Cone penetration testing of gold tailings in a small calibration chamber

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ABSTRACT

Assessing the stability of tailings dams is often difficult, due to the continuous changes in the hydro-mechanical conditions within a dam. This time-dependent tailings state can be monitored using automated piezometers to provide an indication of pore water pressure, complemented by in situ testing. For such testing, the cone penetration test (CPT) is preferred, mainly because of worldwide availability, and the rich database of correlations and interpretations from CPT data available to practitioners.

Most of the cone penetration test correlations have been made for either sands or clays, whereas many tailings are predominantly silts or silty sands. Existing correlations are also primarily for soils tested in denser states than those found in many tailings storage facilities, that have been built using hydraulic deposition techniques.

This paper discusses cone penetration test correlations for loose gold tailings that were developed within a critical state soil mechanics framework. The development of a new calibration chamber for cone penetration testing that consists of a modified triaxial cell is described. Some of the early development and commissioning issues that were encountered, as well as the solutions adopted are outlined, including the system to prepare the samples and to acquire high-quality data from the testing. Also, the triaxial laboratory testing required to achieve the critical state line is described, including some of the basic precautions considered necessary as good practice. Additionally, the system adopted for volume tracking of the calibration chamber sample is described, which is essential for ensuring a reliable state parameter comparison against the cone penetration test data that is acquired. Finally, some laboratory test data from the calibration chamber is plotted against the soil behaviour type charts currently available from various authors.