

## Experimental Studies on Morphological Changes induced by Groins

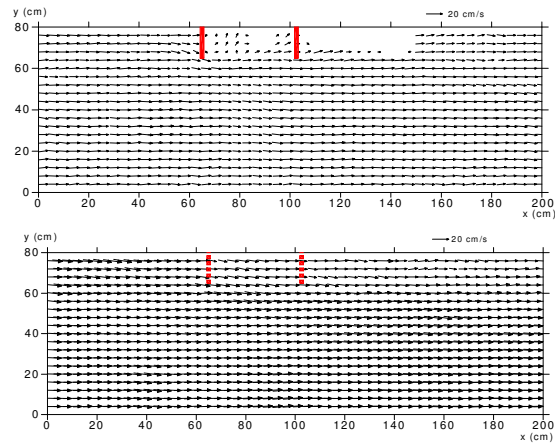
○ Hiroshi TERAGUCHI, Hajime NAKAGAWA, Kenji KAWAIKE, Yasuyuki BABA, Hao ZHANG

Groins are hydraulic structures built in rivers that can fulfill multiple objectives. The most usual are: maintain channel navigability by keeping the flow away from the banks; minimizing bank erosion; restoring fish habitat to degraded streams and enhancing the diversity of the river ecosystem.

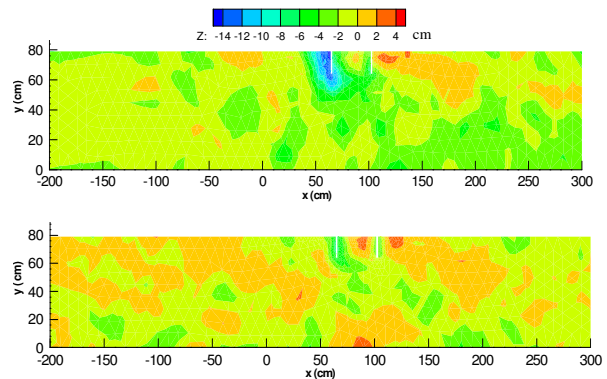
Experiments were conducted in a laboratory flume to study the influence of two groins on the flow field and bed deformation under non-submerged and submerged conditions. To study the characteristics of groins was used impermeable and permeable groins and bandal structure, i.e. a structure commonly applied to improve or maintain the flow depths for navigation during low water periods in alluvial rivers of Indian sub-continent. The essential characteristics of bandal structure are that there is an opening below (permeable) it while the upper portion is blocked (impermeable). As a practical rule the blockage of the flow section should be about 50% in order to maintain the flow acceleration.

During the experiments was measured in the groins region the velocity field in horizontal plane and representative cross-sections in vertical plane (transversal and longitudinal directions), the water level and the bed profile for the final equilibrium condition. In the impermeable groins cases, the erosion especially around the upstream groin is deeper than the cases with permeable groins and bandal structures (Fig.1). From the velocity field measurements is possible to verify under non-submerged condition the formation of recirculation currents between the groins in impermeable case, but in permeable groins case the

flow passing through the structure with a little reduction of velocity (Fig.2). The present investigation aims to measure the three-dimensional turbulent flow field and bed deformation around groins and bandal structures. The scour depths at non-submerged condition are compared with those at submerged condition for each type of structure to verify the effect of submergence on local scour.



**Fig.1** Velocity field under non-submerged condition – top: Plane XY - impermeable groins; bottom: Plane XY – permeable groins (experimental).



**Fig.2** Bed Deformation under non-submerged condition – top: Impermeable Groins; bottom: Bandal structures (experimental).