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Andersen, Thomas Lykke; Burcharth, Hans F.

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TRAVEL DISTANCE OF SINGLE WAVE OVERTOPPING VOLUMES

Lykke Andersen, T. , Aalborg University, Denmark, tla@civil.aau.dk
Burcharth, H. F., Aalborg University, Denmark, hfb@civil.aau.dk

INTRODUCTION

Most coastal structures suffer a certain degree of overtopping, because in most situations it is not economically feasible to construct coastal structures high enough to prevent wave overtopping. Certain functions of the breakwater impose restrictions to the allowable overtopping discharge in order to avoid damage to the breakwater itself and to objects located behind the breakwater. Extreme overtopping events result in water and spray thrown over the crest with considerable velocities. These events can be extremely dangerous as people, cars and even trains have been washed into the sea. Buildings are quite often damaged.

Previously Lykke Andersen & Burcharth (2006) presented a formula for prediction of the landward distributions of the average overtopping water based on 1000 model tests.

However, the formula does not give any information about the volume of large single overtopping events and their travel distance. These parameters are important as overtopping is a very non-linear phenomenon where the overtopping discharge varies considerably from wave to wave and the overtopping discharge is very unevenly distributed in time and space. The major part of the overtopping water during a storm is due to a small fraction of the waves, the ones with the highest (fictitious) run-up levels. In fact, the local overtopping discharge from a single wave can be more than 100 times the average overtopping discharge during the storm peak. The volume distribution of the overtopping events has been investigated by Franco, de Gerloni and van der Meer (1994) and van der Meer and Jansson (1995).

The discharge intensity of the individually overtopping waves is important because most damaging impacts on persons, vehicles and structures are caused by overtopping of large single waves. Nevertheless, the amount of allowable overtopping is normally based on the time averaged overtopping discharge.
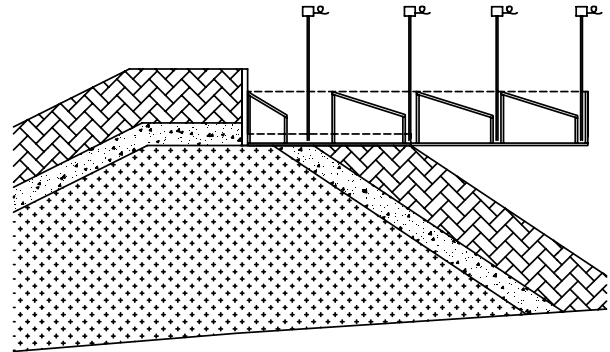

Figure 1 -Test set-up for measuring spatial distribution of overtopping water on a rubble mound breakwater.

OBJECTIVES

Several physical model test programmes at Aalborg University have focused on spatial distributing of overtopping volumes. The landward distribution of overtopping has been measured using several overtopping trays, cf. Fig. 1.

From many of the tests mentioned above it is possible to derive large single waves overtopping volumes and their travel distances. The objectives of the present study are:

1) Verification or updating existing formula for distribution of single wave overtopping volumes.
2) Derivation of a formula to estimate the travel distance of single wave overtopping volumes.

The overtopping velocity and the momentum of the overtopping water can be estimated from such formulae. Therefore, the two formulae are important in estimating impact forces on objects located on the breakwater during the wave overtopping event.

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