8th International Congress in Civil Engineering,
May 11-13, 2009, Shiraz University, Shiraz, Iran

Armoring in graded loosed grains river bed

G. Akbari
Asst. Prof. Civil Engineering, University of Sistan and Baluchestan, Zahedan, Iran

gakbari@hamoon.usb.ac.ir

Abstract
Armoring in a desert river with a graded loosed grains bed was studied. Major sediment parameters involved was optimized. A grain sorting and armoring algorithm was established found working well incorporated into both, the non-linear coupled model for graded loosed grains (NCLG) and uncoupled model for graded bed loosed grains sediments (NULG). Bed level changes and the time dependent grain size distribution of the amour layer due to bed degradation was investigated found slightly differs from currently available models in terms of assumptions made for active layer thickness, hiding factor, and treatment of difference between potential and realized sediment transport.
Keywords: non-linear coupled/uncoupled, bed armoring.

1. INTRODUCTION

The response of loosed graded river bed channels to man-made changes and flooding in Baluchestan deserts has resulted in severe bed level changes and size gradation. As the result, sediment deposition upstream, scouring downstream when clear water released from reservoirs were examples studied here. Effects of bed level changes and reservoir depletion at upstream a dam was found critical to river regime extending many kilometers downstream from the reservoir site. Bed degradation was also found dangerous not only to the existing structures and loosed banks along the river but also to planned projects. Generally the surface of stream beds downstream from large reservoirs was found coarsen as they degrade. Prolonged degradation and coarsening of the bed sediment of streams led to armoring of the bed and to reduction in the rate of degradation and sediment discharge.

This is in accordance with when the bed slope in the upstream reach is reduced far enough such that the bed shear stress corresponding to the maximum discharge is equal to the critical shear stress of the bed material, the river bed may stabilize. As the upstream portions become stable, active degradation shifts progressively downstream. Degradation may continue until the river adjusts its slope to the value that reduces the bed shear stress until it is equal to the critical shear stress.

2. GOVERNING EQUATIONS

Following flow-sediment equations were used and solved by numerical finite difference schemes;
Equation for each particle of a graded bed sediment material involved in flow-sediment motion are equations of sediment continuity (1), flow continuity (2), dynamic of flow-sediment (3), friction equation (4), and sediment discharge (5). The latest equation is developed by Author [1].

$$\frac{\partial Q_s}{\partial x} + p\frac{\partial A_d}{\partial t} + \frac{\partial AC_s}{\partial t} = q\ell_s \tag{1}$$

$$\frac{\partial Q}{\partial x} + \frac{\partial A}{\partial t} + \frac{\partial A_d}{\partial t} = q\ell \tag{2}$$

$$\rho\frac{\partial Q}{\partial t} + \beta\frac{\partial}{\partial x}\left(\rho\frac{Q^2}{A}\right) + \rho g\frac{A}{T}\frac{\partial A}{\partial x} - \rho g A\left(S - S_f\right) - \rho q_\ell\frac{Q}{A} + \rho\frac{Q}{A}\frac{\partial A_d}{\partial t} = 0 \tag{3}$$

$$S_f = \left(n\frac{Q}{AR^{\frac{2}{3}}}\right)^2 \tag{4}$$