Abstract FEM modelling for block revetment research

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Dutch flood prone area's are protected with clay dikes with pitched natural stone revetments. A modern version of this structure is the concrete block revetment. The blocks or columns are 0.25 to 0.55 m thick.

The design of these systems, characterized with the stone weight, the hydraulic properties, the slope angle, the joints and the interlocking, the toe structure, etc, were developed empirically. Since the 1970's laboratory testing started. In practice small damages happed to occur regularly under not severe conditions during yearly storms. The research was intensified with full scale testing in the 1980's and 90's.

Over the years 2002-2008 a research programme of Royal Haskoning and Rijkswaterstaat has been carried out which resulted in improvement of the physical models and new design rules. The research included all testing that was carried out in the past. Apart from the full scale tests with typical wave loads, a huge number of simple single stone pull tests was available. In addition to that Royal Haskoning developed and executed a number of other tests.

The tests were studied and the knowledge of the results of the overall failure values and the tested mechanisms was brought into integrated models of the physical behaviour of the revetment systems. The definition of failure probabilities was one of the research objectives also.

As a part of the research a number of FEM models have been made with Diana. Amongst them quasi static hindcasting models for parameter estimation of the structural joints and a simulation of the wave load cycle in a time-integrated dynamic response calculation.

The FEM modelling results contribute to better understanding of the physics and failure probabilities of the revetment systems.