The Geo-Institute Sustainability in Geotechnical Engineering Technical Committee will live-stream the session **"Recent Advances in Shallow Foundations"** on Friday, December 6, at 2 PM EST. The topics include:

"Design of Stiffened Slabs on Grad" **Jean-Louis Briaud**

When a light building is to be founded on a shrink swell soil where the water table is at some depth, the soil layer between the foundation level and the water table can shrink and swell during the seasons. This induces a soil movement under the foundation which is larger at the edges than at the center of the foundation; this distorts and potentially cracks a brittle structure. The role of the foundation is to be stiff enough to minimize that distortion to an acceptable level. Stiffened slabs on grade sometimes called waffle slabs consist of deep beams in both directions covered by a thin slab on grade. Limiting the deflection at the edges of the slab is the basis for the design of such foundation which are common for one to three stories light buildings such as houses and warehouses. The presentation describes a method which has been developed over years of research to calculate the required depth of the beams. Given the load on the slab, the method called TAMU-Slab allows the engineer to calculate the bending moment, the shear force, and the deflection in the beam. Given the distortion criterion, it iterates on beam depth until the criterion is satisfied. The parameters involved in the calculations include the depth of the active zone, the change in water content or water tension in the soil, the beam spacing, the structural load, and the distortion criterion. The output is the beam depth. Two case histories are presented to illustrate the design.

"Interpretation of Level Surveys for Moisture-Sensitive Unsaturated Soils" **Sandra Houston**

The demerits of level surveys for assessing foundation movements associated with moisture-induced volume change of soils have been well discussed and debated in the literature. In spite of the limitations of level surveys, and the associated strong desirability of benchmarked survey data for assessment of foundations movements on moisture sensitive soils, unbenchmarked level surveys continue to be used in forensic studies of buildings damaged by expansive and collapsible soils. The common uses and limitations of level survey data are briefly reviewed, and unbenchmarked level survey data are presented and discussed for three different cases of residential structures founded on collapsible and/or expansive clays. The level survey data are used, together with other available sources of information, in developing plausible explanations for building damage resulting from soil-wetting-induced differential movement of the structures.

"Modeling Residential Buildings on Expansive Soils in Response to Climatic Conditions" **Xiong Zhang**

Expansive soils are some of the most widely distributed and costly natural hazards. Expansive unsaturated soils cover one-fourth of the United States and undergo large amounts of heaving and shrinking in response to seasonal variations of climatic conditions. These movements lead to cracking and buckling of the structures built on expansive soils and result in billions of dollars of damage annually. Though expansive soils have been studied for several decades, it remains a great challenge to accurately predict expansive soil movement and subsequent structural performance under real climatic conditions due to the complex nature of structures built on expansive soils. In this study, an integration of multi-disciplinary techniques was established to investigate the behavior of residential buildings on expansive soils. A coupled hydro-mechanical stress analysis was used to simulate the volume change of expansive soils due to both mechanical stress and water content variations. The soil-structure interaction and structure behavior were then simulated using coupled hydro-mechanical stress jointed elements and general shell elements. The analysis incorporated the effects of climate, materials, construction, and structural factors including daily weather data such as rainfall, solar radiation, air temperature, relative humidity and wind speed, soil stiffness and permeability, moisture distribution and variations in the soil, structural loads and rigidity, vegetation, and landscaping. The approach was further verified using measured data at an experimental site. The presentation uses residential buildings built on expansive soil as an example. However, the approach proposed can be used for other structures/infrastructure built on both saturated and unsaturated soils.

"Levee Foundation and Seepage Investigation Using Electrical Resistivity Imaging" **Hossain, J**

A levee may be composed of multiple features acting as a physical barrier to prevent water from entering the leveed area. It is important to identify the lateral and vertical extent of seepage water to properly design these levee features. The current industry practice involves performing geotechnical drilling on the levee to assist in the design of such features. However, geotechnical drilling provides information only at one point and interpolation and engineering judgement is required to establish the possible subsurface condition between the boreholes. The current case study focuses on the use of geophysical methods in addition to geotechnical drilling to establish a continuous image of subsurface condition for the Evaluation of the Levee Seepage and Stability at both embankment and foundation soil. Multichannel Electrical Resistivity Imaging (ERI) was used for enhanced mapping of lateral and vertical variations in subsurface and extent of the seepage zone at the Levee and Foundation Soil. Based on the ERI results, soil test borings were performed within and outside of the seepage zone to obtain physical properties of the subsurface soil strata. Seepage analyses were performed in GEOSLOPE which matched the observed phenomena in the field. The benefit of the current approach to designing different levee features is discussed.

"Mapping Voids under the Existing Foundations using a combination of Ground Penetration Radar and Electrical Resistivity Imaging Methods" **Khan, S**

Voids can undermine soil and foundation stability, leading to sudden collapses or gradual settlement. In transportation infrastructure, unnoticed voids can cause road subsidence, bridge failures, or tunnel collapses, resulting in disruptions and significant safety concerns. This study explores the effectiveness of combining Electrical Resistivity Imaging (ERI) and Ground Penetrating Radar (GPR) for detecting and characterizing subsurface voids at shallower depths at a construction site. Using a comprehensive approach, the research conducted surveys in both longitudinal and horizontal directions. The results revealed strong correlations between ERI and GPR data, effectively identifying voids at various depths and detecting extensions of void influences beyond initial areas. The integration of ERI and GPR proved highly effective in distinguishing between void and non-void areas, offering a more reliable and detailed subsurface assessment than either method alone. This study advances geotechnical engineering by demonstrating that combining ERI and GPR enhances project safety, reduces unexpected costs, and improves infrastructure sustainability. The integrated approach facilitates early detection and characterization of subsurface voids, providing a robust method for mitigating risks associated with underground anomalies in construction and transportation projects.