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Effects of permeable groins on river regime in the lower Yellow River

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Abstract: To control the river regime in the wandering river channels is an important work of ecological protection and high-quality development in the Yellow River Basin. Using MIKE21, this study compared and analyzed the control effects of the spur dike group on the river regime under different oriented angles, layout methods, and dam types. The results show that: (1) A optimal oriented angle existed that can efficiently control the river regime. Among the dikes with three oriented angles designed in this study, the spur dam of 45° has the strongest effect blocking the flow, and the corresponding uniformity coefficient of the flow velocity CV reached the lowest value, 0.44, at this time. Under this condition, the flow-velocity distribution was more stable than that of other angles, dynamic pressure on the bank foundation was relatively small, and thus the groins could play a relatively effective influence on the protection of the river bend. (2) The effect on the river regime of a spur-dike group was more than the total amount of all single spur dikes. If only a single spur dike were arranged, the spur dike would keep the high-speed flow away from the concave bank and protect the riparian line with a length of about 80 m. In contrast, if the spur dikes worked as a group, a single spur dike would protect the riparian line with a length of about 100 m. (3) The diversion effect of the permeable groin in the lower Yellow River is the same as that of the solid groin with the same layout. Both the flow reduction rates of the permeable and solid groins are all close to 80%. It is concluded that the impermeable groins can be widely used in the lower Yellow River for it is able to achieve the expected control effect and relatively safe operation condition in virtue of permeability.

Keywords: wandering river channel; permeable groins; flow characteristics; MIKE21