Investigation of the effects of bed forms on sediment transport coefficient by taking interaction of wave-current into account

Ansari .M.[1] , Lashteh Neshai .S.A. [2] , Mehrdad M.A.[3]
1- MSC student, Department of Civil Engineering, University of Guilan, Rasht, Iran
2- Assistant professor, Department of Civil Engineering, University of Guilan, Rasht, Iran
3- Assistant professor, Department of Civil Engineering, University of Guilan, Rasht, Iran

Mahsa_ansari@ymail.com

Abstract

In this paper, the effects of bed forms on sediment transport coefficient were studied by using two physical and mathematical modeling programs, in order to generate the graphical changes of bed profiles under effects of waves and currents. Sediment transport coefficient (STC) is defined as the ratio of sediment velocity to the velocity of water particles. STC was studied at different states of currents, waves, and wave's interaction with currents in order to define a modified ratio for bed load movements in the boundary layer. If applying this modified ratio (STC), in the mathematical program, improve the graphical changes in bed level and have a better fitness with the measured changes, it will have more validity to use it in the modeling programs instead of using the previous values of STC which considered a single value for this ratio. However, reliable experimental data are essentially required to examine the validity of the model.

Keywords: **Sediment transport, two phase flow, seabed profiles, current, wave.**

1. INTRODUCTION

The sediment transport field is conventionally divided in to the following two regions: the bed load region where the sediment concentration is high and the particles are mainly supported by the intergranular stress, and the suspended load region where the sediment concentration is small and the particles are mainly supported by the fluid turbulence stress. Studies of the bed load region have recently received much attention because a large amount of sand is transport under this mode.

The Bed load is defined as the part of the total load that is in contact with the bed during the transport. It primarily includes grains that roll, slide, or jump along the bed. At the lowest transport stage, particles move by rolling over the surface of the bed, but with a small increase in bed shear velocity, these grains will hop up from the bed. This later mode of transport is known as saltation. The suspended load is the part of the total load that is moving without continuous contact with the bed as a result of the agitation of fluid turbulence. Grains will not move at very small flow velocities, but when the flow velocity becomes large enough, the driving forces on the sediment particles will exceeds the stabilizing forces, and the sediment will start to move. This flow velocity is called the critical flow velocity.

In this paper, the measured bed shear velocities are smaller than the particles fall velocities, therefore particles movements are limited to sliding, rolling and saltation below the bed load layer. There has been a growing interest in development and application of two phases flow models for generating more information about cross shore sediment transport and beach profile evolution on an open beach and a beach fronting a partially reflective seawall. To consider the effects of reflective structures on costal sediment transport and beach morphology, experiments have been performed at laboratory model scale on a partially reflective seawall located in the surf zone. A number of researchers have shown that the beach change near seawalls, both in magnitude and temporal variation is smaller to that on beaches without seawalls, if a sediment supply exists. The physical processes of the seawall and beach interaction must be well understood in order to assess the relative performance of seawalls and alternative shore protection methods.

Hanes – Bowen (1985) have proposed a granular – fluid model to describe intense bed –load transport in a unidirectional flow. They have derived a relation mathematically between the grain transport rate and applied shear stress. In the present paper, the authors have proposed a two – phase model for bed loads over a ripple bed under moderate shear stress. The mathematical formulations are performed by