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Original Research

Scour hole reduction at a diversion channel junction using different entrance edge shapes

Ahmed Yahya Abdulhafedh [a], Nashwan Kamalaldeen Alomari [a], Ahmed Mohammed Sami Al-Janabi [b]

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Abstract

In the current study, the effect of the entrance edge shape on the scour hole in the diversion junction region was experimentally investigated. The investigation has considered three entrance models-rounded edge shapes on one or both sides of the diversion channel entrance-with five different inlet edge radius ratios (r_r) of 25%, 37.5%, 50%, 62.5%, and 75% and five different diversion discharge ratios (Q_r) of 7.5%, 12.5%, 17.5%, 22.5%, and 30%. The results have found the direct relation between Q_r and the scour depth to the diversion channel water depth ratio (d_s/y_b). Moreover, the use of a rounded edge shape on one or both sides of the diversion channel entrance instead of a sharp shape results in a reduction in scour depth to diversion channel water depth ratio (d_s/y_b) when the Q_r is greater than 20%. The results also indicated that the largest decrease in the scour coefficient (K_{ds}) for the model with a rounded downstream edge compared with the sharp edge diversion channel entrance shape was 22% at a discharge ratio of 22.5% and an edge radius ratio of 37.5%. In addition, the entrance shape model with a rounded edge at the upstream outperformed other models in scour reduction with an average of all experiments of 5.77%. Finally, empirical relations for estimating scour depth for different rounded edge models in terms of the effective dimensionless parameters were established with coefficients of determination (R^2) of not less than 0.853.