Tuesday 3/14/2017

9:45–11:15 a.m.

Geosynthetics in Foundations

Chairs: Reinaldo Vega-Meyer, TEK+ Integral Solutions LLC; Amr Morsy, University of Texas at Austin

Geofoam Inclusions for Reducing Passive Force on Bridge Abutments Based on Large-Scale Tests

Kyle M. Rollins, Brigham Young University; Eric Scott, CKR Engineers; Aaron Marsh, DOWL Engineers

To decrease lateral earth pressures on structures, a zone of compressible material or an “inclusion” can be used as a barrier to decrease lateral earth pressures on structures. The compressible material is typically expanded polystyrene or geofoam. Little guidance is available on the development of passive force with an inclusion. To explore this issue, large-scale passive force tests were conducted with and without a geofoam inclusion acting as a barrier between the backfill soil and a simulated bridge abutment. The presence of the geofoam inclusion reduced the passive force by 70% relative to the sand backfill alone. Although the measured force and failure geometry appeared to conform to a log-spiral mechanism when only sand backfill was used, the geofoam inclusion transforms the failure geometry to a Rankine failure mechanism. This suggests that the geofoam acted to reduce the interface friction between the wall and the backfill sand thereby reducing the passive resistance.

Observation of Progressive Failure Mechanism of Reinforced Foundation Soil Using Digital Image Correlation (DIC) Technique

Mazhar Arshad, MCE, NUST; Monica Prezzi and Rodrigo Salgado, Purdue Universty

Geosynthetic materials have been widely used in reinforcing the weak soil underneath the shallow foundations in the recent years. Many previous static loading studies have shown that the bearing capacity of the soil with a shallow foundation on the surface is greatly increased when the soil is reinforced by a layer of geosynthetic material. The present study visualizes the deformation field and failure mechanism in geosynthetic-reinforced soil underlying shallow foundations using digital image correlation (DIC) technique. A small-scale calibration chamber was built to model a plane-strain condition for a strip footing system. A series of indentation tests were conducted using a rigid model strip footing on unreinforced soil and with soil reinforced with geonet and woven fabric geotextile. The effect of number of reinforcement layers on the deformation field within the bearing soil has been studied. The results highlighted the suitability of DIC technique to visualize the deformation in laboratory-scale experiments and clearly illustrated the effect of reinforcement on progressive failure mechanism of model footing.

Numerical Modelling, Design and Construction of a Geotextile Reinforced Soil-Metal Buried Structure (GRS) under Deep Fills in Challenging Soil Conditions

Meckkey MME El-Sharnouby, Phil Carroll, Dave Worsley, Atlantic Industries Ltd.; Calvin VanBuskirk, Terratech Consulting Ltd.

This paper presents a case history of design and construction of a geotextile reinforced soil-metal (GRS) 2040 mm diameter structural plate culvert under a 42 m high embankment at a mine in South America. The geotechnical data indicated that the underlying SAPROLITE and laterite soils were very soft with predicted consolidation settlement under the conduit and embankment of up to 3m. Due to the complexity of the problem, two-dimensional non-linear finite element analysis was employed to analyze the soil-structure and soil-geotextile interaction. Results showed that the composite system

considerably improved the performance of the culvert under the considered loading conditions. The structure was constructed in 2015 to 2016 and it is reported that the structure is performing satisfactory. The composite GRS-culvert system provided a viable solution for challenging site conditions.

Protecting Buried HDPE Pipes Subjected to Ground Subsidence Using Geosynthetics

Min Zhou, Fei Wang, and Yanjun Du, Southeast University

High density polyethylene (HDPE) double-wall corrugated pipe is commonly used for drainage purpose. However, this type of pipe can be damaged by ground subsidence due to its relative low stiffness. In this study, physical model tests are conducted to investigate the effectiveness of geosynthetics to protect buried HDPE pipes subjected to ground subsidence. The tests are carried out in a custom-made test box with a dimension of 2 m in length, 2 m in width, and 1.5 m in height. Two model tests with the inclusion of the geotextile and the geogrid and one test without geosynthics reinforcement are conducted. Test results demonstrate that both types of geosynthetics are effective to reinforce the HDPE pipes in the ground subsidence condition, in terms of reducing vertical displacement and circumferential strain of the pipes. The pipe protected by the geotextile performs better than that reinforced by the geogrid.