Project Requirements Form USDOT
CREATE UTC Contract Number 69A3552348330
Center Lead: Texas State University; Texas A&M University

Research Project Name: Composite Mangroves for Reducing Soil Erosion Near Transportation Infrastructure

Improving the Durability and Extending the Life of Transportation Infrastructure

Principal Investigator(s):
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Project Partners: N/A

Research Project Funding:
Federal: $125,034 Match: $62,517 (TAMU)

Project Start Date: 09/01/2023 **Project End Date**: 02/28/2025

Project Description:
Coastal erosion results in the movement of land or the long-term removal of sediment and rocks from the action of waves, currents, tides, wind-driven water, or waterborne ice. This creates gaps within the underlying subsoils supporting transportation infrastructure. Infrastructure such as pavements and piers experience distress due to loss of soil support, which will lead to failure. The objective of this research is to use synthetic composite materials to mimic mangroves as a Natural and Nature-Based Features (NNBF) system. Mangroves can withstand wave energies, and reduce wave velocities, this study will evaluate how the synthetic mangroves mitigate coastal wave-induced erosion around transportation infrastructure. Unique designs of these composite mangroves with different root systems will be studied in the laboratory to assess the reductions in wave velocities and energies. These results will be incorporated into various design methods and coastal infrastructure design software to study the use of artificial mangroves to reduce soil erosion around pavements, bridge piers, MSE walls and other infrastructure.

US DOT Priorities:
Development of the artificial mangroves for coastal protection will provide advancements in tackling the future climatic issues faced by the coastal communities. The use of the hybrid solution will play a central role in the promotion of sustainable and resilient solutions for coastal transportation infrastructures. This promotes the US DOT strategy on *Climate and Sustainability*. The research also advocates *Economic Strength and Global Competitiveness* and *Equity* goals of USDOT through engaging people and communities to promote safe, affordable, accessible services and opportunities while reducing coastal transportation-related disparities, and subsequently contributing towards the growth of the blue economy. This novel design will bring in transformative research and innovation for coastal pavements which will help in modernizing the transportation systems by providing a more resilient and sustainable coastal protection system and would also help in improving the safety against future climatic impacts. Therefore, the research also addresses the USDOT strategic objectives on *Transformation* and *Safety* as secondary goals.

Outputs:
The research team will prepare the final report that will include a complete description of the problem, approach, methodology, findings, conclusions, and recommendations developed from Tasks.

Outcomes/Impacts:
The research team will prepare the final report, to include a complete description of the problem, approach, methodology, findings, conclusions, and recommendations developed from four tasks. The results of this work will be also presented and published at national conferences such as TRB Annual Meetings and ASCE GeoCongress conferences.

The research team will prepare educational materials that will be incorporated into classroom teaching in courses such as CVEN 720 Design with Geosynthetics. This information will be shared and disseminated to other universities, private industries and government agencies. We anticipate showcasing research demonstration materials like artificial mangroves to K-12 students that visit TAMU for various outreach activities. Our research team will also present them to ASCE-GI Chapter student organizations at Texas A&M University. The proposed workforce development including one doctoral student and one postdoctoral fellow along with undergraduate researcher, outreach activities and education will allow to reach a broad and diverse audience and to educate students on the benefits of this research work.

With respect to commercialization, the team will explore and assess the proposed resilient design system as a provisional patent by discussing with TAMU Commercialization and Entrepreneurship group at College Station, Texas.

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