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Splitter Plate as a Flow-altering Pier Scour Countermeasure

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Abstract

Results of an experimental study on the countermeasure of scour depth at circular piers are presented. Experiments were conducted for pier scour with and without a splitter plate under a steady, uniform clear-water flow condition. The results of pier scour without splitter plate were used as a reference. Different combinations of lengths and thicknesses of splitter plates were tested attaching each of them to a pier at the upstream vertical plane of symmetry. Two different median sediment sizes (d_{50} = 0.96 and 1.8 mm) were considered as bed sediment. The experimental results show that the scour depth consistently decreases with an increase in splitter plate length, while the scour depth remains independent of splitter plate thickness. In addition, temporal evolution of scour depth at piers with and without a splitter plate is observed. The best combination is found to be with a splitter plate thickness of $b/5$ and a length of $2b$. Here, b denotes the pier diameter. An empirical formula for the estimation of equilibrium scour depth at piers with splitter plates is obtained from a multiple linear regression analysis of the experimental data. The flow

fields for various combinations of circular piers with and without splitter plate including plain bed and equilibrium scour conditions were measured by using an acoustic Doppler velocimeter. The turbulent flow fields for various configurations are investigated by plotting the velocity vectors and the turbulent kinetic energy contours on vertical and horizontal planes. The splitter plate attached to the pier deflects the approach flow and thus weakens the strength of the downflow and the horseshoe vortex, being instrumental in reducing the equilibrium scour depth at piers. The proposed method of pier scour countermeasure is easy to install and cost effective as well.

Key words: scour, erosion, scour countermeasure, bridge piers, sediment transport, pier protection, splitter plate.

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