# Coastlab 10

## BOOK OF ABSTRACTS

## CONTENT

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# Breaking Wave Impact on a Vertical Wall with an Overhanging Horizontal Cantilever Slab: Irregular Waves

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Vertical breakwaters and seawalls are frequently used to protect land from sea action such as high water levels and waves. To reduce the overtopping, coastal engineers provide the vertical walls with a return crown wall or even a horizontal cantilever slab. However, wave impacts on the horizontal structure introduce an important uplifting force. The lift forces consist of impact loads of high magnitude and short duration. It is reasonably impossible to substitute these impact effects by static equivalent forces. A detailed description of the space and time distribution of the wave impacts thus becomes imperative. The Pier of Blankenberge which is located along the Belgian coast is an illustrative example of a vertical wall with cantilever surfaces (Verhaeghe et al., 2006).

The qualitative and quantitative determination of wave loads on vertical walls has already been examined intensively in the past decades (e.g. Oumeraci et al., 2001). Uplift loads below horizontal cantilever surfaces are frequently examined in various research projects (McConnell et al., 2003). In opposition to a single vertical or horizontal wall, structures consisting of both vertical parapets and horizontal cantilever slabs have scarcely been considered. A consensus on the necessary approach for the research of this type of structures lacks completely (Okamura, 1993). Due to the special geometry, involving closed angles, which do not allow incident waves to dissipate, the wave kinematics differ fundamentally from the preceding situations.

The main objective of the present research, is to derive a new design tool to assess violent water wave impacts on a vertical wall, including an overhanging horizontal cantilever slab, based on the correlation between the kinematics of breaking waves and the height, distribution, duration and characteristics of the violent wave impacts. In this particular research, small scale model tests subjected to regular and irregular waves have been used.

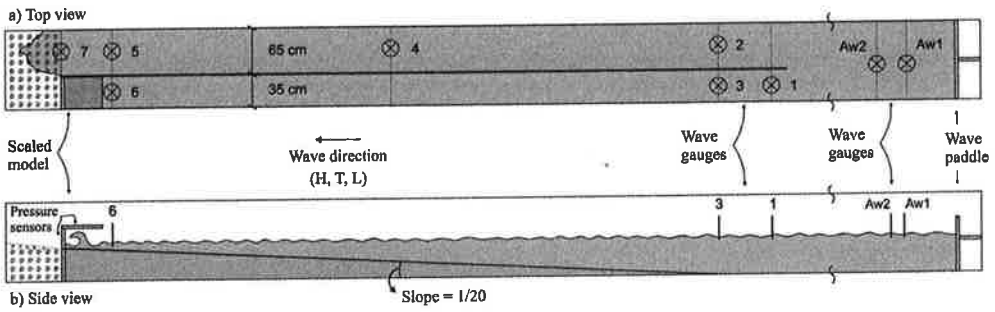


**Fig. 1. The smallscale model set up for irregular wave case. a) Top view, b) Side view.**

b Improved situation, with pretensioning lines of 15 t at each one of the 8 anchorage lines, over the 20 lines available at the initial situation described.

c) Recommended situation. Following this, and after exhaustive analysis of anchor lines and position characteristics was recommended to change position of some bollards, increasing the lengths of several lines were possible, and pretensioning lines with the 15 t on all of the 8 anchor lines previous selected.

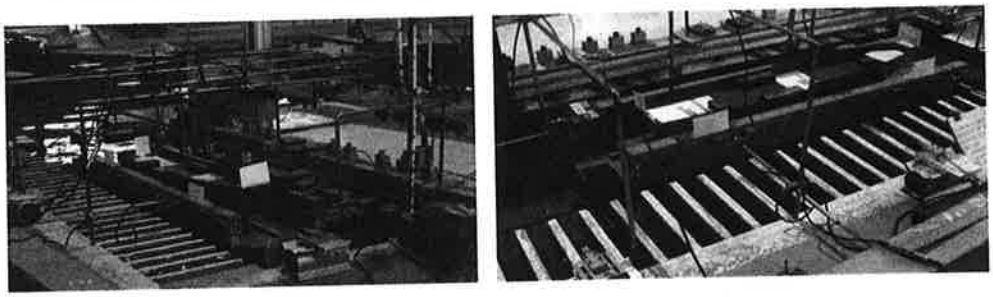

**Figure 2.- Detailed views of the dry-dock model.**

## RESULTS

As the foreseen critical movement for the dry-dock exploitation was considered the surge, produced the highest tensional efforts at the dry-dock's bow lines, situation that was successfully reproduced at tests. Figure 3 show the results for the surge movements in the three situations.

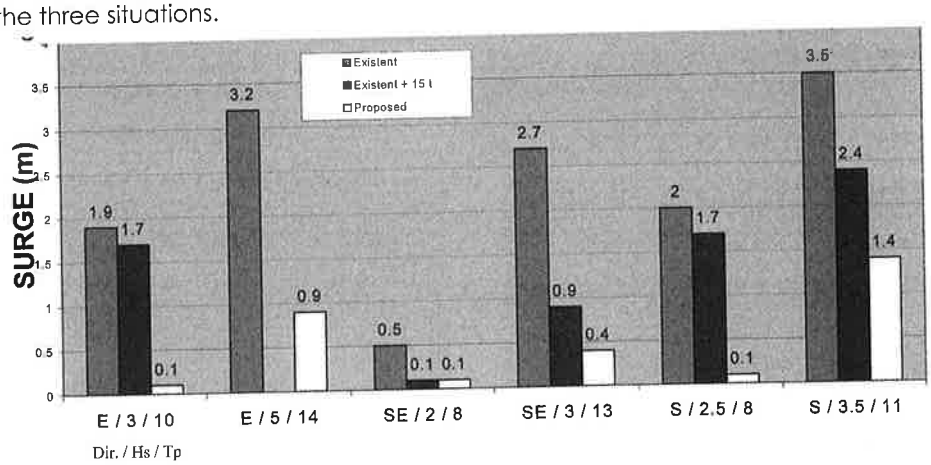


**Figure 3.- Surge movements. Three situations.**

## CONCLUSION

As conclusion, the surge movements were highly reduced with this new proposed anchor lines pattern (recommended situation c). Being this movement the more important affecting the exploitation of the facility, was produced an important improvement in the dry-dock exploitation, and so reducing the fast dynamic tensional efforts in several lines thus avoiding also the breaking patterns and consequently increasing the safety at operation.


## ACKNOWLEDGEMENTS

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