Tuesday 3/14/2017

9:45–11:15 a.m.

Soil Liquefaction 2

Chairs: Katerina Ziotopoulou, Virginia Tech; Jack Montgomery, Auburn University

Analysis of Liquefaction at a Bridge Site in the 2014 Napa Earthquake

Kathleen M. Darby, Ross W. Boulanger, and Jason DeJong, University of California, Davis; Martin W. McIlroy, Shannon & Wilson

An evaluation of liquefaction triggering and deformation analyses for both banks of the Napa River at the crossing of the Napa Valley Wine Train Bridge during the August 24, 2014 Magnitude 6.0 Napa Earthquake is presented. The subsurface stratigraphy, including differences between the point bar and cut bank sides of the river channel, are described using results of cone penetration test (CPT) soundings and borings with standard penetration test (SPT) data. Liquefaction triggering analyses are performed using a simplified procedure and equivalent linear site response analyses. The potential for lateral deformations and settlements are evaluated using one-dimensional liquefaction vulnerability indices and Newmark sliding block methods. The analysis results indicate that liquefaction effects would not be expected on the cut-bank side of the channel, whereas minor amounts of liquefaction-induced settlements would be expected on the point bar side. There were no visible or reported ground deformations, cracks, or differential settlements at or near the bridge abutments on either side of the channel. Possible reasons for the discrepancy between observed and predicted behavior on the point bar side of the channel are discussed.

Shearing and Hydraulic Behavior of MICP Treated Silty Sand

Atefeh Zamani, and Brina Montoya, North Carolina State University

Microbial induced calcite precipitation (MICP) is a biochemical reaction that takes place within the soil producing calcite cementation bonding soil grains together. In this study, MICP method was applied to both Nevada sand and Nevada sand containing 15% silt to assess their improvement in monotonic shear strength, cyclic resistance and also changes in permeability. The change in shear strength properties are evaluated by performing undrained monotonic and cyclic direct simple shear tests on both treated and untreated samples. Reduction in permeability as a result of calcite precipitation is also another objective of this research which is investigated by performing constant head tests on untreated and MICP treated samples. The results show improvement in shear response and reduction in excess pore water pressure in both treated samples. The cyclic resistance also increases by applying MICP. The permeability of soil reduces by applying MICP but the amount of reduction is low in comparison to the change in permeability when fines are added to the Nevada sand.

Study of Electromagnetic-Induced Liquefaction Mitigation and Alteration of Hydraulic Conductivity of Coarse-grained Soils

Rakesh Acharya and Arvin Farid, Boise State University

In this study, the effect of radio-frequency (RF) waves on the generation of excess pore-water pressure (EPWP), and hydraulic conductivity of coarse-grained soils is examined. Apparent viscosity of water can change due to the oscillation of dipole molecules within an alternating electric field. Altering the viscosity alters the hydraulic conductivity and can, hence, minimize the buildup of the EPWP. Constant-head permeability tests were performed to measure the hydraulic conductivity of two types of samples,

glass beads and natural sand with / without RF waves. Impact tests were performed on a box made of Plexiglas to measure the EPWP of glass-bead samples. Different sets of tests were conducted to evaluate the effect of RF waves' power and frequency. The results showed a positive correlation between the RF waves power and hydraulic-conductivity alteration whereas no change was observed in the generation of EPWP.

Modeling the Response of a Pleistocene Sand During In Situ Liquefaction Testing

Michael Esposito, HDR Inc.; Ronald D Andrus and Nadarajah Ravichandran, Clemson University

The results of a numerical study to predict the response of a Pleistocene uncemented sand deposit during an in situ liquefaction test with a mobile field shaker are presented in this paper. A plasticity model is used to represent cyclic stress-strain behavior of the sand. Input model variables are calibrated using results from field geotechnical testing and laboratory monotonic triaxial testing of intact specimens obtained by in situ freezing. The calibration required considerable adjustment of one primary input variable to account for increased liquefaction resistance due to aging processes. The simulations under amplitudes representative of the mobile shaker's highest output predicted an initial tendency towards contraction and maximum excess pore pressure ratios (ru) of < 20%, followed by a dilative response and subsequent reduction in pore pressure.