



Simulation of equilibrium scour hole development around riprap sloping structure using the numerical model

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This paper investigates effect of scour adjacent to the bridge piers with installed riprap as the scour countermeasure. A riprap sloping structure is a conical placement of launchable stones around the bridge pier commonly used as erosion protection. Riprap sloping structure affects the flow in similar manner to groynes, shifting the scour hole downstream of the toe of the structure. Assuming that the installation of the riprap erosion protection deflects the scour hole development downstream of the bridge, experimental model is developed to represent natural environment under different flow scenarios. The 3D model requires calibration of numerical parameters to accurately simulate the prototype conditions – e.g. cell mesh size, turbulence model, and roughness associated with natural riverbed and the riprap sloping structure. Calibration of the Flow-3D numerical model was performed against the flow measurements conducted during field campaign. Flow measurements were collected using Acoustic Doppler current profiler on 20 transects along the river section adjacent to the bridge. Two independent surveys were conducted: for 30 % flow duration and 60 % flow duration (mean flow conditions). After obtaining the results, cross-sectional velocities were analyzed in 3 characteristic transects (upstream, downstream and at the bridge opening). Finally, good agreement was achieved between the model and measured flow field across all transects, enabling numerical setup to be reliable for simulating rare flood events, and associated scour development.

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