

Evaluation of bed shear stress for cohesive sediments erosion-comparison between the Reach-averaged method and the “Law of the wall” method

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The erodibility of cohesive sediments has been recognized to be significantly different from that of non-cohesive beds. The existence of clay particles in the soil often leads to a much greater resistance to erosion. In this study, we analyzed the erosion resistance of sludge collected from the Agongdian Reservoir in southern Taiwan, by laboratory experiments using a 10 m circulating rectangular flume. The soil specimens collected in situ were completely mixed with tap water and reconsolidated by natural settlements for 24, 48, and 72 hours, to create specimens with different bulk densities and moisture contents. Then the flume experiments were carried out for each type of the specimen under different bed shear stress conditions. In order to analyze the bed shear stress caused by the flow in the flume, two methods were applied to calculate the bed shear stress, the Reach-averaged method and the “Law of the wall” method. As the results, a relationship between the erosion rates and bed shear stresses can be obtained for each type of the specimen with respect to the two methods. Consequently, the applicability and reliability of the two bed shear stress calculating methods are compared, and the erosion resistance of cohesive beds and the affecting factors are also discussed. The outcome of this study can be applied to projects of hydraulic engineering that require the estimation of erosion resistance of cohesive sediments in river banks, beds of lakes/reservoirs, and coastal areas.

Keywords: cohesive sediments, erosion, shear stress