NUMERICAL SIMULATION OF BRAIDED RIVERS WITH ERODIBLE BANKS

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The morphological changes of rivers are deeply interrelated to the bed deformation and bank erosion because of the mutual relationship between water flow and sediment transport, and better understanding of these process and mechanism is very important for river engineering purposes to manage hydraulic structures and prevent disaster from flood, and environmental engineering purposes to maintain river ecosystem and landscape.

A two-dimensional numerical model was developed to simulate braided river with erodible bed and banks composed of well sorted-sandy materials. A generalized coordinate system was employed to calculate water flow, bed change, and bank erosion. CIP (Cubic Interpolated Pseudo-particle) method was used to calculate flow, which introduced little numerical diffusion. Sediment transport equation in the streamline and transverse wise, considering the secondary flow, was used to estimate bed and bank evolution in time. Bank erosion was simulated by following the procedure proposed by Shimiz(2002).

Braided river in laboratory was reproduced for verifying the numerical model in the channel filled with nearly uniform sandy materials. The suggested numerical model is applied to verify the applicability at the actual experimental reach, 10m, with erodible banks. Experiment for Run-1 was carried out under the initial condition that the channel width to depth ratio corresponding to the transition regime (aspect ratio = 59.1) between alternate bars and braided bars, and for Run-2 was done corresponding to the condition for braided bras (aspect ratio = 89.9), according to the Kuroki and Kishi (1985)'s regime criteria on bars and braids in alluvial straight channels in the space given by dimensionless tractive force and the channel width to depth ratio considering the channel slope.

Fig. 1 shows that braided river is developed from meandering channel because aspect ratio is increased more and more while bank erosion is advanced on left and right alternately as time is progressed. The process and mechanism of braided river from an initial straight channel with erodible banks investigated by Ashmore(1982) were shown for Run-1. Alternate bars were grown up in the straight channel, and then a meandering channel was developed due to the side banks erosion by the flow deflection of the bars. Fig. 2 displays that a braided river is shown up from the initial stage and is remarkably developed while the channel width is enlarged since the side banks are eroded. Flow was concentrated into lower channels, and some of them were scoured deeply. Bars appeared

to the downstream of the lower channels and complicated braided bars were developed due to flow division around the bars, leading to bank erosion.

The calculation results are in overall agreement with the experimental results, although the longitudinal wavelength and thalweg of the bed in the calculation are a little difference from those of the experiment.

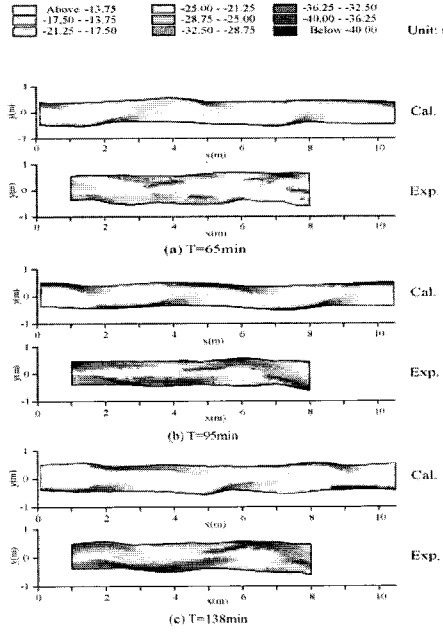

Fig.1 Comparison of the channel deformation between calculation and experiment for Run-1.

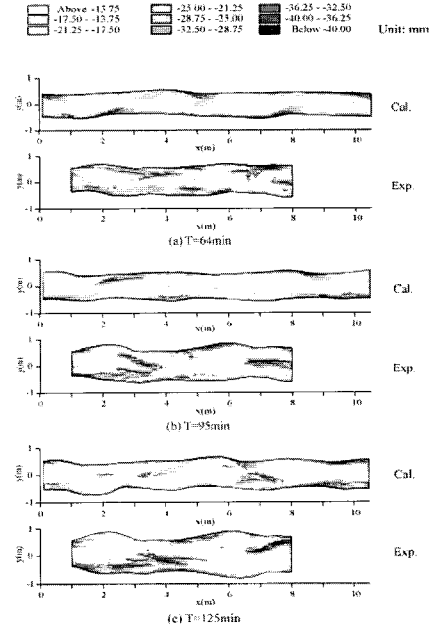

Fig.2 Comparison of channel deformation between calculation and experiment for Run-2

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