A tool to help improve the understanding of the brittleness of tailings materials

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# ABSTRACT

The International Commission on Large Dams (ICOLD), in Bulletin No. 194, has provided updated guidance on assessing brittle and ductile behaviour. ICOLD recognised different opinions within the geotechnical engineering profession on applying the classical Bishop’s brittleness index and highlighted that conventional approaches may not directly address the strain aspects related to brittleness. The Global Industry Standard on Tailings Management (GISTM) requires that brittle failure modes be identified and addressed with conservative criteria. In ICOLD words, *there is currently very little guidance in the technical literature* [to guide brittle behaviour identification]. ICOLD also provided stress-strain curves of ductile and brittle materials. This paper explores the development and early work of a laboratory testing technique that aims to provide insights into tailings' brittle behaviour. An approach that integrates elements of stress-strain, such as the triaxial test, is combined with the mini-vane shear test. This combination of triaxial and vane shear tests is named Trivane. It involves a vane shear mechanism inside a triaxial chamber, allowing for shear strength measurements using a vane shear under controlled confining pressures. This enables a more refined prediction of undrained shear strength for future dam construction stages. Current field vane and laboratory vane shear testing only allow testing at surface conditions in the case of conventional mini-vane laboratory testing and as-built conditions in the case of field vane testing. This study describes the development of the tool and presents early results in well-behaved Kaolin clay and the initial test trials with tailings materials. The paper summarises the learnings and future work required to help bridge the gap highlighted by ICOLD.