

Stone stability under stationary non-uniform flows

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Abstract

A stability parameter for rock in bed protections under non-uniform stationary flow is derived. The influence of the mean flow velocity, turbulence and mean acceleration of the flow are included explicitly in the parameter. The relatively new notion of explicitly incorporating the mean acceleration of the flow significantly improves the description of stone stability. The new stability parameter can be used in the design of granular bed protections using a numerical model, for a large variety of flows. The coefficients in the stability parameter are determined by regarding measured low-mobility entrainment rate of rocks as a function of the stability parameter. Measurements of flow characteristics and stone entrainment of four different previous studies and many configurations (uniform flow, expansion, contraction, sill) are used. These configurations have different relative contributions of mean flow, turbulence and stationary acceleration. The coefficients in the parameter are fit to all data to obtain a formulation that is applicable to many configurations with non-uniform flow.

Keywords: Stone stability, Riprap, Turbulence, Acceleration

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