

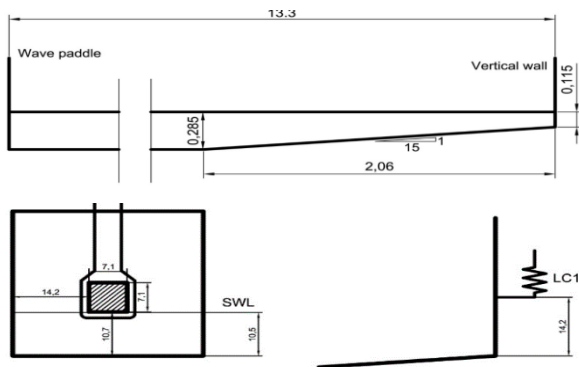
# Coherence of wave impact induced pressures on a vertical seawall

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## Summary

Short in duration and high in magnitude pressure pulses are induced by waves impacting on vertical structures like seawalls. Previously, seminal research projects like PROVERBS and VOWS have highlighted the importance of such impulsive pressures in the design of coastal defenses. Nowadays, the distribution, and in particular the vertical distribution, of impact induced pressures at the face of steep-fronted structures is very well understood and documented in small- and large-scale experiments and in field measurements see for example [1 to 3]. Nevertheless, very little is still known about the spatial and temporal coherence of pressures imparted by waves breaking on a seawall.

In the present work, the experimental results of [4] and [5] are revisited with the emphasis placed on the evolution over time and the shape of pressure fields developed at the face of a vertical structure. The experiments of [4] and [5] were carried out in the 18m long, 0.38m wide and 0.56m deep (CIEMito) wave flume of the Laboratori d'Enginyeria Marítima (LIM) of the Universitat Politècnica de Catalunya (UPC), with a vertical seawall model placed at the end of a 1:15 smooth slope. The pressure fields introduced by regular waves breaking on the wall are captured by a pressure mapping system recording at a relatively high spatial and sampling frequency, specifically 196 single point measurements over an area of 50cm<sup>2</sup> are recorded simultaneously at a rate of 4kHz. The measurements are conducted on a segmented part of the vertical wall that is mounted on a load cell, thereby enabling the acquisition of simultaneous wave induced loads as well; a schematic of the experimental set-up can be seen in Figure 1.

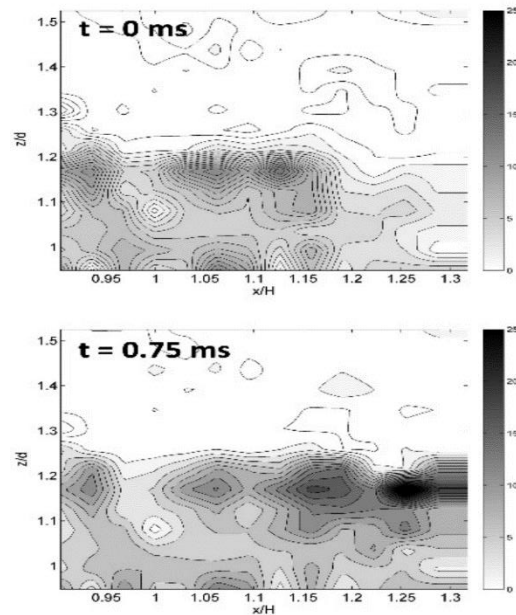


**Figure 1:** Schematic of, top: the wave flume at UPC, and bottom: the pressure measuring area at the wall (on the left) and the load cell (right).

An example of the temporal and spatial evolution of a pressure field induced by a wave plunging on the wall is presented in Figure 2. Here, the 'pressure maps' of more than 360 wave impacts are re-analyzed to explore and discuss the spatiotemporal distribution and coherence of pressures for different breaker types. Empirical statistics are then used to illustrate the relation(s) between the highest pressure peak recorded at the ('traditional') mid-line of the wall and the one recorded over the whole

measuring area. Finally, pressure integrals with different spatial limits are computed and compared with the simultaneous load cell measurements.

Overall, this work will present experimental evidence that aspire to trigger the formulation of answers to long standing questions like, 'what is the probability of missing the highest pressure peak when measuring at single points along the mid-line of a model structure', and 'how important is this pressure peak to the evaluation of wave induced loads at the structure'.



**Figure 2:** Temporal snapshots of the pressure field introduced by a wave plunging at the wall.  $t = 0$  ms is the time of impact. Grey scale in  $P_{peak} / \rho g H$ .

## REFERENCES

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