The role played by the feed texture on the bed adjustments in sediment feed experiments.

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Introduction

River bed adjustments depend on sediment transport rate, water discharge, grain size distribution of the bed surface, etc. This investigation is focused on the role played by the grain size distribution of the feeding texture in the bed adjustments.

Methods

A set of constant feed experiments were performed in the Hydraulic Laboratory in the Geography Department of the Hebrew University of Jerusalem. Runs were conducted in a tilting flume with a length of 9 m a width of 0.60 m and a depth of 0.50 m. 13 runs were carried out using four different textures as a feeding (see Fig.1).

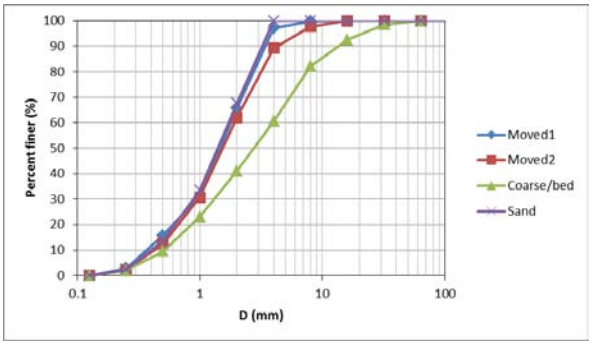

Fig. 1: Feeding textures used in the experiments.

The initial bed texture was the same for all runs (coarse/bed texture in Fig.1), and the initial bed slope ranged between 0.0080 m/m and 0.0085 m/m. Two different water discharges were used (Q_w = 0.021 m^3/s and 0.032 m^3/s). Feed rates ranged between 0.14 g/m/s and 0.75 g/m/s. Two more experiments were conducted under starving conditions. The duration of all runs was 96 h. Sediment transport rate and its texture was measured at different time during each run. The evolution of the bed surface texture was also recorded at the center of the flume.

Results and Discussion

Preliminary results show that feeding texture plays an important role in the bed adjustments for given sediment feed rate and water discharge under partial transport regime. In sediment feed experiments, equilibrium is achieved when bedload transport rate equals feeding rate (in its magnitude and in its grain size distribution). The experiments presented herein show that bedload transport rate can drop below the feed rate in its evolution towards equilibrium when differences in particle mobility among grain sizes contained in the feed texture are sufficiently high. Under certain circumstances, bedload texture adjustments may change easing bedload transport rate to approach sediment feed rate. Thus, the temporal evolution towards equilibrium is produced following an oscillating path rather than an asymptotic way. The higher the differences in particle mobility the longer it takes for the bedload transport to recover and approach the feed rate.

The experiments also suggest that surface bed adjustments may evolve differently for a given flow conditions (water discharge and sediment feed rate) depending on the feed texture. Preliminary results point out that fine sediment can be either infiltrated underneath the surface or be hidden behind coarser grain sizes depending on the feeding texture.

All these results then suggest that bed and surface textures, bedload and time scales of the adjustments can be highly modified when a little fraction of coarse gravel is included in the feed texture under partially mobile flow.