



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

<b>Research Project Name:</b> Vehicles over Dunes: Biocementation-based Coastal Infrastructure for Flood Protection and Beach Access (TAMU)	
Improving the Durability and Extending the Life of Transportation Infrastructure:	
<b>Principal Investigator:</b> Jens Figlus, Ph.D., figlusj@tamu.edu; 0000-0001-7355-8943, (409) 741-4317, Texas A&M University	
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<b>Research Project Funding:</b> Federal: \$100,282 <span style="float:right">Match: \$53,548 (TAMU)</span>	
<b>Project Start Date:</b> 09/01/2024	<b>Project End Date:</b> 08/31/2025
<b>Project Description:</b> The research team proposes to study bio-cementation (via microbially- and enzymatically induced carbonate precipitation) as a method to stabilize engineered dune slopes in coastal areas. These stabilization methods are intended as a nature-based engineering solution for use in the construction of beach access ramps that can support vehicular traffic loads while simultaneously resisting erosion due to wave impact. The erosion resistance will be evaluated by subjecting untreated and treated dune sand slopes to varying wave forcing conditions in a moveable-bed wave flume. The resistance to traffic loading will be evaluated by measuring the unconfined compression strength and resilient modulus of untreated and bio-cemented soil columns. Test results will be analyzed to address the effectiveness of both bio-cementation methods in stabilizing dune slopes.	
<b>US DOT Priorities:</b> The engineered dune system that we seek to study is intended to provide beach access while protecting the inland from flooding. Thus, by reducing the probability of flooding, the durability and service life of existing inland infrastructure is improved (USDOT Priority Area D). In addition, the proposed technique is in line with engineering-with-nature approaches to reduce coastal risk of flooding and erosion and provides a sustainable option to protect critical coastal transportation infrastructure. The proposed research benefits local communities by: (i) expanding access to the beach while reducing flood risk and (ii) supporting the development of larger-scale infrastructure in coastal high-hazard areas with a current example being the planned storm surge risk reduction coastal barrier for the Houston-Galveston Metropolitan Area (U.S. Army Corps of Engineers).	
<b>Outputs:</b> The project will evaluate the application of a relatively new nature-based ground improvement technology, i.e., bio-cementation, in the construction of vehicle access ramps over beach dunes that can support vehicle loads while resisting erosion due to wave impact. The results of the work performed will be documented in the final report, as well as in journal and conference publications. We will also be conducting a workshop for interested federal, state, and local organizations involved in designing surge risk suppression systems that involve dunes and	



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provide for transportation vehicular access to beaches (e.g., TxDOT, USACE, TX General Land Office, Local MPOs)

Our project advisory board includes staff from the Texas Department of Transportation and the U.S. Army Corps of Engineers, as detailed below.

Patrick Kerr, Ph.D., PE, D.WRE, Chief, Hydrology & Hydraulics (H&H) Branch-U.S. Army Corps of Engineers – Galveston District

Ray Newby, P.G., Waterways Program Coordinator, Maritime Division, Texas Department of Transportation

**Outcomes/Impacts:** In the long-term, the data collected as a part of this project will aid in the evaluation of bio-cementation as a method to stabilize dunes while providing vehicle beach access. Many states have (open) beach access laws that require them to make this public good accessible to the public. At the same time states have a need to protect onshore infrastructure against flooding and storm impacts under changing climate conditions which requires innovative strategies and nature-based solutions to accomplish.

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