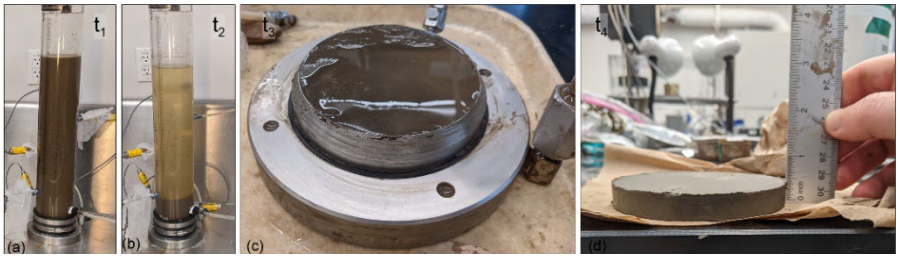
Improved BUDM Laboratory Methods for Low Stress Consolidation and Erodibility

Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS BUILDING STRONG®

Focus Area

Dredged Material Management



Problem

Coastal environments in the United States and across the world are under threat due to sea level rise, subsidence, sediment starvation, and anthropogenic disturbances. Coastal managers are increasingly challenged to identify opportunities to restore degraded marsh ecosystems in a manner than enhances their ability to keep pace with SLR which is contingent on biogeomorphic feedbacks between hydroperiod, accretion, and vegetation growth. A common practice employed by the USACE to nourish degraded marshes is the BUDM, and USACE has an internal goal of reaching 70% of material dredged used beneficially by 2030. An obstacle to achieving this goal is the difficultly District engineers have designing marsh nourishment projects that use fine-grained sediment because this material is intrinsically more complex than coarse sands, as fines remain in suspension longer and will experience significant degrees of consolidation. The viability of wetlands is centered on elevation within the tidal frame so accurately estimating the correct design range to place sediment to yield the optimal plant performance is paramount. By redeveloping the methods the USACE currently employs to test fine-grained sediments and coupling it with erosion testing capabilities, this proposal seeks to revolutionize the way the USACE and industry handle fine-grained sediments by providing engineers with the data and relationships required to accurately model these phenomenon. The engineering properties of these cohesive sediments are intrinsically more difficult to handle than sands but will serve as a major solution to our degraded marshes if we can better understand their behaviors.

Study Description

This work seeks to update and advance ERDC's laboratory procedures for testing dredged material properties, which currently involve standalone settling column and self-weight consolidation tests. The new method will employ an instrumented settling column coupled to a constant rate of strain consolidation device (CRS) further coupled to an erodibility cell that will drastically reduce testing times and labor costs, increase accuracy, and expand ERDC's testing capabilities beyond those used past or present.

Products

- New testing capabilities at ERDC for a semi-autonomous method to record geotechnical properties of sediment from deposition through long-term consolidation, with corresponding erosion testing, bringing ERDC to the state-of-the-art in sediment testing.
- Journal publication on geotechnical correlations for ultra-low stress sediment properties to field-scale stress and erodibility properties.
- Guidance for district engineers on improved testing methodology.

Summary

The USCAE is improving sediment characterization methodology as part of a larger effort to increase the beneficial use of dredged sediment across the nation. This project is developing a technique to characterize cohesive sediment consolidation and erodibility properties to better understand placed sediment from deposition to long-term behavior.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

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