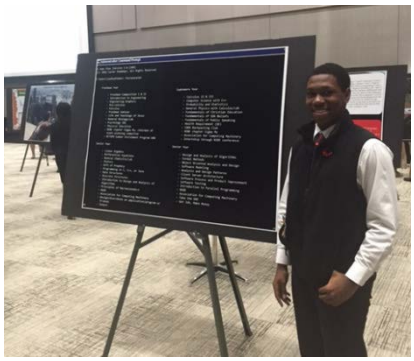
- GT funded four female students of which two were minority students, and two minority male students for participation in UTC activities.
- The NCTSPM program has provided opportunities for 15 minority students at FIU to receive internship training at various transportation agencies.
- One minority undergraduate student at FIU completed an internship at FDOT District 6.
- UCF involved female graduate students in multiple transportation research projects.

Photographs from the NCTSPM Summer Enrichment Program hosted by UAB

SEP Awards and Promotion Ceremony

A student presents her career roadmap poster

Students meet with Dr. Fouad, head of Civil Engineering



Marcus Hatcher with his career roadmap

Act as a national resource for the debates and discussions that focus on the evolving national transportation program and future directions

UCF researchers found that low-visibility weather condition is affecting driving behaviors such as driving speed, braking, and deceleration rate. It is suggested that the early warning system (e.g., dynamic message sign) might enhance the traffic safety under low-visibility condition.

UAB has hosted conferences on NCTSPM topics as well as sustainable transportation and development.

Georgia Tech hosted eight seminars during the reporting period, bringing a variety of speakers to discuss their research and professional pursuits. Speakers and their topics included:

- Dr. Venu Madhav Garikapati, "Activity Patterns, Time Use, and Travel of Millenials: A Generation in Transition?"
- Dr. Chandra Bhat, "Capturing Cause-Effect Relationships in Multidimensional Integrated Models: A New Econometric Approach with Application to Residential, Auto Ownership, and Activity Choices"

- Dr. Asad J. Khattak, "The Role of Connected and Automated Vehicles: How Can Urban Areas Use the Data They Create?"
- Dr. Imad L. Al-Qadi, "The Future of Flexible Pavement Sustainability"
- Dr. Daniel A. Rodriguez, "The Path Taken: Built Environment and Walking Route Choices"
- Dr. Eric Huang, "Optimization of Modern Transportation Systems under Large-scale Complexity, Uncertainty, and Dynamics"
- Dr. Cynthia Chen, "From warnings to awareness and actions: Understanding resilience through the lens of human activities"
- Dr. Hani S. Mahmassani, “Autonomous Vehicles and Connected Systems: Market Adoption and Flow Implications”

FIU hosted ten seminars with guest speakers from government agencies and consulting companies.

- January 21, 2016: “Transportation and Land Use Collaboration: Imagine 2040” by Ms. Melissa Zornitta, APA Florida Chapter President & Executive Director of the Hillsborough City-County Planning Commission
- January 25, 2016: “How Transportation Systems Management and Operations strategies Combine ITS Technology” by Mr. Steve Lockwood, Senior Vice President of Parsons Brinckerhoff.
- January 29, 2016: “Arterial Traffic Management in Palm Beach County” by Mr. Giri Jeedigunta, P.E., Acting Director of Traffic Engineering Division of Palm Beach County.
- February 5, 2016: “A Different Aspect of the Civil Engineering Profession” by Ms. Alexandra Lopez, ITS Specialist, ITS Office at FDOT District Six.
- February 5, 2016: “FDOT District 6 Signal Retiming Efforts on SR 5/US 1” by Dr. Elio Espino, P.E., Senior Project Manager, A&P Consulting, Inc.
- February 12, 2016: “Cyber Security, Time Traveler and Open Payments Systems” by Mr. William Martinez, Principal Client Relationship Executive, Computer Science Corporation (CSC).
- February 19, 2016: “Development of Congestion Causal Pie Charts for Arterial Roadways” by Dr. Ali Soltani-Sobh, Research Associate, Florida Atlantic University. Dr. Soltani-Sobh presented findings
- February 26, 2016: “Kadence Traffic Adaptive System and City of Hamilton Rapid Traffic Management Deployment” by Mr. Aleksandar Mitrovic, Associate Software Engineer, Kimley-Horn and Associates.
- March 4, 2016: “The Florida Transportation Plan and Trends Influencing Planning and Implementation” by Ms. Karen Kiselwski, Senior Associate, Cambridge Systematics.
- March 11, 2016: “Woman and Transportation” by Ms. Stacy L. Miller- Novello, Director of Transportation Development in FDOT District 4.

Explore international cooperative activities with research entities in selected countries where similar research interests exist

Many of our researchers are collaborating and presenting their work internationally.

UCF is currently reviewing different cases of implemented roadway and ITS countermeasures in different countries (e.g., Sweden, Germany, Japan, South Korea, etc.) for low-visibility condition.

A UAB researcher continues to use UTC funds to leverage an ongoing NSF collaboration on B-WIM with universities in Ireland and the UK.

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

In the reporting period, more than 40 students participated in NCTSPM research projects, which provided them with valuable training. Some gained field experience via data collection for research projects, while many others gained experience conducting analyses and writing.

NCTSPM provided funding for six graduate students from UAB to travel to the TRB Annual Meeting in Washington, D.C. in January, 2016. Several UAB students presented posters at the meeting. UAB also sponsored a group of six undergraduate and graduate students who traveled to England and Egypt during May 2016 to study sustainable transportation and development. Through a combination of tours, lab visits, seminars, and meetings with industry leaders in those countries, the students explored principles of sustainable urban engineering and developed reports for potential implementation of these practices in Birmingham and the broader U.S.

UAB faculty presented to the Birmingham Regional Planning Commission Technical Committee on the topic of incident management and the impacts of incidents and EMS response times on traffic congestion in the Birmingham Region. The purpose was to educate local officials of the importance of incident response and non-recurring congestion on the region. UAB faculty have been invited to present on this topic at an FHWA sponsored Regional Training Planning Workshop in Birmingham in September 2016.

UCF has had involvement of three Ph.D. students in the Freight O/D Project directed by Dr. Oloufa

Several UCF graduate students and a postdoctoral associate are currently directed by a researcher under the visibility project and involved in the following training and professional development:

1) Comprehensive statistical analysis techniques to analyze the traffic safety under low-visibility condition
2) Experiments using driving simulator
3) Big data handling and processing procedures with different data sources including crash, traffic, and weather data
4) Training of graduate students by multiple projects
5) Communication with FDOT practitioners and providing technical assistant

How have the results been disseminated?

The NCTSPM website remains the main point of contact and promotion of best practices. Related documents, such as presentations, pictures, reports, and posters, have been uploaded when available. Most of the presentations hosted by the center have been recorded and posted to YouTube and other social media accounts.

Researchers have produced a number of technical papers and presentations to disseminate their work. During this reporting period, NCTSPM produced over 102 research reports and journal publications which were published in a variety of journals such as Transportation Research Record, Accident Analysis & Prevention, Journal of Transportation Safety and Security, ASCE Journal of Composites for Construction, Journal of Civil Engineering and Architecture, Traffic Injury Prevention, etc. NCTSPM researchers presented over 55 conference proceedings, invited presentations/lectures on research findings, workshops, seminars, and webinars on a variety of research projects and produced one patent. Research papers were cited over 55 times in the reporting period.

NCTSPM researchers presented work at the Transportation Research Board 95th Annual Meeting in January 2016.

The 2016 UTC Conference for the Southeastern Region was held from March 31 to April 1 and was hosted by the Southeastern Transportation Center UTC and the University of Tennessee, Knoxville. In the words of its organizers, "this innovative conference will bring together faculty, students, practitioners, and public agencies in the southeast to showcase recent achievements and collaborations. The program promises to be a fast-paced and engaging opportunity to share where we've been and where we're going in transportation research, education, and tech transfer".
Six FIU students attended the Fourth Annual UTC Conference of the Southeast Region held at the University of Tennessee, Knoxville, Tennessee, March 31 – April 1, 2016, and made the following presentations:

- “Estimation of the Total Cost of Bridge Construction for use in Accelerated Bridge Construction Selection Decisions” by Jianmin Jia.
- “Performance of Rectangular Rapid Flashing Beacons (RRFBs) at Midblock Pedestrian Crossings” by Homa Fartash.
- “Comparison Real-time Travel Time Prediction Methods” by Leila Azizi.
- “Utilization of the HCM Urban Facility Procedures for the Estimation and Real-Time Prediction of Travel Time with Consideration of Rain Impacts’ by Homa Fartash.
- “Modeling Adaptive Ramp Metering in Macroscopic Simulation Environment” by Samaneh Khazraeian.
- “Improved Model for Estimating Incident Impact on Urban Street Travel Time with Consideration of Upstream Intersection Capacity Reduction” by Aidin Massahi.
- “Simulate Bluetooth Travel Time from Vehicle Trajectory Data” by Md Shahadat Iqbal.
- “Detection of Freeway Incidents Based on Vehicle Acceleration Measurements Using Connected Vehicle Data” by Samantha Khazraeian.

GT students presented:

- Shaw, F.A., A. T. Greenwood, J. Bae, G. M. Corso, M. O. Rodgers, and M. P. Hunter. “Modeling Perceived Complexity of Static Roadway Environments.” Poster presented at the

University Transportation Center (UTC) Conference for the Southeastern Region, Knoxville, Tennessee, March 2016.

- Greenwood, A.T., Y. Xu, G. Corso, M. O. Rodgers, and M. P. Hunter. "Modeling Comprehension of Work Zone Traffic Control." Poster presented at the University Transportation Center (UTC) Conference for the Southeastern Region, Knoxville, Tennessee, March 2016.

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

Research will continue on the active NCTSPM projects; project information forms posted on the website provide detailed work plans. Final reports are expected for a number of projects.

NCTSPM researchers will present work at the Transportation Research Board 96th Annual Meeting in January 2017.

Georgia Tech will host five seminars during the Fall 2016 semester. These events are open to Georgia Tech students, faculty, and staff, as well as alumni and general members of the public. Recording of these seminars are available on the center's YouTube channel.

UAB will continue research on the active NCTSPM research projects. There are also a number of important initiatives planned for the second half of 2016 under the UAB institutional grant that will further advance center goals. Funding will again be provided for UAB students to attend the 2017 TRB Annual Meeting in Washington, DC. UAB will host the 2017 Sustainable Smart Cities Symposium in October in Birmingham with NCTSPM sponsorship.

UCF will focus on developing O/D statistics for commercial vehicles.

Products

The center's website, http://nctspm.gatech.edu continues to be updated regularly with updates on research projects, educational initiatives, and news related to NCTSPM researchers.

The center produces newsletters that provide updates on research projects, educational activities, and the people behind center. The summer newsletter highlighted two research projects, a researcher profile and a student profile, recent events and upcoming events.

Our researchers will continue to produce technical papers and deliver presentations to disseminate their work throughout the nation and internationally.

Participants and Other Collaborating Organizations

NCTPSM Participants at Georgia Institute of Technology

The following individuals from Georgia Tech have worked on the NCTSPM at the programmatic level.

Name	*Michael Hunter, Ph.D.*
Program/Project Role	*NCTSPM Director*
Number of hours worked during the reporting period	*Approximately 500 hours*
Contribution to Program/Project	*Responsible for oversight and governance of NCTSPM*
Funding Support	*UTC, GDOT*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Name	*Catherine Ross, Ph.D.*
Program/Project Role	*NCTSPM Deputy Director for Policy, Education and Workforce Development*
Number of hours worked during the reporting period	*Approximately 60 hrs.*
Contribution to Program/Project	*Responsible for administrative oversight and faculty coordination; liaison to NCTSPM researchers.*
Funding Support	*UTC, GDOT*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Name	*Michael O. Rodgers, Ph.D.*
Program/Project Role	*NCTSPM Deputy Director for Research and Technology Transfer*
Number of hours worked during the reporting period	*Approximately 350 hours*
Contribution to Program/Project	*Oversees subcontract reporting requirements and research products and is responsible for coordinating technology transfer activities of the center*
Funding Support	*UTC, GDOT, U.S. DOE,*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Name	*Charlene Mingus, MCSRP MSCE*
Program/Project Role	*Research Program Coordinator*
Number of hours worked during the reporting period	Approximately 800 hours
Contribution to Program/Project	*Provided administrative management and assistance to Center.*
Funding Support	*UTC, GDOT*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Name	*Ms. Marjorie Jorgenson*
Program/Project Role	*Transportation Faculty Assistant*
Number of hours worked during the reporting period	*Approximately 250 hrs.*
Contribution to Program/Project	*Provide assistance to Director and Research Coordinator for UTC management*
Funding Support	*GT*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

NCTSPM University Partner Representatives

These individuals have served as liaisons between NCTSPM and their institutions to organize joint efforts related to research, education, technology transfer, and workforce development. These met with the NCTSPM Director and Deputy Director, via teleconference, in an initial kick-off meeting in order to establish governing parameters for the management and coordination of the center's research and activities. They also coordinated submissions of proposals and cost sharing from their respective institutions and were members of the proposal selection committee. Subsequently, these individuals served to facilitate the subcontracting process within their institutions.

University of Alabama, Birmingham

Fouad H. Fouad, Professor and Chair, Department of Civil Construction and Environmental Engineering
Email: ffouad@uab.edu

Name	*Fouad H. Fouad, Ph.D.*
Program/Project Role	*NCTSPM Partner Representative/University of Alabama, Birmingham*
Number of hours worked during the reporting period	*Approximately 15 hours*
Contribution to Program/Project	*Liaison between UTC and the University of Alabama, Birmingham*
Funding Support	*UTC, ADOT, UAB*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Florida International University

Dr. Albert Gan, Email: gana@fiu.edu

Name	*Albert Gan, Ph.D.*
Program/Project Role	*NCTSPM Partner Representative / Florida International University*
Number of hours worked during the reporting period	*Approximately 200 hours*
Contribution to Program/Project	*Liaison between UTC and Florida International University*
Funding Support	*UTC, FDOT, FIU*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

University of Central Florida

Dr. Essam Radwan, Email: Ahmed.Radwan@ucf.edu

Name	*Essam Radwan, Ph.D.*
Program/Project Role	*NCTSPM Partner Representative/University of Central Florida*
Number of hours worked during the reporting period	*Approximately 40 hours*
Contribution to Program/Project	*Liaison between UTC and the University of Central Florida*
Funding Support	*UTC, FDOT, UCF*
Collaborated with individual in foreign country	*N/A*
Country(ies) of foreign collaborator	*N/A*
Travelled to foreign country	*N/A*
If traveled to foreign country(ies), duration of stay	*N/A*

Advisory Board and Other Collaborators

The following are members of the NCTSPM Advisory Board:

F.T. "Tread" Davis, Jr. – Senior Counsel, McKenna Long & Aldridge, LLP (Board Chair) and Board Member, Atlanta Regional Commission
Harry L. Anderson - Senior Vice President, Global Business and Technology Services, The Coca-Cola Company
James Balloun – Financial Investor and Former CEO (Past Chair)
Harold Barley – Executive Director, MetroPlan Orlando
Mark Bartlett – FHWA Division Administrator, Alabama
Jeffrey W. Brown – Alabama DOT Bureau Chief, Research and Development
Mike Dover – GDOT Deputy Commissioner
Bill Johnson – Director, Port of Miami
Michelle Livingstone – Vice President for Transportation Distribution, The Home Depot
Todd Long – Chief Operating Officer, Fulton County
Russell McMurry – GDOT Commissioner
George Overstreet – Executive Board Member and Vice President of Operations, Alabama Trucking Association
G. P. "Bud" Peterson – President, Georgia Tech, Ex Officio
Jay Roberts – GDOT Division of Planning
Daniel L. Rodgers – President, Dunn Investment Company
Randy Stashick – Global Vice President of Engineering, UPS
Yvette Taylor – Regional Administrator, FTA
Dave Williams – Vice President of Infrastructure and Government Affairs, Metro Atlanta Chamber of Commerce

Other Partnering Organizations:

Georgia Department of Transportation (GDOT)
Florida Department of Transportation (FDOT)
Alabama Department of Transportation (ADOT)

Other Collaborators:

Morehead State University
Saint Louis University
Georgia State University
Georgia Southern University
Kennesaw State University

Impact

What is the impact on the development of the principal discipline(s) of the program?

Our research is producing results that contribute to the body of knowledge on transportation safety, economic competitiveness, and state-of-good-repair. Research results are disseminated through publications and presentations, with the potential to impact transportation practitioners well beyond the Southeast region.

At UCF research is being conducted into the impact of reducing travel time on society, sustainability, and transportation economics. For example, additional research provides a comparative analysis of using the conventional bridge girders and FIBs that can and will be considered on major projects such as I-4 Ultimate. This document can provide valuable data for modeling, analysis, rating of such bridges. UCF and partner NCTSPM institutions are becoming recognized as leaders in the use of advanced materials for repair and retrofit of nation's infrastructure.

At Georgia Tech a Ph.D. student is researching the "inevitable" impact of autonomous vehicles, in order to develop modeling and performance measurement tools, and to demonstrate how these tools can be applied to high-volume freight corridors in Georgia. Another Ph.D. is focusing on the measurement of transportation system users' performance.

At Georgia Tech, research for the project "Assessment of High Early Strength Limestone Blended Cement for Next Generation Transportation Structure" focused on advancing the viability of "green" concrete made with more environmentally friendly materials.

The majority of bridge failures in the U.S. are caused by foundations scour, but it is difficult to determine which bridges are most vulnerable and it is not financially feasible to inspect every bridge in a state. The Georgia Tech project "Extending HYRISK to Predict Scour Risk as a Function of Soil Erodibility Characteristics" developed a risk assessment tool, HYRISK, which calculates the probability of bridge failures because of scour and enables state agencies to prioritize and identify a subset of at-risk bridges to perform scour screenings and evaluations.

The project "Evaluation of Signage Alternatives for Express Lane Facilities" at FIU determined the amount of information to display and the manner in which the information is communicated to drivers to ensure a safe and effective operation of express lane facilities. The research will help prioritize the types of information to include and how best to display the information.

At UAB the project, "Evaluation of Anchor Bolt Clearance Discrepancies", has developed analysis procedures and design methods for computing the stress distribution for anchor bolts with excessive and uneven standoff distances, something that was not available prior to the project. It has also developed a procedure to identify structures that are susceptible to damage resulting from this condition. The results of this study should help to eliminate the types of structural failures that the Alabama DOT has experienced in the past.

The UAB project "Bridge Rail Design Procedures" updated the procedures for designing bridge rails based on the recent production of the revised Manual for Assessing Safety Hardware (MASH).

What is the impact on other disciplines?

The interdisciplinary nature of NCTSPM's work impacts disciplines beyond transportation engineering. Our work spans public policy, public health, and economics.

The project "Enhanced Role of Activity Center Transportation Organizations in Regional Mobility" at Georgia Tech focuses on the implementation of road operations strategies for local Community Improvement District; assesses the feasibility and effectiveness of activity center management associations in such strategies; and generalize the results of the research to other activity center contexts.

The results of the UCF project "A Comprehensive Investigation of Visibility Problems on Highways: Developing Real Time Monitoring and Prediction System for Reduced Visibility and Understanding Traffic and Human Factors Implications" supplemented with quick and accurate weather prediction will be essential for providing timely and adequate preemptive countermeasures to avoid traffic crashes.

What is the impact on transportation workforce development?

NCTSPM places a heavy emphasis on workforce development. Each partner university engages in a variety of activities to support this work.

During the reporting period, over 40 students were involved in our research projects, providing them with valuable experience in transportation research and over 20 of those students received degrees.

The transportation graduate program at UCF has produced graduates receiving both MS and Ph.D. degrees and engineering consulting firms, academia, and public agencies employed their recipients. Specifically, the Florida Department of Transportation, the Florida Turnpike Enterprises, and the City of Orlando are the three public agencies that hired the majority of our MS graduates. Other Ph.D. graduates were hired in academic institutions in Australia, China, and the US. The program was also able to obtain a computational tool in their research group which can be used for educational and research purposes.

At FIU during the reporting period:

- Undergraduate student, Mr. Daniel Irigoyen, completed his internship with District 6 Florida Department of Transportation in February 2016.
- About 30 undergraduate and graduate students have been funded to conduct research for NCTSPM and match projects.

At UAB during the reporting period students developed or completed the following master's theses and dissertations:

- MS Thesis: Yahya M. Abdelrazek: "Cyber physical system for monitoring and controlling loads" (To be Graduated Summer 2016).
- MS Thesis: Amin Pahlevannejad (MS Thesis leading to PhD): "Impact Simulation of Reinforced Concrete in LS-DYNA", (Expected Graduation Summer 2016).
- MS Project: Chris Arias: "The Use of Three Dimensional Finite Element Analysis to Simulate a Vehicle Moving Across a Bridge (Expected Graduation Fall 2016).

- PhD Dissertation Proposal (approved) by Ahmed Hattab: Drive-by Bridge Monitoring and Damage Identification
- PhD Dissertation Proposal (approved) by Erik Winardi: Simulation of Dynamic Interaction of Bridge with Wind and vehicle

To date at UAB, 24 graduate students have been funded through this center to perform research in areas related to the NCTSPM goals. Nine undergraduate students have been provided internships with local transportation agencies, providing valuable experience and exposure to the transportation profession. The Summer Enrichment Program has provided transportation engineering training to 29 freshman and sophomore minority students. The middle school Youth Champions Program has provided education and learning activities related to transportation for approximately 52 middle school students.

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

Nothing new to report.

What is the impact on technology transfer?

Technology transfer is an important component of our program. Many of our research projects have a focus on being applied, so that transportation agencies can readily apply them to their own work.

The main vehicle for technology transfer is presentations and publications delivered by our researchers. During this reporting period, NCTSPM produced over 102 research reports and journal publications, and presented over 55 conference proceedings, invited presentations/lectures on research findings, workshops, seminars, and webinars on a variety of research projects and produced one patent. Research papers were cited over 55 times in the reporting period.

UAB projects have been presented at conferences and in technical journals (see previous sections). UAB is also working to transfer the Birmingham freight model to the Birmingham Regional Planning Commission to improve regional modeling efforts.

FIU presented 19 research papers at the 95th Annual Meeting of the Transportation Research Board and made eight presentations at the Fourth Annual Meeting of the Southeast Region University Transportation Centers.

The UCF research project, “Automated Data Collection for Origin/Destination Studies of Freight Movement“, resulted in the application of low-power high-resolution imaging on a 24/7 basis.

Georgia Tech presented approximately 13 research papers at the 95th Annual Meeting of the Transportation Research Board.

The Georgia Tech project “Field Validation of a Drive-by Bridge Inspection System with Wireless BWIM and NDE Devices” developed an automated drive-by inspection system to provide convenient evaluation of transportation infrastructure safety. This wireless sensing system measures both truck excitation and the corresponding bridge vibration and ultrasonic characteristics, providing an unprecedented mix of heterogeneous data for bridge safety management and maintenance planning.

What is the impact on society beyond science and technology?

We expect several projects will have impacts beyond science/engineering professions.

The primary objective of the Georgia Tech project "A Data Driven Approach to State Transportation Investment Decision: A Transportation Project Investment and Evaluation Resource (T-PIER)" was to provide a data-driven resource that planners and engineers, policymakers, service providers, and researchers could use to determine how investments should be made in the future by balancing available resources to maximize return on investment (ROI). T-PIER is equipped to examine the performance of improvements to small- and medium-scale transportation networks with multiple interacting modes such as driving, biking, and walking. The tool assists planners and engineers in determining the optimal allocation of projects for obtaining maximum benefits when resources are limited and scarce. The T-PIER framework combines a travel demand model with a resource allocation model, which allows for interactive communication to obtain an optimal set of projects for maximizing ROI.

The Georgia Tech project "Bringing Freight Components into Statewide and Regional Travel Demand Forecasting" has already demonstrated improvements over traditional freight models and will continue to pursue implementation of the tour based model in Birmingham. This could lead to better freight facilities for private carriers. Goods movement will also be impacted by the results of "Automated Data Collection for Origin/Destination Studies of Freight Movement," as it has the potential to reduce the cost of transporting goods.

The UAB project "Impact and Feasibility Study of Solutions for Doubling Heavy Vehicles" will, in the end, impact the trucking and commercial freight industries.

"Digital Advertising Billboards and Driver Distraction", a UAB project, may ultimately have impacts to both State DOT's as well as the advertising industry.

Changes/Problems

Changes in approach and reasons for change: The UCF research project, "Automated Data Collection for Origin/Destination Studies of Freight Movement", required a redesign due to changes in sensor technology and encountered challenges related to continuous improvement of the system to reduce power consumption.
Changes that have a significant impact on expenditures: Nothing to Report
Significant changes in use or care of human subjects, vertebrate animals and/or biohazards: Nothing to Report
Change of primary performance site location from that originally proposed: Nothing to Report

Special Reporting Requirements

Specific Requirements

Website: Created and operational in 2013; continues to be updated regularly as new information becomes available
Directory of Key Personnel: Information available on the program website and updated as needed
Financial and Annual Share Reports: The SF425 requirements will be met by separate report.
FFATA Subaward and Executive Compensation Report: Will be met by separate submission

Research Project Descriptions: Available on program website. The projects selected and funded by the center are provided below.

Projects Selected for Funding by NCTSPM

Project Title	Lead Uniy	Principal Investigator
Integrating Safety in Developing a Variable Speed Limit System	UCF	Mohamed Abdel-Aty
Reducing Service Interruptions in Linear Infrastructure Systems (Transportation and Water/Sewer) by Synchronizing Schedules for Selected Maintenance Activities	FIU	Berrin Tansel
Performance Measurements of Transportation Systems based on Fine-Grained Data Collected by AVI and AVL Systems	FIU	Mohammed Hadi
Full-Scale Wall of Wind Testing of Variable Message Signs (VMS) Structures to Develop Drag Coefficients for AASHTO Supports Specifications	FIU	Arindam Chowdhury
Information Services in Social Networked Transportation	GT	Hans Klein
Traffic Management Centers: Challenges, Best Practices, and Future Plans	FIU	Xia Jin
Digital Advertising Billboards and Driver Distraction	UAB	Virginia Sisiopiku
Impact and Feasibility Study of Solutions for Doubling Heavy Vehicles	UAB	Nasim Uddin
Optimizing EMS Through The Use of Intelligent Transportation Systems (ITS) Technologies	UAB	Andrew Sullivan
Efficient Utilization of the Existing Its System and the Viability of a Proactive Traffic Management System for the Orlando-Orange County Expressway Authority System	UCF	Mohamed Abdel-Aty
Development of a Prototype Evidence-Based Database and Planning Tool: Applying Performance Management Principles in Asset Management Program Development	GT	Adjo Amekudzi
Bringing Freight Components into Statewide and Regional Travel Demand Forecasting	GT	David Lee
Development of Risk Management Strategies for State DOTs to Effectively Deal with Volatile Prices of Transportation Construction Materials	GT	Baabak Ashuri
Freight Movement and Economic Competitiveness from the Megaregion Perspective	GT	Catherine Ross
Economic Development and Workforce Impacts of State DOT Expenditures	GT	Danny Boston
Factors Influencing Visual Search in Complex Driving Environments	GT	Mike Hunter
Next-Generation Wireless Bridge Weigh-in-Motion (WIM) System Incorporated with Nondestructive Evaluation (NDE) Capability for Transportation Infrastructure Safety	GT	Yang Wang
Micro-Dynamics of Business Location and Growth and its Effects on the Transportation Network and Congestion in Georgia and the Southeast Region	GT	Frank Southworth
Automated Data Collection for Origin/Destination Studies of Freight Movement	UCF	Amr A. Oloufa
Enhanced Role of Activity Center Transportation Organizations in Regional Mobility	GT	Angshuman Guin
Georgia SPLOST Database and Clearinghouse for Transportation Finance	GT	Catherine Ross
GRTA/GDOT Real-Time Tracking and Choice Data	GT	Randall Guensler
Evaluation of Signage Alternatives for Express Lane Facilities	FIU	Albert Gan
Innovative Modular High Performance Lightweight Decks for Accelerated Bridge Construction	FIU	Amir Mirmiran
Field Validation of a Drive-By Bridge Inspection System with Wireless BWIM + NDE Devices	GT	Yang Wang
Development of a Web-based Decision Making Tool for the Highway Safety Manual Implementation	FIU	Priyanka Alluri
A Data Driven Approach to State Transportation Investment Decisions: a Transportation Project Investment and Evaluation Resource (T-Pier)	GT	Timothy F. Welch
Freight impacts on Small Urban and Rural Areas	GT	Catherine Ross
HOV to HOT Conversion Impacts on Carpooling	GT	Yanzhi "Ann" Xu
Consumer Response to Road Pricing: Macro and Micro Modeling Tools for Socioeconomic Evaluation and Pricing of Managed Lanes	GT	Randall Guensler
Evaluation of the Cost Effectiveness of Illumination as a Safety Treatment at Rural Intersections	GT	Angshuman Guin

Assessment of High Early Strength Limestone Blended Cement for Next Generation Transportation Structures	GT	Kimberly Kurtis
Managing Transportation System Health: Setting Performance Targets and Policies in Non-Uniform Regions and Jurisdictions to Achieve Uniform Statewide and National Objectives	GT	Adjo Amekudzi
Extending HYRISK to Predict Scour Risk as a Function of Soil Erodibility Characteristics	GT	Laurie Garrow
Cooperative Vehicle-Highway Automation (CVHA) Technology: Simulation of Benefits and Operational Issues	GT	Michael Rodgers
Next Generation Crack Sealing Planning Tool for Pavement Preservation	GT	James Tsai
Estimating the Monetary Benefits of Reducing Delays on Heavily Trafficked Truck Freight Corridors in Georgia	GT	Frank Southworth
A Comprehensive Investigation of Visibility Problems on Highways: Developing Real Time Monitoring and Prediction System for Reduced Visibility and Understanding Traffic and Human Factors Implications	UCF	Mohamed Abdel-Aty
Evaluating the Impact of Real-time Transit Passenger Information on Ridership and Mode Share	GT	Kari Watkins
Bridge Rail Design Procedures	UAB	Dean Sicking
Evaluation of Anchor Bolt Clearance Discrepancies	UAB	Ian Hosch
Examining the Value of Travel Time Reliability for Freight Transportation to Support Freight Planning and Decision-Making	FIU	Xia Jin