Contractive Behaviour in Compacted Earthfill and Lessons for Embankment Stability

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# ABSTRACT

This study addressed potential contractive behaviour in compacted earthfill. The transition from dilative to contractive behaviour has been given some attention lately. The question is typically applied to tailings and foundation materials. Less thought is given to the behaviour of compacted earthfill. However, yield stress can be reached within embankments as low as 10m high. Failing to see this could increase the risk of embankment failure. This is an important topic where dams are incrementally raised. The topic was investigated at an existing Tailings Storage Facility. The main embankment comprised a starter dyke and three upstream raises. The hypothesis was that contractive behaviour was possible within the lower embankment. This was tested by estimating the yield stress of the compacted earthfill. Undisturbed and recompacted samples were tested. Parallel strength and consolidation tests were run. Results showed that local zones could become contractive. Yield stress was relatively consistent and typical values were in the range of 200kPa to 300kPa. This was an apparent preconsolidation due to compaction. The results were used to develop a hybrid strength model which considered both contractive and dilative behaviour. The model was then applied in an embankment stability assessment. Challenges included capturing evolution of the yield surface, treatment of pore pressures, and mapping between normal and consolidation stresses. The work is significant because contractive earthfill behaviour is typically overlooked. Key learnings relate to applying a hybrid strength model in embankment stability assessment.