# Overtopping reduction for a sloping dyke at Blankenberge harbour, Belgium

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The Belgian littoral is still vulnerable to the extreme storms such as the one with the return period of 1000 years. To face the coastal hazards, a Coastal Safety Masterplan was adopted aiming to improve the coastal defences against extreme storm events. The harbour of Blankenberge represents one of the weakest areas along the entire Belgian coast: waves can penetrate and produce significant overtopping on the slopping dyke in the south-western part of the harbour. The wave conditions at the dyke toe are: angle of 70-80° respect to the structure normal, significant height 2.5 – 5.0 m and peak period of 12 s.

In the literature there are validated formulas to calculate the overtopping discharge for sloping dykes under the attack of oblique waves and also for the presence of storm return wall. However, the formulas were not designed for the combined effect of the wave obliqueness and the storm return wall position and height. To investigate these combined effects a 3D physical model was designed and built at FHR. The scale of the experiment is 1:50 and the built structure consists of a part replicating the harbour quay with a 1:2.5 slope at the front side and overtopping collecting boxes at the backside. On top of the structure a storm return wall (0.02/0.04 m, in model scale dimensions) is placed at different positions with respect to the front edge of the quay. The water level is varying few centimetres with respect to the quay level, while the waves have Hs=0.030-0.045 m and Tp=1.7s. The wave angle used for simulations ranges between 45 and 80° with respect to the normal. The water surface elevation and incident wave characteristics are measured by resistive wave gauges placed in front and at the toe of the structure (Fig. 1).

The results confirm the abrupt decrease of the overtopping with the increase of the wave angle as mentioned in the literature. The presence of the storm return wall at the crest of the sloping dyke is reducing significantly the overtopping, but the storm return wall is very efficient in preventing overtopping when its position is shifted few meters inland from the dyke's crest. It can also be noticed that the height has less influence than position of the storm return wall for preventing the overtopping. The combined effect of the high wave obliqueness and the inland position of the storm return wall led to almost no overtopping even for the larger waves which normally can occur in the Blankenberge harbour.

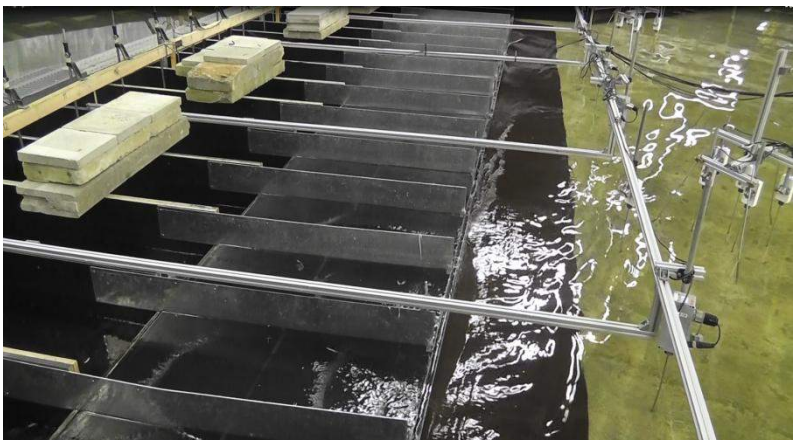

Figure 1. The physical model used to estimate the overtopping discharge at Blankenberge harbour.