



## USDOT Tier 1 University Transportation Center

### Program Progress Performance Report #5

Agency: Office of the Assistant Secretary for Research and Technology

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

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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#5	Objective Addressed
# of ongoing projects in each MarTREC research area	16	R1
# of peer-reviewed journal articles (published, accepted, submitted)	13	R3
# of conference presentations	12	R3
# of tenure track faculty who conduct MarTREC research activities	11	R2
# of external partners involved in center research activities	14	R3
# of research activities that impact diversity through participants and/or outcomes	11	R2
# of UG/G students participating in transportation research projects funded by UTC	36	R2
# of MS/PhD transportation-related advanced degree programs	11	R2
# of MS/PhD graduate students supported by MarTREC	21	R2
# of MS/PhD students supported by MarTREC who received degrees	1	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:

<b>Metric</b>	<b>Achieved PPPR#5</b>	<b>Objective Addressed</b>
# of national and regional leadership positions held	31	L1
# of conference planning positions held	10	L1
# of invited talks given	1	L1
# of leadership and research awards received	2	L1
# of impactful research citations by stakeholders	0	L2
# of UG/G students participating in transportation research projects funded by UTC	36	L1
# of junior faculty mentored	2	L1
# of leadership workshops held	2	L2
# of external grant proposals submitted	14	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 EWD goal
- EWD2) Educate college students within MarTREC theme
- EWD3) Conduct workforce development related to MarTREC theme
- EWD4) Conduct outreach activities related to MarTREC theme
- EWD5) Make societal impact related to EWD goal

Accomplishments:

<b>Metric</b>	<b>Achieved PPPR#5</b>	<b>Objective Addressed</b>
# of projects in MarTREC educational and workforce development areas	1	EWD1
# of UG/G transportation-related courses associated with UTC	89	EWD2
# of distinguished lectures & seminars offered	10	EWD3
participant count of distinguished lectures & seminars offered	244	EWD3
# of short courses and workshops offered	1	EWD3
participant count of short courses and workshops offered	1	EWD3
# of times technician certification programs are offered	24	EWD3
participant count of technician certification programs offered	357	EWD3
# of educational modules and case studies developed	0	EWD2
# of student-authored publications	10	EWD2
# of student-presented presentations	9	EWD2
# of K-12 programs offered	1	EWD4
participant count of K-12 programs (events) offered	30	EWD4
% of female participants in K-12 programs	50%	EWD4
% of minority participants in K-12 programs	50%	EWD4
# of pre-college programs offered	8	EWD4
participant count of pre-college programs offered	1900	EWD4
# of online K-12 educational resources posted	6	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:

<b>Metric</b>	<b>Achieved PPPR#5</b>	<b>Objective Addressed</b>
# of peer-reviewed journal articles (published, accepted, under review)	13	TT2
# of conference presentations	12	TT2
# of technical briefs	1	TT2
# of guidebooks	3	TT2
# of short courses and workshops offered	1	TT1
participant count of short courses and workshops offered	1	TT1
# of conference planning positions held	10	TT1
# of editorial journal positions held	7	TT1
# of technician certification programs offered	9	TT1
participant count of technician certification programs offered	357	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:

<b>Metric</b>	<b>Achieved PPPR#5</b>	<b>Objective Addressed</b>
# of collaborative partnerships formed	41	C1
# of collaborative activities conducted	14	C2
# of collaborative deliverables completed	2	C2
# of collaborative team events	12	C1
# of collaborative outreach events held	9	C2
# of faculty involved in collaborative activities	3	C3
# of students involved in collaborative activities	2	C3

### **1.1.6 Plans for Next Reporting Cycle**

MarTREC had sixteen active research projects 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. The Center has completed six of twenty-one projects. One of those projects was completed during this reporting period. Four of the twenty-one projects were approved as new projects during this reporting period. We will continue to emphasize educational and technology transfer activities. And we are planning our next annual Advisory Board meeting for November 18, 2016.

## **1.2 Project-Level Accomplishments**

### **1.2.1 Maritime and Multimodal Logistics Management Projects**

#### **Regional Economic Impact Study of the McClellan-Kerr Arkansas River Navigation System April 16, 2014-August 30, 2015**

**Heather Nachtmann, Ph.D.**

**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.

#### **Multimodal Transport and TransLoad Facilities in Arkansas July 15, 2014-December 31, 2014**

**Justin Chimka, Ph.D.**

**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.

#### **Dynamic Decision Modeling for Inland Waterway Disruptions August 1, 2014-June 30, 2016**

**Shengfan Zhang, Ph.D.**

**Heather Nachtmann, Ph.D.**

**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. The optimal policy from the MDP model determines whether it is more economical to reroute using another mode of transportation or to wait on the waterway.

**Project plans:** A district-specific probabilistic model will be developed to quantify the uncertainty associated with inland waterway closure. The MDP model will be improved considering the additional uncertainty in deterioration and security of cargo value, congestion and safety status at the offloading/rerouting point. Any necessary constraints on the delivery due date will be added to the model.

### **Efficient Dredging Strategies for Improving Transportation Infrastructure Resilience**

**August 1, 2014-June 30, 2016**

**Kelly Sullivan, Ph.D.**

**Accomplishments:** Developed mathematical modeling approaches to explore cost-efficient maintenance strategies for hardening inland waterway infrastructure against the possible impacts of shoaling, weather events, and lock degradation are in progress.

**Project plans:** I plan to extend the models to schedule maintenance projects dynamically over time as new information about hydrologic conditions becomes known.

### **Supporting Secure and Resilient Inland Waterways**

**August 1, 2014-June 30, 2017**

**Heather Nachtmann, Ph.D.**

**Justin Chimka, Ph.D.**

**Accomplishments:** We have developed a linear approach to extend our Cargo Prioritization Terminal Allocation Problem (CPTAP) modeling capability. This new approach, when validated, may allow us to solve realistic response scenarios more quickly.

**Project plans:** Our next steps are to test the new approach and compare this with our existing models. 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.

### **Economic Impacts of Lock Usage and Unavailability**

**August 18, 2014-June 30, 2016**

**Justin Chimka, Ph.D.**

**Accomplishments:** Consolidated Lock Use, Performance, and Characteristics data collected by the U.S. Army Corps of Engineers (USACE). Estimated statistical models of annual tons locked by commodity group and lock, as a function of lock usage and unavailability, to learn about economic consequences of system disruption. Separated large dataset into meaningful subsets for analysis, with respect to interdependence among usage and unavailability variables, and missing data.

**Project plans:** We are currently generating results from the Arkansas, Mississippi and Ohio Rivers, and looking for consistencies upon which to base conclusions.

## **1.2.2 Building Resilient and Sustainable Multimodal Infrastructure Projects**

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

**October 1, 2013-June 30, 2015**

**Brian Wolshon, Ph.D.**

**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.

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

**April 15, 2014-January 31, 2016**

**Bethany Stich, Ph.D.**

**Accomplishments:** Concerning any extant best practices which could be adapted to LNG bunkering at the Port of New Orleans, our USCG focus group directed us to the federal regulations concerning port-sited LNG bunkering facilities, which are detailed in CFR 33-127. This is the only extant record of best practices by federal officials. Our focus group discussion led us to the three primary factors taken into account by the USCG when considering the Port of New Orleans as a site for the bunkering of LNG as a marine fuel: severe weather probabilities, proximity to neighborhoods, and proximity to roadways. Secondly, regarding the acceleration of LNG as an industrial feedstock for new industry however, our fieldwork revealed a petrochemical manufacturing boom in the parishes between New Orleans and Baton Rouge. Thirdly, Louisiana is experiencing a new cargo export potential with LNG and the construction of the required LNG Export Terminals in diverse locations.

**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.

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

**July 1, 2014-June 30, 2016**

**Wei Zheng, Ph.D.**

**Accomplishments:** We have conducted numerical analysis based on the finite element model of a prototype nine-span concrete bridge to validate the feasibility and effectiveness of our proposed probabilistic framework for promptly assessing barge-bridge collision damage. Results show that the framework can rapidly determine the probability of structural damage caused by collision accident in less than one second. We finished the numerical simulation of the optimization deployment of sensors for promptly assessing barge-bridge collision damage.

**Project plans:** Efforts are moved to the organization of the results and the writing of the second manuscript for publication.

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

**July 1, 2014-June 30, 2016**

**Yadong Li, Ph.D.**

**Lin Li, Ph.D.**

**Accomplishments:** After testing ten different additives on their absorptions of Cu and Zn, two types of additives, i.e., Granular Bentonite produced by Texas Sodium Bentonite and Sodium Bentonite by Charles B. Chrystal Co., were identified to be the most effective in absorbing Cu and Zn. Permeability, air voids, and compressive strength of the samples were tested. The absorptions of the samples on Cu and Zn were also tested using batch absorption test and dynamic absorption test. It was found that these additives do not improve the physical properties of the PCP samples, neither the absorption abilities on Cu and Zn.

**Project plans:** Concentrations of Cu and Zn in the solutions that we used in the absorption tests could be too high (up to 10 mg/L). We are now testing the absorption of the PCP samples using much lower Cu and Zn concentrations (0.1-0.5 mg/L) to see if the results will be different.

## **Optimal Dredge Fleet Scheduling within Environmental Work Windows**

**August 1, 2014-June 30, 2016**

**Chase Rainwater, Ph.D.**

**Heather Nachtmann, Ph.D.**

**Accomplishments:** Added secondary objective function to decision tool that allows user to consider maximizing cubic yards dredged and minimizing equipment travel time simultaneously. New module was incorporated into optimization tool and installed on UASACE servers in spring 2016. First dredge scheduling meeting with updated tool was held with Vicksburg, MS administrators to brief leadership on the tools capabilities for upcoming planning cycles.

**Project plans:** We will explore the integration of learning-based decision systems with existing constraint programming framework to aid in scaling the decision framework by at least one order of magnitude.

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

**January 1, 2015-December 31, 2016**

**Clint Wood, Ph.D.**

**Michelle Bernhardt, Ph.D.**

**Accomplishments:** A comprehensive literature review has been compiled which identified main levee failure mechanisms, the corresponding defects associated with these failures mechanisms, and the non-destructive geophysical methods that have been used to detect these defects. A small earthen dam has been identified and tested using surface wave methods and resistivity in association with Natural Resource Conservation Service (NRCS). Data processing is near completion for the dam. The results will be used to establish the data processing and preliminary statistical framework. Lab work has also been conducted to understand the relationship between resistivity, density, and water content.

**Project plans:** We plan to conduct the main field study in early summer at levees which were identified in the Midwest during the GEER reconnaissance. We also plan to continue the lab

experiments to understand the relationship between resistivity, density, and water content of standardized soil samples.

### **Quantifying Resiliency of Maritime Transportation Systems**

**October 1, 2015-June 1, 2018**

**Brian Wolshon, Ph.D.**

**Scott Parr, Ph.D.**

**Accomplishments:** Collection and analysis of the relevant literature in the related fields of NAIS data, port operations and resiliency analysis are complete. Preliminary development of model capable of processing NAIS data to provide reliable estimates of port operations is complete.

**Project Plans:** Continued development of a model capable of processing NAIS data to provide reliable estimates of port operations will occur. Application of this model to quantify the resiliency of port operations on case study areas will be conducted.

### **Innovative Bio-Mediated Particulate Materials for Sustainable Maritime Transportation Infrastructure**

**November 1, 2015-October 31, 2016**

**Lin Li, Ph.D.**

**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 experimental study of fine grained soils (silt and clay) on the effect of microbial improved sandy soil.

**Project plans:** Compare the multi-treatment effect with single-treatment, analyze the results and come to conclusions.

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

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

**October 1, 2013-June 30, 2015**

**Neila Donovan, Ph.D.**

**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.

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

**October 1, 2013-September 30, 2017**

**John Renne, Ph.D.**

**Accomplishments:** Progress was 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.

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

**July 1, 2014-July 31, 2015**

**Feng Wang, Ph.D.**

**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**

**May 1, 2015-April 30, 2017**

**Scott Parr, Ph.D.**

**Brian Wolshon, Ph.D.**

**Accomplishments:** We are currently collecting and statistically analyzing the simulated network results. Initial results from this research project have been accepted for publication in two journals.

**Project plans:** We will complete collection of simulation results and analysis of these results.

## **Vulnerability of Fuel Distribution Systems to Hazards in Coastal Communities**

**May 1, 2015-April 30, 2016**

**John Pardue, Ph.D.**

**Accomplishments:** Developed extensive network model of coastal Louisiana communities capturing roads, fueling stations, and bulk terminals. Model captures all details of the lower portion of LA Highway 1, fuel capacities, supply routes and storage types (above-ground and below ground fuel storage).

**Project plans:** With model, efforts will assess vulnerability of fuel distribution system to flooding with consequence including immediate loss of fueling capacity, and system capacity after 1, 3 and 6 months based on past recovery periods derived from other flood events.

## **Statistical Analysis of Vehicle Crashes in Mississippi based on Crash Data**

**November 1, 2015-October 31, 2016**

**Feng Wang, Ph.D.**

**Accomplishments:** In the first task, characteristics of vehicle crashes in Mississippi were indicated. Initial 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. Second task, literature review was conducted to locate effective methods to analyze the crash data. Regression was applied to the crash data analysis by researchers in recent years.

**Project plans:** The development of statistical analysis related to crash severity in coastal area versus non-coastal area in MS and the utilization of negative binomial models to analyze the effect of geometric properties on arterial roads in Mississippi coastal area.

## **Measurement of Traffic Network Vulnerability for Mississippi Coastal Region**

**November 1, 2015-October 31, 2016**

**Feng Wang, Ph.D.**

**Accomplishments:** First task, the potential critical links related to the evacuation traffic in the evacuation network in Mississippi Gulf coast region were identified using the game-theory approach to determine accessibility and priority of the network links. The calculation result has been mapped and visualized in ArcMap GIS. The second task, look at 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. Data of the maximum surge heights over the land surfaces of 261,021 selected monitoring locations in the past one hundred years in the study area were analyzed. The probability of the inundation over a road surface was determined by using the estimated maximum surge height over the land surfaces. The study result has been mapped and visualized in ArcMap GIS.

**Project Plans:** Measure evacuation network vulnerability, evaluate different evacuation strategies and develop final report.

## **2. Products**

### **2.1 Publications**

#### **Journal Articles**

1. Lowe, Kate and Kim Mosby (student). "The conceptual mismatch: A qualitative analysis of transportation costs and stressors for low-income adults," *Transport Police*, Volume 49, 2016, pp. 1-8.
2. Stich, Bethany, Jim Amdal, and Peter Webb (student), "Liquefied Natural Gas: A Status Report from LA: Staying Number One," *Public Works Management & Policy* (under revision).
3. Bu, L. (student), F. Wang, X. Zhou, and C. Yin, "Modeling Gate Control Strategy for Traffic Management in Emergency Evacuation" *International Journal of Transportation* (accepted).
4. Bu, L. (student), Z. Jiang, F. Wang, C. Yin, and B. Zhu, "Optimization Model for Bus Deployment to Subway Station in Emergency Evacuation," *Public Transport*, (in review).

5. Bu, L. (student), F. Wang, and C. Yin, "Graphical Visualization of Traffic Condition of Mississippi Gulf Coast Area," *Software, Practice and Experience*, (in review).
6. Oztanriseven, Furkan, (student) and Heather Nachtmann, "Economic Impact Analysis of Inland Waterway Disruption Response," *The Engineering Economist* (accepted).
7. Tong, Jingjing, and Heather Nachtmann, "Cargo Prioritization and Terminal Allocation Problem for Inland Waterway Disruptions," *Maritime Economics & Logistics* (accepted).
8. Gedik, Ridvan, Chase Rainwater, Heather Nachtmann, and Edward Pohl, "Analysis of a Parallel Machine Scheduling Problem with Sequence Dependent Setup Times and Job Availability Intervals," *European Journal of Operational Research*, Vol. 251, No. 2 (accepted).
9. Ogbonnaya, U. (student), Wen, K. (student), and Li, L., "The Effects of Fine-Grained Content on Microbial Improved Sandy Materials," *Journal of Materials in Civil Engineering, ASCE* (in review).
10. Wei Zheng and Feng Qian "Probabilistic-Based Machine Learning Approach to Promptly Assessing Probability of Barge-Bridge Collision Damage of Piers," *Journal of Civil Health Monitoring* (in review).
11. Zhang, Z., S. Parr, H. Jiang, and B. Wolshon, "Optimization Model for Regional Evacuation Transportation Systems Using Macroscopic Productivity Function," *Transportation Research, Part B: Methodological*, Vol. 81, 2015, pp. 616-630.
12. Zhang, Z., S. Parr, and B. Wolshon, "Application of a Productivity Function to Assess Network Performance during Mass Evacuations," submitted for publication in the *International Journal of Transportation*, (in review).
13. Farhadi, N. (Student), S. Parr, K. Mitchell and B. Wolshon, "Quantifying Resiliency of Maritime Transportation Systems using NAIS Data," *Transportation Research Record: Journal of the Transportation Research Board*, No. 2549 (accepted).

### **Conference Papers**

1. Delgado Hidalgo, Liliana (student), Heather Nachtmann, and Jingjing Tong, "Analytic Hierarchy Approach to Inland Waterway Cargo Prioritization and Terminal Allocation," *American Society for Engineering Management Conference Proceedings*, October 2015.
2. Whalin, Robert W., "Department of Defense Minority Serving Institution Research and Development, A Proposed New Strategy, Assessment and Sunset Provision," *Proceedings of the NAAAS, NAHLS, NANAS, IAAS 23rd Joint National Conference*, February 2015, Baton Rouge, LA, October 2015.
3. Whalin, Robert W., Pagan Setal, "A Quarter Century of Resounding Success for a University/Federal Laboratory Partnership," *Proceedings of the 2016 Annual Conference, American Society for Engineering Education* (accepted).
4. Li, L., Amini, F., Zhao, Q. (student), Li, C., Wen, K. (student), Li, M., and Ogbonnaya, U. (student), "Development of a Flexible Mold for Bio-Mediated Soil Materials", *Geotechnical Special Publication*, No. 256: 2339-2348, ASCE, 2015.
5. Madadi, M., Holmer, R. (student), Zhang, S. and Nachtmann, H. "Dynamic Decision Modeling for Inland Waterway Disruptions", In *Proceedings of the 2016 Industrial and Systems Engineering Research Conference*, Anaheim, CA (accepted).

6. Farhadi, N. (student), S. Parr, K. Mitchell and B. Wolshon, "Quantifying Resiliency of Maritime Transportation Systems using NAIS Data," accepted for presentation at the Annual Meeting of the Transportation Research Board, January 2016.

### **Conference Presentations**

1. Stich, Bethany, "The Challenges of Establishing Maritime Shipping Corridors in the Gulf of Mexico between the U.S., Mexico, and Cuba," American Society for Public Administration; March 2016.
2. Stich, Bethany and Kyle Griffith (student), "Assessing the Potential for Gulf Coast NAFTA Maritime Trade Corridors," METRANS International Urban Freight Conference; October 2015.
3. Stich, Bethany and Kyle Griffith (student), "The Gulf Coast Megaregion: In Search of a New Scale to Freight Transportation & Economic Development," METRANS International Urban Freight Conference, October 2015.
4. Nachtmann, Heather, "Regional Economic Impact Study of the McClellan-Kerr Arkansas River Navigation System," Transportation Committee Senate and House Transportation Committee of the Arkansas General Assembly, Pine Bluff, Arkansas, November 2015.
5. Oztanriseven, Furkan (student) and Heather Nachtmann, "System Dynamics in Navigable Inland Waterways," DECISION SCIENCES INSTITUTE, San Francisco, November 2015.
6. Hidalgo, Liliana Delgado (student), "Cargo Prioritization and Terminal Allocation in Case of Inland Waterway Disruption," INFORMS 2015, Philadelphia, November 2015.
7. Oztanriseven, Furkan (student), Inland Waterway System Dynamics, INFORMS 2015, Philadelphia, November 2015.
8. Ahadi, Khatereh, Ph.D. Student, "Selecting Inland Waterway Maintenance Projects under Consideration of Random Disruptions" INFORMS, November 2015.
9. Li, L., Li, M., Ogbonnaya, U., Wen, K., (students) and Amini, F., 2016, "Experimental Investigation of Discrete Randomly Distributed Fiber on the Mechanical Properties of Microbial-Induced Soil Improvement," ASCE Geotechnical & Structural Engineering Congress, Phoenix, AZ, February 2016.
10. Jackson, A. (student), and Li, L., "Laboratory Study of Flexure Mold on Properties of Bio-Inspired Sandy Soil", 95th Annual Meeting of TRB, Washington DC, January 2016.
11. Bates, Darius T. (student), Divya Sinha, and Yadong Li, "Removal of Heavy Metals from Highway Runoff through Modified Pervious Cement Pavement," Emerging Researchers National Conference in STEM, Washington, DC, February 2016.
12. Wolshon, Brian, "Quantifying Resilience of Maritime Transportation Systems Using Nationwide Automatic Identification System Data," Session 296: Current Research on Port Resilience, Disruptions, Vulnerability, and Cargo Diversion, 95th Annual Meeting of the Transportation Research Board, Washington, DC, January 2016.

### **Books/Other One Time Publications**

1. Technical Brief: Nachtmann, Heather, Othman Boudhoum (student), and Furkan Oztanriseven (student), Regional Economic Impact Study for the McClellan Kerr Arkansas River Navigation System, MarTREC Final report, October 15, 2015.

2. Guidebook: Matherly, D., N. Langdon, A. Kuriger, I. Sahu, B. Wolshon, J. Renne, R. Thomas, P. Murray-Tuite, and V. Dixit, "A Guide to Regional Transportation Planning for Disasters, Emergencies, and Significant Events", National Cooperative Highway Research Program, Report 777, ISBN: 978-0-309-07023-2, Transportation Research Board, National Research Council, Washington DC, 2014, 148 pp.
3. Guidebook: Pesesky, L., D. Ismart, C. Huffman, Y.C. Chiu, H. Zheng, E. Nava, V. Dixit, B. Wolshon, E. Radwan, W. Sampson, J. Morales, E. Perry, E. Bromage, L. Bromage, and D. Matherly, "Strategic Approaches at the Corridor and Network Level to Minimize Disruption from the Renewal Process", Strategic Highway Research Program Report Number S2-R11-RW-1, ISBN: 978-0-309-12981-7, Transportation Research Board, National Research Council, Washington DC, 2014, 112 pp.
4. Guidebook: Matherly, D., J. Mobley, B. Wolshon, J. Renne, R. Thomas, and E. Nichols, Elisa, "A Transportation Guide for All-Hazards Emergency Evacuation, Strategic Highway Research Program", Report 740, ISBN: 978-0-309-25901-9, Transportation Research Board, National Research Council, Washington DC, 2013, 193 pp.

## 2.2 Websites

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

## 2.3 Technologies or Techniques

Optimal Dredge Fleet Scheduling within Environmental Work Windows Research led to installation of and use of software optimization tools designed by MarTREC team for the US Army Corps of Engineers. The decision tools produced from the project are now actively being used at multiple US Army Corps of Engineer dredge planning locations. Decision-makers have gained notable confidence in quantitative approaches to planning their operations.

## 2.4 Inventions

Nothing to report

## 2.5 Other Products

Nothing to report

## 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 collaborators
Mr. Christopher King, United States Department of Agriculture, Natural Resources Conservation Service (NRCS)	Little Rock, AR	collaborative research Co-data collection at Kinion Lake
Chongqing University of Science & Technology; Inner Mongolia Institute of Technology	Peoples Republic of China	joint research effort
Port of New Orleans	New Orleans, LA	collaborator
Critical Commodities Conference	New Orleans, LA	collaborator
Mississippi Valley Trade & Transport Council	New Orleans, LA	collaborator

### 3.2 Other Collaborators

<b>Organization Name</b>	<b>Location</b>	<b>Collaboration</b>
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
Mr. Trevor Timberlake, Arkansas Natural Resources Commission (ANRC)	Little Rock	discuss Arkansas levees
Mr. Brian Brasher and Ms. Anita Branch, U.S. Army Corps of Engineers Fort Worth District	Fort Worth, TX	levee soil data and possible testing locations
Mr. Bryant Robbins, U.S. Army Corps of Engineers	Oklahoma City, OK	prior geophysical testing data and equipment
Dr. Brady Cox, University of Texas at Austin	Austin, TX	workshop collaboration
California State University, Fullerton	Fullerton, CA	center collaborator
Army Corps of Engineering's	Baton Rouge, LA	collaborator
International Freight Forwarders & Customs Brokers Assn. of N.O.	New Orleans, LA	contact
World Trade Center Transportation Committee	New Orleans, LA	contact

Louisiana Complete Streets	New Orleans, LA	contact
Bike Easy	New Orleans, LA	contact
American Society of Civil Engineers	New Orleans, LA	contact
New Orleans Sustainable Transportation Advisory Committee	New Orleans, LA	contact
RIDE New Orleans	New Orleans, LA	contact
Regional Transit Authority	New Orleans, LA	contact
Women Transportation Seminar (WTS)	New Orleans, LA	contact
Regional Planning Commission	New Orleans, LA	contact
Louisiana Center for Women in Government & Business; Traffic & Transportation Club of Greater New Orleans	New Orleans, LA	contact
Greater New Orleans Inc.	New Orleans, LA	contact
Port Safety Committee	New Orleans, LA	contact
Ports Assn. of Louisiana	New Orleans, LA	contact
Propeller Club of the U.S. Port of New Orleans	New Orleans, LA	contact
Coastal Cargo	New Orleans, LA	contact
Dr. Sam Brody, Dr. Wes Highfield, Dr. Jens Figlis and Dr. William Merrell	Texas A&M Galveston	collaborator
Dr. Bas Jonkman	Technical University Delft, The Netherlands	collaborator
Dr. Auroop Ganuly	Northeastern University	collaborator
Dr. Barry Keim	Louisiana State University	collaborator
Mr. James Watkins	Mississippi Department of Transportation	evaluator
Dr. Helen Chen and Johnson C.	Smith University Northampton, MA	collaborator
Dr. Ismael Pagan and Dr. Ricardo Lopez	University Puerto Rico, Mayaguez	collaborator
Dr. Sandra Knight	University of Maryland	collaborator
Dr. Meherun Liaju	Tougaloo College	collaborator

## 4. Impacts

### 4.1 Impacts on Principal Disciplines

#### *Leadership Positions*

1. Transportation Research Board: Intermodal Freight Committee; 2. Transportation Research Board: Committee on Transportation and Economic Development; 3. Transportation Research

Board: Logistics of Disaster Response and Business Continuity; 4. Past President and Board Member: Mississippi Heritage Trust; 5. American Society for Public Administration Member -- a) Women in Public Administration; b) Executive Committee Public Administration Research; c) Past President Transportation Policy and Administration; 6. Past Board Member, Industry Advisory Council (IAC) - Center for Logistics, Trade and Transportation at the University of Southern Mississippi; 7. Greater Starkville Development Partnership Convention and Visitors Bureau – Vice Chair; 8. Phi Kappa Phi Member; 9. Pi Sigma Alpha Member; 10. Pi Alpha Alpha Member; 11. Chair, Transportation and Land Development Committee, Transportation Research Board; 12. Member City of New Orleans Pedestrian and Bicycle Safety Advisory Committee; 13. Member, New Orleans Sustainable Transportation Action Committee; 14. Advisory Committee, Louisiana Council, Urban Land Institute; 15. Board Member, Evacueer.org; 16. Member Emergency Evacuation Committee, TRB; 17. Member, Committee on Social and Economic Factors in Transportation, TRB; 18. TRB, University Representative; 19. Transportation Choices for Sustainable Communities Research & Policy Institute, San Francisco, CA, Board of Directors. 20. Chair, Transportation Research Board, Standing Committee on Emergency Evacuation; 21. Steering Committee co-Chair, National Evacuation Conference; 22. Committee Member for the Transportation Research Board, Standing Committee on Emergency Evacuation 23. Served as TRB’s representative at JSU and managed the Minority Fellowship Program; 24. Served in TRB’s Emergency Evacuation Committee (ABR30); 25. TRB’s Pavement Management Systems Committee (AFD10); 26. Served as team leader for TRB’s Pavement Management Systems Committee (AFD10); 27. American Society for Engineering Management, President Elect; 28. Advisory Council for Transportation Research Member, Arkansas State Highway and Transportation Department; 29. National Engineering Economy Teaching Excellence Award Committee Member, American Society for Engineering Education; 30. Scholarship Fund Trustee Chair, Institute of Industrial Engineers; 31. Chair, Ocean and Marine Division, American society for Engineering Education; 32. President, Junior Faculty Interest Group, Institute for Operations Research and Management Sciences (INFORMS).

#### *Leadership Awards*

- Heather Nachtmann, Ph.D., Top 15 Externally Funded Researcher, University of Arkansas, March 2016.
- Heather Nachtmann, Ph.D., IISE Fellow Award - recognizes outstanding leaders of the profession who have made significant, nationally recognized contributions to industrial engineering, March 2016.

#### **4.2 Impacts on Other Disciplines**

##### *Related External Grants*

1. “Guidance for Security Management Systems”; January 28, 2016; National Safe Skies Alliance.
2. NRT-INFEWS: INTREPID: “Interdisciplinary Graduate Training in Protecting Food Production and Water Supply Systems”, March 7, 2016, NSF.
3. “Engineering Research Center for Climate Adaptation and Resilient Engineering”, NSF preproposal, \$3.5M, with Northeastern University, submitted on October 24, 2015.

4. "Mississippi Based RESTORE Act Center of Excellence (MBRACE)", MDEQ, \$4M, participator, with USM, submitted on May 6, 2015.
5. "CC\*DNI Integration: DIAMOND: Data-Intensive Adaptive Multi-Domain Traffic Aggregation, Modeling, and Deployment", NSF, \$1M, Co-PI, with ASU, submitted on March 25, 2015.
6. "Mobile Learning Mechanism for Promoting Engineering Academic Achievements in HBCU", NSF, \$500k, PI, submitted on September 11, 2015.
7. "Update and Documentation of MDOT Warranty Process and Distress Thresholds", MDOT, \$200k, PI, submitted on February 9, 2016.
8. Coastal Hazards Center (Education and Workforce Development) October 2015, Department of Homeland Security, \$150,000.
9. Coastal Resilience Center (Department of Homeland Security) October 2015, University of North Carolina, \$183,270.
10. Galveston Bay Area Coastal Protection Alliance, \$98,647, March 2016.
11. Partnership for International Research and Education (PIRE), NSF subcontract from Texas A&M University, \$71,914, October 1, 2015.
12. Coastal Hazards Center (Science and Engineering Workforce Development), Department of Homeland Security, \$150,000, November 2015.
13. Coastal Resilience Center (Department of Homeland Security), subcontract from University of North Carolina \$183,270, January 2016.
14. MRI: Acquisition of a Multi-Beam SEM/FIB for Multidisciplinary Materials Study and Training; PI: Li, L.; Co-PI: Amini, F., Hamme, A., Walters, W.; Total Amount: \$ 800,014.00 (FUNDED); Supported by: National Science Foundation; 2015-2018.

### **4.3 Impacts on Transportation Workforce Development**

#### *Outreach*

- "Get to Know UNO;" 400+ high school students and parents; Fall 2015.
- "Explore UNO;" 400+ high school students and parents; February 27, 2016.
- Mississippi Summer Transportation Institute, 30 high school students, 50% male, 50% female, 100% African American.

#### *Internships*

- Derreck Deason, Internship with Port of New Orleans
- Adeola Yusuf, Internship with Wal-Mart Logistics
- Emily Moneka Francis Xavier, Internship with J.B. Hunt Logistics

### **4.4 Impacts on Physical, Institutional, and Informational Resources**

Dynamic Decision Modeling for Inland Waterway Disruptions project collected data on disruption reports in several districts, with a focus on weather-related disruptions.

### **4.5 Impacts on Technology Transfer**

At the University of Arkansas, Center for Training Transportation Professional (CTTP) certified 357 students in nine transportation-related disciplines during reporting period.

Technical Brief - Nachtmann, Heather, Regional Economic Impact Study for the McClellan Kerr Arkansas River Navigation System- Executive Summary, MarTREC Technical Brief, October 2015.

Two Leadership Workshops“ Traffic Engineering Handbook, 7th Edition - A Sneak Peek,” ITE Learning Hub Webinar Series, Institute for Transportation Engineers, Washington, DC, March 2016 and “Roadway Jerk Cluster Analysis for the Forecasting of High Crash Potential Road Locations,” Louisiana Engineering Society, Baton Rouge, LA, December 2015.

LSU produced three guidebooks focused on disasters, disruptions, and evacuation (see Books/Other One Time Publications).

#### **4.6 Impacts on Society beyond Science and Technology**

##### *Distinguished Lectures*

1. Douglas J. Grubbs, "Evolution of Pilotage", October 28, 2015; 2. James M. Baldwin, October 8, 2015; 3. David Scoggin, October 8, 2015; 4. Randy Guillot, October 9, 2015; 5. William D. Ankner, Ph.D., "The Role of Transportation in Society", November 12, 2015; 6. Kristin Gisleson Palmer, Fall 2015; 7. Walter Brooks, Fall 2015; 8. Trevor Theunissen, Fall 2015; 9. Gene Higginbotham, Arkansas Waterways Commission and Heather Nachtmann, MarTREC Director presented on “Regional Economic Impact Study for the McClellan Kerr Arkansas River Navigation System”, Fall 2015; 10. Jeffrey Melby, Ph.D., Research Coastal Engineer, Engineer Research and Development Center, "Breakwater Design Considerations", March 22, 2016.

##### *Conference Planning Positions*

1. American Society for Engineering Management Conference Track Co-Chair; 2. Institute of Industrial Engineers (ISERC) Operations Research Track Chair; 3. Session Moderator for 6th international conference on earthquake geotechnical engineering (GICEGE) (Christchurch NZ) November 2-4, 2015; 4. Organizing committee member for 100th Arkansas Academy of Science meeting/conference (Fayetteville, AR) April 1-2, 2016; 5. Scientific Committee for the International Journal Pavements conference in Germany, and the moderator position for ICPPP2015 conference in Austin, TX; 6. Session chair, Bio-Mediated Soil at the ASCE GeoChicago 2016 Conference, Chicago, IL, August 14-16, 2016; 7. Conference Organizing Committee, “National Evacuation Conference,” New Orleans LA, February 2016; 8. Co-Chair, Civil Engineering Section, Southeast Symposium on Contemporary Engineering Topics; 9. Peer-reviewer for the 2016 ASEE Annual Conference; 10. Moderator for the 2016 National Association of African American Studies National Conference.

#### **5. Changes/Problems**

The additional four months’ worth of Federal FY15 funding were awarded and added to the grant on October 2, 2015. Our Tier 1 UTC received an additional \$469,600. The termination date of the grant remained the same at September 30, 2018.

#### **6. Special Reporting Requirements**

Nothing to report