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Non-deposition self-cleansing design criteria for drainage systems

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Abstract Self-cleansing is a substantial aspect of the drainage systems in which it is desired to minimize the sediment deposition that can cause channel blockage and surcharge early overflows. In the conventional self-cleansing design criteria of drainage systems, a single value of velocity or shear stress is used based on experience. In the recent decades rather than using a single value, non-deposition design concept has been further modified to develop self-cleansing models based on higher number of parameters considering flow, fluid, sediment and channel characteristics. However, non-deposition self-cleansing models have been mostly developed for circular channels, and none of the models considers yet the effect of channel cross-section although some models take into account the pipe diameter, hydraulic radius and cross-section area as independent variables. In this study, a self-cleansing model considering the effect of cross-section by a shape factor available in the literature is developed to determine the non-deposition particle Froude number for bed load sediment transport. The model is developed using experimental data of circular, rectangular and U-shape channel cross-sections from the literature; and data of trapezoidal channel cross-section from experiments carried out in this study. For validation of the model, data collected in this study is used together with four different sources of data taken from the literature. Validation of the model for each cross-section data shows its wide range applicability in terms of different channel cross-sections.

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