6th Annual Web Conferences 2020
Technical Committees

Live Streaming Daily – Technical Case Studies

December 6 – 10, 2021

The Geo-Institute Sustainability in Geotechnical Engineering Technical Committee will live-stream the session "*Recent Advances in Sustainable Approaches to Geotechnical Engineering Works*" on Friday, December 10 at 11 AM EST. The topics include:

"*Sustainable Practices in Geotechnical Engineering*," **Dipanjan Basu**, Ph.D., P.E., M.ASCE

Sustainability is a normative concept that focuses on managing resources in such a way that guarantees welfare and promotes equity of current and future generations. Naturally, sustainability attempts to prevent the detrimental effects of anthropogenic development on the environment and society at multiple levels, and promotes development that balances the three Es – environment, economy, and equity. Resilience is a descriptive concept often closely associated with sustainability. Resilience is mostly understood as the ability of a system to "bounce back" to normal functionality when subjected to disruptions. In the context of infrastructure, resilience can be understood as the ability of a system to withstand disruptions and continue to function by rapidly recovering from and adapting to the disruptions. It is necessary to develop resilience in civil infrastructure systems as the effects of climate change are becoming more and more apparent, and the frequency of natural disasters are increasing. Geotechnical engineering practices contribute significantly to global pollution and consume significant amount of natural resources. At the same time, geotechnical engineers play a significant role in disaster mitigation. Thus, sustainable practices within geotechnical engineering are extremely important. In this presentation, the perspectives on sustainability and resilience and their connection to geotechnical engineering will be provided. How practices can be made sustainable within geotechnical engineering will be briefly outlined.

"*Addressing Sustainability as a Ground Contractor*," **Kimberly Martin**, Ph.D, P.E., M.ASCE

At Keller we have taken on the challenge of addressing sustainability through focusing on the UN Sustainable Development Goals for which we believe we can have the largest impact. From an environmental perspective we focus on doing less harm; from a social perspective we focus on having a positive impact on our employees and communities. This talk will describe case studies where we have successfully decreased our emissions, our initiatives in the environmental and social areas, the challenges we have in affecting change in our industry, and the goals we have for the future.

"*Geothermal Energy: A Renewable and Sustainable Source to Heat and Cool the Building's Envelope*," **Omid Ghasemi-Fare**, Ph.D., P.E., M.ASCE

This research analyzes heat exchange in the ground and through geothermal piles by developing a numerical model that can capture all key features of heat transfer through these piles. The developed model effectively simulates complex heat and fluid flow in the ground surrounding a heat source. In this presentation, the heat transfer mechanism in dry, saturated, and unsaturated soils will be discussed. In saturated soil with high permeability (e.g., sand), temperature increments change groundwater density and therefore might create thermally driven pore fluid flow. The thermally induced pore fluid flow in sand facilitates heat transfer in the ground and results in heat convection even under hydrostatic conditions. However, in unsaturated soil, thermal loading induces moisture and vapor flow and results in soil drying close to the geothermal heat exchangers. Therefore, a precise hydro-thermal model must be considered to accurately simulate the heat transfer in the ground. Besides, in this presentation, the efficiency of the ground source heat pump systems and the relative effect of different input parameters on the thermal performance of these systems will be discussed.

"*The "Green" Lightweight Contender*," **Archie Filshill**, Ph.D., P.E., ENV SP. M.ASCE

Ultra-Lightweight Foamed Glass Aggregates (UL-FGA) are produced from 100% post-consumer recycled glass. The aggregate is highly frictional and when combined with a low unit weight and excellent insulating properties, it makes foamed glass aggregate ideal as a lightweight or insulating fill material. Although relatively new to the US market, UL-FGA has been successfully used in Europe for over 25 years for both infrastructure and commercial development projects. Since its introduction to North America, UL-FGA has been used on numerous State DOT projects, commercial development projects, and residential construction throughout the

USA. This presentation will review UL-FGA material properties, applications and relevance within both the LEED and ENVISION framework.

"*Field Study of Recycled Concrete Aggregate in French Drain*," **Boo Hyun Nam**, Ph.D., P.E., M.ASCE

A field study of recycled concrete aggregate (RCA) in French drains was conducted to evaluate in situ exfiltration drainage performance of RCA as a pipe backfill material. The project was aimed at: (a) developing field test protocols to measure the exfiltration drainage performance of the RCA French drain, (b) long-term monitoring (12 months in this study) of the field drainage behaviors of RCA French drains, and (c) investigation of clogging buildup in the drains over time. Four French drains were designed and constructed with different aggregate type and condition, which involve limestone, RCA 'as is', RCA with 2% fines, and RCA with 4% fines. Field and laboratory tests were conducted. First, the flow rate and discharge rate of French drains were monitored for 12 months to evaluate the short- and long-term performances of RCA French drains. Second, permittivity testing was conducted on the geotextile samples taken from the four French drains after 12 months of field conditioning. Third, visual inspection inside the pipes was conducted at 3, 6, 9, and 12 months. Lastly, X-ray diffraction (XRD) tests were conducted on RCA field models, which were embedded underground for 6, 12, and 18 months to identify re-cementation and calcite precipitation. The results of laboratory and field tests indicated that the drainage performance of RCA French drain is mainly controlled by soil conditions (e.g., groundwater table, permeability of surrounding soils, etc.) and the amounts of excessive fines in the drain system; however, the aggregate type is not a critical factor affecting exfiltration drainage performance. Therefore, it was concluded that RCA in French drains performs similarly to limestone and causes no significant reduction in exfiltration drainage performance.