Attrition of Mud Aggregates through Dredge Pipelines for Beneficial Use Projects

Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS BUILDING STRONG®

Focus Area

Innovation in Sediment Management - Innovative Construction and Operations Technologies

Problem

The dredging of fine-grained sediments (FGS) may either coalesce into clay lumps or become slurried depending on the properties of that particular material. One of the problems faced in FGS dredging is the unpredictable formation and subsequent breakdown of mud aggregates during pipeline transport. Accurately predicting the final soil state is important for matching the suitability FGS material to its intended use, such as dike construction or thin layer placement, and for assessing risks associated with nearshore placement and beach nourishment involving dredged material. Furthermore, the soil state during hydraulic transport will affect the transport efficiency and energy consumption required to move the material. Thus, understanding and predicting aggregate formation and attrition will optimize dredge planning and operations while minimizing disruptions.

Mud aggregates rest atop of a sand bed accumulated within a hopper dredge and ultimately persisted during pumpout.

Study Description

This study aims to refine the understanding of mud aggregate size and attrition in dredging operations by leveraging existing compaction and liquidity index data complemented by recent experimental work by the study team. This approach will combine datasets for empirical validation of an existing aggregate abrasion model, and extends the predictions into the spatial domain, assuming the datasets align. If the fit is unsatisfactory, additional parameters will be explored and further laboratory or field tests will be proposed. If the fit is promising, the application of the predictive tool will require validation in the field through future dredging projects.

Products

This study will produce a simple predictive tool that calculates aggregate size and attrition rates based on the pumping distance and sediment source characteristics, such as clay content and critical water contents (i.e., Atterberg limits). The findings of this work will be communicated in an ERDC Technical Report and through various stakeholder meetings and webinars.

Summary

Understanding aggregate durability and attrition behavior though hydraulic pipelines will facilitate the selection of the most appropriate use cases for dredged FGS and optimize operational planning. This knowledge will be realized through the use of a predictive tool to anticipate changes in the size of mud aggregates based on sediment characteristics and transport distance. Ultimately, this RT shows promise to improve construction planning and ensure resource-efficient dredging operations.

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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