Tuesday 3/14/2017

3–4:30 p.m.

Site Investigation and Characterization 1

Chairs: David Frost, Georgia Tech; Alejandro Martinez, University of California, Davis

Site Characterization of an Abandoned Gold Mine using the Multi-Channel Analysis of Surface Waves Method

Nigel Crook, Shawn Calendine, and Marc Levitt, HydroGeophysics Inc.

Geophysical methods and tools are becoming more widely used in the geotechnical and engineering arena. The non-invasive nature and capability to survey significant areas in a rapid and cost-efficient manner typically make them an attractive complementary tool to conventional drilling and invasive investigations. The Multi-channel Analysis of Surface Waves (MASW) is one method that has seen growing application in the geotechnical world. We present a case study from an assessment of a historic gold mine site in Colorado. The site was extensively mined in the late 19th and early 20th centuries and left a legacy of collapsed shafts and shallow, typically poorly documented, mine workings. The objective of the survey was to investigate the upper 30 to 50 feet of the subsurface to characterize potential collapsed or backfilled mine workings in advance of the construction of a new mill pond. A total of 40 MASW profiles were collected, along several 1000 foot sections of the targeted mineral veins across the site. While there are numerous surface expressions of old or collapsed shafts across the site, there was limited additional subsurface information to ground truth the geophysics. A significant number of targets in the subsurface were identified in the MASW profiles. A hazards map of the site was produced highlighting potential weak zones or void space in the subsurface for the ensuing earthworks and construction activities.

Penetrating in Granular Materials: Effects of the Penetrator Dynamics

Sichuan Huang and Junliang Tao, University of Akron

It's reported that Ensis directus (a species of Bivalves) achieves exceptionally high penetrating efficiency through periodically expanding/contracting its body during burrowing. This paper provides insights into the cyclic expanding/contracting process in cohesionless granules based on a simplified Discrete Element Method (DEM) framework. In this DEM model, Razor clam is simulated by a circular cavity with a radius changing in a sinusoidal fashion. Different expanding frequencies are considered to study the interaction pattern between the cavity and the surrounding granules. Various stages of expanding process including initial movement, progressive expansion and contraction are captured. A static penetration case is included for comparison of penetration performance. Results positively confirm the contribution of dynamic expansion on the reduction of penetration resistance and energy saving. A critical expanding frequency exists, under which energy saving is optimal. Findings from this study can shed light on the design of smart devices for self-boring or site characterization.

An Instrumented Becker Penetration Test for Estimation of Soil Penetration Resistance and Pile Capacity in Gravelly Soils

Kevin Kuei, Anthony Rossiter, Alexander Sturm, Jason DeJong, and Daniel W. Wilson, University of California, Davis

The recently developed Instrumented Becker Penetration Test (iBPT) can provide direct measurements of force and acceleration directly behind the driving shoe and at up to four locations along the drill string. This paper describes details of the test system and presents representative results from iBPT soundings performed at a project site where piles, supporting a bridge deck, were installed in relatively clean gravelly soils to a depth of approximately 18 m. The ability of the iBPT system to estimate equivalent SPT N60 values is demonstrated. Dynamic data from individual hammer blows obtained at the tip and along the shaft, as well as fitting of the data with simple spring-dashpot model is presented. Finally, results from static tension load tests showing the measured load distribution along the pile length is presented.

Three-dimensional Visualization Model of the Eagle Mountain Dam Using Cone Penetration Test Data Based on Geostatistics

Santiago Caballero, Tejo Bheemasetti, and Anand J. Puppala, University of Texas at Arlington; Louie Verreault and Dorota Koterba, Tarrant Regional Water District

Hydraulic filling dams provides high variability in soil properties. Interpretation of variation of soil profile along a hydraulic fill dam is challenging due to the complexity involved with variability of materials deposited. In this research, an attempt was performed using geostatistical theory to interpret the variation of soil properties by constructing a three-dimensional visualization model for a hydraulic fill dam. Eagle Mountain Lake Dam located in Fort Worth, Texas constructed using hydraulic filling and wetted and rolled procedure was considered for performing the analysis. Cone Penetration tests (CPT) were conducted along the crest and toe of the dam and the results showed that the soil properties change dramatically from one location to another. Data collected was interpolated using ordinary Kriging that is methodology based on Geostatistics. The Earth Volumetric Studio and Mining Visualization System (EVS & MVS) software by C-Tech was used to perform the interpolation. A more reliable soil characterization is developed and a three-dimensional model of soil properties within the dam is presented.

New Research Benchmark Test Sites in Norway

Jean-Sebastien L'Heureux, Roselyn Caroll, Suzanne Lacasse, Tom Lunne, and Stein O. Strandvik, NGI; Samson A. Degago, NPRA; Arne Instanæs, UNIS; Steinar Nordal, NTNU; Anatoly Synitsen, SINTEF Building & Infrastructure

The Norwegian GeoTest Sites infrastructure project, with funding from The Research Council of Norway, is a national research facility for geotechnical research. The infrastructure comprises five test sites in different soils located in Norway and on the Svalbard territory north of Norway. The data collected at these sites will be collated in a web-structured database. The benchmark sites are to be developed as field research laboratories for the testing, calibration and verification of new soil investigation equipment and methods in geotechnical engineering. The research sites cover soft clay, quick clay, silt, medium-dense sand soil conditions and permafrost in Longyear-byen on Svalbard. Earlier Norwegian benchmark sites have been lost due to urbanization and other developments. The new research facility will be operation for at least 10 to 20 years. This paper briefly presents the five test sites, including initial geotechnical characterization data, i.e. in situ and laboratory test results. The soft clay site at Onsøy is of medium sensitivity and has an apparent overconsolidation due to aging. The plasticity of the clay is between 25 and 40% and has similarity to a number of offshore clays. The quick clay site near Trondheim consists of a thick quick clay layer of up to 30 m (remolded strength < 0.5 kPa). The site at Halden consists of intermediate silty materials. The silt is about 10 m thick and normally to slightly

overconsolidat-ed. The medium dense sand site near Trondheim in mid-Norway has a 20-m thick homogenous deposit of fine to medium coarse uniform medium dense sand with a predominance of quartz minerals and some plagioclase and micas. The permafrost site near Longyearbyen on Svalbard consists of layered clay, silt and sand with ice lenses, and salt content typical for marine sedi-ments.