

A COMPARISON OF HOMOGENEOUS AND MULTI-LAYERED BERM BREAKWATERS WITH RESPECT TO OVERTOPPING AND STABILITY

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INTRODUCTION

The paper deals with homogeneous and multi-layer berm breakwaters designed to maximize the utilization of the quarry material. Two wide stone classes are typically used for berm breakwaters with a homogeneous berm. Formulae for overtopping and recession of homogeneous berm breakwaters have been developed by Lykke Andersen (2006). These formulae were based on existing data and data from approximately 700 new model tests. However, the validity of these formulae for multi-layer Icelandic type berm breakwaters has not been studied very extensively. Moreover, the failure of multi-layered berm breakwaters could be very complex as damage not necessarily starts in the top front part of the berm. The damage could just as well start in one of the other layers.

OVERTOPPING FORMULA

The evaluation of the overtopping formula developed by Lykke Andersen (2006) for homogeneous berm breakwaters is shown in Fig. 1. It can be seen that the formula by Lykke Andersen (2006) predicts the overtopping discharge with great accuracy taken into account the scatter typically seen on overtopping data and formulae. The formula was verified for reshaping and non-reshaping berm breakwaters with homogeneous berm. However, the validation of the formula for multi-layered berm breakwaters has not yet been performed.

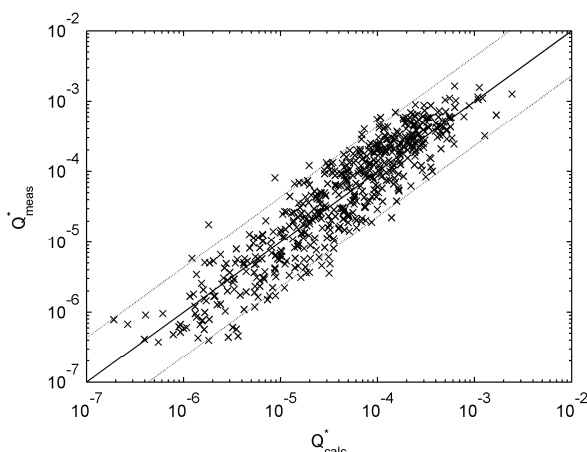


Figure 1 - Evaluation of overtopping formula presented by Lykke Andersen (2006)

RECESSION FORMULA

Lykke Andersen (2006) developed also a formula to predict berm recession for homogeneous berm breakwaters. The formula was fitted based on available

data from other researchers and approximately 700 new model tests. The formula includes the influence of sea state, stone diameter and grading, water depth, berm elevation, front slope. Fig. 2 shows the evaluation of the formula against the model test data by Lykke Andersen (2006). It can be seen that the formula predicts berm recession with great accuracy in most cases.

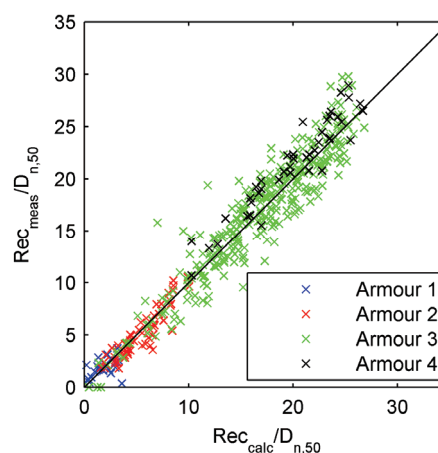


Figure 2 - Evaluation of recession formula presented by Lykke Andersen (2006)

NEW MODEL TEST STUDY

New model tests have been performed to compare stability and overtopping performance of homogeneous and multi-layered berm breakwaters. In both cases the breakwater has been designed to maximize the yield of the quarry material. The berm stones for the homogeneous berm breakwater are thus a mix of the berm stones used for the multi-layer type. That means a very wide grading is used for the homogeneous berm.

In the paper guidance on overtopping and stability assessment of multi-layered berm breakwaters will be given.

As expected the preliminary test results have shown that for a given design sea state an additional volume is needed for the homogeneous berm breakwater compared to the multi-layer berm breakwater to obtain stability.

Preliminary results have shown that the overtopping formula by Lykke Andersen (2006) seems to predict overtopping discharges also for multi-layered berm breakwaters with great accuracy.

REFERENCES

Lykke Andersen, T. (2006). Hydraulic Response of Rubble Mound Breakwaters. Scale Effects - Berm Breakwaters. PhD thesis from Aalborg University.