Bed morphodynamics at the intake of a side channel controlled by sill geometry

Authors: T.V. de Ruijsscher[a] , A.J.F. Hoitink[a] , S. Naqshband[a] , A.J. Paarlberg[b]

[a]Hydrology and Quantitative Water Management Group, Department of Environmental Sciences, Wageningen University, Wageningen, The Netherlands
[b]HKV, Lelystad, The Netherlands

Abstract

As part of a general trend towards river management solutions that provide more room for the river, longitudinal training dams (LTDs) have recently been constructed in the inner bend of the Dutch Waal River, replacing groynes. LTDs split the river in a main channel and a bank-connected side channel with a sill at the entrance. In the present study, a physical scale model with mobile bed was used to study morphological patterns and dis- charge division in the entrance region of such a side channel. Alternative geometric designs of the sill are tested to investigate the controls on the diversion of water and sediment into the side channel. After reaching a morphodynamic equilibrium, two bar features were observed in the side channel under low flow conditions. An inner-bend depositional bar emerged against the LTD, resembling depositional bars observed in sharp river bends. A second bar occurred in the most upstream part of the side channel, next to the sill, induced by divergence of the flow by widening of the channel and an increasing flow depth after the sill, hence defined as a divergence bar. The morphologically most active system in the side channel emerges for the configuration in which the sill height de- creases in downstream direction. For such a geometry, the sediment that settles during low flow is largely eroded during high flow, reducing maintenance needs. A qualitative comparison based on a lab experiment mimicking field conditions demonstrates the realism of the experiments.

Keywords:

Longitudinal training dam, River morphology, Side channel , Bifurcation, Physical scale model.