

Bridge Pier Scour Mitigation under Steady and Unsteady Flow Conditions

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A b s t r a c t

Watercourse morphology is affected by local scouring when the flow interferes with anthropic structures. Controlling the scour hole size is of predominant importance to guarantee bridge safety as well as to limit the variations of river morphology. A combined countermeasure against bridge pier scour is proposed and tested in order to reduce the maximum scour depth and deviate it away from the bridge foundation. In the first part of the laboratory campaign, combination of two countermeasures (bed-sill and collar) was evaluated for a circular pier under clear-water and live-bed steady flow conditions. The proposed combined countermeasure exhibited an efficiency of about 64% in terms of scour depth reduction. Afterwards, it was tested in unsteady flow conditions, first for a circular pier, then in the case of a rectangular pier with round nose and tail, two circular in-line piers and two rectangular in-line piers, under a hydrograph with a peak flow velocity slightly above the threshold condition of sediment motion. Results showed that the combined countermeasure had an efficiency of about 63% for a single circular pier; however, higher efficiency (about 75%) was obtained in applications to rectangular pier and two in-line circular or rectangular piers.

Key words: bridge pier, scour, bed-sill, countermeasure, collar, unsteady flow.