Influence of Core Permeability on Accropode Armour Layer Stability

Burcharth, Hans F.; Jensen, Thomas; Frigaard, Peter

Influence of core permeability on Accropode armour layer stability

by

Prof.,dr.techn. H.F. Burcharth, research ass. M.Sc. Thomas Jensen and
associate prof. Peter Frigaard
Aalborg University

Introduction

The potential of single layer armour has been demonstrated by the economical performance of Accropodes ®. A model test research programme on the behaviour of single layer armour was initiated at Aalborg University in 1995. Hydraulic stability as well as wave run-up and wave reflection were studied for Accropode armour placed in accordance with recommendations from SOGREAH, and for a patern placed single layer of Dolosse. Moreover, the sensitivity of hydraulic stability and wave run-up to the permeability of the core material was investigated for Accropode armour. The present paper describes the outcome of this part of the programme in which it was demonstrated that the core permeability has a very significant influence especially on the hydraulic stability. The scaling of the core material, which is a key issue, is discussed as well. A comparison with the results of other researchers is made.

Test set-up and test programme

Tests were performed in a 1.2 m wide wave flume. Two types of core material were used in the cross section shown in Fig. 1. The *fine* core material was sharp sand of 2-3 mm, while the coarse material was crushed stones of 5–8 mm. The Accropodes were 111 g having an equivalent cube length of $D_n = 0.036$ m.

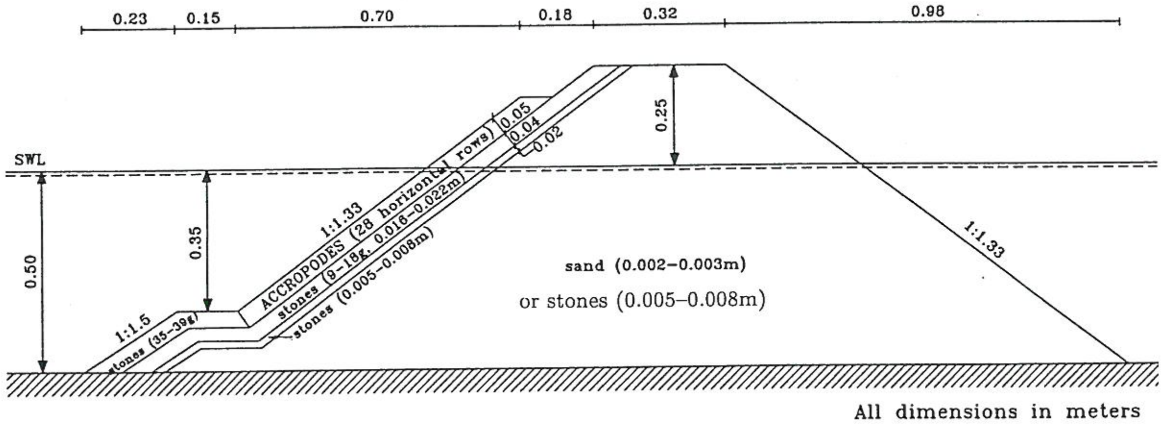

Fig. 1. Cross section of model.

Waves were irregular (JONSWAP-type) corresponding to Iribarren numbers $\xi_P = 3.75$ and 5.00, with increasing wave heights (7 steps) within the range $H_{mo} = 0.08$–0.20 m. Each seastate contained app. 1,000 waves. The damage level D was defined as percentage of units displaced a distance D_n or more, and was determined by photo overlay technique. Incident and reflected waves were separated by surface elevation analysis. Each test series was repeated minimum 5 times in order to evaluate the scatter.

Choice of core material

A discussion is given on the scaling of the core material based on various formulae including the formulae for the hydraulic gradient (Burcharth & Andersen, 1995). Determining parameters are the geometric scale, the characteristics of the prototype core material, and the characteristic velocities. It is demonstrated that the coarse model core material corresponds to prototype material with D_{n50} = app. 0.2 m.

Surface armouring of the fine core material

Thin geotechnical sheet slip failures occurred due to the steep slope of $1:1.33$. Being very difficult to observe, such failures can be misinterpreted as armour stability failures. A special pin reinforcement was applied in order to avoid this soil strength scale effect.

Extract of test results

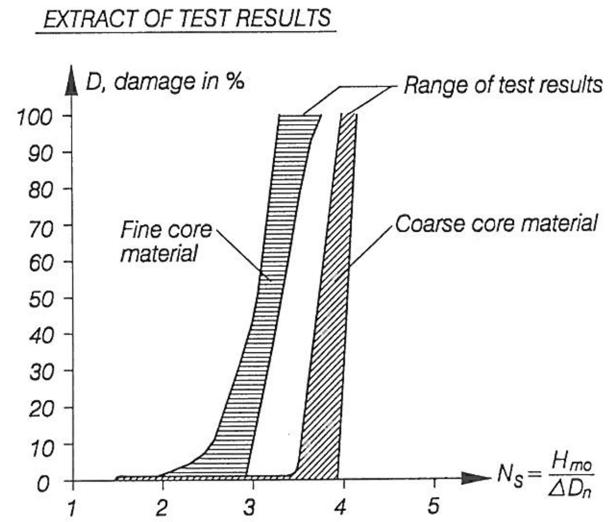

Fig. 2. Hydraulic stability for ξ_P = 3.75.

The final paper presents confidence intervals for the stability tests, as well as comparison with results of others. Results of the run-up tests are also presented.

References

Burcharth, H.F. and Andersen, O.H. (1995). On the one-dimensional steady and unsteady porous flow equations. Coastal Engineering, Vol. 24.

van der Meer, J. (1988). Stability of cubes, Tetrapodes and Accropode. Proc. Int. Conf. on Breakwaters, U.K.

Christensen, M. and Burcharth, H.F. (1995). Hydraulic stability of single-layer Dolos and Accropode armour layers. Final Proc. MAS2–CT92–0042 project on Rubble Mound Breakwater Failure Modes, Aalborg University, Denmark.

Holtzhansen, A.H. and Zwamborn, J.A. (1991). Stability of Accropode and comparison with Dolosse. Coastal Engineering 15.

Kobayashi, M. and Kaihatsu, S. (1994). Hydraulic Characteristics and Field Experience of New Wave Dissipating Concrete Blocks (Accropode). Proc. 24th Int. Conf. on Coastal Eng., Kobe, Japan.