Monday 3/13/2017

12:15–1:45 p.m.

Advancements in Coastal Geotechnics 1

Chairs: Nina Stark, Virginia Tech; Malay Ghose Hajra, University of New Orleans

Development of a P-Wave Transponder System for Tracking Buried Objects in 1-g and Geotechnical Centrifuge Models

Ryan D. Beemer, Andrew Van Dam, and Mark J. Cassidy, University of Western Australia

Locating and tracking buried objects underground can be a difficult task especially in the case of plate anchors in soft clays. These plates, used offshore, gain their large vertical capacity by being embedded deep into the seafloor. Most commonly they are installed by either dragging horizontally tens to hundreds times their fluke length (drag embedment anchors) or by a suction caisson, which is then removed, and then dragging the anchor multiple fluke lengths, (suction embedded plate anchors). They can be extremely cost effective given their capacity to weight ratios, but they also have significant uncertainty in their capacity since plate anchor installation depths are exceedingly difficult to measure and predict. These difficulties exist not only in the field, but also in the laboratory. In the past decade significant progress has been made towards measuring plate anchor kinematics in 1-g laboratory experiments with the development of magnetometer tracking systems and translucent soil simulates. However, these methods are not easily transferable to the geotechnical centrifuge, where models with field scale effective stresses can be tested. In this paper we propose a new method for tracking plate anchors within a soft clay small scale model using an acoustic transponder attached directly to the plate anchor. We demonstrate the systems feasibility with analytical calculations and a prototype experiment in water. Though this active acoustic system is being developed for plate anchors in clay it could be used to detect the location and trajectory of any object buried in soil.

Design and Preliminary Tests of Mobile Seafloor Layer Sampler Prototypes as an Add-on Unit for Portable Free-fall Penetrometers

Cagdas Bilici and Nina Stark, Virginia Tech

Portable free-fall penetrometers (PFFP) are used as an innovative approach to investigate the uppermost seabed stratification, including the mobile layer. The aim of this study is to design an add-on sampler for PFFPs to collect simultaneously sediment, with focus on the mobile sediment layer. Here, we present three prototype designs and preliminary tests, based on the lessons learned from other systems such as gravity and piston corers. The prototypes differ in shape, sampling tube dimensions, wall thickness ratios, and core catching mechanisms. In preliminary tests, the sample quality was assessed based on visuals, recovery ratio and volume change. Promising results were achieved using suction only to hold the material in the sampling tube, causing the least sample disturbance. Still, the results showed that core catcher increased the chance of recovery of sand. Based on the results, recommendations for further sampler improvements, and particularly, a new core catcher design are given.

Soil-torpedo Interactions during Installation of Finless Torpedoes

Mehdi Omidvar, Manhattan College; Magued Iskander, New York University

Rapid penetration of torpedoes into the sea floor encompasses a host of complex phenomena.

Determining the kinematics of soil-torpedo interactions, needed for development and validation of state-of-the-art numerical simulations, remains one of the major challenges in design and analysis of torpedo anchors. In this study, results of rapid penetration tests in reduced scale physical models of synthetic soils are presented. The granular media consists of saturated refractive-index-matched transparent quartz particles. High-speed imaging is used to capture images during the penetration event. Digital image correlation is then performed to investigate soil-torpedo interactions. Results of the analyses provide high fidelity data with regards to kinematics of soil-torpedo interaction at various stages of penetration. These data reveal a deviation of the soil response ahead of the torpedo from both cylindrical and spherical cavity expansion.

In-situ geotechnical investigation of nearshore sediments with regard to cross-shore morphodynamics

Ali Albatal and Nina Stark, Virginia Tech; Jesse E. McNinch and Heidi Wadman, U.S. Army Corps of Engineers Waterways Experiment Station

Sediment dynamics cause continuous changes in nearshore morphology and play a major role in coastline evolution as well as for engineering activities in the coastal zone. A portable, free-fall penetrometer was used to investigate the geotechnical characteristics of surficial seabed sediments in the energetic nearshore zone of the U.S. Army Corps of Engineers Field Research Facility at Duck, NC. Penetrometer deployments were carried out along four cross-shore transects in water depths of 0.8-14.3 m. Duplicate deployments demonstrated the reproducibility of the results. The derived maximum quasi-static bearing capacities ranged from 8.7-251 kPa, with a decrease in the qsbc and in the scatter in the seaward direction. Significant differences in sediment strength were observed in the vicinity of the actively migrating, shore parallel sandbar. The study shows a strong relationship between geotechnical characteristics and active morphodynamics of the nearshore seabed. The depth of closure was reflected in the penetrometer results.