

MarTREC



Maritime Transportation Research & Education Center

October 2021-September 2022

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Cover photo courtesy of ARDOT

MarTREC



UNIVERSITY OF
ARKANSAS



VANDERBILT



MESSAGE FROM THE DIRECTOR



I would like to recognize and thank Kevin Hall. Kevin served as the Executive Director of the Mack-Blackwell Transportation Center at the University of Arkansas since 2006. He is an internationally known researcher in transportation pavements and materials and a devoted professor of civil engineering. Kevin stepped back from his formal leadership role in our center to fully dedicate his time to his new position as associate dean for academics in the College of Engineering. We are grateful for his past leadership and many contributions and wish him well in his new role. We are thrilled to be back in-person and approaching a near-normal presence on our consortium campuses. Our research efforts are back to normal, travel has begun, and we were very excited to welcome our k-12 outreach participants back to campus. I hope you enjoy reading this year's annual report. Heather Nachtmann, MarTREC Director

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WELCOME OUR NEW MarTREC ASSOCIATE DIRECTOR



Michelle Barry, Ph.D., P.E. has been appointed Associate Director of the Maritime Transportation Research and Education Center. Barry is an Associate Professor within the Department of Civil Engineering at the University of Arkansas. She received her degrees in Civil Engineering from Texas A&M University. Barry teaches undergraduate Soil Mechanics along with Numerical Modeling, Soil Dynamics, and Measurement of Soil Properties at the graduate level and is a licensed professional engineer in the state of Arkansas. She is a 2018 recipient of the prestigious National Science Foundation Faculty Early Career Development (CAREER) Award.

Shown below with one of her research teams, Barry's research interests include the multi-scale characterization of particulate materials, with a specific focus on the use of experimental testing and discrete element method modeling to link fundamental material properties to the global observed behavior. Her research has been applied to levee erosion, levee assessment and performance, fouled ballast behavior, additive manufacturing materials and processes, particle shape and strength characterization, and characterization of aggregates and mine tailings through large-scale direct shear and simple shear testing. While much of her work focuses on soil behavior, she also studies and develops additive manufacturing for the construction of civil infrastructure.



Photo courtesy of Clint Wood, University of Arkansas

BRIEF HISTORY OF UTCS AT THE UNIVERSITY OF ARKANSAS

The University of Arkansas has served the nation and state of Arkansas for over 30 years by providing innovative transportation research and technology transfer and cutting-edge transportation education and workforce development.

In 1987, Congress authorized the U.S. Department of Transportation (USDOT) University Transportation Center (UTC) program. The UTC program was designed to improve transportation research and education in the United States by advancing technology and expertise across multiple modes of transportation and addressing vital workforce needs for the next generation of transportation leaders. The first UTC at the University of Arkansas center was named in the Intermodal Surface Transportation Efficiency Act of 1991 as the National Rural Transportation Study Center. The Mack-Blackwell Rural Transportation Center continued to operate as a UTC through continued funding under SAFETEA-LU and TEA-21.

In 2007, MBTC was designated as one of seven members of the U.S. Department of Homeland Security National Transportation Security Center of Excellence, in accordance with the Implementing Recommendations of the 9/11 Commission Act of 2007. The center fulfilled transportation security research needs for six years under this designation.

In 2013, the University of Arkansas partnered with Jackson State University, Louisiana State University and the University of New Orleans to form the Maritime Transportation Research and Education Center (MarTREC), which was competitively selected as a USDOT Tier 1 UTC under the MAP-21. In 2016 with continued funding through the FAST Act, the MarTREC consortium added Texas A&M University and Vanderbilt University and is currently working to preserve the nation's transportation system through efficient, resilient, and sustainable maritime and multimodal logistics and infrastructure.



Photo courtesy of ARDOT

MarTREC OVERVIEW

ABOUT

MarTREC is a U.S. Department of Transportation Tier 1 University Transportation Center funded through the Office of the Assistant Secretary for Research and Technology. Under MAP-21, MarTREC contributed to economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems. MarTREC, through continued funding under the FAST Act, is working to preserve the nation's transportation system through efficient, resilient, and sustainable maritime and multimodal logistics and infrastructure.

VISION

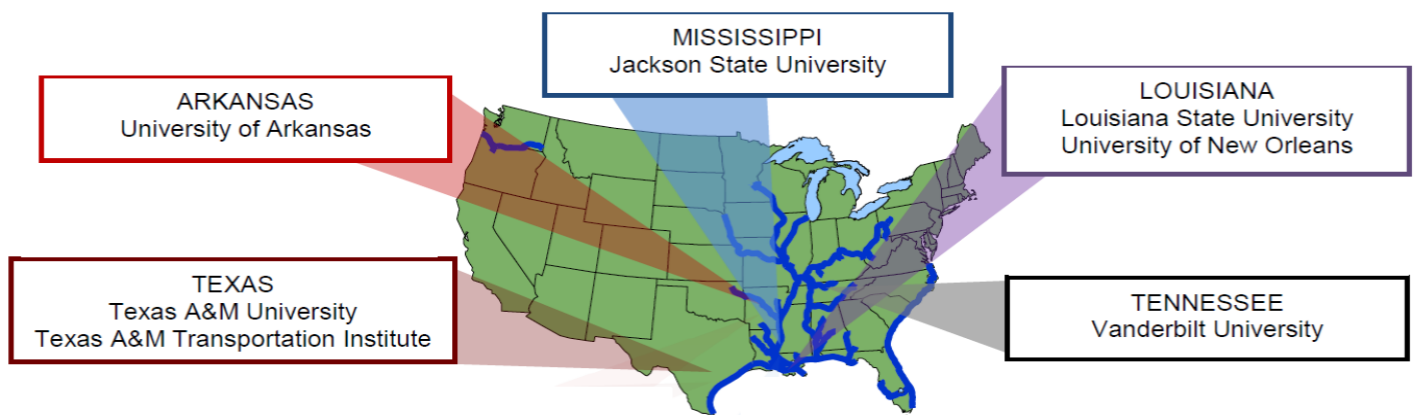
Our vision is to be recognized as the Nation's premier source for expertise on maritime and multimodal transportation research and education. The MarTREC consortium consists of renowned maritime transportation researchers dedicated to transferrable research and inclusive education and workforce development.

CONSORTIUM

Our consortium includes the University of Arkansas (UARK), Jackson State University (JSU), Louisiana State University (LSU), Texas A&M University/Texas A&M Transportation Institute (TAMU/TTI), University of New Orleans (UNO), and Vanderbilt University (VU). Each consortium member is strategically located to support MarTREC's theme: UARK, JSU, LSU, and UNO are located along the Mississippi River; VU along the Cumberland River; and JSU, LSU, UNO, and TAMU/TTI along the Gulf Coast.

RESEARCH

MarTREC conducts research activities in three topic areas: 1) Maritime and Multimodal Logistics Management to expand decision support and facilitate improved operations within the Nation's multimodal supply chain networks; 2) Maritime and Multimodal Infrastructure Preservation to advance state-of-the-art resilient multimodal transportation infrastructure preservation, repair, design, and construction; and 3) Disaster Response and Transportation Planning for Coastal and River Valley Communities to enable the resilience, safety, efficiency, and effectiveness of multimodal transportation systems during disaster response or other major events.



CENTER FOR TRAINING TRANSPORTATION PROFESSIONALS



Front row: Roselie Conley, Lab Certification Manager; Stacy Williams, Director; Mary Fleck, Instruction and Curriculum Manager; Katie Juniel, Administrative Assistant

Back row: Julian Pearson, Support Technician; Talley Faulkner, Online Programs Manager; Austin Williams, Programmer

This year, more than 800 technician certifications were granted through the Center for Training Transportation Professionals (CTTP). The CTTP partners with the American Concrete Institute (ACI) to offer the ACI Aggregates – Level 1 certification, and a record number of technicians have requested this dual certification. The CTTP teaching laboratory spaces were renovated this year to provide dedicated equipment and facilities for multiple workstations for small-group work. The renovated facility is now more flexible for teaching multiple topics in the same area and allows for a more targeted instructional environment.

Although most of the restrictions associated with the pandemic have ended, the CTTP online training materials are still used extensively, especially for helping technicians to prepare for in-person class attendance. The CTTP website provides 50 training modules and 62 videos, along with classroom presentations, study guides, and additional practice problems for each course topic. This year, approximately 5,300 training module completions were tracked as well as 300,000 video views.

The Technology Transfer program has now transitioned to its new title of Arkansas Local Technical Assistance Program (AR LTAP). This year, approximately 1700 local agency employees attended training sessions focusing on safety, maintenance, and infrastructure. Several participants also completed the requirements for the ROADS Scholar program, resulting in a total of 182 Level 1 recipients and 33 Level 2 recipients.

FOURTH ANNUAL GirITREC CAMP

We held our fourth annual Girls Transportation Engineering Camp (GirITREC) on the University of Arkansas campus in July 2022. The one-week day camp is designed for rising sixth and seventh grade girls to engage with transportation-focused STEM activities and learn about future career opportunities in transportation engineering. The camp provides campers with engaging, hands-on activities related to transportation engineering from roads to railroads to waterways and gives them daily opportunities to engage with female engineers and engineering students. Educational content was developed and taught by several civil and industrial engineering faculty including Drs. Richard Cassady, Sandra Eksioglu, Sarah Hernandez, Kevin Hall, Ashlea Milburn, Suman Mitra, Heather Nachtmann, Kim Needy, Gary Prinz, and Shengfan Zhang.

The campers designed and tested bridges, engaged in accessible transportation design, learned how social media data can inform (and misinform) during a transportation-related disruption response, drove driving simulators, learned about supply chain operations and risks, and interacted with robotic transportation systems. Campers also had the opportunity to hear from and engage with Megan Gray, the founder and CEO of moment.ai, whose company develops artificial intelligence technology for vehicles.



DISTINGUISHED SPEAKER SPOTLIGHT

Megan Gray, July 2022

Megan Gray, a graduate of the University of Kentucky, was diagnosed with epilepsy at age 23. Upon diagnosis, she was told she could no longer operate an automobile. This motivated Gray, a Product Manager at Google, to develop an Artificial Intelligence-based software solution that uses facial recognition to monitor driver safety. Her goal was to be allowed to drive herself to work.

Gray founded moment.ai, an artificial intelligence-based technology provider for vulnerable drivers. The startup partnered with George Washington University to develop its software in early 2021. It works to detect signs of health issues from seizures to heart attacks to fatigue and reduce car crashes for vulnerable populations including the elderly, individuals with existing conditions, and those under high stress.

Gray is now focused on growing moment.ai and is continuing to develop products and services for autonomous vehicles. In 2022, Gray was named a Woman Innovator of the Year by Women In Voice, sponsored by Amazon and Google AI teams.

Gray is passionate about working with youth. She joined our GirlTREC camp this year and spoke with our campers about being a female CEO and technology developer (pictured above).



Michael Thompson, April 2022



Securing the Maritime Transportation Systems Industry: The Not So Hidden Problem of Operational Technology Cybersecurity
Dan Flowers Distinguished Lecture

Michael Thompson has more than 25 years of industry experience in the world of Engineering, Operational Technology, and Cybersecurity. Thompson spent much of his career as a Process Control and Functional Safety Engineer designing the systems that drive manufacturing and also designing the safe guards that keep these processes safe. He has been a director at Koch Industries, a CTO for one of the worlds largest Siemens Distributors, and now works for MITRE in the National Cybersecurity FFRDC helping to make the world a safer place. Thompson has a Master's degree from the Johns Hopkins University in Systems Engineering. Recently, Thompson has worked on the Maritime Transportation System Liquified

Natural Gas Cybersecurity Framework Industry Profile and the latest revision to NIST 800-82 Guide to Industrial Control Systems Security.

CURRENT AND FUTURE STUDENTS



Brittany Waggener, MarTREC 2021 Outstanding Student of the Year

Brittany Waggener completed a bachelor's degree in Political Science in 2008 at Tennessee Technological University, a Juris Doctor in 2011 from Samford University and is currently a Ph.D. candidate in Urban Studies at the University of New Orleans. Waggener has completed research on short sea shipping, updates to multinational agreements related to tariffs, the Louisiana State Rail Plan, and the development of LNG facilities in southern U.S. ports through her position at the University of New Orleans Transportation Institute. She is currently working on projects related to tariff rate adjustments for Plaquemines Parish and chassis supply issues in the United States.



Brittany Waggener, doctoral student, and **Bailey Bullock**, master's student, of University of New Orleans (pictured on right) presented on "Community Planning, Engagement, and Urban Affairs" at the Southeastern Conference for Public Administration (SECoPA) in September 2022 in Lexington, Kentucky.

John Kiefer, MarTREC site assistant director Carol Short, and MarTREC site director Bethany Stich (pictured on left) also attended the conference.



Girls STEM Academy Summer Program

The Girls STEM Academy Summer Program was held in July 2022 at Jackson State University. The program introduces girls in grades ninth through twelve to science, technology, engineering and mathematics and include short courses on robotics as well as programming and designing automated vehicles. The academy is managed by the College of Science, Engineering, and Technology.

WOMEN IN TRANSPORTATION



Janey Camp, Research Associate Professor of Civil and Environmental Engineering at Vanderbilt University and MarTREC site director, has been named the director of the Vanderbilt Engineering Center for Transportation and Operational Resiliency (VECTOR) where interdisciplinary groups work on a variety of transportation and infrastructure resilience projects using groundbreaking applications and risk management practices. Camp is a licensed civil engineer in Tennessee and is a member of the American Society of Civil Engineers, the Tennessee Geographic Information Council, and the Tennessee Association for State Floodplain Managers Committee. She served as president of the Tennessee Society of Professional Engineers and has served on the ASCE Committee for America's Infrastructure since 2012.



Shannon Newton, president of the Arkansas Trucking Association and MBTC/MarTREC advisory board member, has been named to the Transportation Industry Council of the Federal Reserve Bank of St. Louis. The St. Louis Fed created four District Industry Councils in 2006, each designed to provide the Fed with important feedback about economic conditions in key Eighth District industry sectors. The members' observations, along with the economic data developed through the Federal Reserve Board's Beige Book and meetings of the Reserve Bank's board of directors, help ensure conditions in Main Street America are represented in monetary policy deliberations in Washington. Each council is supported by one of the St. Louis four federal offices: St. Louis, MO; Little Rock, AR; Louisville, KY; and Memphis, TN.



Melissa Tooley, Texas A&M Transportation Institute (TTI) director of external initiatives and MBTC/MarTREC advisory board member, received a Distinguished Alumni award at the University of Arkansas College of Engineering Alumni Awards Banquet. The Department of Civil Engineering chose Tooley as their award recipient, one of the highest honors given to College of Engineering alumni. The College of Engineering Distinguished Alumni Award honors the exceptional professional and personal achievements of University of Arkansas College of Engineering graduates. Recipients have achieved distinction in their fields and have provided outstanding leadership and service to the College of Engineering and to the organizations and communities to which these distinguished alumni belong.

NEW FAST ACT PROJECTS

Evaluating the Resilience of Port Operations

Jim Kruse, MBA

Texas A&M Transportation Institute

December 2021-August 2023

This project will develop a quantitative model of the local and regional road and rail network that serves a port and the flow of goods to and from the port.

Documenting the Need for Value-Chain Approaches

Leah Dundon, JD, PhD

Vanderbilt University

April 2022-August 2023

The project is a critical first step in determining what factors may lead to eventual successes and challenges to decarbonization.

Analysis of the Impacts of the COVID-19 Pandemic

Brian Wolshon, PhD, PE, PTOE

Louisiana State University

April 2022-August 2023

This research will investigate shifts in cargo movements by commodity for both import and export operations for several ports across the US.

Impacts of COVID Restrictions on Freight

Brian Wolshon, PhD, PE, PTOE

Louisiana State University

April 2022-August 2023

The level of impact was influenced not only by the virus itself, but more so by the nature, extent, and duration of governmental restriction on commerce and personal activity to limit its spread.

International Port Dependencies and Resilience

Brian Wolshon, PhD, PE, PTOE

Louisiana State University

April 2022-August 2023

The objective is to find applications in resolving supply-chain related issues in the cargo ship network.

Vehicle to Infrastructure (V2I) and Vehicle to Vehicle (V2V) Passenger and Freight Vehicle Applications

Brian Wolshon, PhD, PE, PTOE

Louisiana State University

April 2022-August 2023

The research will address the limitations using driving

simulators to assess how drivers interact with V2V and V2I advisories during emergency evacuations.

Supply Chain-Oriented Methodology to Analyze Performance of Port-related Multimodal Infrastructure

Jim Kruse, MBA

Texas A&M Transportation Institute

August 2022-August 2023

This project will build on past studies to develop a supply chain-oriented methodology to analyze performance of the port-related multimodal freight infrastructure.

Big Data and Artificial Intelligence Analytics Methods for Tracking and Monitoring Maritime Traffic

Tor A. Kwembe, PhD

Jackson State University

November 2021-August 2023

This project will utilize Automatic Identification System datasets to design scalable Maritime Traffic Monitoring and Analysis applications and tools.

Network Science-based Analysis of the US Marine Highway Network

Natarajan Meghanathan, PhD

Jackson State University

November 2021-August 2023

This project will analyze the marine highway network using algorithms to detect where connections could be a bottleneck and capacities need to be enhanced.

Mississippi Multimodal Freight Analysis Mode

Tzusheng Pei, PhD

Jackson State University

November 2021-August 2023

The project objective is to develop a multimodal freight transportation analysis model for Mississippi.

Assessing Maritime Infrastructure along the MS

Berneece S. Herbert, PhD

Jackson State University

November 2021-August 2023

Key outputs of the project will include developing GIS maps of maritime transportation infrastructure along the river delta and database and maps on physical and policy chokepoints.

ONGOING FAST ACT PROJECTS

Changing Trade and Transportation Patterns

Bethany Stich, PhD

University of New Orleans

March 2018-August 2023

This research is working toward determining how changes in NAFTA has affected intermodal freight flows in the Gulf Coast region. The transportation planning process can no longer solely rely on the basics of engineering; it is now forced to find the way in a sea of data, values and actors towards a comprehensive and integrated solution.

Informing Post-Disaster Restoration through Modeling Interdependent Agriculture and Transportation Networks-Part II

Janey Camp, PhD, PE, GISP, CFM

Vanderbilt University

October 2018-August 2023

Collaborative project with Informing Post-Disaster Restoration through Modeling Interdependent Agriculture and Transportation Networks—Part I

Modeling Dynamic Behavior of Navigable Inland Waterways

Heather Nachtmann, PhD and Justin Chimka, PhD

University of Arkansas

August 2018-August 2023

The inland waterway transportation system of the United States handles 11.7 billion tons of freight annually and connects the heartland of the United States with the rest of the world. The system is challenged with aging infrastructure and limited operations and maintenance budgets which can cause transportation delays and economic losses. We have developed gap research areas and questions to explore related to the McClellan-Kerr Arkansas River Navigation System (MKARNS) and the feasibility of developing container-on-barge transport in the US.

Assessment of Evacuation Network Performance under Different Evacuation Scenarios

Brian Wolshon, PhD, PE, PTOE and Scott Parr, PhD

Louisiana State University

July 2019-August 2023

This study will utilize data from Hurricane Irma (2017) to compare traffic characteristics during the evacua-

tion with those observed during routine non-emergency operations. The research will be conducted in the coastal communities in the Florida Keys.

Development of Freeway Corridor Capacity Measure to Improve Transportation Resilience

Brian Wolshon, PhD, PE, PTOE and

Siavash Shojaat, PhD

Louisiana State University

July 2019-October 2022

Although evacuations have a long track record of success, they can be complex, costly, and risky. An approach which considers the whole freeway corridor as a system with bottlenecks and different characteristics is needed to assess traffic carrying ability. This study will introduce the concept of corridor capacity to estimate the resilience of freeway operation.

Planning for Managed Retreat: Decision Making in the Face of Climate Uncertainty

Leah Dundon, JD, PhD and Mark Abkowitz, PhD

Vanderbilt University

December 2019-August 2023

Sea level rise, increased frequency and intensity of flooding, and other extreme weather events have sparked a growing recognition that managed retreat must be among the solutions considered. This project examines the need for managed retreat and the significant challenges to implementing managed retreat.

Bio-Inspired Stabilization of Levee Slope on Expansive Yazoo Clay at the Maritime and Multimodal Transportation Infrastructure in Mississippi

Sadik Kahn, PhD, PE

Jackson State University

April 2020 – August 2023

The existence of Yazoo clay in Mississippi frequently causes distress in levee and highway embankment slopes, which are an integral component of maritime and multimodal transportation infrastructure. This project investigates the effect of vetiver grassroots to stabilize levee slopes at the maritime and multimodal transportation infrastructures at Mississippi.

Evacuation Behavior and its Mobility Impacts in Coastal Communities from Across the Nation
Brian Wolshon, PhD, PE, PTOE and Scott Parr, PhD
Louisiana State University
July 2020-August 2023

Coastal communities are at risk from a multitude of potentially disruptive events. Severe weather, climate change, and sea-level rise all pose serious and long term societal challenges. This research seeks to develop an understanding of the travel flow principles that govern the evacuation process and its impact on the mobility of a community for different hazards.

Identifying Critical Waterway Infrastructure and Managing Risk Associated with Natural Disasters
Michelle Barry, PhD, PE and Shengfan Zhang, PhD
University of Arkansas
July 2020-August 2023

The transportation system is extremely vulnerable to disruptions and delays from natural disasters. There is a need for an assessment strategy capable of capturing the probability of failure and economic impacts for maritime and inland waterway infrastructure. This research will develop an assessment to aid decision making and mitigation strategies.

Modifying Ramp Management Strategies to Enhance Resiliency of Freeway Facilities
Brian Wolshon, PhD, PE, PTOE
Louisiana State University
July 2020-August 2023

Increased traffic demand of coastal areas during emergency evacuations have been shown to affect transportation systems negatively. Application of the ramp management algorithms modified by this method becomes increasingly important during emergency evacuation. This project will study and improve these ramp management strategies.

Port Infrastructure Resilience through Combined Wind-Surge Demand Characterization
Gary Prinz, PhD, PE
University of Arkansas
July 2020-August 2023

This project aims to understand the interactive effects of severe wind and storm surge demands on port infrastructure and to develop hazard demand models to aid improvements to infrastructure design.

An integrated analytical and experimental research approach will combine information from detailed fluid-structure-interaction simulations and scaled wind-wave experiments to support port resilience.

Rapid Assessment of Internal Erosion Damage and Erodibility in Levees
Michelle Barry, PhD, PE and Clint Wood, PhD, PE
University of Arkansas
July 2020-August 2023

Recent flooding events have tested our nation's levee systems and highlighted the vulnerability of our transportation system. Traditional drilling and sampling techniques only provide discrete data points which can lead to ineffective repairs and wasted funds. The ability of geophysical methods to enable quick measurements of material properties over large areas was demonstrated in previous project. This project seeks to make a correlation between geophysical properties and vital engineering properties.

The Unintended Consequences of Flood Mitigation along Inland Waterways – A Look at Resilience and Social Vulnerabilities
Janey Camp, PhD, PE, GISP, CFM
Vanderbilt University
July 2020-March 2023

The objective of this project is to evaluate different flood mitigation efforts in terms of the community costs such as residential buyouts or elevation of structures. This research utilizes agent-based models and data from select communities where significant buyouts have taken place.

Policy and Infrastructure Evaluation Model of Commodity Flows through Inland Waterway Ports
Sarah Hernandez, PhD, PE and Sandra Eksioglu, PhD
University of Arkansas
August 2020-October 2022

The purpose of this project is to guide strategic investment into port capacity through the development of a policy and infrastructure evaluation model of inland waterway commodity flows. A multi-stage stochastic optimization model will be developed to evaluate tradeoffs in strategic, long-term port infrastructure investment with mid-term capacity expansion decisions and complementary highway infrastructure and shorter-term operational practices.

The Changing Legal Landscape of Intermodalism

Bethany Stich, PhD

University of New Orleans

July 2021-August 2023

This project investigates the ongoing legal challenges surrounding chassis. In 2020, Intermodal Motor Carriers Conference (IMCC) of American Trucking Associations and the Ocean Carriers Equipment Management Association (OCEMA) were involved in negotiations to resolve what IMCC charged were high-priced and inferior quality chassis at many of the nation's ports. Chassis are considered the linchpin of the intermodal system. Legal challenges could alter the dynamics of intermodalism and the associated supply chains that rely upon it. The economic loss associated with chassis mismanagement in the United States is in the billions of dollars. Helping the maritime, drayage and terminal operators understand the changing environment in which chassis must legally operate will be essential to avoid disruptions in the transportation system and domestic supply chains.

The Changing Legal Landscape of Intermodalism – Part 2

Janey Camp, PhD, PE, GISP, CFM

Vanderbilt University

August 2021-August 2023

Collaborative project with The Changing Legal Landscape of Intermodalism - Part 1

A Digital Twin for Visualizing, Evaluating and Maintaining Multimodal Transportation

Haitao Liao, PhD, Shengfan Zhang, PhD, and Heather Nachtmann, PhD

University of Arkansas

August 2021-August 2023

This research project will develop a digital twin that enables visualizing, evaluating and maintaining multimodal transportation infrastructure. The ultimate goal is to provide an opensource software tool and machine learning-based decision-making approaches that assist the relevant stakeholders in improving their information collection and tracking capabilities, and enhancing the resilience of multimodal transportation infrastructure and beyond.

Driving Simulators as Educational Outreach for Freight Transportation

Sarah Hernandez, PhD, PE

University of Arkansas

August 2021-June 2023

The purpose of this project is to enhance outreach efforts for middle and high school student groups for freight career awareness by using truck driving simulators. There is a shortage of truck drivers which contributes to inefficiency in the freight system. There are many complex factors leading to the driver shortage, lack of awareness of the trucking profession is one. Through outreach programs, it may be possible to attract a new generation to freight careers.

Continued Study of Rapidly Deployable Soil-Cement Mixtures

Cameron Murray, PhD, PE & Michelle Barry, PhD, PE

University of Arkansas

September 2021-August 2023

The maintenance and repair of maritime infrastructure is critical to maintaining important shipping channels and preventing unnecessary loss of life or economic impact from severe weather events. The objective of this research is to identify the properties and proportioning of Belitic Calcium Sulfoaluminate (BCSA) soil-cement mixtures most effective for use in waterway structures. BCSA cement is a rapid setting, low-shrinkage cement which can be used in a similar fashion to portland cement.

K8 MEMES: K-8 Maritime Education Modules to Engage Students

Gary Prinz, PhD, PE

University of Arkansas

September 2021-August 2023

This education project will create entertaining, informative, and STEM promoting curriculum learning modules for K-8 educators, using maritime transportation and infrastructure related topics to teach STEM concepts. Coupling music memory, fun STEM theories, and innovative experiential demonstrations into entertaining video learning modules, the objective of this project is to open the door for student excitement in learning of science topics.

COMPLETED FAST ACT PROJECTS

Economic Impact of the Gulf Intracoastal Waterway on the States It Serves

Jim Kruse, MBA and Brianne Glover, JD
Texas A&M Transportation Institute
September 2017-August 2018

This project examined the total economic impact of the GIWW across all sectors shipping goods along the waterway, in the states that it serves. Using IMPLAN (Economic Impact Analysis for Planning), this report estimated the economic impact of the GIWW to be \$61.5 billion annually. Of this, \$31.8 billion was generated in Texas, \$23.1 billion in Louisiana, \$4.5 billion in Mississippi, \$1.9 billion in Alabama, and \$0.2 billion in Florida. Furthermore, the GIWW supports 143,000 jobs and generates \$14.5 billion in labor income annually, with the majority of this occurring in Texas and Louisiana. The GIWW complements the highway system and rail network, requiring less additional investment to add capacity.

A Multimodal Network Approach to the Inland and Coastal Waterway System

Bruce Wang, PhD
Texas A&M University
July 2017-November 2018

Two different maintenance operations are performed annually to rehabilitate the waterway system and keep it functional: dredging which removes sediments in the waterway to restore the lost navigational draft depth, and lock and dam repair due to aging and deterioration. The results show that the optimal solution is not dependent on the perceived value of time in vessel delay at locks and dams, nor on the costs of vessels. It shows a clear preference to locks and dams repair over dredging operations in the optimal allocation of the maintenance budget.

Large Scale Evaluation of Erosion Resistance of Biocementation against Bridge Scour and Roadway Shoulder Erosion

Lin Li, PhD, PE
Jackson State University
March 2018-February 2019

This study explored an alternative approach for arming the riverbed with biocementation through

MICP to mitigate soil erosion. Results indicated that the bio-mediated particulate material based on MICP can provide an effective solution for problematic cases of sandy soil in prevention of bridge scour and road shoulder erosion.

Developing and Applying a Methodology to Identify Flow Generation Influences between Vessel and Truck Shipments

Mario Monsreal, PhD and Jim Kruse, MBA
Texas A&M Transportation Institute
December 2017-March 2019

Truck activity is logically connected to, and generated by, vessel activity at a port. In turn, vessel activity is generated by truck shipments. Although one might expect a 1-to-1 relation between the two types of shipments, that is unlikely the case. This study shed light on the relationship between multimodal flows (trucks and vessels), which will enable agencies and organizations to increase efficiency – and thus competitiveness. Specifically, this analysis provided estimates of specific traffic changes in specific roads, with specific directions of traffic flows and the time when those changes could be expected. These coefficients represent the main contribution of this study. Even though general results are intuitively straightforward, the magnitude of the impact and delays may not be obtained by simple observation.

Development and Implementation of Sustainable Transportation Resilience Indicators

Mark Abkowitz, PhD
Vanderbilt University
June 2017-June 2019

Much has been discussed about resilient transportation infrastructure as well as sustainable practices, but only recently have their interdependencies been brought to light in terms of a community's ability to develop sustainable (economic, social and environmental) resource capacity necessary to be resilient in the face of natural hazard events that could lead to catastrophic consequences. This research created a methodology that can be replicated by other regions who wish to evaluate their flood resilience and improve decisions regarding future flood management.

Interdependency of Port Clusters During Regional Disasters

**Brian Wolshon, PhD, PE, PTOE and Scott Parr, PhD
Louisiana State University
January 2018-August 2019**

Ports play a vital role in our economy of and provide a critical link in the supply chain. Ports form the gateway by which essential goods are received within large geographic regions. Ports are exposed to substantial risk of flooding, storm events, sea-level-rise, and climate change. This research quantified port resiliency applicable at the individual port level and regionally. In general, the results showed that regionally, ports are more resilient to disruptive events than the individual ports that make up the region. This was likely because as one port enters the disrupted state, another may be entering the recovered state.

Exposure to STEM:

Diversity in Maritime Transportation

**Rick Coffman, PhD, PE
University of Arkansas
August 2018-September 2019**

The goal of this project was to develop an educational model to open doors to all students, regardless of socio-economic background, who want to pursue careers in maritime and multimodal transportation. The project proved successful in exposing underrepresented students to STEM related concepts by using examples of maritime and multimodal transport infrastructure. First through fourth grade students were afforded with hands-on experiences with soils that fluoresce and panel dams to help make science fun. Ninth through twelfth grade students were provided an opportunity to tour several lock and dam systems.

Shipping Container Chassis in the US: The Legacy of Ocean Carriers

**Bethany Stich, PhD
University of New Orleans
March 2018-November 2019**

Containerized shipping, which accounts for approximately 60 percent of all world seaborne trade while generating approximately 12 trillion United States (US) dollars in 2017, links trading partners between the water, rail, and air modes. If motor carriers could choose a lessor from among the chassis pools, based upon cost-competitiveness, rather than being man-

dated to one with legacy linkages to ocean carriers, the market would generate cost savings. A necessary condition to achieve this is the exit of the ocean carriers from the chassis node of the supply chain. A fuller answer is to encourage the developing practice of trucker ownership of chassis, this is the global model.

Liquefied Natural Gas (LNG) Phase II: The Future of LNG for the US and Gulf Coast Economies

**Bethany Stich, PhD
November 2017-December 2019**

The continued growth of Liquefied Natural Gas (LNG) production and long-distance trade has traditionally been taken as a given by global energy analysts, who have premised their positive estimates on gas being both relatively scarce and demand for it virtually unquenchable. Current conditions in the global energy market suggest perpetual increase in the volume of traded LNG is in fact a bubble that is in the process of bursting. This project evaluated the feasibility and best practices of equipping the Port of New Orleans for potential storage and shore-side infrastructure for fueling vessels powered by LNG, as well as the feasibility of widespread use of LNG as marine fuel.

Effect of Permeability Variation of Expansive Yazoo Clay at the Maritime and Multimodal Transportation Infrastructure in Mississippi

**Sadik Khan, PhD, PE
Jackson State University
September 2018-December 2019**

Yazoo clay soil in Mississippi frequently causes pavement distress in multimodal transportation infrastructure. This study investigated the change in unsaturated vertical and horizontal permeability and its effect on the maritime and multimodal infrastructures such



Photo courtesy of ARDOT

as pavement subgrade's moisture variation. The analysis improves the design of the undercut of the pavement, which is critical for deformation and deterioration of pavement of multimodal infrastructure.

Green Technology Approach for Capturing Pollution Washed from Transportation Infrastructures

Danuta Leszczynska, PhD

Jackson State University

March 2018-December 2019

The aim of this research was to produce and investigate a carbon-based substance, namely biochar, as a new material for the in-situ adsorption of pollutants carried by the stormwater runoff from the roads. Biochar, was manufactured from waste biomasses, and investigated in correlation between sources of biomass, firing conditions, presence/absence of oxygen during production, time and temperature of pyrolysis.

Liquefied Natural Gas Phase III: Export Competition in a Well Supplied, Flow-Shifting Global Economy

Bethany Stich, PhD

University of New Orleans

March 2018-December 2019

With trillions of cubic feet of shale reserves, the United States' (US) abundance of natural gas has prompted an increase in production of LNG as an export

commodity. UNOTI continues to urge that U.S. natural gas energy policy best practice is not to focus on export and export alone, but rather adopt a diversified and climate responsible energy policy that focuses on the U.S. remaining globally competitive by investing in LNG fueling infrastructure, as well as continued investment in the existing petrochemical sector of Coastal Louisiana and the Gulf Coast.

Trade-Off Analytics for Infrastructure Preservation

Greg Parnell, PhD and Ed Pohl, PhD

University of Arkansas

August 2018-December 2019

This project developed a course that could be taught to civil engineers, industrial engineers, and the maritime and multimodal infrastructure community for trade-off analytics as a tool to assist in their infrastructure preservation efforts. This course was also packaged as a webinar for practicing professionals.

Visualizing Sea Level Rise Impacts in Transportation Planning

Brian Wolshon, PhD, PE, PTOE & John L. Renne, PhD

Louisiana State University

January 2018-December 2019

Transportation planners regularly engage communities through public meetings to seek input and en-



Photo courtesy of ARDOT

agement on planning for the future including impacts of sea level rise on streets and neighborhoods. New media options allow for three-dimensional (3D) imaging utilizing virtual and augmented reality. It is displayed on glasses that connect to smartphones. This project tested and compared new technologies in South Florida to see if 3D technology helps residents better understand the impacts of sea level rise on transportation infrastructure and communities.

Utilizing Graceful Failure As An Opportunity for Flood Mitigation Downstream to Protect Communities and Infrastructure

**Janey Camp, PhD, PE, GISP, CFM & Craig Philip, PhD
Vanderbilt University
May 2018-March 2020**

In 2011, prior research observed how “graceful failure” through planned damages to the Birds Point Levee by the U.S. Army Corps of Engineers (USACE) was enacted to alleviate extreme flooding on the Mississippi River. This action reduced flooding and damage to waterway infrastructure and communities downstream. This research identified areas presently protected by levees that could be utilized for floodwater attenuation and storage along inland waterways.

Interdisciplinary Educational Outreach with Traffic Sensor Build Kits

**Sarah Hernandez, PhD, PE
University of Arkansas
May 2019-May 2020**

The purpose of this project was to develop learning modules that introduce students to new transportation data collection technologies that can be applied to better understand inland waterway port activity. The research developed a low-cost traffic sensor build kit that includes a mini inductive loop detector, detector card, and laptop. To accompany the build kit, we created lesson plans, how loops function, how to build a loop, and two additional lesson plans with targeted activities for middle and high school students. Each lesson plan includes a colorful slide presentation that features a scenarios of port investment prioritization with examples local to Arkansas. Six complete build kits were assembled and in future work, will be shared with summer camps at the UA and with professional transportation groups for outreach events.

Measures of Freight Network Resiliency: An expanded data capture of Truck Drivers and Support Services under Pandemic Distress

**Sarah Hernandez, PhD, PE
University of Arkansas
May 2020-September 2020**

COVID-19 responses by public agencies and private citizens have affected drivers and driver support systems. The purpose of this research was to collect timely data on the impacts of the Covid-19 pandemic on truck driver and trucking operations with a specific focus on issues that affect driver health and safety. An online opt-in panel survey was developed using the Qualtrics survey platform. The survey questionnaire contained 65 questions with skip logic dependent on responses. A total of 523 responses were collected between May and June. The dates correspond to the period of lifted HOS restrictions.

Analysis of Blockchain's Impacts on and Applicability to Maritime Industry

**Jim Kruse, MBA
Texas A&M Transportation Institute
May 2019-October 2020**

It is unclear how relevant or critical the use of blockchain is for maritime business. It is clear to maritime shipping industry members that cargo tracking is an important function for customer satisfaction as it ties the physical movement of goods with payments, inventory management, and accountability. Since it is new to an industry that is international, fragmented, and complex, this project explored questions from the application of blockchain to maritime supply chains and logistics, in particular, the possible integration with existing technologies such as automatic identification and data capture technologies.

Combining Truck and Vessel Tracking Data to Estimate Performance and Impacts of Inland Ports

**Sarah Hernandez, PhD, PE and Chase Rainwater, PhD
University of Arkansas
January 2019-December 2020**

Performance-driven prioritization has shifted public sector focus to freight performance measurement. As a result, quality, multi-modal data is needed to support planning efforts, such as long-range freight travel demand modeling. The purpose of this project is to develop a method to fuse truck and marine vessel

tracking data to better estimate performance of multi-modal supply chains that use inland waterway ports.

Engaging the Business and Tourism Industry in Visualizing Sea Level Rise Impacts to Transportation Infrastructure in Waikiki, Hawaii

**Brian Wolshon, PhD, PE, PTOE and John Renne, PhD
Louisiana State University
March 2018-December 2020**

This research built upon another related project that focused on visualizing sea level rise impacts to transportation infrastructure in South Florida and extends and focuses on the business and tourism industry of Waikiki HI. Waikiki is facing major impacts from sea level rise. Transportation and community planners engaged with stakeholders to seek input and engagement on planning for the future impacts of sea level rise on streets, buildings and neighborhoods.

Fatigue Crack Control in Waterway Lock Gate Pintle Locations Subjected to Multi-Modal Fracture

**Gary Prinz, PhD, PE
University of Arkansas
August 2018-March 2021**

Lock gates are an important part of the transportation infrastructure within the United States, having many economic, safety, and environmental benefits over rail and highway transportation systems. Many existing lock gates throughout the U.S. have reached or exceeded their initial design life and require frequent repairs to remain in service. This project sought to improve lock gate reliability by identifying and de-

veloping fracture mitigation strategies for multi-mode fatigue issues that arise near key pintle locations.

Towards Integrating Resilience into Everyday Transportation in Coastal Communities

**Brian Wolshon PhD, PE, PTOE
Louisiana State University
August 2018-March 2021**

Coastal communities have become increasingly vulnerable to sea level rise, hurricanes and other natural disasters. These events force the communities to evacuate in a relatively unpredictable way. This research leveraged technologies such as traffic simulation to help transportation agency entities maximize their resilience practices within their budgets.

Development of AIS Model of Texas Gulf Intracoastal Waterway Travel Times

**Jim Kruse, MBA
Texas A&M Transportation Institute
October 2019-April 2021**

The focus of this research was to perform analysis on the Texas portion of the Gulf Intracoastal Waterway (GIWW). The Texas GIWW presents a level of complexity significantly greater than rivers mentioned above because of the intersections with ship channels and the fact that some barges go into and exit port areas while others pass through. The project established origins and destinations, segmented the waterway into links, analyzed AIS data to identify vessel transits and associated transit times on the links, and developed a methodology for predicting travel times.

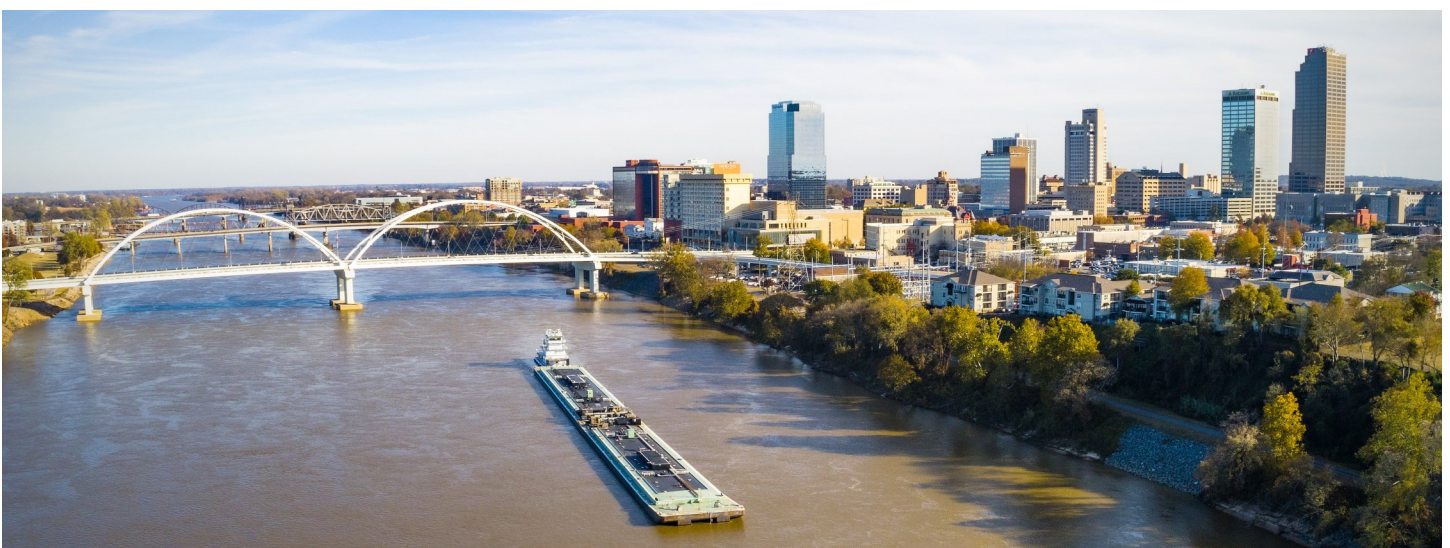


Photo courtesy of ARDOT

Learning from USACE Open Data for Locks

Justin Chimka, PhD

University of Arkansas

August 2018-May 2021

In August 2017, the USACE began to enable unprecedented data access by publishing its Open Data for Navigation online. This project sought to explore the new USACE Open Data for Locks, describe its relevant datasets, and inventory their contents, identify responses or variables across relevant datasets, and diagnose efficient statistical models of the usable subsets in order to make general statements about USACE lock data and public lock unavailability.

Using CSA Cement for Novel Waterway Repair Materials

Cameron Murray, PhD, PE and Michelle Bernhardt, PhD, PE

University of Arkansas

August 2018-May 2021

Calcium Sulfoaluminate-Belite (CSA) cement is a rapid setting hydraulic cement. Due to its rapid hardening characteristics and lower shrinkage and creep compared to typical portland cement, it is an ideal candidate as a repair material. This research worked on developing new mixtures utilizing CSA cement that can be applied to waterway repairs. A grout mixture capable of setting up rapidly underwater and a soil-cement mixture that can rapidly stabilize slopes and waterway structures will be developed.

Informing Post-Disaster Restoration Through Modeling Interdependent Agriculture and Transportation Networks

Sarah Nurre, PhD, Kelly Sullivan, PhD, and Benjamin Runkle, PhD

University of Arkansas

August 2018-November 2021

Agriculture supply chains are of utmost importance for the function of society and are complex due to their interdependency with critical infrastructure systems including energy, water, and maritime and multimodal transportation. This complexity is increased due to the dependence on time-sensitive and capital-intensive operations, uncertain natural events, and volatile commodity markets. This project developed models that determine how to effectively use transportation to make ag supply chains more resilient.

Evaluation of Hydrogel–stabilized Expansive Soils in Mississippi for Sustainable Maritime Infrastructure Design

Yadong Li, PhD, PE

Jackson State University

August 2019-December 2021

Expansive soil causes a variety of maritime transportation infrastructure problem, such as cracks, damage to pipeline, and the differential settlement of foundation. This project sought the feasibility of using innovative hydrogel treatment as alternative expansive soil stabilization.

Dredging Projects Selection when the Random Shoaling Effect is Considered

Bruce Wang, PhD

Texas A&M University

October 2019-December 2021

Dredging is a constant operation necessary to maintain the waterway shipping capacity. This project provided a decision support tool to achieve a maximum network capacity for dredging operations to support the regional and national economies.

Modal Comparison Update: 2001-2019

Jim Kruse, MBA

Texas A&M Transportation Institute

March 2021-December 2021

In December 2007, the Texas A&M Transportation Institute submitted a report to the U.S. Maritime Administration and the National Waterways Foundation titled “A Modal Comparison of Domestic Freight Transportation Effects on the General Public”. Since that time, several updates to the study have been performed, with the last update covering the period 2001 to 2014. This study covered the 2001 to 2019.

Inland Waterway Travel Time Prediction

Jim Kruse, MBA

Texas A&M Transportation Institute

November 2020-April 2022

This project built an inland waterways travel time prediction model that builds on and improves existing work at the U.S. Army Corps of Engineers. In the first iteration the team forecasted and analyzed travel times in one of the simplest river segments. The resulting forecast model was applied to a more complex river segment involving locks and bridges.

TRANSPORTATION AND MARITIME ANALYTICS PARTNERSHIPS HUB

Transportation and Maritime Analytics Partnerships (TransMAP) Hub

Justin Chimka, PhD, Jack Cothren, PhD, Heather Nachtmann, PhD, and Chase Rainwater, PhD

University of Arkansas

Jim Kruse, MBA

Texas A&M Transportation Institute

October 2019-September 2022

Conducted through the Maritime Transportation Research and Education Center (MarTREC), the Transportation and Maritime Analytics Partnerships Hub (TransMAP) project is supported by the Maritime Administration of the U.S. Department of Transportation. The team, led by the University of Arkansas in partnership with the Texas A&M Transportation Institute, made available a large-scale data and visualization online platform related to maritime freight transportation on infrastructure, systems, and net-

works accessible to humans and machines through the Internet of things, in order to enable improved resilience, planning, investment and operational decisions.

Efficient, resilient, and sustainable multimodal transportation is a national priority. To meet the challenging environment of the Nation's complex and ever-changing transportation system, large-scale data sets need to be captured and analyzed to support research and planning, and made available for real-time access for use by government agencies, industry and citizens. Intelligently using big data is critical to manage, improve, maintain, design and build our transportation infrastructure. TransMAP's goal was to provide a 'visual decision space' for effective planning, management, and advancement of efficient, resilient, and sustainable multimodal transportation systems including highway, rail, maritime, and pipeline.



Photo courtesy of Unsplash

SMART MOBILITY PLANNING GRANT

MarTREC Director Heather Nachtmann is leading a planning grant will support the University of Arkansas' vision of becoming the preeminent university in smart mobility. Smart mobility – autonomous, electrified, interconnected and shared – is revolutionizing how we move goods and people and will disrupt transportation sector business models. Now more than ever, it is easy to imagine how smart mobility innovation will transform traditional supply chains and change the way we travel, shop, work and build.

The planning grant from the Walton Family Charitable Support Foundation will span eight months and support efforts such as pilot research studies, industry and peer benchmarking, content marketing, and education and workforce development planning. The university's targeted smart mobility innovation areas include Next-Generation Vehicles, Unmanned Aerial Mobility, and Artificial Intelligence for Smart Mobility.

Nachtmann was recently appointed to the Arkansas Council on Future Mobility. Chaired by Cyrus Sigari, co-founder of UP Partners, the council includes representatives from Walmart, Canoo, J.B. Hunt, Entergy, Arkansas Trucking Association, Arkansas Auto Dealers Association and multiple state agencies. Nachtmann will serve on the council's Academic and Workforce Development Subcommittee.

“As the emerging field of smart mobility progresses, it is critical to develop our comprehensive vision now to leverage our competitive edge in this rapidly evolving industry,” said Nachtmann. “We have all the critical components - strategic industry partners, an innovative ecosystem and world-renowned experts. This planning grant will enable the university to elevate our existing capacity into a transformational vision to drive smart mobility workforce development and innovation.” U of A News, July 05, 2022



Photo by Jared Sorrells, 4media group

COMPLETED AND ARCHIVED MAP-21 PROJECTS

Maritime and Multimodal Logistics Management

Dynamic Decision Modeling for Inland Waterway Disruptions

Shengfan Zhang, Ph.D.
Heather Nachtmann, Ph.D.
University of Arkansas
December 2016

https://martrec.uark.edu/research/dynamic_decision_modeling_final_report.pdf

Economic Impacts of Lock Usage and Unavailability

Justin R. Chimka, Ph.D.
University of Arkansas
June 2016

<https://martrec.uark.edu/research/chimka-final-report-2016.pdf>

Efficient Dredging Strategies for Improving Transportation Infrastructure Resilience

Kelly Sullivan, Ph.D.
University of Arkansas
December 2016

https://martrec.uark.edu/research/efficient_dredging_strategies_final_report.pdf

Multimodal Transport and TransLoad Facilities in Arkansas

Justin R. Chimka, Ph.D.
University of Arkansas
January 2015

<https://martrec.uark.edu/research/multimodal-transport-and-transload-facilities-in-arkansas.pdf>

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

Heather Nachtmann, Ph.D.
University of Arkansas
August 2015

https://martrec.uark.edu/research/mkarns_final.pdf

Supporting Secure and Resilient Inland Waterways

Heather Nachtmann, Ph.D.
Justin Chimka, Ph.D.
University of Arkansas
June 2018

https://martrec.uark.edu/research/ua_ssriwi_final.pdf

Supporting Secure and Resilient Inland Waterways: Phase Two

Heather Nachtmann, Ph.D.
Justin Chimka, Ph.D.
University of Arkansas
August 2018

https://martrec.uark.edu/research/ua_ssriwii_final.pdf

Maritime and Multimodal Infrastructure Preservation

Climate Impacts on Lock Use and Performance

Justin Chimka, Ph.D.
University of Arkansas
August 2018

https://martrec.uark.edu/research/ua_climate_final.pdf

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

Gary Prinz, Ph.D., P.E.
Clint Wood, Ph.D., P.E.
University of Arkansas
September 2018

https://martrec.uark.edu/research/ua_corrosion_final_report.pdf

Effect of Swell-Shrink Characteristics on Landslides in Yazoo Clay

Mohammad Sadik Khan, Ph.D., P.E.
Jackson State University
June 2018

https://martrec.uark.edu/research/jsu_final_effect.pdf

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

Yadong Li, Ph.D., P.E.
Lin Li, Ph.D., P.E.
Jackson State University
June 2016
<https://martrec.uark.edu/research/yadong-li-final-report-2016.pdf>

Evaluating the Performance of Intermodal Connectors

Sarah Hernandez, Ph.D.
University of Arkansas
September 2018
https://martrec.uark.edu/research/ua_evaluating_performance_final_report.pdf

Development of a Design Protocol: Sustainable Stabilization of Slope using Recycled Plastic Pins in MS

Mohammad Sadik Khan, Ph.D., P.E.
Jackson State University
October 2017
https://martrec.uark.edu/research/development_of_a_design_protocol.pdf

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

Brian Wolshon, Ph.D., P.E., PTOE
Louisiana State University
June 2015
https://martrec.uark.edu/research/identifying_high_risk_roadways_corrected.pdf

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

Wei Zheng, Ph.D., P.E.
Jackson State University
June 2016
<https://martrec.uark.edu/research/wei-zheng-final-report-2016.pdf>

Innovative Bio-Mediated Particulate Materials for Sustainable Maritime Transportation Infrastructure

Lin Li, Ph.D., P.E.
Jackson State University
June 2017
https://martrec.uark.edu/research/lsu_innovative_bio-mediated_final.pdf

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

Bethany Stich, Ph.D.
James R. Amdal
University of New Orleans
January 2016
https://martrec.uark.edu/research/uno_lng.pdf

Optimal Dredge Fleet Scheduling within Environmental Work Windows

Chase Rainwater, Ph.D.
Heather Nachtmann, Ph.D.
University of Arkansas
August 2016
<https://martrec.uark.edu/research/optimal.pdf>

Optimal Dredge Fleet Scheduling - Phase 2 Research

Chase Rainwater, Ph.D.
Heather Nachtmann, Ph.D.
University of Arkansas
November 2017
https://martrec.uark.edu/research/ua_optimal_dredge_phase2.pdf

Predicting Soil Type from Non-destructive Geophysical Data using Bayesian Statistical Methods

Michelle Bernhardt, Ph.D, P.E.
University of Arkansas
August 2018
https://martrec.uark.edu/research/ua_predicting_final.pdf

Quantifying Resiliency of Maritime Transportation Systems

Brian Wolshon, Ph.D., P.E., PTOE
Louisiana State University
June 2018
https://martrec.uark.edu/research/lsu_quantifying_final_report.pdf

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

Clinton Wood, Ph.D., P.E.
Michelle Bernhardt, Ph.D., P.E.
University of Arkansas
July 2017

https://martrec.uark.edu/research/ua_final_levees.pdf

Disaster Response and Transportation Planning for Coastal and River Valley Communities

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

Feng Wang, Ph.D., P.E.
Jackson State University
August 2015

https://martrec.uark.edu/research/martrec_final_report_development.pdf

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

Scott Parr, Ph.D., E.I.T.
Louisiana State University
May 2017

https://martrec.uark.edu/research/evaluating_coastal_lsu.pdf

Measurement of Traffic Network Vulnerability for Mississippi Coastal Region

Feng Wang, Ph.D., P.E.
Jackson State University
July 2017

https://martrec.uark.edu/research/jsu_final_measurement_of_traffic.pdf

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

John L. Renne, Ph.D., AICP
University of New Orleans
September 2017

https://martrec.uark.edu/research/uno_tod.pdf

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

Himangshu Das, Ph.D., P.E.
Jackson State University
April 2017

https://martrec.uark.edu/research/quantification_multimodal.pdf

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

Neila J. Donovan, Ph.D.
Louisiana State University
June 2015

<https://martrec.uark.edu/research/road-sign-recognition-during-computer-testing.pdf>

Statistical Analysis of Vehicle Crashes in Mississippi

Feng Wang, Ph.D., P.E.
Jackson State University
July 2017

https://martrec.uark.edu/research/jsu_final_statistical_analysis.pdf

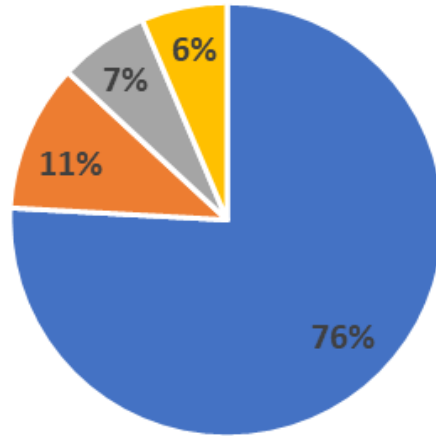
Vulnerability of Fuel Distribution Systems to Hazards in Coastal Communities

John Pardue, Ph.D., P.E.
Louisiana State University
March 2017

https://martrec.uark.edu/research/vulnerability_fp.pdf

FY 2022 FINANCIALS

Fiscal Year 2022 Total Expenditures \$2,707,696



■ research ■ technology transfer ■ education ■ administration

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