

EXPERIMENTAL STUDY ON DEPOSITION PROMOTION OF PERMEABLE STRUCTURE

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The traditional river regulating structure is mainly permanent solid structure, such as spur, longitudinal dike, underground dam, closure dam and so on, which can block the tributary and make the dispersed flow convergence to the main stream, train for discharge sluicing sand and so on. But it is proved that these solid constructions have some disadvantage. Such as the complexity of construct, high cost, local erosion around them and etc. Relative to solid structure, the permeable regulating structure has the advantages of adapting flood with different standard, not occupying the space of river, no need to rush to deal with any emergency, protecting environments, lower investment and so on, which is used for river regulation gradually now. But, the research on permeable regulating structure is at exploring stage. The systematic research about it at home and abroad is few. There are some shortages about not only the design of permeable regulating structure but also the project effect, and also there is no mature theory research about the effect on flow structure and sediment movement of permeable regulating structure, which brings many difficulties to the wide application of the permeable regulating structure.

In this paper a device is proposed to alter the local flow regime, dissipate energy and promote sediment deposition. The research includes device form selection, flow characteristics and deposition principle analysis by flume experiment, and experiment on the spot.

Based on the principle such as simple structure, easy to be used, low cost and etc. After comparison of four devices through flume experiment, the effect of TMPF is the best and not easy to be affected by the flow condition. So it is confirmed as the best experiment device and used to further experiment.

The flume experiment is carried out in the adjustable slope tank with 33m long, 0.5m wide and 0.5m high. Working zone is 15m long, the adjustable slope range is 0-10% and the maximum discharge is 85 l/s. The Acoustic-Doppler Velocimeter (ADV) which has no effect on flow structure and can do three-dimensional measuring is used to measure the velocity.

With the help of flow experiment, devices of different characteristics of water penetration are studied on their disturbing effect to flow structure nearby. At first, the mean vertical line velocities at the axle wire of the flume before the TMPF where the flow structure is not disturbed and 30cm behind the TMPF are measured. The relationship between the mesh and deceleration rate is concluded. Then, the full-scale flow velocity measurement is carried out with the selected TMPF of 8 mesh, 12 mesh and 16 mesh on the three flow conditions for analyzing the effect of TMPF on flow structure comprehensively. The result shows that the TMPF can change the velocity greatly and the TMPF with different mesh has different effect on the flow regime. on the experiment conditions, all the measured vertical lines mean velocities behind the TMPF are less than

that before the TMPF. The TMPF has the ability to slack water flow and dissipate energy.

The deposition promotion experiment is carried out to investigate the device's effect on sediment deposition promotion. The result indicates that the phenomena of the flow experiment and the deposition experiment match well. There are different phenomena behind the TMPF with different mesh. The TMPF of 8 mesh has best affect on energy dissipation and deposition promotion.

Base on the flume experiment result, the district of Xin hekou of Yao-jian reach of the Yangtze River is selected for field experiment. Two groups of TMPF that each group is made up of four connected TMPF are used in the experiment. After a period of 20 days, a great deposition bulk appears in the experimental area, with the maximum length of 36m, and height of 0.4m. 5 weeks later, the maximum deposition thickness is 1.0m, 7 weeks later, the deposition thickness keeps increasing and the TMPF is buried.

The TMPF designed in this paper can change the inflow angle automatically and has a great effect on deposition promotion, and it is a new device for deposition promotion that worthy of being popularized for its low price and easy execution. Furthermore, it needs no energy supply and resource, bringing benefit not only of economic, but also of social and environmental.

Keywords: Regulating structure; Permeable structure; Deceleration; Deposition promotion