**Advancing Vane Shear Testing: Development and First Field Application of a Piezometer Vane (eVSTu)**

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# ABSTRACT

This paper presents the development and initial field deployment of a prototype variable rate piezometer vane shear test device (VR-eVSTu) designed to measure porewater pressure (PWP) on the vane blade edge during insertion and shearing of soils or tailings in the field. The device was developed to address drainage uncertainties when conducting vane shear testing, in materials such mine tailings, intermediate soils, and dredge materials. Due to the higher permeability exhibited by these materials, standard vane shear protocols—originally designed for clayey soils—can result in partially drained shearing, leading to elevated torque measurements and potential overestimation of undrained shear strength. It has become common practice to undertake VST at variable rotation rates to achieve undrained shearing during the test.

To ensure compatibility with existing VST results, the VR-eVSTu was designed to comply with standard vane dimensions, while integrating additional instrumentation. In addition to recording porewater pressure and torque during shearing, the PWP response is recorded during insertion. In instances where a significant excess porewater pressure was observed during insertion, it was allowed to dissipate before rotation.

The first field campaign was conducted in tin tailings and included testing both fine and coarse fractions in the tailings storage facility. Vane testing was performed at variable rotation rates between 6°/s and 30°/s, and considered both peak and remoulded strengths. These speeds were selected to minimize drainage effects. Observations of induced pore pressure, or lack thereof, during vane insertion and shearing can provide insights into whether materials are undrained, partially drained, or freely draining. By integrating porewater pressure measurement during shearing, the eVSTu has the potential to offer insights into the brittleness, sensitivity, consolidation, and large strain behaviour.