B27

Morphological Changes induced by River training structures: Bandal-like structures and Groins

○ Hiroshi TERAGUCHI, Hajime NAKAGAWA, Kenji KAWAIKE, Yasuyuki BABA, Hao ZHANG

River training structures are usually used to create narrower and deeper river channel for navigation purposes, minimize bank erosion, and recently, restoring fish habitat to degraded streams and enhancing the diversity of the river ecosystem. Previous research suggests river training structures may broadly affect flow conveyance through direct interaction with flow and indirectly by their effects on channel geometry and bed forms.

To better understand the mechanisms by which these structures affect the flow dynamics and river channel morphology, an assessment of river training structures was accomplished by laboratory experiments and numerical model simulations. The experiments were conducted in a straight flume to study the influence of two hydraulic structures on the flow field and bed deformation under non-submerged and submerged conditions. It was used impermeable and permeable groins and bandal-like structures, i.e. low cost structures commonly applied to improve or maintain the flow depths for navigation during low water periods in alluvial rivers of Indian Sub-Continent region like Bangladesh. The essential characteristics of bandal-like structures are that there is an opening below (piles) to allow the sediment material deposition near the bed, and the blockage of upper portion (bended plate) to towards the near surface flow in the main channel direction. As a practical rule the blockage of the flow section should be about 50% in order to maintain the flow acceleration.

To compare the characteristics of each type of structure was measured around them, the velocity field in horizontal plane (including water surface by PIV - Fig. 1) and representative cross-sections in the vertical plane (transversal and longitudinal directions), the water surface level and the bed profile after the dynamic equilibrium condition was achieved. The turbulent flow field and bed deformation due to the presence of groins or bandal-like structures was simulated using a 3D hydrodynamic and sediment transport model, which solves the RANS (Reynolds-averaged Navier Stokes) equations for flow calculation with the k-ε model for turbulence closure, and the sediment transport considering the bed load and the suspended load transport.

The results shows that in the impermeable groins cases due to the blockage of flow and the formation of downward flux, the erosion, especially around the upstream groin is deeper than the cases with permeable groins, where a little reduction of flow velocity passing through the structures can be seen. The bandal-like structures showed intermediate results, where the flow passing through the lower part causes sediment deposition near the structure (riverbank).

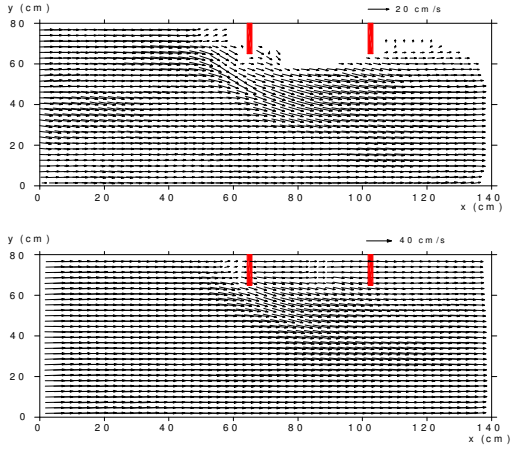

Fig.1 PIV results for water surface velocity vectors – bandal-like structures (top:non-submerged; bottom:submerged)