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Scour Around Bridge Piers in Fluvial Sediments

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ABSTRACT

Scour at piers embedded in a bed of cohesive sediment mixture was investigated to quantify the effects of bed compaction. Experiments were conducted in a large rectangular laboratory flume, with natural clay sediment collected from a stream located at the Chilean coastal range. Non-intrusive and high-resolution topographic measurements of scoured bed in the vicinity of simulated piers were performed during the experimental runs with a laser distance sensor (LDS) that was traversed by precision step-motors. Measurements were taken by the LDS in different azimuthal half-planes to study the spatio-temporal variation of the topography of evolving scour holes. Experiments were conducted over 40 h, until an advanced stage of scour was reached, with the approaching flow having a bed shear stress equal to 95% of the Shields critical condition for the initiation of motion of sand in a sand-clay mixture. Results show that the bed was scoured in the forms of chunks of aggregates, aggregate-by-aggregate and particle-by-particle with an increase in ratio of actual to Proctor's optimum molding water content, $\hat{w}$. Maximum scour depth was mainly observed at the wake region (on the pier downstream) ranging from 10 to 58% of that in sand-alone case with the same size of the sand fraction in the mixtures. For a given compaction energy, scour depth first decreases with $\hat{w}$ < 2.6 as fine clay particles are flocculated and increases with $\hat{w}$ > 2.6 as particles become more dispersed.