World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:18, No:12, 2024

A Comprehensive Approach to Scour Depth Estimation Through HEC-RAS 2D and Physical Modeling

Authors : Ashvinie Thembiliyagoda, Kasun De Silva, Nimal Wijayaratna

Abstract : The lowering of the riverbed level as a result of water erosion is termed as scouring. This phenomenon remarkably undermines the potential stability of the bridge pier, causing a threat of failure or collapse. The formation of vortices in the vicinity of bridges due to the obstruction caused by river flow is the main reason behind this pursuit. Scouring is aggravated by factors including high flow rates, bridge pier geometry, sediment configuration etc. Tackling scour-related problems when they become severe is more costly and disruptive compared to implementing preventive measures based on predicted scour depths. This paper presents a comprehensive investigation of the development of a numerical model that could reproduce the scouring effect around bridge piers and estimate the scour depth. The numerical model was developed for one selected bridge in Sri Lanka, the Kelanisiri Bridge. HEC-RAS two-dimensional (2D) modeling approach was utilized for the development of the model and was calibrated and validated with field data. To further enhance the reliability of the model, a physical model was developed, allowing for additional validation. Results from the numerical model were compared with those obtained from the physical model, revealing a strong correlation between the two methods and confirming the numerical model's accuracy in predicting scour depths. The findings from this study underscore the ability of the HEC-RAS two-dimensional modeling approach for the estimation of scour depth around bridge piers. The developed model is able to estimate the scour depth under varying flow conditions, and its flexibility allows it to be adapted for application to other bridges with similar hydraulic and geomorphological conditions, providing a robust tool for widespread use in scour estimation. The developed two-dimensional model not only offers reliable predictions for the case study bridge but also holds significant potential for broader implementation, contributing to the improved design and maintenance of bridge structures in diverse environments.

Keywords : piers, scouring, HEC-RAS, physical model
Conference Title : ICHM 2024 : International Conference on Hydrology and Meteorology
Conference Location : New York, United States
Conference Dates : December 09-10, 2024