CEE 595F – Geotechnical Seminar – ONLINE

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Durability of Entrapped Gas for Induced-Partial-Saturation Applications

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Abstract: Induced partial saturation (IPS) is a nascent method to suppress the generation of excess pore-water pressure and increase the liquefaction resistance of loose granular soils. Mechanical benefits associated with IPS are linked to the persistence of entrapped bubbles. Civil infrastructure operates for decades, often longer than a century. Thus, the longevity of gas is a salient consideration for adoption of IPS in practice. Modeling the physical and chemical mechanisms that influence the persistence of entrapped bubbles is a practical avenue to address gas durability on these time scales, a limitation of physical experiments. The governing aqueous-phase advection-diffusion processes and interphase gas kinetics associated with bubble dissolution are simulated in a finite-difference numerical framework, validated with elemental and bench-scale experiments, and then extended to address soil resaturation rates under different subsurface conditions. The study demonstrates that emplaced gas is durable to the extent where diffusion-induced and groundwater seepage-induced dissolution should not discourage advancement of IPS, but illustrates that it will not remain indefinitely. Potential solutions to mitigate the decay of a gassy soil layer are discussed.

Speaker Bio: Aaron Gallant is an Assistant Professor of geotechnical engineering in the Civil and Environmental Engineering Dept. at University of Maine (UMaine). He received a B.S. in Civil Engineering from Tufts University in 2009 and M.S. and Ph.D. degrees in Civil Engineering from Northwestern University in 2011 and 2014. Prior to joining UMaine in Fall 2016, he worked as a practicing geotechnical engineer at CH2M Hill (now Jacobs) working on a variety of geotechnical projects in the transportation and water industries. Professor Gallant provides instruction in the area of geotechnical engineering and performs research on a broad range of topics, including foundation engineering, ground improvement, and natural hazards such as earthquake-induced landslides and tsunami loading. He is also a technical thrust lead in the area of "New Systems for Durability and Longevity" for the Transportation Infrastructure Durability Center (Region I University Transportation Center), led by UMaine. He has received recognition for mentoring graduate students and research, including UMaine's "Faculty Mentor Impact Award," the Advanced Structures and Composites Center "Director's Award for Outstanding Faculty Member," and the "Young Professor Paper Competition Special Recognition Award" from the Deep Foundations Institute.