USDOT Tier 1 University Transportation Center

Program Progress Performance Report #5

Agency: Office of the Assistant Secretary for Research and Technology

Federal Grant #: DTRT13-G-UTC50

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

Program Director: Heather Nachtmann, Ph.D., Professor, Department of Industrial Engineering, University of Arkansas, hln@uark.edu, 479.575.6021

Submission Date: April 29, 2016

DUNS: 1914297450000

EIN: 71-6003252

Recipient Organization: University of Arkansas

Project/Grant Period: Start Date September 30, 2013
End Date: September 30, 2018

PPPR#4 Reporting Period Start Date: October 1, 2015
PPPR#4 Reporting Period End Date: March 31, 2016

Report Term or Frequency: six months

Signature: 

Heather Nachtmann
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:

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

<table>
<thead>
<tr>
<th>Metric</th>
<th>Achieved PPPR#5</th>
<th>Objective Addressed</th>
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</thead>
<tbody>
<tr>
<td># of national and regional leadership positions held</td>
<td>31</td>
<td>L1</td>
</tr>
<tr>
<td># of conference planning positions held</td>
<td>10</td>
<td>L1</td>
</tr>
<tr>
<td># of invited talks given</td>
<td>1</td>
<td>L1</td>
</tr>
<tr>
<td># of leadership and research awards received</td>
<td>2</td>
<td>L1</td>
</tr>
<tr>
<td># of impactful research citations by stakeholders</td>
<td>0</td>
<td>L2</td>
</tr>
<tr>
<td># of UG/G students participating in transportation research projects funded by UTC</td>
<td>36</td>
<td>L1</td>
</tr>
<tr>
<td># of junior faculty mentored</td>
<td>2</td>
<td>L1</td>
</tr>
<tr>
<td># of leadership workshops held</td>
<td>2</td>
<td>L2</td>
</tr>
<tr>
<td># of external grant proposals submitted</td>
<td>14</td>
<td>L2</td>
</tr>
</tbody>
</table>

### 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:

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

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:

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

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:

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

Conference Papers

**Conference Presentations**


**Books/Other One Time Publications**


2.2 Websites

<table>
<thead>
<tr>
<th>Website Title</th>
<th>Web Address</th>
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<td>MarTREC</td>
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</tr>
<tr>
<td>Institute for Multimodal Transportation</td>
<td><a href="http://www.jsums.edu/imtrans/">http://www.jsums.edu/imtrans/</a></td>
</tr>
<tr>
<td>Gulf Coast Center for Evacuation and Transportation Resiliency</td>
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</table>

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

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Location</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas State Highway and Transportation Dept.</td>
<td>Little Rock, AR</td>
<td>$40k fund (match project)</td>
</tr>
</tbody>
</table>
3.2 Other Collaborators

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Location</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Jingjing Tong, Assistant Professor, Southeast Missouri State University</td>
<td>Cape Girardeau, MO</td>
<td>case study development</td>
</tr>
<tr>
<td>Dr. Melissa Tooley, Director, Texas Transportation Institute</td>
<td>College Station, TX</td>
<td>center collaborator</td>
</tr>
<tr>
<td>Mr. Trevor Timberlake, Arkansas Natural Resources Commission (ANRC)</td>
<td>Little Rock</td>
<td>discuss Arkansas levees</td>
</tr>
<tr>
<td>Mr. Brian Brasher and Ms. Anita Branch, U.S. Army Corps of Engineers Fort Worth District</td>
<td>Fort Worth, TX</td>
<td>levee soil data and possible testing locations</td>
</tr>
<tr>
<td>Mr. Bryant Robbins, U.S. Army Corps of Engineers</td>
<td>Oklahoma City, OK</td>
<td>prior geophysical testing data and equipment</td>
</tr>
<tr>
<td>Dr. Brady Cox, University of Texas at Austin</td>
<td>Austin, TX</td>
<td>workshop collaboration</td>
</tr>
<tr>
<td>California State University, Fullerton</td>
<td>Fullerton, CA</td>
<td>center collaborator</td>
</tr>
<tr>
<td>Army Corps of Engineering’s</td>
<td>Baton Rouge, LA</td>
<td>collaborator</td>
</tr>
<tr>
<td>International Freight Forwarders &amp; Customs Brokers Assn. of N.O.</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>World Trade Center Transportation Committee</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Organization</td>
<td>Location</td>
<td>Contact</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Louisiana Complete Streets</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Bike Easy</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>American Society of Civil Engineers</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>New Orleans Sustainable Transportation Advisory Committee</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>RIDE New Orleans</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Regional Transit Authority</td>
<td>New Orleans, LA</td>
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<tr>
<td>Women Transportation Seminar (WTS)</td>
<td>New Orleans, LA</td>
<td>contact</td>
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<tr>
<td>Regional Planning Commission</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Louisiana Center for Women in Government &amp; Business; Traffic &amp; Transportation Club of Greater New Orleans</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Greater New Orleans Inc.</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Port Safety Committee</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Ports Assn. of Louisiana</td>
<td>New Orleans, LA</td>
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<tr>
<td>Propeller Club of the U.S. Port of New Orleans</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Coastal Cargo</td>
<td>New Orleans, LA</td>
<td>contact</td>
</tr>
<tr>
<td>Dr. Sam Brody, Dr. Wes Highfield, Dr. Jens Figlis and Dr. William Merrell</td>
<td>Texas A&amp;M Galveston</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Bas Jonkman</td>
<td>Technical University Delft, The Netherlands</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Auroop Ganuly</td>
<td>Northeastern University</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Barry Keim</td>
<td>Louisiana State University</td>
<td>collaborator</td>
</tr>
<tr>
<td>Mr. James Watkins</td>
<td>Mississippi Department of Transportation</td>
<td>evaluator</td>
</tr>
<tr>
<td>Dr. Helen Chen and Johnson C.</td>
<td>Smith University Northampton, MA</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Ismael Pagan and Dr. Ricardo Lopez</td>
<td>University Puerto Rico, Mayaguez</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Sandra Knight</td>
<td>University of Maryland</td>
<td>collaborator</td>
</tr>
<tr>
<td>Dr. Meherun Liaju</td>
<td>Tougaloo College</td>
<td>collaborator</td>
</tr>
</tbody>
</table>

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

Leadership Awards
- 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
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, participant, with USM, submitted on May 6, 2015.
8. Coastal Hazards Center (Education and Workforce Development) October 2015, Department of Homeland Security, $150,000.
11. Partnership for International Research and Education (PIRE), NSF subcontract from Texas A&M University, $71,914, October 1, 2015.
14. MRI: Acquisition of a Multi-Bean 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.


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

Conference Planning Positions

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