Research Project Name: SEAHIVE® solutions to mitigate bridge scour – Phase III (UM)

Improving the Durability and Extending the Life of Transportation Infrastructure

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Federal: $51,441 Match: $25,720 (UM)

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Project Description: This is a collaborative research project conducted in partnership with Texas State University. Phases I and II of the project were conducted during AY24 and AY25. This one-year proposal is for Phase III of the three-phase project. The objective of this research project is to show a proof-of-concept of using innovative hydraulic load dissipating elements, known as SEAHIVE®. This is a modular engineered protection system composed of concrete perforated hexagonal prisms. Perforations on the side faces of the elements provide passage for water flow dissipating the energy within the system while also adding structural complexity which improves its potential for habitat creation.

SEAHIVE® has been under research and development at the University of Miami (UM) for wave energy dissipation and habitat enhancement with three pilot installations completed. This UTC study investigates the performance of the SEAHIVE® system intended for mitigating bridge scour. This project has the potential to create a consortium-wide effort for implementing the SEAHIVE® system into practice and changing how we design or retrofit bridge foundations for mitigating scour. Phase I focused on externally-prestressed elements given the mass production and scaling-up advantage. Externally prestressed (by Glass FRP rovings) units were produced by the dry-cast method with the same equipment used for the production of concrete pipes. Phase II focused on the production of internally-prestressed units using a revolutionary mold system. Using this technique, it will be possible to increase production efficiency and, as importantly, manufacture units of lengths up to 24 ft. that could be necessary for installation in riverine environments. The units produced with this technology were characterized.

Phase III deals with the production and characterization of elements made by wet-casting using a combination of randomly distributed short fibers for the control of cracking with and without the presence of transverse and longitudinal reinforcement made of GFRP bars. This investigation is made possible because of the special formwork that has recently been constructed as shown in Figure 1.

Figure1: Custom SEAHIVE® formwork

The behavior of these units will be compared to others produced with the technologies investigated in the previous Phases I and II.

US DOT Priorities: *Section left blank until USDOT's new priorities and RD&T strategic goals are available in Spring 2026.*
Outputs: Phase III will have technology transfer primarily targeting material selection and construction methods. Concurrently, the PIs will engage state and local bridge owners to explain and market the potential benefit of this technology. Even though the initial focus is scour protection, the potential of this technology has immediate applications in shoreline and port facility protection. Thus, practitioners and owners will be engaged in conversations to explore other uses. The potential partners envisioned for this project are: a) FDOT as a bridge owner is interested in demonstration projects utilizing the proposed technology; and, b) local communities and stakeholders from the Southeastern USA.
Outcomes/Impacts: Soil erosion is a global problem. Mitigating scour with innovative cost-effective design will alleviate this grand challenge in sediment transport. Bridge scour is the top cause of bridge failure. The state of the practice is to use riprap or articulating-block mattresses as needed. Decreasing bridge scour using an effective system will make coastal, estuarine and riverain bridges more durable.
Final Research Report: URL to final Report will be provided upon completion.