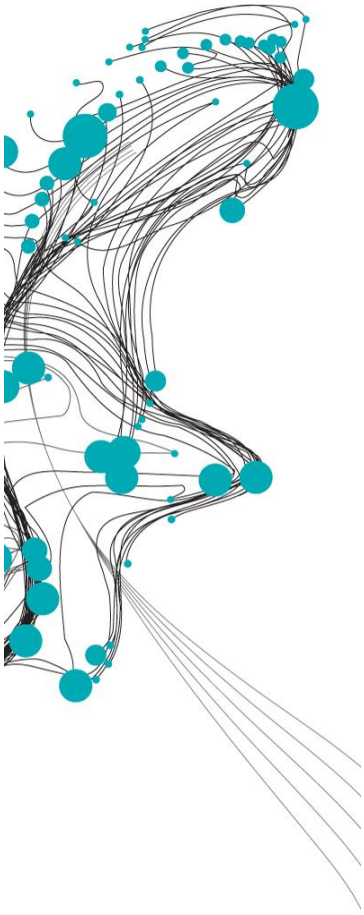
ROAD IMPACT ON EROSION DEVELOPMENT DURING OVERTOPPING FLOOD EVENTS



In the Netherlands, large number of riverine flood defences are combined with roads located at the crest. However, the influence of this road on erosion development during wave overtopping is not yet known. The objective of the research is therefore to quantify the influence of a road located on top of a flood defence on the erosion development during wave overtopping. To reach this objective a coupled hydrodynamic-bed model was developed, which simulates the water released by the wave overtopping simulator and the hydrodynamics and erosion development along the dike profile.

In Millingen aan de Rijn a wave overtopping experiment was performed. Measurements of this experiment were used as boundary conditions and validation data. The simulated eroded dike profiles show some discrepancies compared to the measured data. These discrepancies can be explained by the heterogeneities in soil properties. Local variations of the grass strength were neglected during the simulation, while the berms were damaged due to traffic. In addition, the soil underneath the grass sod includes debris, roots with different strengths and sand. The model assumes a homogenous clay layer, which is a cohesive sediment and has a higher erosion resistance.

Erosion at the crest of the dike increases significant due to a road located on top of the dike. This increase is caused by a combination of the smoother asphalt section and the damaged berms at the transitions. The model is highly sensitive to irregularities in the dike profile. An upward slope with an angle larger than 25˚ leads to a substantial increase of the maximum bed shear stresses. In addition, the overtopping tongue loses less energy due to the lower friction of the road section compared to a grass cover. Moreover, the turbulence of the flow increases due to a sudden increase of the bed roughness at the transition of the road section with the grass sod.

The erosion along the slope and toe of the dike decreases slightly. However, this decrease is small compared to the increase of the amount of scour at the crest. It can therefore be concluded that a road located at the crest has a negative influence on the erosion development during wave overtopping and must be incorporated during the safety assessment.

This research only investigated the influence of a road on erosion development. To evaluate the safety level also factors such as macro stability must be considered.

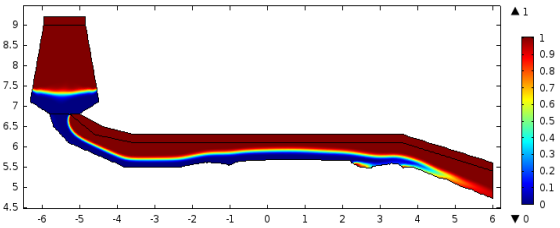


Figure 1: CFD wave overtopping simulation

Figure 2: Test section experiment Millingen aan de Rijn

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