The Geo-Institute **Engineering Geology and Site Characterization** Technical Committee will live-stream the *session* ***"Site Characterization Topics and Engineering in Complex Geology"*** on Tuesday, December 9, at 2 PM EST. The talks include:

Talk #1: ***Site Investigation Tools of the Future: Advancing Geoprofessional Practice*** **(Presented by Kelly Cabal, M.ASCE and Joseph Bindner, Ph.D., P.E., ConeTec)**

In this webinar, ConeTec will explore innovative advancements in site investigation technologies that are set to propel the geoprofessional industry into the future. We will introduce two cutting-edge tools: the Thermal Probe and Magnetic Resonance technology. We will also highlight the industry shift towards cleaner energy and robotics in site investigation practices. These technologies aim to enhance the accuracy, efficiency, and sustainability of site investigations. Join us to learn how these advancements can address current challenges and drive the industry forward, while also discussing the broader trends towards hybrid and automated equipment for a cleaner and safer future.

Talk # 2: ***Particle Size Effects on Large-Diameter Penetrometers*** **(Presented by Andy Kost, P.E. Cornforth Consultants/Landslide Technologies)**

The penetration resistance of soil is often correlated with a soil's state and mechanical properties. Standardized methods of measuring penetration resistance can include cone penetration testing (CPT), standard penetration testing (SPT), and Becker penetration testing (BPT), among others. From a given standardized penetration resistance, a variety of published relationships exist that allow a practitioner to estimate soil characteristics such as relative density, unit weight, strength, and compressibility.

The selected penetrometer (i.e., the probe) must be large enough relative to the representative grain size of the tested materials (i.e., the particle) to provide an accurate penetration resistance. Soil particles which are large in relation to the penetrometer can increase the measured penetration resistance, resulting in a misinterpretation of strength, stiffness, or other correlated properties. The influence of this probe-to-particle ratio results from alterations to the shear bands that form around the probe as the penetrometer advances through the soil. Such effects have been widely noted for SPTs in gravel-containing soils (e.g., Harder, 1988; Ghafghazi et al., 2017) and have also been demonstrated for CPTs (e.g., Sturm, 2019). Similarly, large particles (e.g., >2-inches) can also influence larger penetrometers such as the BPT.

This presentation will discuss published methods of evaluating particle size effects on small-diameter penetrometers, such as the CPT. A recent case history will demonstrate how these approaches were

extended to a large-diameter penetrometer - the BPT. This case history will also discuss practical considerations for interpreting particle-size effects on penetration data and the potential for relative density and gradation shape to influence the magnitude of the probe-to-particle ratio effect.

Talk # 3: ***Evaluation and Stabilization of the Dakota-Federal 42X-36 Well Pad, Dunn County, North Dakota*** **(presented by Charles D. Hubbard, P.E., P.G., M.ASCE – Principal Engineer, Braun Intertec)**

The Dakota-Federal 42X-36 well pad lies within a North Dakota Geologic Survey landslide hazard area dominated by soft rock of the Sentinel Butte Formation. Built in 2009, the pad experienced multiple ground movement events soon after that were unsuccessfully mitigated. Braun Intertec instrumented and began monitoring the pad in 2020 to detect threats to the parent well while further stabilization alternatives were evaluated. No disturbance was allowed downslope from the pad in areas considered most vulnerable to ground movement and most impactful to pad stability. Construction loads including 100,000-pound trucks, cranes, and sand storage bins, as well as a 1,000,000-gallon water storage tank, had to be accommodated. The chosen alternative was a 700-foot long, 16-foot high anchored soldier pile wall to retain the pad and accommodate as deep a cut as allowed downslope from the pad. The wall was comprised of 95 drilled shafts reinforced with HP 14x89 or 14x73 piles, and 190 52/26 hollow bar anchors installed 5 and 12 feet below the tops of the piles. Drilled shaft installation began in May of 2022 but was interrupted in June by another significant ground movement event that required additional temporary stabilization efforts to arrest so that wall construction could resume. This was accomplished by cutting grades down through the destabilized work area and driving 98 HP 14x89 piles downslope from the work area. Wall construction resumed and was completed in August of 2022. Pad monitoring continued to verify post-stabilization wall, pad, and slope performance. To-date, neither the wall nor grades upslope or downslope from the wall have moved. Unforeseen conditions requiring further mitigation have included limited ground cracking adjacent to the toe of the wall from downslope unloading, and the loss of pad berm backfill through lagging from the required impoundment of pad surface drainage.

Talk # 4: ***Setting the Foundation: Key Advantages of Early Geotechnical Investigation in a Bi-State Bridge Project (Without State Agency Oversight)*** **(presented by Nathan Villeneuve, RG, M.ASCE - Senior Geologist, CEG – Geotechnical Resources Inc. (GRI) and Michael Shannon, P.E. – HNTB)**

This presentation explores the strategic importance of early geotechnical information in the preliminary design phase of the ongoing bi-state Hood River – White Salmon Bridge replacement project. The replacement bridge is currently being delivered using the Progressive Design-Build method. Uniquely, the project spans both a major river and state lines yet is managed by the relatively small Hood River – White Salmon Bridge Authority. The presentation will discuss our current approach to developing project criteria and preliminary design and highlight how key steps, such as a proactive subsurface investigation, have informed critical design decisions and risk management strategies. By sharing lessons learned from this ongoing project, we hope to provide valuable insights for practitioners involved in similar projects.