

Submission Date: 12/2/2024
Lead Recipient/Grant Number: University of Arkansas / 69A3552348331
Principal Investigator Institution: University of Arkansas
Center Name: Maritime Transportation Research and Education Center
USDOT Research Priority: Preserving the Existing Transportation System
Primary USDOT Strategic Goal (<i>select drop down</i>): Safety
Principal Investigator(s) with ORCID(s) and Contact Information:
Morgan Broberg - mbroberg@uark.edu, https://orcid.org/0000-0003-2406-8117 , 479-575-6204 Gary Prinz - prinz@uark.edu, https://orcid.org/0000-0003-2579-3214 , 479-575-2494
Project Partners: TBD
Project Type (<i>select drop down</i>): Applied Research
Project Research Topic Type (<i>select drop down</i>): Maritime Sustainable and Resilient Infrastructure
Transportation Modes Involved (<i>check all that apply</i>): <input checked="" type="checkbox"/> Waterway <input checked="" type="checkbox"/> Road <input checked="" type="checkbox"/> Rail <input type="checkbox"/> Pipeline <input type="checkbox"/> Other
Research Project Funding: MarTREC funds: \$199,999; Matching funds: \$100,000; Total funds: \$299,999; with \$15,000 Technology Transfer within the federal funds
Project Start and End Dates (Format month/day/year to month/day/year): 1/01/2025 - 7/15/2026
Project Title: Bracing for Impact: Developing Steel-Concrete Sandwich Panel Retrofits for Increased Bridge Pier Protection
Project Abstract (Brief Description): This research project will address retrofits for piers in and around shipping channels. Bridge pier stability is integral for the continued operation of shipping channels after a vessel-pier collision occurs. Without sufficient pier protection systems, when vessel collisions occur, bridge damage can limit traffic over the bridge and through the waterway below, causing both travel and economic disruption. A novel steel-concrete composite system will be investigated for reducing the collapse potential of vulnerable bridge piers (essentially developing bridge life-preservers). The proposed strengthening method provides an alternative construction approach by installing the system directly onto bridge piers in lieu of constructing more robust barrier type systems. Additionally, the proposed barrier employs energy dissipative mechanisms along with a new structural system (steel-plate composite sandwich panels) that has been recently investigated for use in building applications. The project contains two integrated research components: 1) detailed finite element analysis of retrofit pier details and 2) impact testing of retrofit details. Outcomes of this project include a direct-to-pier retrofit strategy, ultimately improving waterway infrastructure reliability. Additionally, novel impact data for sandwich panels will be generated and engineering graduate students will receive advanced research training providing knowledge transfer to industry upon student graduation.
USDOT Priorities: This research project will support US DOT priorities including transformation and safety. This program will support the transformation and modernization of existing bridge substructures through developing a new pier retrofit. When validated and installed, this project will increase the resilience of existing piers to vessel collision – transforming the existing infrastructure and promoting the safety of persons traveling in and above maritime waterways.

Outputs (results of the work performed): Data generated from this project will include detailed finite element simulations of various bridge pier geometries with different proposed retrofits and experimental results from retrofit testing. The detailed finite element simulations will create data that includes the stress, strain, displacement, and reactions of bridge pier and retrofit components. Experimental data including strain, displacement, and applied loads will be generated in the Grady E. Harvell Civil Engineering Research and Education Center (CEREC) (<https://cerec.uark.edu/>). All procedures and gathered data will be summarized in project reports and will be provided to MarTREC and other project stakeholders at 6-month intervals and in a final report the end of the project duration.

Outcomes/Impacts: The proposed project will result in implementable retrofit strategies for reinforcing vulnerable piers, improving waterway infrastructure reliability.

Technology Transfer Activities: Results and conclusions from this project will be disseminated via at least two peer reviewed journal publication or conference proceeding. Project updates and findings will be presented at annual MarTREC meetings. Interim reports will be provided at six month intervals and a final report will be provided at the conclusion of the project duration. The PI, co-PI, and graduate students involved in this project will have opportunities to present these findings at a regional or national conference. Together these publications will share with the larger community both the modeling approaches developed and fundamental test data. Data and metadata will also be shared directly via CERN's Zenodo Research Repository. (5% of budget)

Final Research Report: Upon completion of the project, a URL link to final report will be provided

Project Deliverables: PI agrees to submit all deliverables within 4 weeks after the project end date.

Data Management Plan (DMP): PI has reviewed and agrees to adhere to MarTREC DMP. Proposed project DMP must be attached to the submission email along with this form.

Center Director Approval Signature and Date:



12.23.24