



USDOT Tier 1 University Transportation Center

Program Progress Performance Report #7

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Project Title: Maritime Transportation Research and Education Center (MarTREC)

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PPPR#4 Reporting Period Start Date: October 1, 2016
PPPR#4 Reporting Period End Date: March 31, 2017

Report Term or Frequency: six months

Signature: 

Maritime Transportation Research & Education Center (MarTREC)

MarTREC is a USDOT Tier 1 University Transportation Center funded in September 30, 2013 under MAP-21. Our consortium consists of the University of Arkansas (UARK), Fayetteville, AR; Jackson State University (JSU), Jackson, MS; Louisiana State University (LSU), Baton Rouge, LA; and University of New Orleans (UNO), New Orleans, LA. Each institution is strategically located to support the MarTREC theme and consists of renowned maritime transportation researchers dedicated to transferrable research and inclusive education and workforce development.

MarTREC's theme is building economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems. Our vision is to be recognized as the Nation's premier source for expertise on maritime and multimodal transportation research and education.

1. Accomplishments

1.1 Consortium-Level Accomplishments

1.1.1 Research

Goal: MarTREC will conduct research that contributes to building economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems.

Objectives:

- R1) Conduct research projects related to MarTREC's research goal
- R2) Engage a diverse set of faculty and students in MarTREC research activities
- R3) Disseminate research findings

Accomplishments:

Metric	Achieved PPPR#7	Objective Addressed
# of ongoing projects in all MarTREC research area	18	R1
# of peer-reviewed journal articles (published, accepted, submitted)	12	R3
# of conference presentations	24	R3
# of tenure track faculty who conduct MarTREC research activities	11	R2
# of external partners involved in center research activities	22	R3
# of research activities that impact diversity through participants and/or outcomes	22	R2
# of UG/G students participating in transportation research projects funded by UTC	32	R2
# of MS/PhD transportation-related advanced degree programs	8	R2
# of MS/PhD graduate students supported by MarTREC	19	R2
# of MS/PhD students supported by MarTREC who received degrees	5	R3

1.1.2 Leadership

Goal: MarTREC will become the premier source for expertise on maritime transportation research, education, and workforce development.

Objectives:

- L1) Demonstrate academic leadership towards MarTREC's leadership goal
- L2) Demonstrate industry leadership towards MarTREC's leadership goal

Accomplishments:

Metric	Achieved PPPR#7	Objective Addressed
# of national and regional leadership positions held	17	L1
# of conference planning positions held	9	L1
# of invited talks given	4	L1
# of leadership and research awards received	3	L1
# of impactful research citations by stakeholders	0	L2
# of UG/G students participating in transportation research projects funded by UTC	33	L1
# of junior faculty mentored	9	L1
# of leadership workshops held	0	L2
# of external grant proposals submitted	7	L2

1.1.3 Education and Workforce Development

Goal: MarTREC will develop educational resources to elucidate scientific and engineering practices involved in maritime and multimodal transportation systems and practices.

Objectives:

EWD1) Conduct education and workforce development (EWD) projects related to the goal

EWD2) Educate college students within MarTREC theme

EWD3) Conduct workforce development related to MarTREC theme

EWD4) Conduct outreach activities related to MarTREC theme

Accomplishments:

Metric	Achieved PPPR#7	Objective Addressed
# of projects in MarTREC educational and workforce development areas	0	EWD1
# of UG/G transportation-related courses associated with UTC	29	EWD2
# of distinguished lectures & seminars offered	4	EWD3
participant count of distinguished lectures & seminars offered	130	EWD3
# of short courses and workshops offered	4	EWD3
participant count of short courses and workshops offered	130	EWD3
# of <i>times</i> technician certification programs are offered	32	EWD3
participant count of technician certification programs offered	637	EWD3
# of educational modules and case studies developed	1	EWD2
# of student-authored publications	8	EWD2
# of student-presented presentations	9	EWD2
# of K-12 programs offered	0	EWD4
participant count of K-12 programs (events) offered	0	EWD4
% of female participants in K-12 programs	0	EWD4
% of minority participants in K-12 programs	0	EWD4
# of pre-college programs offered	0	EWD4
participant count of pre-college programs offered	0	EWD4
# of online K-12 educational resources posted	0	EWD4

1.1.4 Technology Transfer

Goal: MarTREC consortium institutions will participate in national, regional, and local education and workforce development outreach to provide state-of-the-art knowledge to private and public transportation organizations and provide a forum where government employees, academic researchers, and private sector can exchange ideas on current issues.

Objectives:

TT1) Transfer MarTREC outcomes into practice

TT2) Develop products in support of MarTREC technology transfer goal

Accomplishments:

Metric	Achieved PPPR#7	Objective Addressed
# of peer-reviewed journal articles (published, accepted, under review)	12	TT2
# of conference presentations	24	TT2
# of technical briefs	0	TT2
# of guidebooks	3	TT2
# of short courses and workshops offered	4	TT1
participant count of short courses and workshops offered	130	TT1
# of conference planning positions held	9	TT1
# of editorial journal positions held	11	TT1
# of technician certification <i>programs</i> offered	13	TT1
participant count of technician certification programs offered	637	TT1

1.1.5 Collaboration

Goal: MarTREC will continue our existing partnerships with maritime and multimodal transportation stakeholders and develop new partnerships at the consortium, institution, and project levels to facilitate our planned research, leadership, education, workforce development, and technology transfer activities.

Objectives:

C1) Develop external partnerships related to MarTREC's collaboration goal

C2) Develop collaborative products related to MarTREC's collaboration goal

C3) Engage faculty and students in achieving MarTREC's collaboration goal

Accomplishments:

Metric	Achieved PPPR#7	Objective Addressed
# of collaborative partnerships formed	19	C1
# of collaborative activities conducted	24	C2
# of collaborative deliverables completed	10	C2
# of collaborative team events	9	C1
# of collaborative outreach events held	6	C2
# of faculty involved in collaborative activities	1	C3
# of students involved in collaborative activities	2	C3

1.1.6 Plans for Next Reporting Cycle

MarTREC had 18 active research projects during this reporting period. The Center has completed 13 projects over the life of the grant. Three projects were completed during this reporting period. The faculty researchers will continue to engage with industry experts to ensure that these projects are making transformational contributions. The consortium will continue to expand our collaborative partnerships to support this. We will continue to emphasize educational and technology transfer activities. Our next annual Advisory Board meeting is planned for November 10, 2017.

1.2 Project-Level Accomplishments

1.2.1 Maritime and Multimodal Logistics Management Projects

Dynamic Decision Modeling for Inland Waterway Disruptions

Shengfan Zhang, Ph.D.

Heather Nachtmann, Ph.D.

August 2014-December 2016

Accomplishments: Collected and studied lock and dam closure reports, with a focus on unscheduled, weather-related disruptions. Reasons for closure and duration of disruptions were recorded. A Markov Decision Process (MDP) model was developed from the barge owner perspective that considers the uncertainty in the status of the closed or partially closed lock and dam as well as the traffic and safety status of barges remaining on the waterway.

Completed project: Conducted by U of A, this project was completed in December 2016. Final project report was submitted on time and distributed as per grant guidelines.

Economic Impacts of Lock Usage and Unavailability

Justin Chimka, Ph.D.

August 2014-June 2016

Accomplishments: The research objective is to estimate annual tons locked by commodity group and lock, as a function of lock usage and unavailability (1993-2013). Results include effects of lock usage and unavailability on tons locked by commodity group. Twenty-two out of the 42 datasets resulted in at least one useful subset where we could employ our alternative to stepwise regression to find a linear model which is efficient and practically appropriate according to our definitions of those characteristics. We are currently extending the project to study Climate Impacts on Lock Use and Performance.

Completed project: Conducted by U of A, this project was completed in June 2016. Final project report was submitted on time and distributed as per grant guidelines.

Efficient Dredging Strategies for Improving Transportation Infrastructure Resilience

Kelly Sullivan, Ph.D.

August 2014-December 2016

Accomplishments We developed an optimization model for this problem that incorporates uncertainty due to unpredictable amount of budget required for emergency dredging. We developed a mathematical model to explore inland dredging strategies (i.e., how to allocate funds into districts, which sites should be dredged) that are efficient with respect to cost and ensuring minimum disruption to freight transportation. We produced a case study that illustrates the application of our model to the U.S. inland waterway network. We demonstrated how our model and algorithms can be used at a variety of resource levels to allocate maintenance budget to districts. Using these results, we demonstrated the tradeoff between available maintenance budget and system-wide performance.

Furthermore, we demonstrated insights (e.g., which locations are more critical for dredging) that can be created as a result of solving our model.

Completed project: Conducted by U of A, this project was completed in December 2016. Final project report was submitted on time and distributed as per grant guidelines.

Multimodal Transport and TransLoad Facilities in Arkansas

Justin Chimka, Ph.D.

July 2014-December 2014

Accomplishments: This project is based on the theory regional and short line railroads are underutilized, and a key to unlocking greater economic value in Arkansas is additional TransLoad Facilities that enable Multimodal Transport. Determined what should be the locations and capabilities of additional facilities, and producing a guidebook for people interested in developing a TransLoad Facility.

Completed project: Conducted by UA, this project, funded by the Arkansas Economic Development Commission as a MarTREC match project, was completed in January 2015. Final project report was submitted on time and distributed as per grant guidelines.

Regional Economic Impact Study of the McClellan-Kerr Arkansas River Navigation System

Heather Nachtmann, Ph.D.

April 2014-August 2015

Accomplishments: The project implemented a multiregional social accounting matrix framework to estimate the economic impacts of the McClellan-Kerr Arkansas River Navigation System (MKARNS) found that the total economic impacts of the MKARNS nationwide are \$8.5 billion in sales, \$4.3 billion in gross domestic product (GDP), and \$2.5 billion in labor income.

Completed project: Conducted by UA, this project, funded by the Arkansas State Highway and Transportation Department as a MarTREC match project, was completed in August 2015. Final project report was submitted on time and distributed as per grant guidelines.

Supporting Secure and Resilient Inland Waterways

Heather Nachtmann, Ph.D.

Justin Chimka, Ph.D.

August 2014-June 2017

Accomplishments: We have developed and tested a linear approach to extend our Cargo Prioritization Terminal Allocation Problem (CPTAP) modeling capability. This new approach allows us to solve realistic response scenarios more quickly. Our next steps are to test the new approach and compare this with our existing models. Our research was presented at the 2016 American Society for Engineering Management Conference and Institute for Operations Research and Management Science conference this fall.

Project plans: We will continue to reach our overall project goal to enhance CPTAP capability to provide real-time decision support for disruption response stakeholders to minimize the total value loss of cargo disruptions on the inland waterways.

1.2.2 Building Resilient and Sustainable Multimodal Infrastructure Projects

Climate Impacts on Lock Use and Performance

Justin Chimka, Ph.D.

July 2016-June 2018

Accomplishments: Statistical models of Climate Impacts on Lock Use and Performance will help DOT and USACE integrate Climate Change Adaptation with Lock Operations and Marine Services by

quantifying fixed route infrastructure vulnerability. Currently consolidating locks by district / division and / or waterway data for calendar years 1993 – 2015.

Project plans: Estimate generalized linear models (GLM) of annual tons locked by commodity group and lock, as a function of lock usage and unavailability, general characteristics of locks, and climate variables.

Corrosion-Tolerant Pre-Stressed CFRP Fatigue Retrofits for Improved Waterway Lock Reliability

Gary Prinz, Ph.D., P.E.

Clint Wood, Ph.D., P.E.

July 2016-June 2018

Accomplishments: Fatigue analysis using Miner’s Rule determined that section F13 (Figure 21), has the highest fatigue damage following one lock drain-fill cycle. In this study, the Greenup Lock and Dam was the lock gate analyzed under a moving hydrostatic pressure using the finite element software package ABAQUS. Critical sections were identified from locations of stress concentration from von Miss stress contours. Each section was given an AASHTO detail category and then the stress history data was collected. The reservoir cycle counting method was used to determine the stress ranges and number of cycles. A linear damage accumulation rule (Miner’s Rule) was used to determine accumulated fatigue damage from the stress cycles and locate the region of highest fatigue damage.

Project plans: Design CFRP retrofits for areas of high stress and fatigue. Test bonding mechanism and fatigue resistance on full scale retrofit components, and install retrofits on a lock gate and attach gages to monitor behavior.

Development of a Design Protocol: Sustainable Stabilization of Slope using Recycled Plastic Pin in Mississippi

Sadik Khan, Ph.D., P.E.

May 2016-October 2017

Accomplishments: In Mississippi, the shallow slope failure is induced by the climatic (temperature and rainfall) variation that cause shrink-swell behavior of expansive Yazoo clay soil, and require significant budget to repair. As a cost effective alternative, Recycled Plastic Pins (RPP) can be utilized to stabilize shallow slope failures, to offer a sustainable option and increase the economic competitiveness to maintain multimodal transportation infrastructure. Soil Investigation of the soil parameters of Highway slopes. Investigation of Rainfall Pattern in Mississippi. Preliminary Finite Element Analysis (2D FEM analysis in Plaxis) and Parametric Study in Finite Element Analysis with Rainfall.

Project plans: Development of Design Protocol and prepare final project report.

Evaluating the Performance of Intermodal Connectors

Sarah Hernandez, Ph.D.

August 2016-June 2018

Accomplishments: Intermodal connectors - critical “last mile” roadways connecting intermodal freight facilities such as maritime ports to the National Highway System. Gathered existing traffic, facility (port), and other relevant data to identify major data gaps for ICs in AR.

Project plans: Design an advanced, non-intrusive traffic sensor capable of providing high quality data for ICs. Assess performance of current routes and identify potential ICs not currently designated as ICs but being used as such. Use field data and stakeholder input to design a set of case studies to highlight IC usage and performance.

Exploration of Novel Multifunctional Open Graded Friction Courses for In-situ Highway Runoff Treatment

Yadong Li, Ph.D., P.E.

Lin Li, Ph.D., P.E.

July 2014-June 2016

Accomplishments: The goal of this study was to examine the removal of the major heavy metals Cu and Zn in roadway runoffs through PCP and Modified PCP (MPCP) and by adding innovative additives to Open Graded Friction Courses (OGFC) to create a new material that has high heavy metal removal capacities. The results of this study bring an important conclusion that not only can the pervious concrete pavement bring traffic-related benefits but also environmental benefits because of its long-term removal capacities for Cu and Zn, which are the major heavy metal contaminants in roadway runoffs. The use of PCP in roadways and parking lots brings positive impacts for the sake of environmental protection.

Completed project: Conducted by JSU, this project was completed in June 2016. Final project report was submitted on time and distributed as per grant guidelines.

Identifying High-Risk Roadways for Infrastructure Investment Using Naturalistic Driving Data

Brian Wolshon, Ph.D., P.E.

October 2013-June 2015

Accomplishments: The final report reveals that clusters of high magnitude jerk events while decelerating were significantly correlated to long-term crash rates at these same locations, and these events can be used as surrogate measures of safety and as a way of predicting safety problems before even a single crash has occurred.

Completed project: Conducted by LSU, this project was completed in June 2015. Final project report was submitted on time and distributed as per grant guidelines.

In-Situ Monitoring and Assessment of Post Barge-Bridge Collision Damage for Minimizing Traffic Delay and Detour

Wei Zheng, Ph.D., P.E.

July 2014-June 2016

Accomplishments: This project developed an efficient in-situ monitoring and data processing scheme for assisting bridge professionals to reliably assess the barge-bridge collision damage and make prompt and informative decision on the operation the bridge and navigation waterways. Once a barge-bridge collision event happens, field dynamic measurements can be collected from the collided bridge structure with the sensor network.

Completed project: Conducted by JSU, this project was completed in June 2016. Final project report was submitted on time and distributed as per grant guidelines.

Innovative Bio-Mediated Particulate Materials for Sustainable Maritime Transportation Infrastructure

Lin Li, Ph.D. P.E.

November 2015-June 2017

Accomplishments: The primary objective of the proposed research project is to develop bio-mediated particulate materials to enhance the resilience and protection of maritime transportation infrastructure elements. The advanced materials are based on MICP for the sandy soils in the coastal area. We've completed the long-term durability experimental study of fine grained soils (silt and clay) on the effect of microbial improved sandy soil and bio-beam experiments.

Project plans: Analyze the experimental results and bio-beam results.

LNG Bunkering for Marine Vessels at the Port of New Orleans: Siting and Facility Components

Bethany Stich, Ph.D.

April 2014-January 2016

Accomplishments: Develop an assessment of best practices regarding the construction of shore-side Liquefied Natural Gas (LNG) bunkering facilities and the overall feasibility of the LNG fueling facility. The best recommendation is for the Port of New Orleans to join with the International Chamber of Shipping in encouraging the International Maritime Organization (IMO) division of the United Nations to continue taking the lead in globally-applied emissions standards. As the shipping industry is committed to the most rapid reduction possible of its share of greenhouse gas emissions, the transfer of the global shipping fleet to LNG is the most efficacious way to attain this end. The Port is best advised to aggressively support an IMO-derived driven global implementation of policies which would make this fleet conversion more cost effective than continued reliance upon cheap diesel as a marine fuel.

Completed project: Conducted by UNO, this project was completed in January 2016. Final project report was submitted on time and distributed as per grant guidelines.

Optimal Dredge Fleet Scheduling within Environmental Work Windows

Chase Rainwater, Ph.D.

Heather Nachtmann, Ph.D.

August 2014-August 2016

Accomplishments: After initial success with the base model, maritime professionals were intrigued by the use of operations research to aid in their decision process. The potential of the initial tool was met with concern over the fact that many realistic components were not considered. The main impact of this project is that every concern presented by USACE has now been addressed from a modeling perspective. The decision makers now understand that optimization tools can be flexible and extendable and, with the appropriate amount of attention, complex challenges can be modeled.

Completed project: Conducted by U of A, this project was completed in August 2016. Final project report was submitted on time and distributed as per grant guidelines.

Optimal Dredge Fleet Scheduling - Phase 2 Research

Chase Rainwater, Ph.D.

Heather Nachtmann, Ph.D.

August 2016-August 2017

Accomplishments: The failure to integrate the selection and scheduling process suggests that opportunity exists for significant financial and operational benefits for transportation planners. Thus far our research has shown improvement in objective function for same job small and medium size instances and negative impact on large size problem.

Project Plans: We will continue to probe the complex challenges of multiple trips to the same job.

Quantifying Resiliency of Maritime Transportation Systems

Brian Wolshon, Ph.D. P.E.

Scott Parr, Ph.D.

October 2015-June 2018

Accomplishments: The work presented in this research uses archival data from the United States Coast Guard's Nationwide Automatic Identification System (NAIS) to quantify the state of resiliency of coastal navigation systems. To illustrate the experimental methodology, case study examples are presented assessing the disruptions that resulted from a collision in March 2014 in the Houston Ship Channel, Texas and from Superstorm Sandy in 2012 on the greater port of New York/New Jersey. From an application viewpoint, the methods and results presented here can be adapted and implemented to

quantitatively evaluate levels of port activity following disruptive events and better understand the factors which lead to more resilient maritime systems.

Project Plans: Application of this model to quantify the resiliency of port operations on case study areas will be conducted.

Rapid and Non-Destructive Assessment of Levees for Strength and Liquefaction Resistance

Clint Wood, Ph.D. P.E.

Michelle Bernhardt, Ph.D.

January 2015-June 2017

Accomplishments: A small earthen dam tested using surface wave methods and resistivity in association with Natural Resource Conservation Service (NRCS). Lab work has been conducted to understand the relationship between resistivity, density, and water content. Field study at levees were identified in the Midwest during the GEER reconnaissance and lab experiments were completed to understand the relationship between resistivity, density, and water content of standardized soil samples.

Project plans: Data is being compiled for final report.

1.2.3 Livability and Emergency Management of Coastal and River Valley Communities Projects

Development of a Large-Scale Traffic Simulation Model for Hurricane Evacuation of Mississippi Coastal Region

Feng Wang, Ph.D., P.E.

July 2014-July 2015

Accomplishments: This project studied improved traffic flow assignment within an evacuation network and indicates that implementation of a gate control strategy could effectively decrease the total travel cost and reduce the degree of conflicts related to traffic movements and trip routes inside the network and improve evacuation performance.

Completed project: Conducted by JSU, this project was completed in July 2015. Final project report was submitted on time and distributed as per grant guidelines.

Evaluating Coastal and River Valley Communities Evacuation Network Performance Using Macroscopic Productivity

Scott Parr, Ph.D.

Brian Wolshon, Ph.D., P.E.

May 2015-May 2017

Accomplishments The simulation of mass evacuation traffic processes, while enormously valuable in emergency planning and management, presents a number of challenges to transportation modelers and analysts. One area where evacuation modeling and analysis has lacked is in the ability to determine the specific evacuation travel demand and capacity and conditions under which a road network can most effectively carry the maximum amount of vehicles, moving at maximum speeds to minimize the overall clearance time for an area under threat of catastrophic disasters. Knowledge of how to reduce the likelihood of oversaturation would be useful, for example, to develop temporally and spatially phased evacuation plans that meter demand into the system for maximum overall benefit. The productivity function, pioneered by Geroliminis and Daganzo (2007, 2008) is used to assess network performance from a macroscopic point of view. Then, an optimization model with the objective of maximizing both total network productivity and maximum outflow is proposed. Further, a simulation based study of the New Orleans metropolitan area is used to validate the effectiveness of the optimization model.

Project plans: Completing final report.

Measurement of Traffic Network Vulnerability for Mississippi Coastal Region

Feng Wang, Ph.D., P.E.

November 2015-October 2017

Accomplishments: Potential critical links related to the flooding surges of a hurricane were identified using a probability distribution approach to obtain the risk of an inundation over a road surface.

Project Plans: Measure evacuation network vulnerability and evaluate different evacuation strategies.

National Inventory and Analysis of Transit Oriented Development in Proximity to Coasts and Port Facilities

John Renne, Ph.D.

October 2013-September 2017

Accomplishments: Progress made on quantifying and examining the number of jobs and residents in station areas near coastal areas, major rivers, and near port facilities across the United States.

Project plans: Efforts will forecast future development and job potential of underbuilt station areas and identify the number and type of jobs located in stations and compare and contrast by typology.

Currently transcribing final set of interviews. Paper titled "Transit—Oriented Development and Ports: A National Analysis in the United States," which is based on the data from this project accepted for presentation at the World Symposium on Transport and Land Use Research, Brisbane, Australia July 3 - 6, 2017. The paper is also being considered for publication in the *Journal of Transport and Land Use*.

Quantification of Multimodal Transportation Network Vulnerability: A Pilot Study in Mississippi

Himangshu Das, Ph.D., P.E.

May 2016-May 2017

Accomplishments: There are pressing needs to develop a network based quantification framework to assess vulnerability of multimodal transportation and infrastructure network exposed to both natural and man-made hazards. The objective of this study is to identify critical transportation networks and its vulnerabilities to a wide variety of hazard conditions based on real-world data. The objectives will be accomplished through systematic inventory of transportation facilities in Mississippi and prognostic modeling of infrastructure vulnerability using network model. Identifying future climate scenarios and inventory of transportation network data. Extreme flood inundation surface related to project area has been analyzed and mapped and model development for multimodal transportation network is ongoing.

Project plans: Completing final report.

Road Sign Recognition during Computer Testing versus Driving Simulator Performance for Stroke and Stroke+Aphasia Groups

Neila Donovan, Ph.D.

October 2013-June 2015

Accomplishments: Research results show that post stroke aphasia significantly impacted accuracy and response time of road sign interpretation, and as language and symbol complexity increased on road signs, the aphasia-affected drivers performed with less accuracy and required more time indicating that designers of road signs and healthcare professionals should consider this when making decisions related to when those impacted to safely return to driving.

Completed project: Conducted by LSU, this project was completed in June 2015. Final project report was submitted on time and distributed as per grant guidelines.

Statistical Analysis of Vehicle Crashes in Mississippi based on Crash Data

Feng Wang, Ph.D., P.E.

November 2015-October 2017

Accomplishments: Analysis of the MDOT crash data showed that more than 15% of fatalities occurred in the coastal counties in 2013, which means vehicle crashes in this area call for extra attention. Models have been built to analyze the vehicle crashes for major highways in the Mississippi coastal area.

Project plans: We are applying the models to crashes on multiple highway corridors and have developed machine learning algorithms to identify traffic crash hot spots on US 49.

Vulnerability of Fuel Distribution Systems to Hazards in Coastal Communities

John Pardue, Ph.D., P.E.

May 2015-March 2017

Accomplishments The combined fueling station and road network constructed for this project is the first spatial representation of this system for a Louisiana coastal parish. While the Louisiana Governor's Office of Homeland Preparedness (GOHSEP) has a GIS-based system with spatial fueling data that can be used in an emergency, it has not been used for any pre-event analysis function. Results presented to the state's Supply Chain / Transportation Council. This organization was formed after the catastrophic floods of 2016 to better prepare the state's transportations network, and by extension, other critical infrastructure systems, from failure during these events.

Completed Project: Conducted by LSU, this project was completed in March 2017. Final project report was submitted and is being distributed as per grant guidelines.

2. Products

2.1 Publications

Journal Articles

1. Oztanriseven, Furkan, and Heather Nachtmann, "Economic Impact Analysis of Inland Waterway Disruption Response," (online 2016). doi: 10.1080/0013791X.2016.1163627. (published)
2. Bu, L. (student), F. Wang, and Y. A. Twumasi. "Graphical Visualization of Traffic Condition of Mississippi Gulf Coast Area," Journal of the Pennsylvania Geographical Society, Vol. 54, No.2, Fall/Winter 2016, pp 3-19. (published)
3. Tomas, M. (student), L. Bu (student), H. Das, and F. Wang. "Analyses of Storm Surge Induced Flood Risk in Coastal Areas of Mississippi," TRB 2017. (under review)
4. Bao, R., Li, J., Li, L., Cutright, T.J., Chen, L, Zhu, J. and Tao, J., "Effect of Microbial Induced Calcite Precipitation on Surface Erosion of Granular Soils," Journal of Transportation Research Board 2017. (accepted)
5. Wen, K. (student), Ogbonnaya, U. (student), Li, L., Li, Y., L, M., Li. C., and Amini, F., "Effects of Multiple MICP Treatment on Sandy Soil with Lower Cementation Media Concentration, Geotechnical Testing Method," ASCE, 2016. (under review)
6. Stich, Bethany and Jeffrey Cavanaugh, "The U.S. Gulf in a Liquefied Natural Gas Rich World," Transportation Review Board, Compendium of Papers, January 2017. (accepted)
7. Stich, Bethany and Peter Webb, "Electronic Navigation: The Future of Waterborne Shipping," Transportation Review Board, Compendium of Papers, January 2017. (accepted)
8. Chakrabarti, S. "How can public transit get people out of their cars: An analysis of transit mode choice for commute trips in Los Angeles," Transport Policy, 54, 80-89, 2017. (published)
9. Chakrabarti, S. and E. J. Shin, "Automobile Dependence and Physical Inactivity: Insights from the California Household Travel Survey," Journal of Transport & Health, 2017. (accepted)

10. Shojaat, S., J. Geistefeldt, S. Parr, C. Wilmot, and B. Wolshon, "Sustained Flow Index: A Stochastic Measure of Freeway Performance," *Transportation Research Record: Journal of Transportation Research Board*, No. 2554, pp. 158-165, 2016. (published)
11. Bagloee, S.A., M. Sarvi, B. Wolshon, and V. Dixit, "Identifying Critical Disruption Scenarios and a Global Robustness Index Tailored to Real Life Road Networks," *Transportation Research, Part E: Logistics and Transportation Review*, Vol. 98, pp. 60-81 February 2017. (published)
12. Farhadi, N., S. Parr, K. Mitchell, and B. Wolshon, "Quantifying Resilience of Maritime Transportation Systems Using Nationwide Automatic Identification System Data," *Transportation Research Record: Journal of Transportation Research Board*, No. 2549, pp. 9-18, 2016. (published)

Conference Papers

1. Tomas, M. (student), L. Bu (student), H. Das, and F. Wang, "Analyses of Storm Surge Induced Flood Risk in Coastal Areas of Mississippi," 96th TRB Annual Meeting, Washington, DC, January 2017. (accepted)
2. Lu, W. (student), L. Bu (student), F. Wang, and L. Liu, "Game-theoretic Analysis of Networks Vulnerability under Hurricane Evacuation," 96th TRB Annual Meeting, Washington, DC, January 2017. (accepted)
3. Lu, W. (student), F. Wang, L. Liu, and G. Hu, "Bottleneck Identification for Network under Hurricane Evacuation," 96th TRB Annual Meeting, Washington, DC, January 2017. (accepted)
4. Yin, C., L. Bu (student), and F. Wang, "Optimization of Transshipping Freight of Less than Container Load at Port Rail-Sea Container Intermodal Terminal," World Transport Convention annual meeting, Beijing, China, February 2017. (submitted)
5. Hu, G., F. Wang, W. Lu, and L. Liu, "The Spatial Partitioning of Traffic Networks for Boundary Flow Control," World Transport Convention annual meeting, Beijing, China, February 2017. (under review)
6. Li, L., Li, M., Ogbonnaya, U., Wen, K., Li, C., (student) and Amini, F., "Experimental Investigation of the Mechanical Properties of MICP-Treated Sands Reinforced with Discrete Randomly Distributed Fiber," *Geotechnical Special Publication*, No. 269: 52-61, ASCE. 2016. (published)
7. Akimana, R.M., Seo, Y., Li, L., Howard, L.J., Dewoolkar, M.M., and Bu, L.B., "Exploring X-Ray Computed Tomography Characterization and Reactive Transport Modelling of Microbially-Induced Calcite Precipitation in Sandy Soils," *Geotechnical Special Publication*, No. 269: 62-71, ASCE. 2016. (published)
8. Whalin, W., "HBCU Engineering Faculty and Graduates Implication for Race, Retention, and Graduation Linkages," NAAAS and Affiliates 2016 Annual Conference, Baton Rouge, LA, October 2016. (accepted)
9. Whalin, W., Qing Pang, La Shon N. Lowe, and Josie Latham, "Assessment of a Summer Bridge Program: Seven Years and Counting," American Society for Engineering Education, 2017 Annual Conference, Columbus, OH March 2017. (accepted)
10. Stich, Bethany, "Energy, Environment, Transportation and Trade," American Society of Public Administration Annual Conference, Atlanta, GA, March 2017. (under review)
11. Chakrabarti, S., Painter, G. D., & Valdez, A., "The Decline of Inter-Urban Migration and Its Impact on Public Transit Ridership," 56th Annual Conference of the Association of Collegiate Schools of Planning, Portland, 2016. (under review)
12. Giuliano, G., and S. Chakrabarti, "Application of the Los Angeles Archived Data Management System (ADMS) to analyze intra-metropolitan variation in highway and arterial system performance," 56th Annual Conference of the Association of Collegiate Schools of Planning, Portland, 2016. (under review)

13. Renne, John, "Transit—Oriented Development and Ports: A National Analysis in the United States," World Symposium on Transport and Land Use Research, Brisbane, Australia July 2017. (accepted)

Conference Presentations

1. Lee, H., Holmer, R. (student), Madadi, M., Zhang, S., Nachtmann, H. "Dynamic Decision Modeling for Inland Waterway Disruptions," 2016 INFORMS Annual Meeting Nashville, TN, November 2016. (Invited Talk)
2. Lee, H., Holmer, R. (student), Madadi, M., Zhang, S., Nachtmann, H. "Dynamic Decision Modeling for Inland Waterway Disruptions," 2016 REDSET Conference, Delhi, India, October 2016.
3. Khatereh Ahadi, (student), "A Stochastic Programming Approach For Selecting Inland Waterway Maintenance Projects," INFORMS Annual Meeting, November 2016. (Invited Talk)
4. Nachtmann, Heather, "Transportation and Logistics Research in Industrial Engineering at the University of Arkansas," IFARHU- SENACYT, Panama City, Panama, October 2016. (Invited Talk)
5. Delgado-Hidalgo, Liliana (student) and Heather Nachtmann, "Integrated Assignment and Scheduling Decisions for Inland Waterway Disruptions," American Society for Engineering Management International Annual Conference, October 2016.
6. Tong, Jingjing, Justin Chimka, and Heather Nachtmann, "Economic Impact of Intermodal Rail-Road Transport According to a Multiple Linear Regression Model of Transportation Industry GDP," American Society for Engineering Management International Annual Conference, October 2016.
7. Delgado-Hidalgo, Liliana and Heather Nachtmann "Barge Assignment and Scheduling during Inland Waterway Disruption Response," INFORMS Annual Conference, November 2016.
8. Wood, Clinton, "Pseudo 2D Imaging of the Mel-Price Wood River Levee via MASW and Resistivity," Non-Intrusive 3D Levee Imaging Workshop, November 2016.
9. Bernhardt, Michelle, "Tying Together Lab and Field Measurements of Vs and Resistivity for Levee Evaluation," Non-Intrusive 3D Levee Imaging Workshop, November 2016.
10. Lozano, Christine, "Pre-stressed CFRP fatigue retrofits for improved waterway lock reliability," presented to the Civil Engineering Dept Graduate Seminar, March 2017.
11. Tomas, M. (student), L. Bu (student), H. Das, and F. Wang. "Analyses of Storm Surge Induced Flood Risk in Coastal Areas of Mississippi," presented in 2017 TRB Annual Meeting.
12. Lu, W. (student), L. Bu (student), F. Wang, and L. Liu. "Game-theoretic Analysis of Networks Vulnerability under Hurricane Evacuation," 2017 TRB Annual Meeting.
13. Lu, W. (student), F. Wang, L. Liu, and G. Hu. "Bottleneck Identification for Network under Hurricane Evacuation," 2017 TRB Annual Meeting.
14. Li, L., Li, M., Ogbonnaya, U., Wen, K. (student), Xu, Y., and Amini, F., 2017, "Study of Discrete Randomly Distributed Fiber on the Tensile Strength Improvement of Microbial-Induced Soil Stabilization," Geotechnical Frontier, Orlando, FL, March 2017.
15. Bao, R., Li, J., Li, L., Cutright, T.J., Chen, L, Zhu, J. and Tao, J., 2017, "Effect of Microbial Induced Calcite Precipitation on Surface Erosion of Granular Soils," Proof of Concept, 96th TRB, Washington DC, January 2017.
16. Whalin, W., "PhD in Engineering (Coastal, Computational) HBCU," Department of Homeland Security, Coastal Resilience Center (CRC) of Excellence Annual PI Meeting, University of North Carolina, February 2017.
17. Whalin, W., "CRC Education and Workforce Development," Department of Homeland Security, Coastal Resilience Center (CRC) of Excellence Annual PI Meeting, University of North Carolina, February 2017.

18. Wolshon, B. and Scott Parr, Session 867, "Training and Prepping for Community Disasters," 96th Annual Meeting of the Transportation Research Board, Meeting of TRB Committee ANB80, Washington, DC, January 2017.
19. Wolshon, B. and Scott Parr, Session 893, "Short-Notice Evacuation Planning, Analysis, and New Training Opportunities," 96th Annual Meeting of the Transportation Research Board, Meeting of TRB Committee ANB80, Washington, DC, January 2017.
20. Wolshon, B. and Scott Parr, Session 501, "Emergency Evacuation Research," 96th Annual Meeting of the Transportation Research Board, Meeting of TRB Committee ANB80, Washington, DC, January 2017.
21. Stich, Bethany and Peter Webb, "Electronic Navigation: The Future of Waterborne Shipping," Transportation Review Board, Washington, DC. January 2017.
22. Stich, Bethany and Jeffrey Cavanaugh, "The U.S. Gulf in a Liquefied Natural Gas Rich World," Transportation Review Board AT045 Committee, Washington, DC. January 2017.
23. Severson, Ian (student), "Containerized Urban Agriculture," LAAPA conference, March 2017.
24. Pardue, James, "Louisiana Supply Chain / Transportation Council on Critical Infrastructure Resilience and Fuel System Resilience," Louisiana Capital Annex, March 2017. (Invited Talk)

Books/Other One Time Publications

1. Wolshon, B. and A. Pande, *Traffic Engineering Handbook – Seventh Edition*, ISBN: 978-1-118-76230-1, John Wiley & Sons, Inc., New York, 2016. (published)

2.2 Websites

Website Title	Web Address
MarTREC	http://martrec.uark.edu/
Institute for Multimodal Transportation	http://www.jsums.edu/imtrans/
Gulf Coast Center for Evacuation and Transportation Resiliency	http://www.evaccenter.lsu.edu/
Merritt C. Becker Jr. UNO Transportation Institute	http://transportation.uno.edu/

2.3 Technologies or Techniques

Nothing to report

2.4 Inventions

Nothing to report

2.5 Other Products

- Project, *Dynamic Decision Modeling for Inland Waterway Disruptions*, developed a decision support tool to assist decision-making in the event of waterway disruption. The data built predictions for durations of lock/dam closures.

3. Participants & Collaborating Organizations

3.1 Partnerships

Organization Name	Location	Collaboration
Arkansas State Highway and Transportation Dept.	Little Rock, AR	\$40k fund (match project)

Dr. Dennis Phillip Robinson, University of Arkansas at Little Rock	Little Rock, AR	research collaborator
Mr. Gene Higginbotham, Executive Director, AR Waterways Commission	Little Rock, AR	research collaborator
Ms. Deidre Smith, Waterways Branch Manager, ODOT	Muskogee, OK	research collaborator
Mr. Matthew Tyler Henry, Regional Economist at the U.S. Army Corps of Engineer	Muskogee, OK	research collaborator
Dr. Jingjing Tong, Assistant Professor, Southeast Missouri State University	Cape Girardeau, MO	research collaborator
Dr. Kenneth Ned Mitchell, Corey Winton, and Mark Cowan Research Civil Engineer, US Army Engineer Research and Development Center Coastal and Hydraulics Laboratory	Vicksburg, MS	research collaborator
Jose Lopez, Ryan Goetz, and Chris Redell, United States Army Corps of Engineers	St. Louis, MO	Collaborated to collect geophysical data
Dr. Lan Liu, Professor of Southwest Jiaotong University	Sichuan Province, China	technical support
Dr. Fan Liang, Dr. Dong Qian, Dr. Bu Changming	Chongqing University	research collaborator
Gary LaGrange, Paul Matthews, Amelia Pellegrin, Port of New Orleans	New Orleans, LA	research collaborator
Mr. Chad Johnston, United States Department of Homeland Security, Office of Infrastructure Protection, Protective Security Advisor	Arkansas District	research collaborator
Mr. Glenn Moore, United States Department of Homeland Security, Office of Infrastructure Protection, Protective Security Advisor	Oklahoma District	research collaborator
Mr. Christopher King, United States Department of Agriculture, Natural Resources Conservation Service (NRCS)	Little Rock, AR	Co-data collection at Kinion Lake
Dr. Brady Cox and Ken Stokoe	University of Texas at Austin	Collaborated for levee evaluation workshop
Dr. Chuanzhong Yin	Shanghai Maritime University, China	Collaborated in research
US Army Engineer Research and Development Center (ERDC),	Vicksburg, MS	Education Partnership
Geotechnical Company Burns Cooley Dennis	Yazoo City, MS	collect Yazoo clay soil sample
Port of South Louisiana	LaPlace, Louisiana	research collaborator
Jefferson Transit	Metairie, Louisiana	research collaborator
Dr. Genevieve Giuliano and Dr. Gary Painter	USC Sol Price School of Public Policy	research collaborator
Dr. Andy Hong	University of British Columbia	research collaborator

3.2 Other Collaborators

Organization Name	Location	Collaboration
Dr. Jingjing Tong, Assistant Professor, Southeast Missouri State University	Cape Girardeau, MO	case study development
Dr. Melissa Tooley, Director, Texas Transportation Institute	College Station, TX	center collaborator
Professor Chi Li	Inner Mongolia Institute of Technology	research collaborator
Associate Professor Changming Bu	Chongqing University of Science & Technology	research collaborator
Associate Professor Fan Liang	Chongqing Jiaotong University	research collaborator
Professor Dong Qian	Chongqing University of Science & Technology	research collaborator
Dr. ConSandra McNeil	Sociology Dept, JSU	CRC research partner at Texas A&M University
Dr. Rick Leuttich	University of North Carolina (UNC)	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Helen Chen	Johnson C. Smith University, Greensboro, NC	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Barry Keim	Louisiana State University, Baton Rouge, LA	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Sandra Knight	University of Maryland College Park, MD	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Gavin Smith	University of North Carolina, Chapel Hill, NC	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Ismael Pagan and Dr. Ricardo Lopez	University of Puerto Rico, Mayaguez, P.R.	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Meherun Laiju	Tougaloo College, Jackson, MS	Annual PI Meeting at UNC (Meeting held Feb. 1-3, 2017)
Dr. Sam Brody, Dr. Wes Highfield, Dr. Jens Figlis and Dr. William Merrell	Texas A&M University	research collaborator
Dr. Bas Jonkman	Technical University Delft (TU Delft), The Netherlands	research collaborator
Dr. Shahadat Hossain	Department of Civil Engineering, UT Arlington	research collaborator
Florida Atlantic University	Boca Raton, FL	research collaborator
Weike Lu, visiting PhD student of Southwest Jiaotong University	Sichuan Province, China	research collaborator

4. Impacts

4.1 Impacts on Principal Disciplines

Leadership Positions

1. Junior Vice President of Programs, Public Sector OR Section, INFORMS
2. President Elect, American Society for Engineering Management

3. President, American Society for Engineering Management
4. Member, Advisory Council for Transportation Research, Arkansas State Highway and Transportation Department
5. Chair, ASCE Methods of Design Committee
6. Member, Transportation Research Board Committee (ABJ90 - Freight Transportation Data)
7. Sub-committee chair, TRB, (ABG20- Transportation Training and Education)
8. Special Projects Subcommittee Chair, Geo-Institute Soil Properties and Modeling
9. Member, TRB Pavement Management Committee
10. Member, TRB Emergency Evacuation Committee
11. Vice chair, AFP-40 committee, TRB
12. Education Director, University of North Carolina, Coastal Resilience Center of Excellence
13. Professional Committee, Serving as an Executive Officer (Industry Representative) for the American Society of Engineering Education's (ASEE)
14. Subcommittee Member, Office of Marine Engineering Division(OMED)
15. Chair, Standing Committee on Emergency Evacuation, Transportation Research Board
16. Committee member, Standing Committee on Emergency Evacuation, Transportation Research Board
17. Member, TRB Intermodal Freight Transport Committee; American Society for Public Administration Section on Transportation Policy and Administration Executive Committee

Leadership Awards

1. JSU, *High-value research in safety and maintenance*, AASHTO 96th TRB Annual Meeting, Washington DC, January 2017, "Evaluation of MSDOT's Distress Thresholds for Maintained Pavement Projects"
2. Robert W. Whalin, Director Emeritus, U.S. Army Engineer Research and Development Center, renewed
3. Khan, M.S., "Gulf Research Fellowship for Early Career Faculty Fellowship"

4.2 Impacts on Other Disciplines

Related External Grants

1. "Data-Enabled Security in Cyber, Transportation, Critical Infrastructure, and Food," (NSF)
2. "Next Generation Ex-Post Analysis for Transportation Economics," (AASHTO EconWorks)
3. "A Virtually Connected Laboratory for Introducing Self-driving Car Technology through a New Mobile-learning Pedagogy," (NSF IUSE)
4. "Coastal Resilience Center of Excellence," subcontract from University of North Carolina, (DHS)
5. "Coastal Flood Risk Reduction," subcontract from Texas A&M University (NSF, PIRE project)
6. "RII Track 4: Collaborative Research to Advance Enhanced Landfill Mining," (NSF EPSCoR)
7. "Building Louisiana coastal resilience to shocks and stressors through collaborative citizen-expert data collection, analysis, and intervention," (Gulf Research Institute)

4.3 Impacts on Transportation Workforce Development

Pre-College and Recruitment

- The University of Arkansas Engineering Career Awareness program (ECAP) is designed to recruit students who are underrepresented in the field of engineering, and to give these students the support they need to feel comfortable, confident and ready to succeed. The ECAP program provides financial assistance to qualifying students, but ECAP is much more than a scholarship.

Starting with the three-week summer bridge program and continuing through graduation and beyond, ECAP students become part of a family.

- LSU Spill Science and Response program attracts students to careers in spill prevention and response science for pipelines, and other forms of transport of hydrocarbons. Industry partner, Kinder Morgan, is the largest energy infrastructure company in the US.
- MarTREC is committed to increasing the diversity of our workforce. Twenty of the 32 MarTREC supported students were either female or a minority.

Internships

- One logistics internship with J.B. Hunt
- Two Arkansas State Highway and Transportation Department internships

4.4 Impacts on Physical, Institutional, and Informational Resources

Collaborative Activities

1. World Trade Center Transportation Committee, October 3, 2016
2. IFFCBANO Membership meeting, October 4, 2016
3. N.O. Public Belt Railroad/Port of New Orleans Tour, October 4, 2016
4. WTSGNO meeting, November 3, 2016
5. MarTREC Advisory Board Meeting, Fayetteville AR, November 18, 2017
6. Marine Night Live, November 29, 2016
7. International Propeller Club honoring Gary LaGrange, January 17, 2017
8. "Turn Services Welcomes the M/V American Pharoah," February 15, 2017
9. Mississippi Valley Trade & Transport Conference, February 22, 2017
10. "Who Works the Rivers", March 23, 2017

Guidebooks

1. Wolshon, B., A. Pande, and J. Riegner, "Design, Operation and Analysis of Multimodal Intersections," Chapter 10, Traffic Engineering Handbook – Seventh Edition, ISBN: 978-1-118-76230-1, John Wiley & Sons, Inc., New York, 2016.
2. Wolshon B. and A Pande, "Introduction to the Traffic Engineering Handbook and its Role in an Evolving Practice," Chapter 1, Traffic Engineering Handbook – Seventh Edition, ISBN: 978-1-118-76230-1, John Wiley & Sons, Inc., New York, 2016.
3. Wolshon B., D. Matherly, P. Murray-Tuite, "Traffic Management during Planned and Unplanned Emergency Events," Chapter 16, Traffic Engineering Handbook – Seventh Edition, ISBN: 978-1-118-76230-1, John Wiley & Sons, Inc., New York, 2016.

4.5 Impacts on Technology Transfer

Editorial Journal Positions

1. Associate Editor, Operations Research Letters
2. Associate Editor, Economic Quality Control
3. Editor, International Journal of Six Sigma and Competitive Advantage
4. Editorial Board, International Journal of Quality Engineering and Technology
5. Associate Editor, Engineering Management Journal
6. Area Editor, The Engineering Economist
7. Editor Board Member, Journal of Geotechnical and Geological Engineering
8. Editorial Board Member, Journal of Frontiers of Structural and Civil Engineering (FSCE)

9. Area Editor, Journal of Transportation Safety System Security
10. Guest Co-Editor, Journal of Advanced Transportation
11. Guest Co-Editor, International Journal of Disaster Risk Reduction

Transfer of Results

1. Invited presentation to Louisiana Supply Chain / Transportation Council Louisiana Capital Annex, *Critical Infrastructure Resilience and Fuel System Resilience*, March 30, 2017.
2. Version 4, scheduling optimization tool, developed and transferred to US Army Corps of Engineer systems.

4.6 Impacts on Society beyond Science and Technology

Distinguished Lectures

1. Dr. Craig Philip, Research Professor and VECTOR Director Department of Civil and Environmental Engineering Vanderbilt University, "Logistics and Supply Chains in the 21st Century: Uncertainty, Change, and a Look toward the Future" Some Observations from an "Operator" turned "Academic", November 2016. (35 attendees)
2. Dr. Jefferey Melby, U.S. Army Engineer Research and Development Center, "Invention of the Core Loc Concrete Armor Unit and Reinforcing Recommendations" October 2016. (30 attendees)
3. University of New South Wales, Australia, August 2017. (40 attendees)
4. Technical University of Delft (TU Delft), Netherlands, December 2016. (25 attendees)

Conference Planning Positions

1. Cluster Co-chair, Public Sector OR Cluster, INFORMS 2017
2. Operations Research Track Organizer - IISE
3. Session Moderator, 2016 American Society for Engineering Management International Annual Conference
4. Track Co-Chair, American Society for Engineering Management Conference
5. Committee Member, Transportation Research Board (ABJ90 - Freight Transportation Data)
6. Sub-committee chair, TRB (ABG20- Transportation Training and Education)
7. Member, Institute of Transportation Engineers (ITE) MOVITE Section Local Arrangements Committee (LAC)
8. Co-chair, Road Safety and Emergency Management Section Technical Committee, 2017 World Transport Convention (WTC), Beijing, China
9. Session Chair, Battelle Remediation Conference, Miami, FL

5. Changes/Problems

MarTREC was awarded a FAST Act Tier 1 University Transportation Center (UTC). Our theme is *Preserving the Existing Transportation System*.

6. Special Reporting Requirements

Nothing to report