Deltares

Enabling Delta Life

Project Description

Comparative study of block revetments for dikes

Assignment

Comparative study of block revetments for dikes

Client

Rijkswaterstaat, Water Boards (Waterschap Hunze en Aa's, Wetterskip Fryslân, Waterschap Noorderzijlvest) and market parties (Holcim Coastal BV, Hillblock BV, Altena Infra-materialen BV, LBN Betonproducten BV / Berding Beton GmbH)

Period

2013 - 2016

Introduction

In the context of the "Comparative study of block revetments for dikes", Deltares investigated the type specific stability of all modern block revetments. Because the currently available block types have differences in shape and design, they each have specific qualities. For example, some are more stable than others or reduce the wave run-up better. The research was conducted to support the optimum choice of block revetment for each specific case and to include the performance of each type in the design tool Steentoets.

Figure 1 Large scale modelling of Basalton+® revetment in the Delta Flume

Keywords:
bank erosion, river restoration

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2D physical model tests

The research focused on the stability at high wave loading and the reduction of wave run-up (and wave overtopping). The type specific stability was characterized by a stability factor.

Deltares investigated these characteristics using tests in the Scheldt flume (small scale) and in the Delta Flume (large scale). The tests in the Delta Flume were conducted at a scale of 1:2 and 1:1.6, the tests in the Scheldt Flume at a scale of 1:22. The test conditions were the same for all tested revetments.

In this study the following was determined on the basis of experimental research:

- the stability factor for the following types of block revetments:
  - Basalton® and Basalton + from Holcim Coastal BV
  - Hillblock® and Test blocks from Hillblock BV
  - RONA®ton and RONA®Taille from Altena Infra-materialen BV
  - Verkalit® mgv, Verkalit® GOR and C-Star® from LBN Betonproducten BV / Berding Beton GmbH
- the roughness coefficient with respect to the wave run-up of 3 types or block revetments:
  - Hillblock® from Hillblock BV
  - RONA®Taille from Altena Infra-materialen BV
  - Verkalit® GOR from LBN Betonproducten BV / Berding Beton GmbH
- the roughness coefficient with respect to the wave overtopping effect of block revetments that are placed in a checkerboard or ribbed pattern.

Results

The study resulted in a stability factor for each revetment type. The stability factor was included in the calculation model STEENTOETS, with which block revetments are designed and the safety assessment is carried out. The introduction of the stability factor ensures that the specific stability of each type of block revetment is represented by the calculation model, taking into account a safety margin. That ensures that the block revetments that have a high stability according to the tests in the Delta Flume can be designed with a smaller thickness than revetment blocks with a low stability.

The roughness coefficients can be used to calculate the wave overtopping and wave run-up with the formulas from TAW (2002). This can be used to optimize the crest height of dikes.

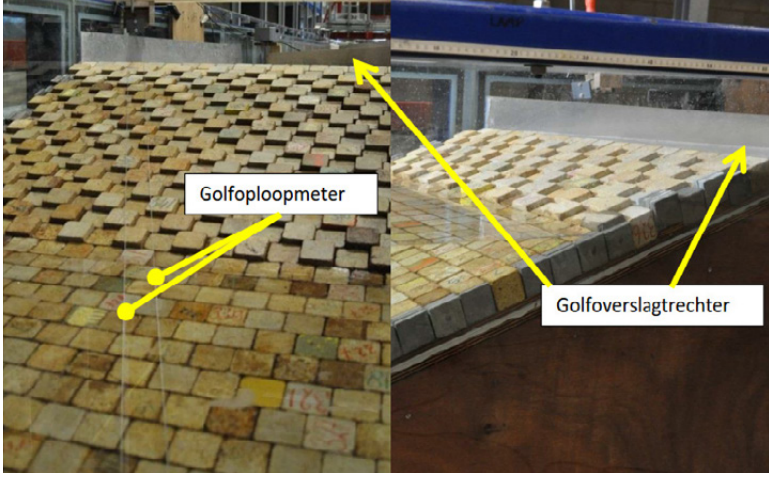

Figure 3 Modelling of block revetments in checkerboard or ribbed pattern (Scheldt Flume)

Figure 4 Basalton® revetment placed in checkerboard pattern

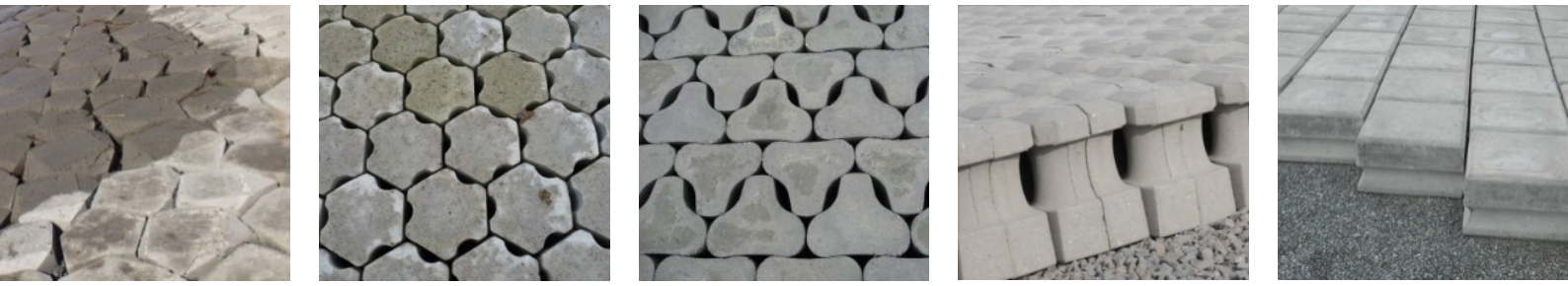

Figure 2 Different types of block revetments tested (from left to right: Basalton®, RONA®ton, C-Star®, Hillblock®, Verkalit®)

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