UNIVERSITEIT GENT

FACULTY OF ENGINEERING AND ARCHITECTURE

Experimental model tests on wave overtopping

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techBOOST voor ingenieurs

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Background

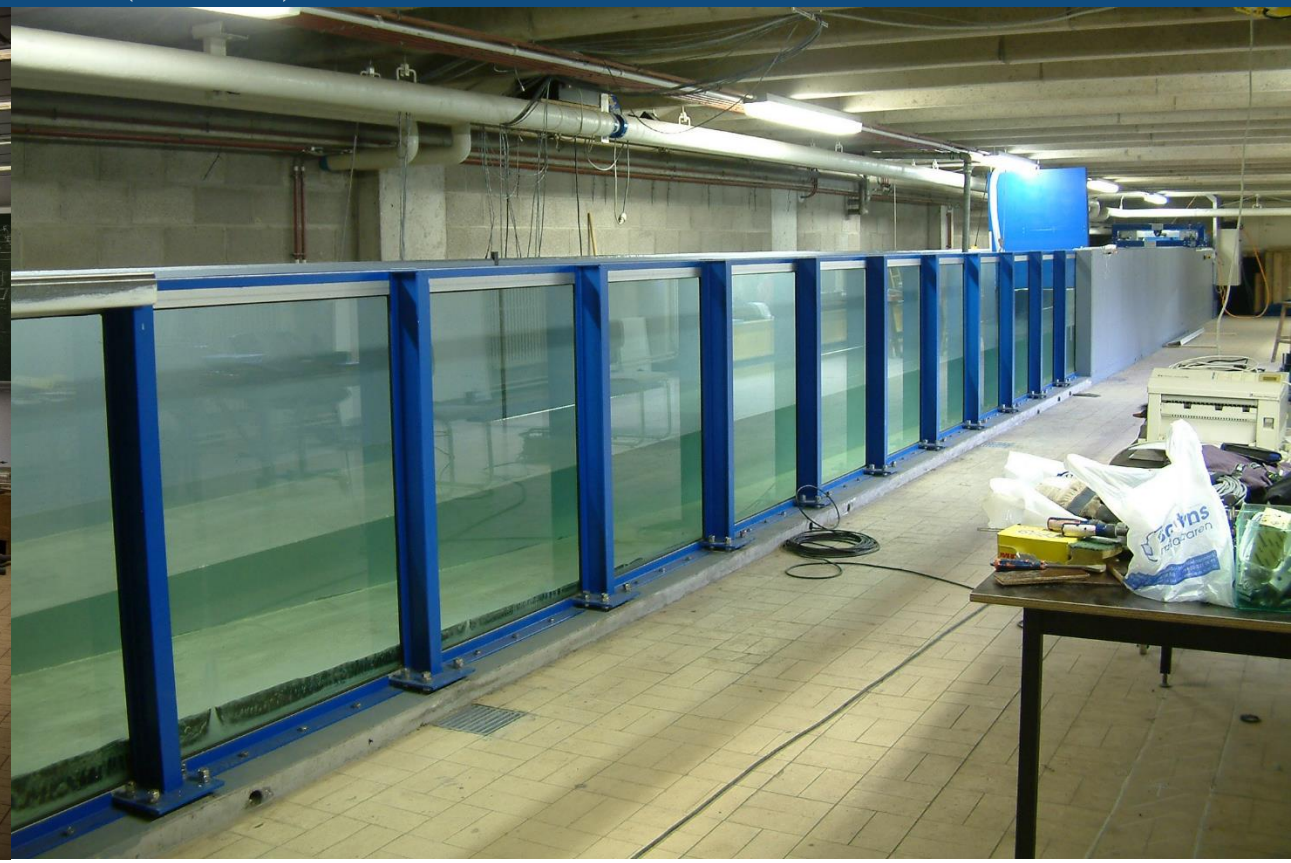
Wave overtopping can affect people, buildings and infrastructures located behind a sea defence structure causing loss of lives and structural damage behind the coastal defence.

An understanding of the overtopping process for different structure types (sloping structures and vertical walls) is key to provide a reliable design of coastal structures, reducing its harmful effect on people and property.

The Coastal Engineering Research Group has extensive experience in modelling wave overtopping in our facilities (two wave flumes). A new facility for 3D model tests -the Coastal And Ocean Basin (COB)- is under construction.

Wave overtopping model tests in a wave flume (AWW)

Small scale wave flume (AWW, UGent)



Medium scale wave flume (AWW, UGent)

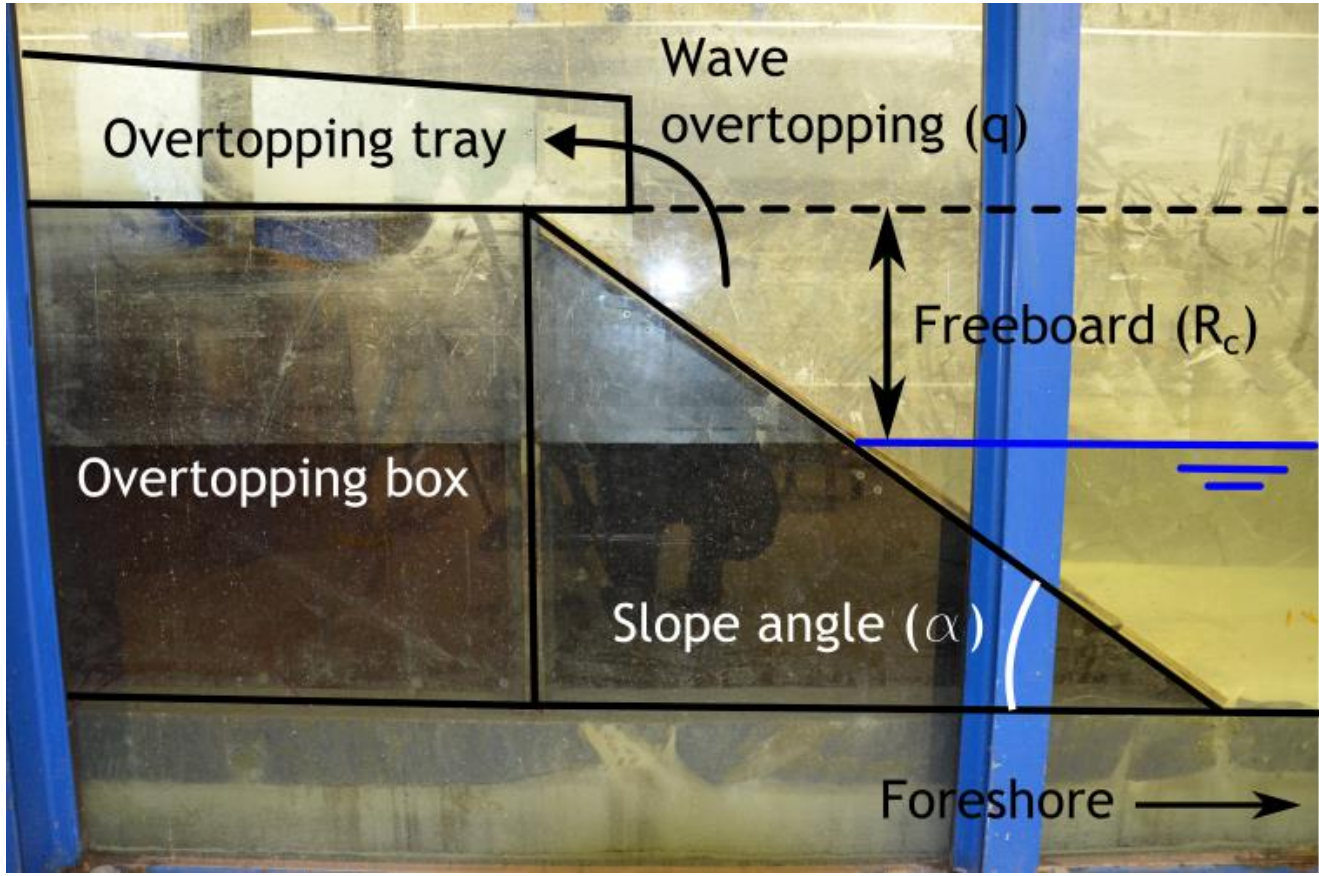
At the Coastal Engineering Research Group we model wave overtopping in our facilities: a small scale wave flume and a medium scale wave flume

Wave overtopping model tests in a wave flume (AWW)

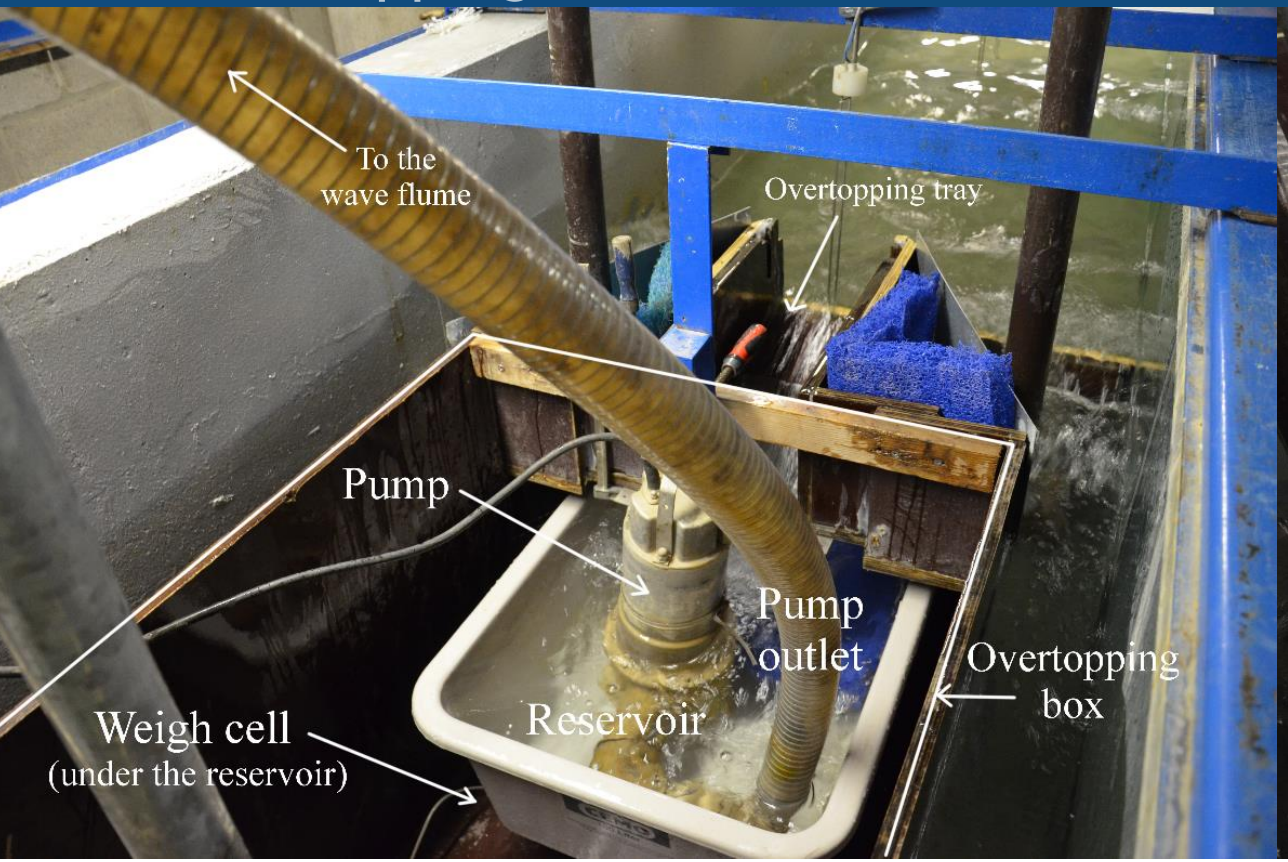
Set-up of a wave overtopping model test:

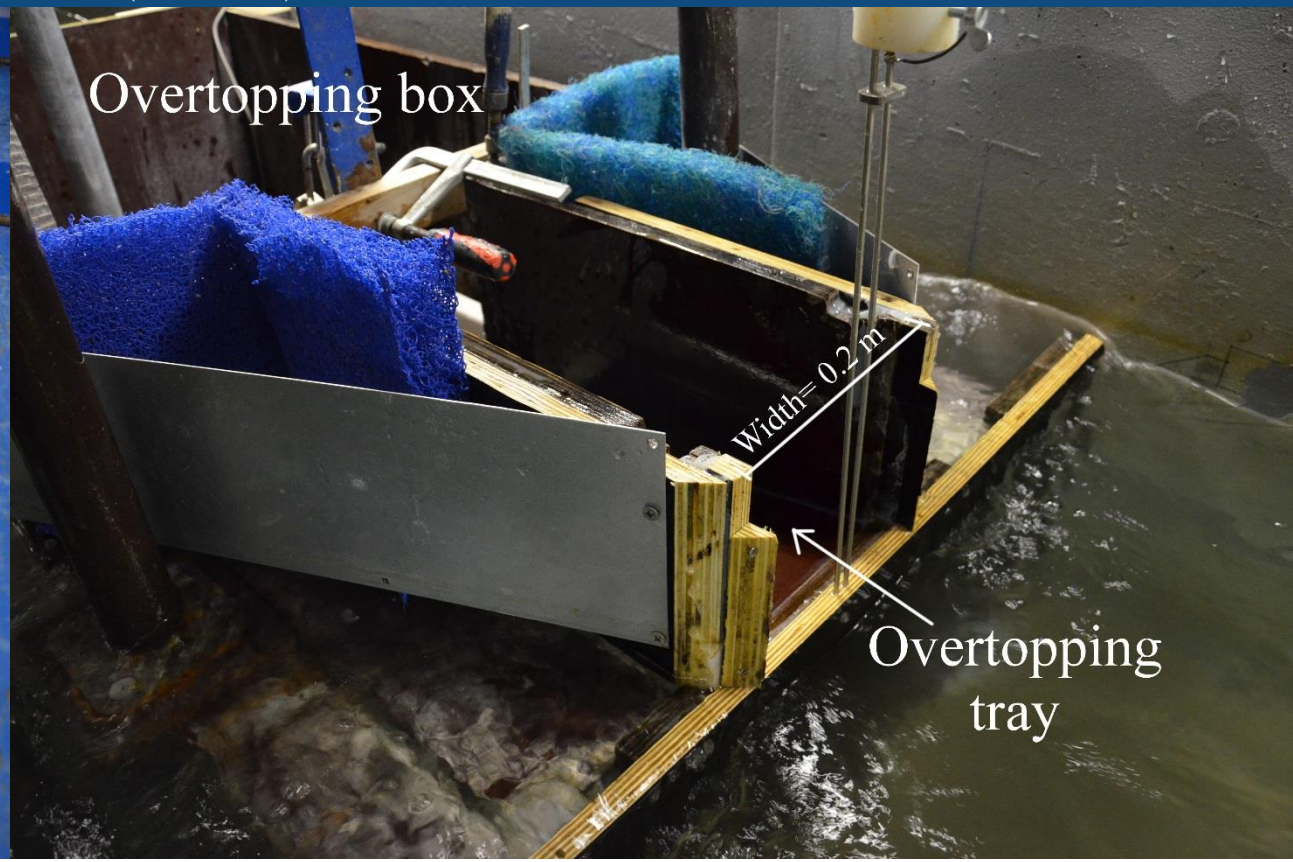
- A foreshore along the wave flume.
- A structure forming a slope angle (α) with the foreshore.
- An overtopping box where the wave overtopping rate (q) is measured

The main governing parameter of wave overtopping is the freeboard (R_c): the smaller the freeboard, the larger the overtopping rate.



Wave overtopping model tests in a wave flume (AWW)





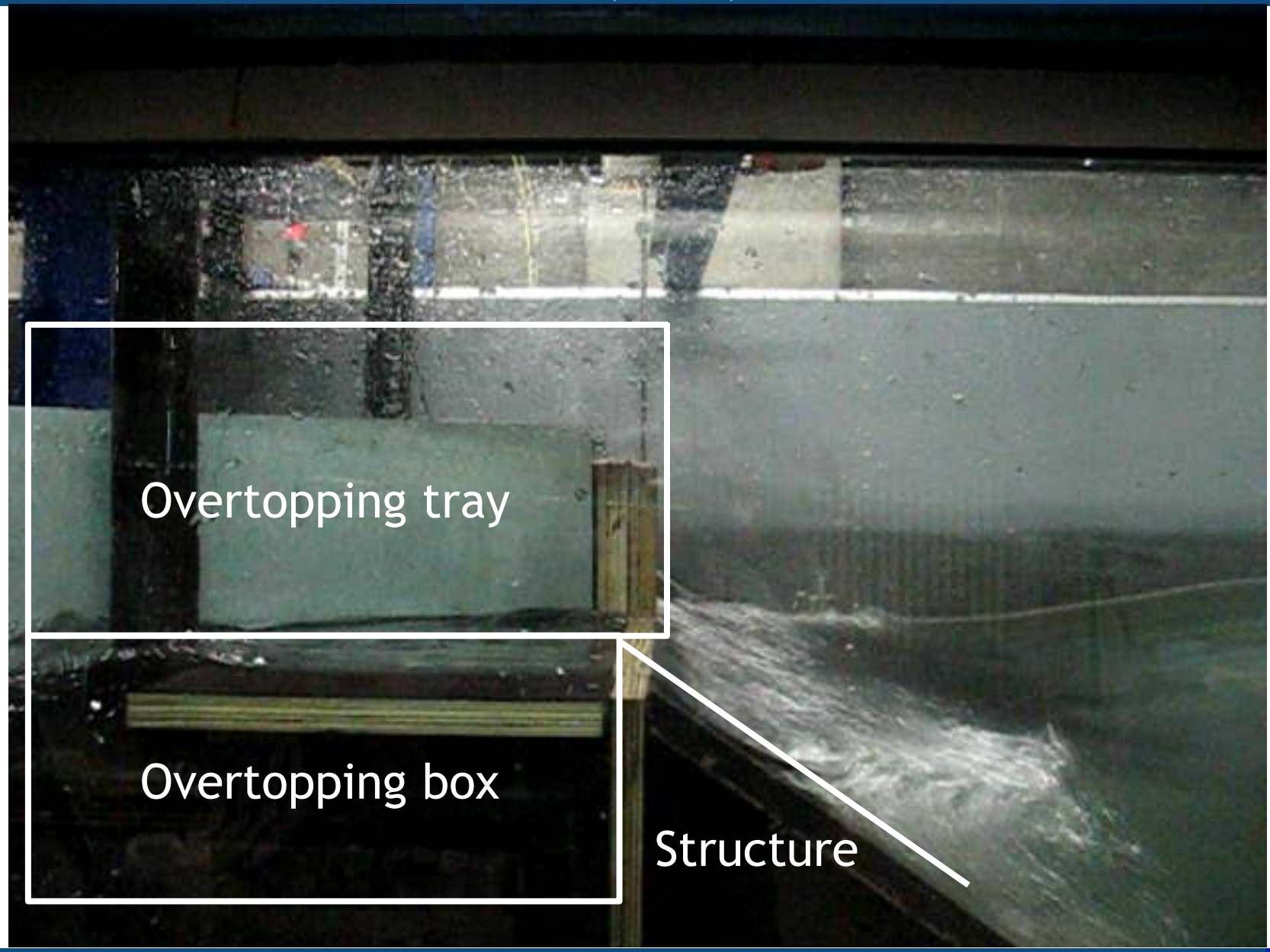
During a model test, wave overtopping is measured by the overtopping box:

1. The overtopped water is collected through the overtopping tray into a reservoir.
2. A weigh cell measures and records the weigh change in the reservoir.
3. A pump returns the overtopped water from the reservoir to the wave flume.
4. The overtopping rate is calculated with a script based on the weigh signal.

Wave overtopping model tests in a wave flume (AWW)

Smooth 35° slope
Zero freeboard

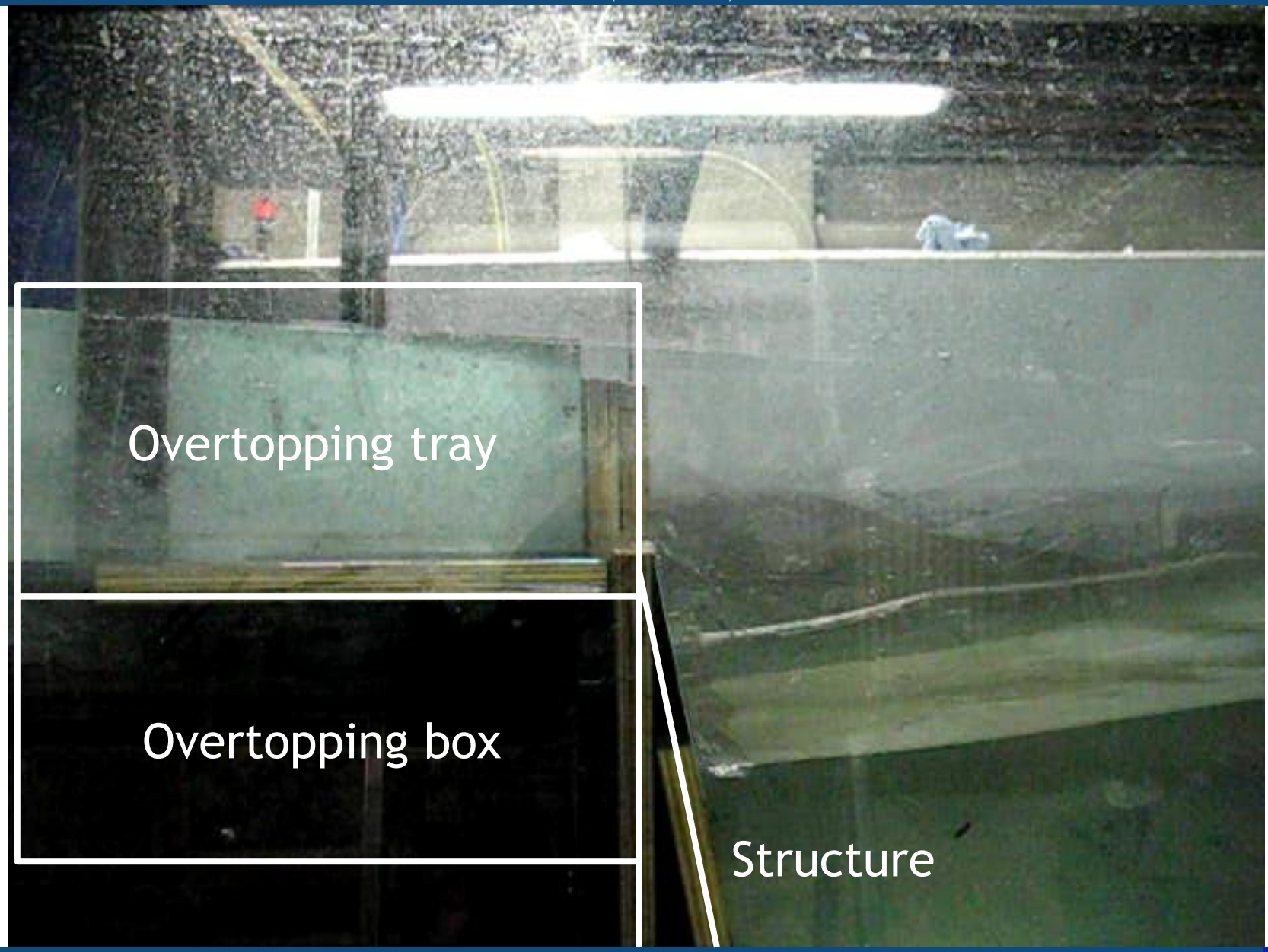
Large overtopping



Wave overtopping model tests in a wave flume (AWW)

Smooth 80° slope
Large freeboard

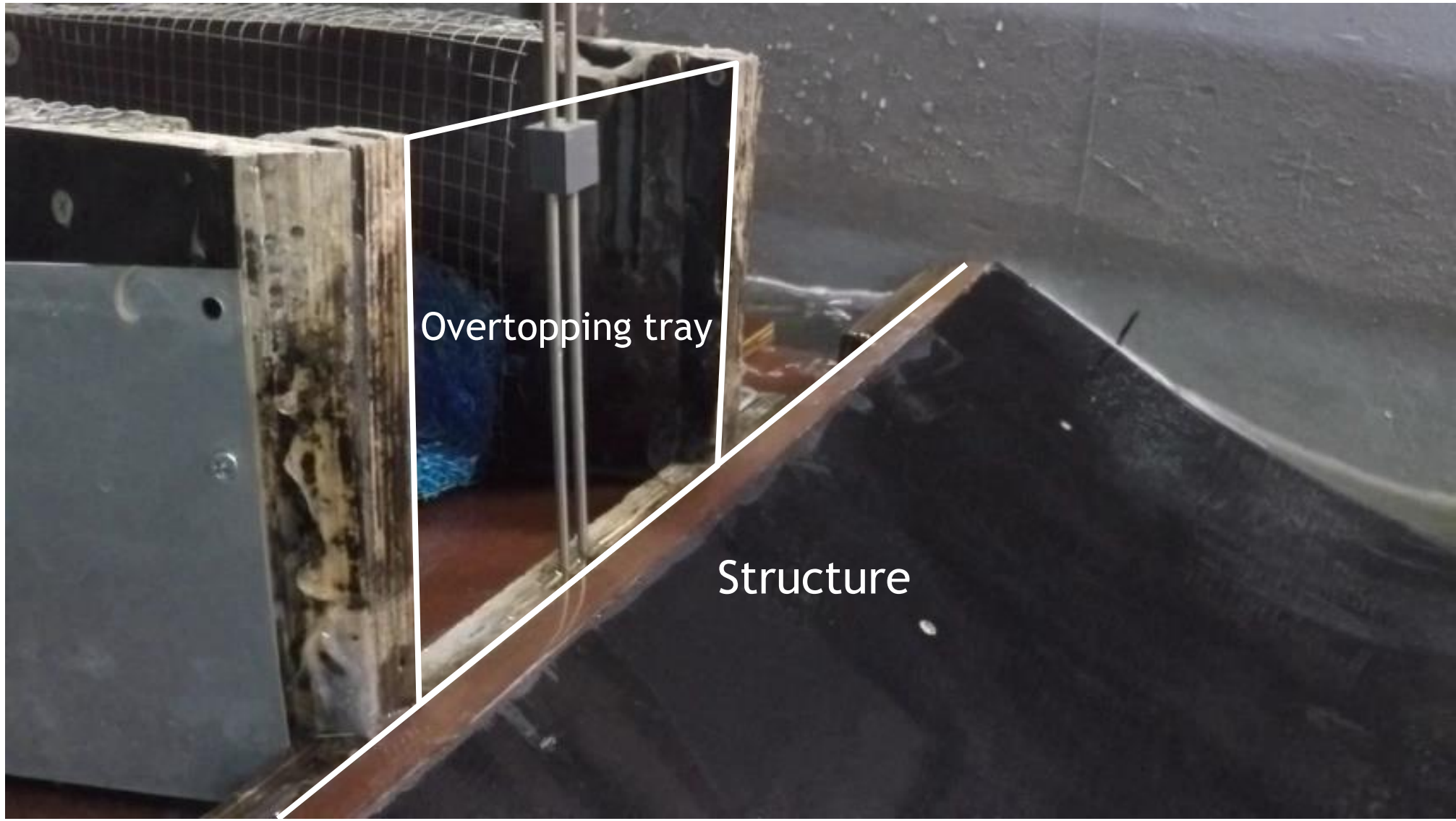
Small overtopping



Wave overtopping model tests in a wave flume (AWW)

Smooth 26.5° slope
Small freeboard

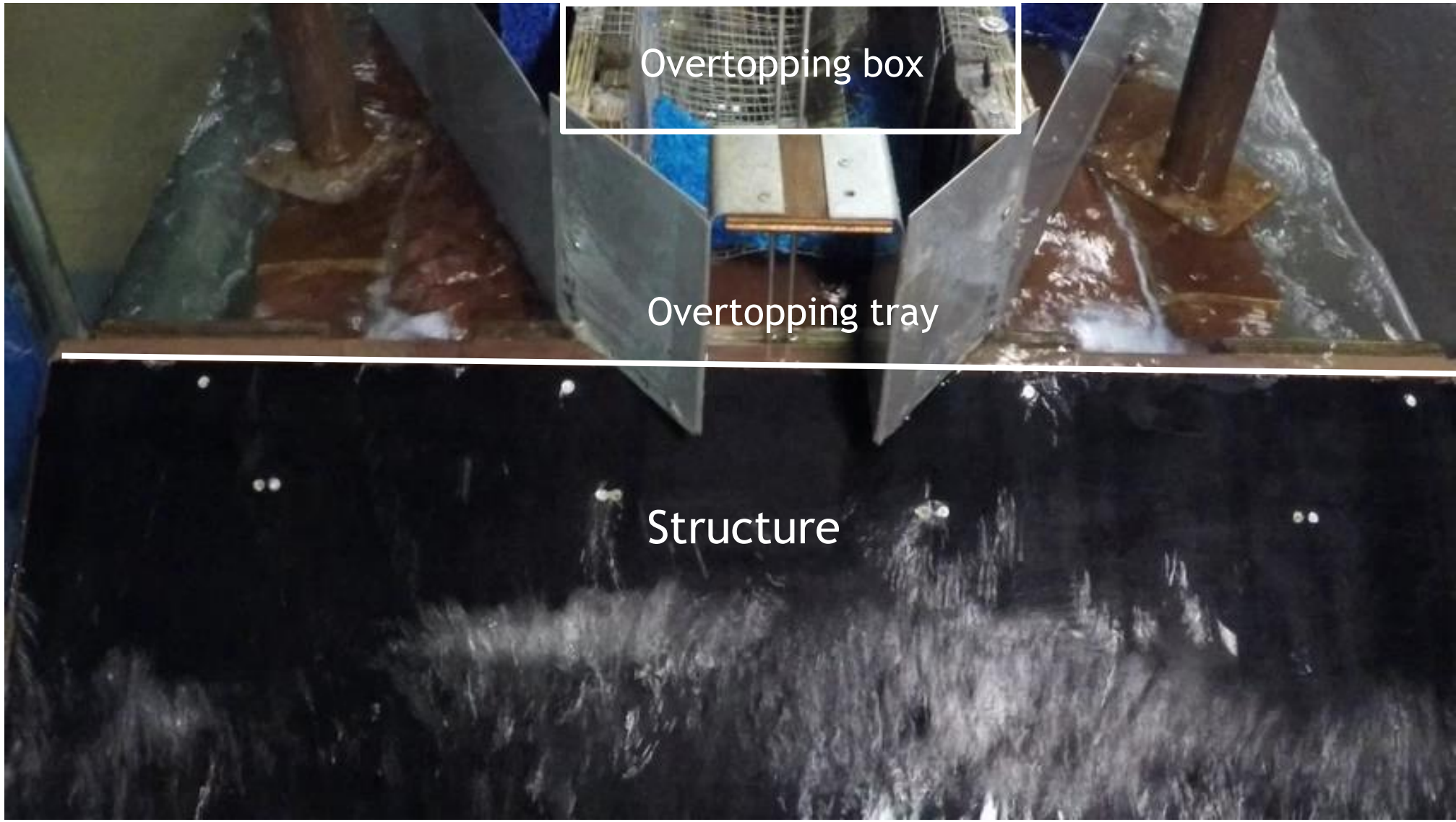
Large overtopping



Wave overtopping model tests in a wave flume (AWW)

Smooth 26.5° slope
Small freeboard

Large overtopping



Model tests in a large scale wave flume (Großer Wellenkanal, Hannover University)

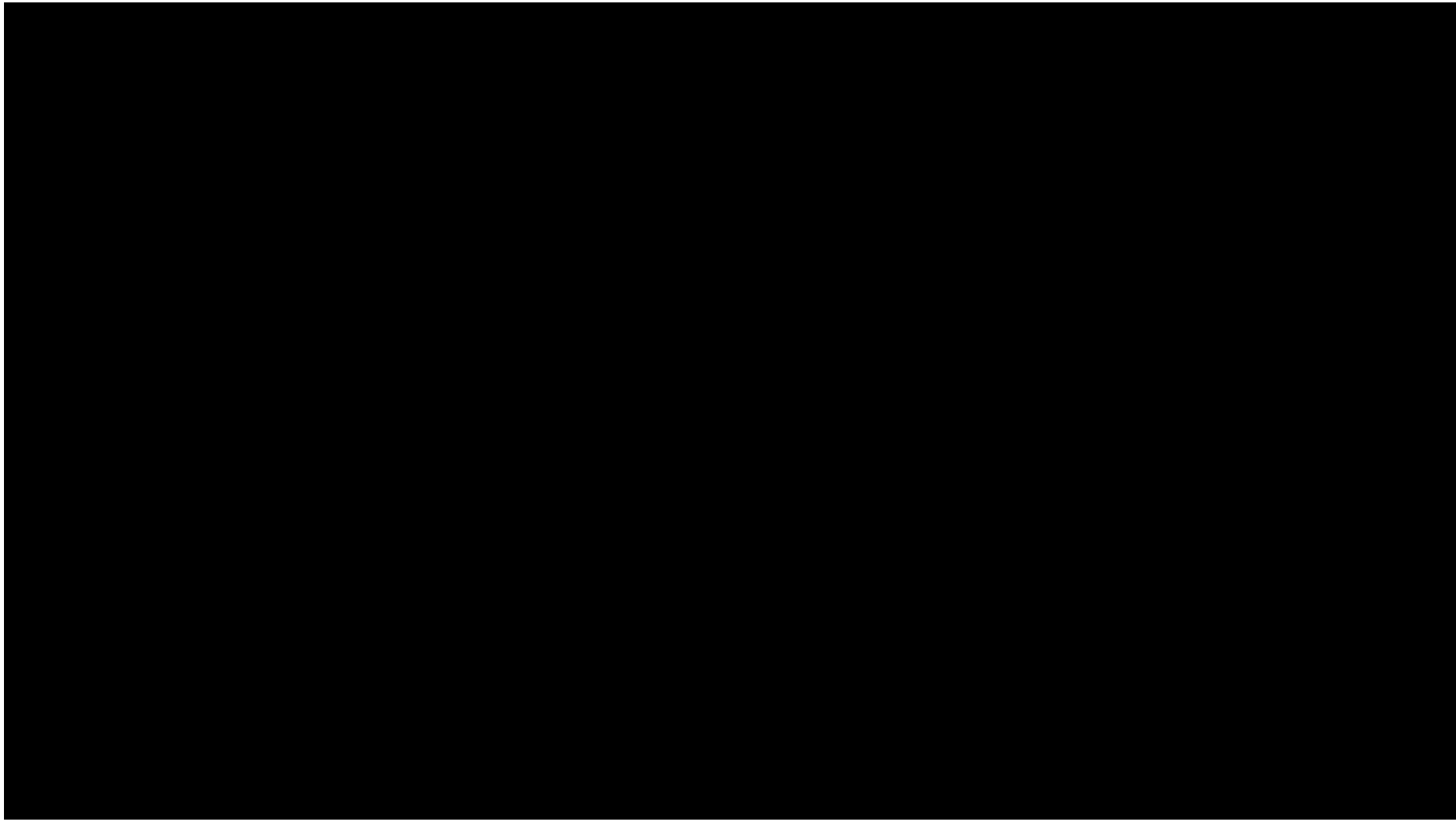
Freak wave

Wave height = 2 m

Model tests in a large scale wave flume (Großer Wellenkanal, Hannover University)

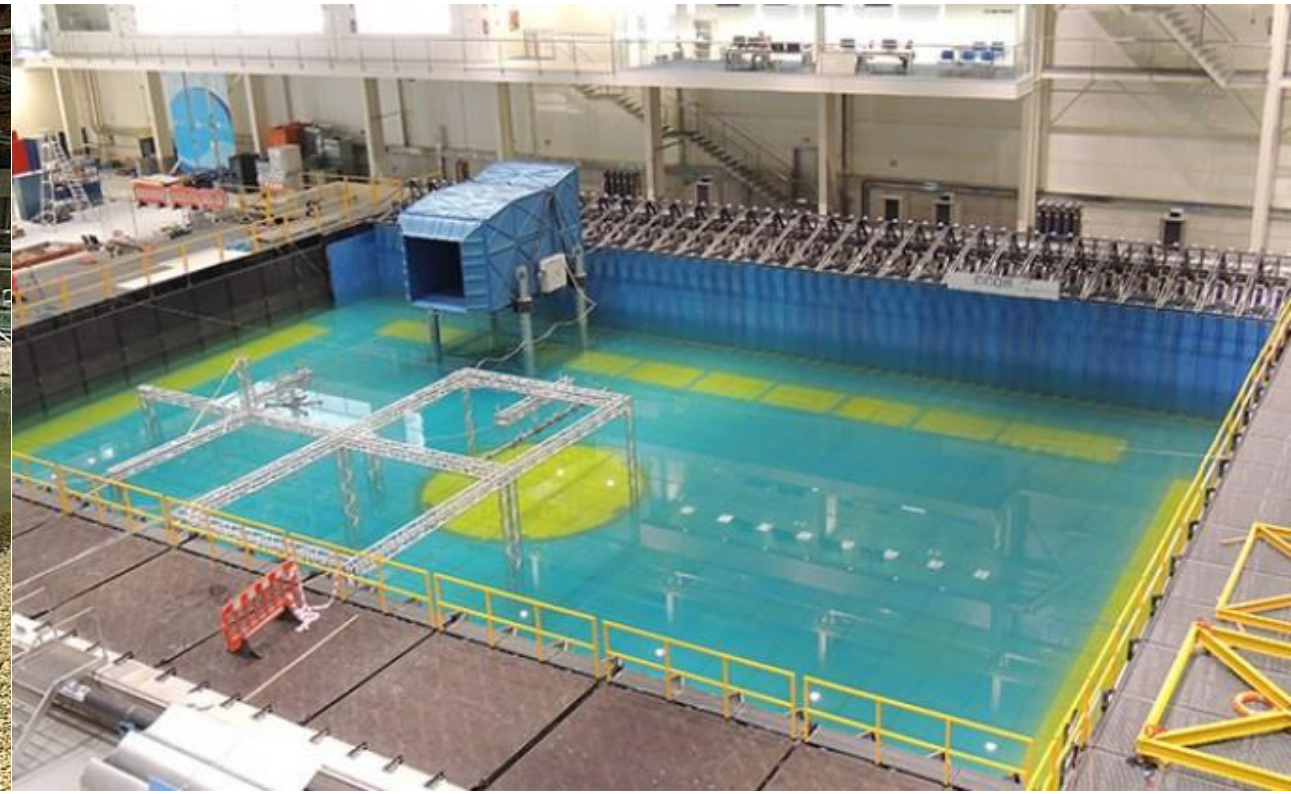
Regular waves hitting
a vertical wall

Incident wave height = 1.8 m



Wave basins: 3D model tests

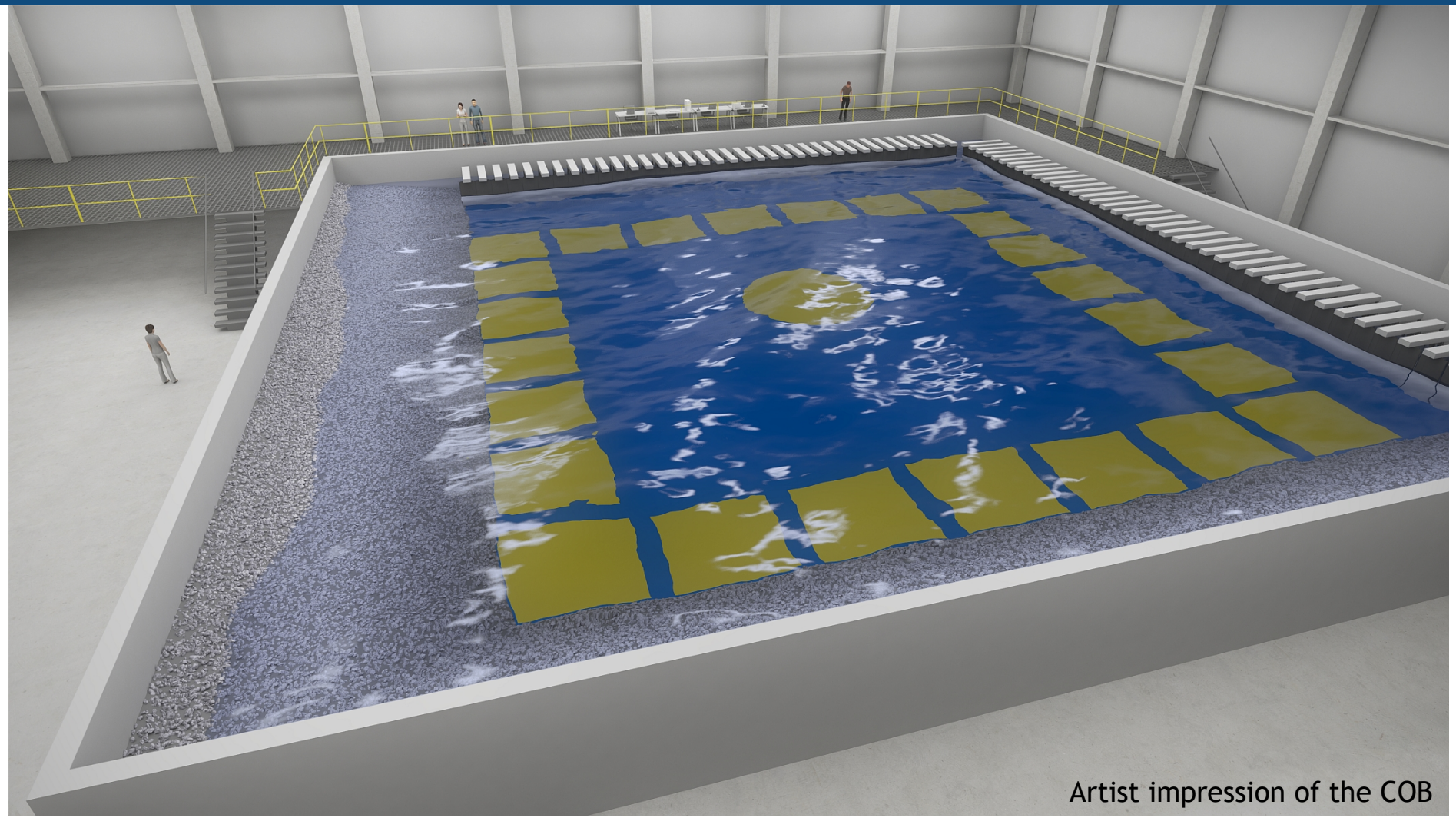
Delta wave basin
(Deltares, The Netherlands)



Cantabria Coastal and Ocean Basin
(IH Cantabria, Spain)

FloWave basin
(University of Edinburgh, UK)

New facility: Coastal and Ocean Basin (GreenBridge park, Ostend, Belgium)



A new 3D facility for 3D model tests in Belgium:
the Coastal and Ocean Basin (COB)

When things go wrong…

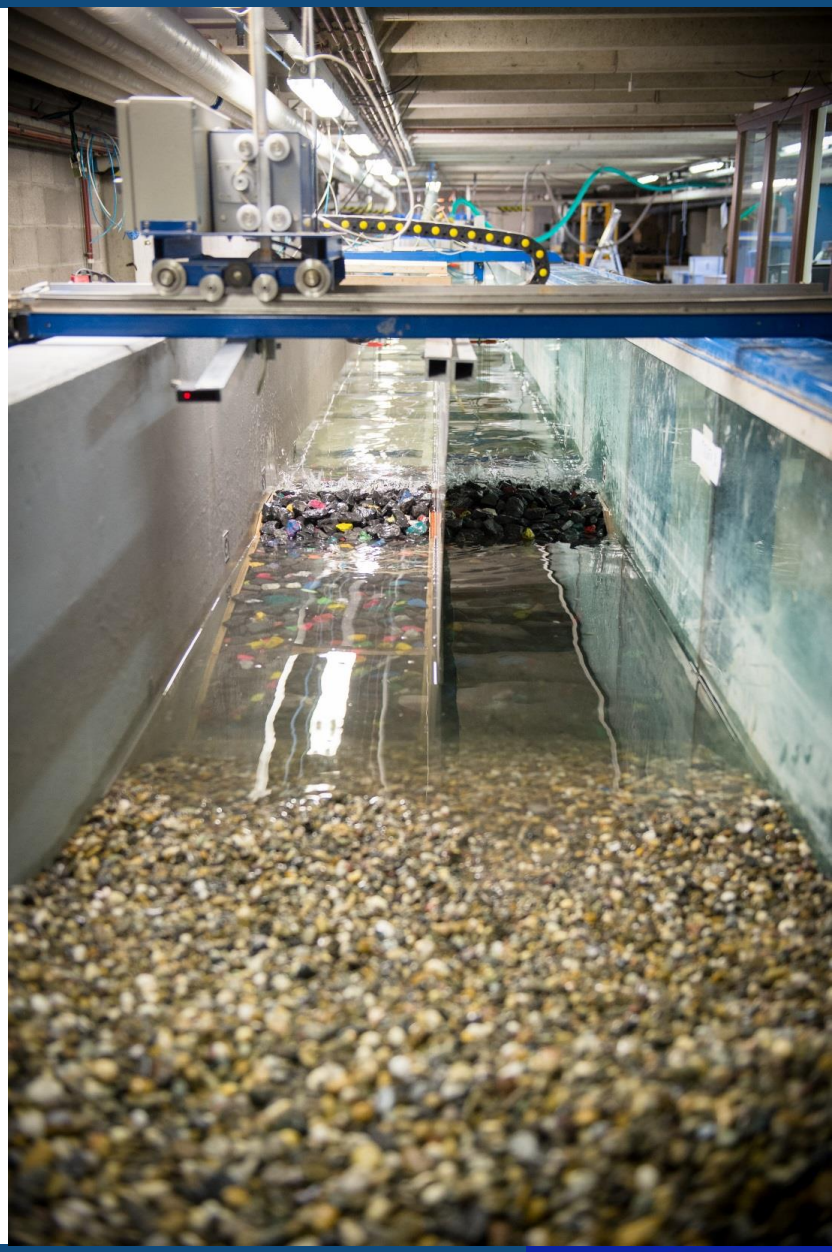
… accidents can happen

When things go wrong…

… people get soaked

Current projects at the Coastal Engineering Research Group:

- Wave overtopping for steep low-crested structures
- Wave overtopping for storm walls
- Effect of parapets on wave overtopping
- Study of individual overtopping events
- Wave impacts on storm walls and buildings
- Study of the relation between wave impacts and wave overtopping
- Design guidelines for wave loads on storm walls and buildings



The Coastal Engineering Research Group is co-authoring the new update of the EurOtop manual, which is a world-renowned manual describing methods to predict wave overtopping of sea defences and related coastal or shoreline structures. Several research results from our group will be included in this new version of the EurOtop manual.