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Analyzing Parameters Influencing Scour Bed in Confluence Channels Using Flow3D Numerical Model

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Abstract

Channels junction is a phenomenon which is used in most of irrigating and drainage networks and in hydraulic engineering in general. In two channels junction, main and secondary channels encounter with each other and move to the channel downstream. Scour holes and sedimentation zones are created in channels bed. 3D simulation of scour hole created in these channels is influenced by various factors. The ratio of main channel width to secondary channel width is one of the most important influencing factors. This parameter is the main focus of the present research. In the present study, a model calibrated with laboratory results has been simulated. The numerical model results have revealed that decreasing the ratio of main channel width to secondary channel width causes the secondary channel flow encounters to the front wall of the secondary channel. Also, it leads to creating scour near the front wall and the main hole is drawn towards the wall. Furthermore, in the present research, topographical changes of the bed with running time of the numerical model for the middle channel axis has been extracted and presented.

Keywords: Scour Hole; Numerical Simulation; Secondary Channel; Open-Channel Junction.

1. Introduction

As one of the complex phenomenon considered in open channels related studies, it can be referred to the movement of deposition s with water flow and deposition or erosion of channel. This phenomenon is more complex in channels junction. Such that, flow behavior depends on some variables such as discharge ratios, branches width, the junction angel of two branches of channel, bed balance variation at junction, flow characteristic in the upstream of each branches as well as flow Froude number. As evident, the maximum depth of scour occurs in particle movement threshold conditions, i.e. the border between clear water and water containing deposition. Under clear water conditions, the scour depth is increased a result of flow velocity increase; also, the maximum scour depth occurs under clear water conditions and at deposition particle movement [1, 2].

Paphitis (2000) investigated the movement of deposition particles under one dimensional flows using movement threshold curves. Using these curves, movement threshold of deposition particles was predicted. To define movement threshold states, there are no definite stochastic theories under which deposition particles can be replaced. Nevertheless, movement threshold responses range always exists [3]. Arumugam and Mason (1985) performed many studies on various relations resulted by turbulences using 47 laboratory models. According to analyzing the laboratory resulted data, they found the factor of d50 more appropriate than d90 and d85 to investigate the phenomenon of deposition by water [4]. Silviaand Gerardo (1999) explored scour hole in tidal channels junction. To identify the origin and gradual growth pattern, this study was conducted on the hole created in Baha-Blanca Estuary located in Argentina. The experiments were performed on two large holes located at Baha-Blanca Estuary. Based on the researcher observations, determining net value of carried deposition and gradual growth of holes created depends on the range of active flooding and tidal range. Moreover, it was observed that holes in the selected species moves towards upstream

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