

Master's Thesis

Laboratory Investigation of Sediment Infiltration Masses in Rhombohedral Packing Arrangement of  
Spheres

Submitted by

Saeed Nourollah

WAREM

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3208676

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Examiner: Prof. Dr.-Ing. Silke Wieprecht

Supervisors: Dr.-Ing. Markus Noack

M.Sc. Mohammad Assem Mayar

## Abstract

One of the ecological effects of the fine sediment infiltration into the gaps and voids of the river bed is the clogging of the river bed pores which influence the spawning process of the fish and habitats in the water environments. This process can affect the population of sea creatures. Even it can be dangerous for the species which are at the verge of extinction.

Most of the investigations which measure the sediment infiltration masses counted as a destructive measuring technique. The techniques like freeze coring, sediment trap, or sampling cylinder. In these methods, the infiltrated sediments should be extracted for the experiment and analyses, which destroy the river bed and makes further examinations on the token sample impossible. The dynamic measurements of the filling processes are also neglected in this series of methods.

In this thesis, the gamma-ray attenuation method (GRA) which is a non-destructive method is used to assess the sediment infiltration masses into the idealized sediment bed in a laboratory flume. Then the infiltrated sediment mass is measured in a vertical profile of the flume to have high-resolution details of sediment vertical distribution and also in one position of the idealized sediment bed structure during the infiltration to have an idea about the dynamic development of the filling process.

These experiments will follow the previous experiments of this series which were done with simple cubic packing design of idealized sediment bed and produced out of table tennis balls.

The focus of this study is on a body-centered cubic structure (rhombohedral) which has more complexity and less porosity in comparison with simple cubic packing structure.

The boundary conditions that are applied to the experiments are sediment grain size, sediment quantity, and sediment feeding rate. Rest of the terms like water discharge and flume circumstances are constant and equal with the other experiments.

The obtained results give us a better understanding of the infiltration processes in the river bed structures and applied gamma ray attenuation method proved to be a practical method to analysis the sedimentation in the rhombohedral structure. The study of the results suggests that the fine sediment grain size has more infiltrated through the sediment bed whereas the coarse sediment grain size transported more by water to downstream of the flume. The comparison of the infiltrated sediment bed of cubic packing and rhombohedral structure shows that the porosity in the rhombohedral structure is less on average and has more variation in different vertical positions.