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

| |
|---|
| **Research Project Name**: COLLABORATIVE: Quantifying Vessel Propeller Wash Impacts on Sedimentation in Shallow-Bay Ports and Waterways |
| Improving the Durability and Extending the Life of Transportation Infrastructure |
| **Principal Investigator**(s) (Include Contact info and ORCID):<br>Jens Figlus, figlusj@tamu.edu, 0000-0001-7355-8943, Texas A&M University<br>Stacey Kulesza, PhD, PE, sekulesza@txstate.edu, 0000-0003-3283-6235, Texas State University |
| **Project Partners**: Texas A&M University & Texas State University |
| **Research Project Funding**:<br>Federal: $183,932 ($91,501 TAMU; $92,432 TXST) Match: $210,812 (TAMU & TXST) |
| **Project Start Date**: 9/1/2023 **Project End Date**: 5/31/2025 |
| **Project Description**: Shallow-bay ports and waterways in bay systems along the Gulf of Mexico coast are critical transportation infrastructure and the Nation's economic drivers. The durability of this infrastructure relies heavily on dredging maintenance to keep channels navigable. Vessel propeller wash is the sediment movement induced by the hydrodynamic forces generated from propeller rotation. Deep-draft vessels with propellers located close to the channel bed during transit mobilize a large amount of sediment that may settle out in locations where it can cause unwanted extensive shoaling issues. As maritime traffic volume and vessel size are predicted to increase further in the future, so will the expensive maintenance dredging requirements. The hydro- and sediment dynamics of propeller rotation induced water jets and turbulence interacting with sediments on the channel bed and slopes are complex and depend on various parameters related to vessel geometry and propulsion, channel morphology, draft clearance, and sediment characteristics. While some limited studies on vessel-wake impact to sedimentation exist, no comprehensive field measurements of propeller wash sedimentation drivers have been conducted and it is thus not known to what extent vessel traffic is responsible for channel sedimentation issues.<br><br>The objective of this research project is to measure propeller wash dynamics and quantify resultant sediment suspension caused by deep-draft vessels in the Houston Ship Channel in Galveston Bay, Texas. This will be accomplished by Texas A&M (Figlus) using a vessel-mounted Acoustic Doppler Current Profiler (ADCP) and echo sounder system capable of high-resolution 3D velocity and suspended sediment concentration (SSC) measurements throughout the water column. Texas State (Kulesza) will support field measurements with qualitative marine electrical resistivity measurements of the extent and magnitude of the suspended sediment column. Available Automated Information System (AIS) data for the deep-draft vessels and channel bathymetry data will be used to correlate measured SSC values with vessel and site characteristics and to quantify mobilized sediment mass. Using these results future researchers can better predict sediment drivers. Such data can be incorporated in asset management plans to forecast dredging needs based on supply chain projections. |
| **US DOT Priorities:** The *durability* of the nation's ports and shallow waterways relies on routine dredging maintenance. Quantifying the contribution of large vessels on sediment |

transport will help engineers to plan dredging maintenance including the predicted vessel traffic. Understanding vessel dynamics' contributions to channel and port infrastructure sedimentation issues will allow for more *equitable* and economically sound maintenance/preservation of existing infrastructure as well as more informed planning of future extensions and new channel/port projects. This will allow ports to remain open, which addresses the US DOT *Economic Strength* call for addressing supply chain and logistic needs.

**Outputs**: The results of this research will be disseminated in a comprehensive, collaborative report. This report will include a field implementation guide and an applied design example for a channel management plan. The limitations of the study and implementation will be clearly documented. If successful, we will seek additional supplemental funding for technology transfer workshops with a focus on stakeholders with shallow-bay ports where sedimentation issues are critical for infrastructure durability.

**Outcomes/Impacts**: These results will benefit the US DOT and multiple other agencies such as the U.S. Army Corps of Engineers (USACE) and the Houston Port Authority (HPA). Aside from sharing the report, presentations will be given to interested agency personnel to help implement guidance on updated channel management strategies incorporating the new information. In addition, findings can be incorporated as a component into the FHWA Advanced Geotechnical Methods in Exploration (A-GaME) toolbox for marine environments to enhance channel design reliability and avoid cost escalations for maintenance dredging.

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