

ON THE FORMATION OF STABLE RIVER COURSE

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1. Introduction

Stable river course discussed in the present study is such a river that follows a designated path insuring adequate protection to the river bank and forming deep navigational channel in the main stream preserving its natural environment. Series of impermeable groins installed from single side or both side of river banks are traditionally adopted to achieve those objectives.

Due to the flow separation at the groin head, return currents are developed towards the groin field area and often attack the river bank if the groins are not installed at sufficiently close spacing. Owing to these difficulties, sometimes, permeable groins are adopted as a solution of the above problem. The flow passes through the permeable groins opposes the very weak return current develops at the last pile to come in the groin field.

2. Experimental Methods and Results

In the present study, the effectiveness of impermeable groins (perpendicular), permeable groins (perpendicular) and bandals (50% of the water depth at the bottom is opened and placed at 40° angle from the side wall towards the downstream) is tested under the clear-water condition of approach flow. Total 10 pairs of structures are installed at a spacing of 4 times of the lateral length of groins resulting 30% of the approach width reduction at control sections. 3-D flow velocities and deformed bed levels were measured at the equilibrium state using velocity meter and laser sensor, respectively.

It was found that for the impermeable and permeable groins, main channel degradation was very similar in terms of depth. But for permeable case, the degraded bed was more uniform. The deposition in the groin field was more pronounced in the permeable case because of the absence of return current. For the bandal experiment, flow diversion towards the main channel was observed both from the upstream and downstream side of the bandal forming deeper main channel. Initially, sediment coming from the main channel was deposited in the bandal fields. Functionally, bandal showed very effective performance for navigational channel formation and land reclamation within the bandal fields. But as the accelerated down flow passing bandals was strong enough to transport the deposited sediment from the bandal area, the sediment was transported towards the downstream direction. Finally, a new structure was developed and tested that consists of

bandal plate at the top and permeable groins at the bottom in order to keep the bandal function with more reduced flow towards the bandal field. It was found that the newly developed structures would be capable in forming stable river course that would ensure deep navigational channel and bank protection as well (Fig. 1).

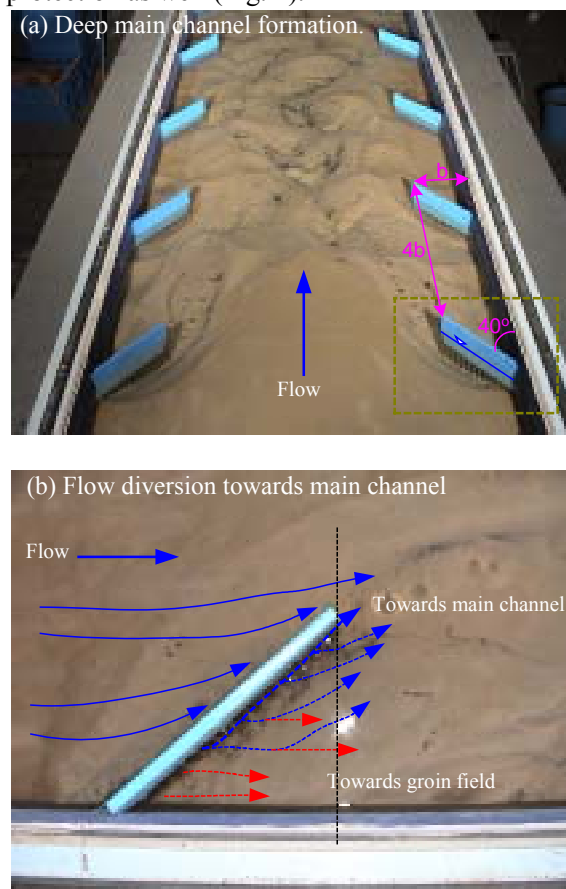


Fig. 1 Flow diversion towards the main channel (Dotted lines are downward flow passes below the bandal through the piles).

3. Prediction Model

Based on the above results and observation, analytical model for the prediction of main channel degradation, local scouring and deposition close to the river bank due to each of these structures are developed and compared with the experimental data and other methods.

4. Conclusions

The newly developed structure is capable to form stable channels under the adopted hydraulic condition of the present experiments. However, more researches are required in order to test its general applicability.