Some considerations on the characterisation of subaqueously-deposited silts

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ABSTRACT

Many of the relevant engineering behaviours of tailings are controlled to a large degree by the density. For example, loose tailings are prone to shear-induced pore pressures and potentially brittle strength loss, while dense tailings are dilative (i.e. gain strength) at large shear strains. The critical state framework has been successfully developed over the past few decades to assess whether in situ conditions are contractive or dilative, and estimate relevant engineering parameters on that basis. Tailings comprising primarily silt-sized particles, when subaqueously deposited, often form a particularly loose state compared to subaerially deposited material of similar index properties. Such subaqueous deposition occurs in the decant pond area, where the tailings typically pluviate in quiescent conditions within a pond of standing water. Silt tailings deposited in such a manner have been observed to be extremely loose in a number of TSF investigations. Of particular concern, the deposited material in such cases appear to be significantly looser than can be reproduced in the laboratory - even using moist tamping, the sample preparation method which can usually produce the loosest samples possible in laboratory conditions. While the loose density of subaqueously deposited silt tailings is clear, in a well-managed upstream-raised TSF the decant pond is usually small and far from the perimeter embankment. However, there are a number of examples where the engineering performance of such materials becomes relevant – for example, when historical deposition practices were poor, resulting in subaqueous deposition near the perimeter embankment. This paper outlines the geotechnical characterisation of a number of such subaqueously-deposited zones, compares the in situ state to that achievable in the laboratory, and discusses options for assessing the expected engineering performance of such materials when laboratory tests from the same state are unavailable.