Vancouver Geotechnical Society
A Local Section of the Canadian Geotechnical Society

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NOTICE OF UPCOMING TECHNICAL PRESENTATION
Wednesday, 27 April 2022

TOPIC: **Liquefaction-Induced Downdrag on Piles: Centrifuge and Numerical Modeling, and Design Procedures**

SPEAKER: **Sumeet Kumar Sinha, Ph.D. – Post Doctoral Scholar, University of California Berkeley.**

Sumeet Kumar Sinha is a postdoctoral scholar in Soga Research Group at the University of California Berkeley working on the development of distributed fiber optic sensing system and its application to geo-systems. He received his undergraduate degree from the Indian Institute of Technology Delhi and MSc and Ph.D. from the University of California Davis. He also holds a minor degree in computer science and engineering. His research experience includes: Experiments - on centrifuge modeling, Numerical - on development of soil-structure interface models and Real-ESSI Finite Element Simulation system, Design Procedures - on pile design and redistribution effects, and Sensing - on non-contact methods of measuring displacement. His interest lies in Liquefaction, Pile Foundation, Earthquake Engineering, Soil-Structure Interaction, Computational Geomechanics, and Sensing Technologies.

CONTENT: Pile foundations are designed to transfer superstructure loads through positive skin friction and tip resistance while undergoing acceptable settlements. For sites with liquefiable soil, estimating drag load (from soil reconsolidation) and pile settlement (from seismic loads, reduced pile capacity from excess pore pressures, and downdrag) becomes an important design consideration. Most of the challenges related to the liquefaction-induced downdrag phenomenon are the incomplete understanding of the different mechanisms that affect drag load and pile settlement leading to over-conservative or unsafely designed piles. A series of centrifuge model tests were performed on liquefiable soil deposits to assess liquefaction-induced drag load and pile settlement, understand the mechanisms of pore pressure generation/dissipation, and soil/pile settlement during and after a shaking event. A numerical modeling approach, dynamic TzQzLiq analysis, was developed incorporating the observed mechanism and validated with centrifuge test results. It consisted of the existing TzLiq and a new QzLiq material (implemented in OpenSees), which accounted for the changes in the pile's shaft and the tip capacity as free-field excess pore pressures develop/dissipate in soil, initial drag load on piles, and sequencing of excess pore pressure and soil settlement. Results provided time-history of axially loading distribution and settlement of piles during an asking event. Finally, a displacement-based procedure was proposed for industry using a simplified pseudo-static (four-step) TzQzLiq analysis for designing axially loaded piles subject to seismic loading and liquefaction-induced downdrag. The redistribution of high pore pressures from liquefiable to adjacent non-liquefiable deposits also impacted pile performance significantly. Therefore, an analytical procedure was also developed to estimate excess pore pressure redistribution in liquefiable and non-liquefiable layers.

DETAILS: **Technical Presentation: 5:30 p.m. to 6:30 p.m.**
Link: https://attendee.gotowebinar.com/register/7462499089541578508