Monday 3/13/2017

9:45–11:15 a.m.

Slope Stability and Stabilization 1

Chairs: Binod Tiwari, California State University, Fullerton; Beena Ajmera, California State University, Fullerton

Effect of Infiltration from Retrofit Rain Gardens on Slope Stability

Zachary Zukowski and Andrea L Welker, Villanova University

The use of sustainable practices in infrastructure improvements has been progressing in practice. Rain gardens are one type of sustainable stormwater control measure (SCM) used to control rainfall runoff. Rain gardens that are constructed without liners will infiltrate water to recharge the underlying aquifer. The geotechnical changes, which come with these hydrological changes, must be considered when installing rain gardens near infrastructure such as pavements, slopes, and foundations. In this study, a model was produced in GeoStudio 2012 to show how infiltration from a rain garden can affect slope stability. Decreases in slope stability from rain garden infiltration were quantifiable, implying that these types of models should be considered during the design phase of retrofit rain gardens because engineers that designed existing infrastructure likely did not consider additional infiltration from green infrastructure.

Cleveland Harbor, Ohio Interim Dredge Disposal Plan: Geotextile Reinforcement of Raised Dredged Disposal Containment Dikes

Eugene Lenhardt, U.S. Army Corps of Engineers, Buffalo District

The U.S. Army Corps of Engineers, Buffalo District, performs yearly maintenance dredging in the Cuyahoga River federal navigation channel in Cleveland, Ohio. Up to the present, the Corps has disposed of dredge material in three diked rubble mound (armor and fill stone) confined disposal facilities (CDFs) in Cleveland Harbor, Ohio. In 2003, it became evident that capacity in these facilities was rapidly being depleted. To provide more capacity, the facilities were vertically expanded with raised earth dikes: the first was CDF 12, constructed in 2008; the second was CDF 9 in 2010. This paper discusses the engineering analysis performed using geotextile reinforcement for raised CDFs and stabilization. It presents a design approach for geotextile reinforced embankments considering rotational mode of failure using GEO-SLOPE International Ltd.'s SLOPE/W software.

Stability Analysis and Support Assessment in Rockfall Zone

Altaf Usmani, Chandan Kumar, and Atul Nanda, Engineers India Ltd.; Anirban Mandal, Visvesvaraya National Institute of Technology Nagpur

This paper presents a case study of a large wedge failure occurred during excavation of the last bench of storage cavern with an approximate dimension of 80 m length and up to 20 m height with a depth of 8 m. The adopted intervention followed a structured approach, which included immediate rock support, geotechnical and geological investigations in the failure zone and design modifications. Back analyses of the failure zone were also carried out to assess design parameters in failure zone. Final design in the failure zone was carried out using modified design parameters, which included shorter benches, rock support installation schemes such as longer rock bolts, reinforced ribs of shotcrete and reduced construction advances. Geotechnical monitoring in and around failure zone were carried out for

recording any alarming movements in the rock mass. The paper discusses the failure, investigation, analysis, design, back analysis, remedial measures and results of geotechnical monitoring carried out.

Resilience of Transportation Network from a Geotechnical Perspective

MIna Lee and Dipanjan Basu, University of Waterloo

Climate change, and natural and man-made disasters cause failure of crucial geotechnical components in civil infrastructure systems, which may result in catastrophic damage not only to the civil infrastructure but also to local communities. For example, road embankments provide structural support to transportation infrastructure; thus, they greatly influence the mobility of public to access essential human needs such as food, shelter, work, and medical care. The concept of resilience, which is defined as the ability to absorb, recover from, and adapt to disruptions, introduces a new paradigm to overcome challenges with inevitable disruptive events arising from climate change, natural and man-made disasters. In this paper, a quantitative framework is proposed for evaluating the resilience of geotechnical infrastructure along with consideration of its sustainability. The framework is demonstrated through a hypothetical case study based on a selected road network in the province of Ontario, Canada.

Geological, Topographical and Seismological Control on the Co-Seismic Landslides Triggered by the 2015 Gorkha Earthquake

Binod Tiwari, Beena Ajmera, and Smriti Dhital, California State University, Fullerton

The 2015 Gorkha Earthquake struck Nepal on April 25, 2015 leaving over 22,000 people injured and almost 9,000 people dead in addition to damaging many buildings. The earthquake was also followed by more than 400 aftershocks, the largest of which occurred on May 12, 2015. A major concern was the potential for landslides following the 2015 Gorkha earthquake and its aftershocks. This study details a geospatial landslide database, containing over 4,000 post- Gorkha Earthquake landslides that was developed using high resolution Google Earth images and helicopter surveys conducted during the post-earthquake reconnaissance. The geological, topographical and seismological patterns of the co-seismic landslides are discussed. The results show that the majority of the landslides were observed in the area between the epicenters of the main shock on April 25th and the major aftershock on May 12th with the most landslides observed in the Gorkha, Sindhupalanchowk, and Dhanding districts. Further analysis revealed that most of the landslides occurred in gneiss, migmatite formations followed by those in quartzite materials.

Dam Failures From a 1,000-Year Rainfall Event in South Carolina

Inthuorn Sasanakul, Sarah Gassman, Charles Pierce, Emad Gheibi, Wiliam Ovalle, Mostaqur Rahman, and Ryan Starcher, University of South Carolina

A series of devastating dam failures caused significant damage to communities throughout South Carolina in October 2015. The South Carolina Department of Health and Environmental Control (SC-DHEC) reported a total of 47 dams breached, with 22 of them located in the Columbia area. South Carolina has at least 2,500 dams, of which, 205 are classified as high-hazard potential structures. Many of these dams are privately owned and often lack the attention and funding needed for maintenance, monitoring, and upgrades. This paper presents results from a post-flood reconnaissance study aimed to collect perishable data from select dams that failed during the extreme flooding in Columbia. The study included collection of extensive photographic evidence and documentation of descriptive information

related to the failure; collection of soil samples, and field and laboratory geotechnical tests. These data form valuable sets of well-documented case histories that can be used in the future to support large-scale research for advancing our fundamental understanding of complex failure mechanisms in extreme scenarios.