The Geo-Institute Sustainability in Geotechnical Engineering Technical Committee will live-stream the *session "Adaptive use of Energy, Infrastructure and Materials for a Greener Future"* on Thursday, December 11, at 2 PM EST. The talks include:

Talk # 1: *Energy Harvesting through Thermo-active Foundations - Review, Analysis, and Modeling*
(Presented by *Omid Ghasemi*, Ph.D., M.ASCE)

Geothermal piles—foundation elements designed to exchange heat with the ground—provide an effective solution for harvesting shallow geothermal energy, as ground temperatures remain relatively stable beyond a few meters below the surface. This study presents and validates numerical models to simulate heat transfer between geothermal piles and surrounding soil, with predictions compared against analytical solutions, field data, and laboratory tests in various soil conditions. While natural convection is known to significantly influence heat transfer in saturated soils under hydrostatic conditions, its role alongside forced convection due to groundwater flow has often been overlooked. This study demonstrates that even in the presence of unconfined groundwater flow, natural convection can meaningfully affect the soil temperature distribution near embedded heat sources, emphasizing the need to account for both mechanisms in geothermal pile design.

***Talk # 2: Foundation Reuse – is there a movement* (Presented by *Gerald Verbeek*, M.ASCE)**

Normally when there is movement in a foundation it is bad news, and would require immediate corrective action before it can continued to be used, let alone reused. However, when there is movement in foundation reuse it is good news, as it provides an potential option to improve not only the economics of new construction projects, but also the carbon footprint of these projects. In this presentation recent developments in the area of foundation reuse will be discussed with a special emphasis on developments in the United States.

Talk # 3: *Advancing High-Frequency Ultrasonics for Sustainable Infrastructure Assessment* (presented by *Giovanni Cascante*, Ph.D., P.Eng)

The growing number of civil infrastructure failures—driven by aging, seismic activity, and climate change—underscores the urgent need for reliable, noninvasive condition assessment methods. High-frequency ultrasonic testing holds significant promise as a nondestructive evaluation (NDE) tool, offering the potential to detect internal damage without dismantling or disturbing the structure—supporting longer infrastructure lifespans and reduced environmental impact. Despite their widespread use, current ultrasonic methods often struggle with accuracy due to complex wave-material interactions and limitations in interpreting wave velocity and

attenuation data. Our research addresses this challenge by enhancing the reliability of ultrasonic NDE techniques through the integration of advanced technologies, robust experimental and numerical modeling, and modern signal processing approaches, including artificial intelligence.

We employ high-frequency ultrasonics, ultrasonic photoelastic imaging (UPI), and laser vibrometry with fiber optics to improve damage detection in concrete, asphalt, wood, and earthen structures. By correlating wave behavior with structural conditions, our work improves the understanding of wave propagation in heterogeneous, dissipative materials.

This presentation outlines our approach to ultrasonic transducer characterization, wave-material interaction modeling, and validation using both lab-scale and field-scale testing. The findings demonstrate that high-frequency ultrasonics, when properly applied, can significantly enhance the reliability of NDT methods—supporting more sustainable, cost-effective infrastructure management.

Talk # 4: *Utilization of Recycled Concrete Aggregate Fines for Enhancing Sustainability and Durability of Transportation Infrastructure* (presented by Nripojyoti Biswas, Ph.D., M.ASCE)

Transportation infrastructures such as pavements founded on weak subgrades often deteriorate under cyclic environmental stressors, compromising long-term serviceability and durability. Incorporating recycled concrete aggregate fines (fRCA), a byproduct of concrete demolition, as a co-additive alongside low-carbon Portland Limestone cement (PLC) stabilizers offers a sustainable solution that diverts millions of tons of concrete waste from landfills each year. To evaluate this approach, a research study was performed to treat expansive soils with optimized dosages of fRCA and PLC and conducted an array of engineering tests—including strength, stiffness, wet–dry and freeze–thaw durability - to assess mechanical performance and long-term resilience. Microstructural analyses including scanning electron microscopy and thermogravimetric analysis elucidated the mechanisms behind strength gains and enhanced durability after just seven days of curing. Finally, a cradle-to-site Life Cycle Sustainability Assessment, combining Life Cycle Analysis and Life Cycle Costing, compared different treatment techniques with Ordinary Portland Cement, PLC alone, and PLC+fRCA. Results show that PLC+fRCA stabilization not only matches or exceeds the engineering performance of conventional methods but also reduces environmental emissions and life-cycle costs, making it a promising strategy for more sustainable pavement subgrades.