**Research Project Name**: SEAHIVE® solutions to mitigate bridge scour – Phase II

Improving the Durability and Extending the Life of Transportation Infrastructure

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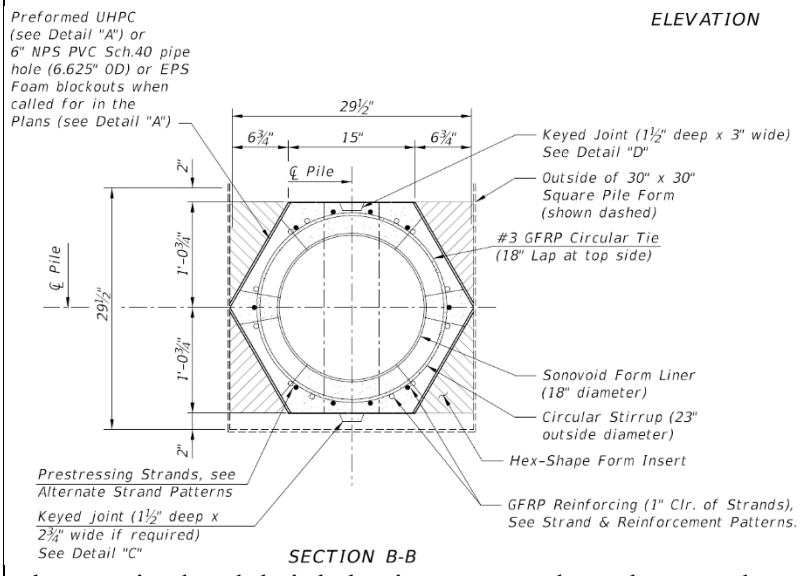
Federal: $193,305 Match: $96,548

**Project Start Date**: June 1, 2024 **Project End Date**: May 31, 2025

**Project Description:** This one-year proposal is for Phase II of the three-phase project conducted in partnership with Texas State University. Specifically, this study will investigate the performance of the SEAHIVE® system in mitigating bridge scour. SEAHIVE® 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.

This Phase II will focus on the production of internally prestressed units using conventional precast beds currently available for producing 30-inch square piles. 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 scouring applications in marine and riverine environments. The units produced with this technology will be fully characterized and their behavior compared to others produced by wet-cast (no prestressing) and externally- prestressed. This latter objective will be accomplished through laboratory testing in compression and bending of units designed aiming to the same structural performance.




In order to guarantee the durability of the precast elements subjected to harsh wet-and-dry conditions, the prestressing tendons will be made of #3 (3/8 in.-diameter) glass fiber reinforced polymer (GFRP) bars shipped to the precast plant in coils. In fact, no steel reinforcement will be used to avoid corrosion. The anchors for tensioning will be conventionally split wedges and sleeves used for 0.375 in. seven-wire steel

strands. It is expected that these units will perform in flexure as partially prestressed longitudinal members. In addition to being cost-effective, this method of construction also enables greater distress to be observed for load conditions above the Service Limit State through the prevalence of transverse cracking without any concerns for corrosion due to the inert prestressing tendons.

The project has the potential to create a consortium-wide effort for implementing the SEAHIVE® system into practice providing a novel efficient and ecofriendly solution for scour mitigation in bridge foundations.

**US DOT Priorities:** Bridge scour is the top cause of bridge failure; the state of the practice is to monitor for bridge scour and to use riprap or articulating-block mattresses as needed. Decreasing bridge scour using an effective and ecofriendly system will make coastal, estuarine and riverain bridges more durable while promoting habitat creation.

Soil erosion is a global environmental problem. Mitigating scour with innovative cost-effective design will alleviate this grand challenge in sediment transport.

**Outputs:** The second-year Phase-two will engage a prestressed-concrete (PC) precaster potentially interested in the manufacturing of SEAHIVE® units. 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; b) Standard Concrete Products (SCP) is a company in Tampa, FL, interested in developing a partnership with UM for the manufacturing of SEAHIVE® elements using the PC technology; and, c) local communities and stakeholders from South Florida.

**Outcomes/Impacts:** (Describe anticipated products, or patents or practice changes. Discuss how this research output will positively impact transportation system in terms of safety, reliability, durability, cost, etc.):

SEAHIVE® is a registered UM trademark. It is possible that a patent application will be filed soon for SEAHIVE® elements using PC technology.

According to the FDOT, *bridge scour is the largest cause of bridge failure in the United States and a major factor that contributes to the total construction and maintenance costs of bridges in the United States.* Therefore, reducing and preventing scour using an efficient and eco-friendly sustainable system such as SEAHIVE® can have great positive impact in the transportation system all across the United States.

**Final Research Report**: URL to final Report will be provided upon completion.