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LOW-CRESTED STRUCTURES IN FRONT OF COASTAL STRUCTURES

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1 INTRODUCTION

Climate adaptation of coastal structures has become more important due to climate change, resulting in sea level rise and increased wave loading for coastal structures with depth-limited wave conditions. If sea level rise causes wave loading that becomes too severe, one of the options is to reduce the wave loading before the waves reach the existing coastal structure (see for instance Van Gent, 2019, and Van Gent and Teng, 2023). This can be achieved by increasing the foreshore (*e.g.* sand nourishment) or by constructing a low-crested structure in front of the coastal structure. In this study the climate adaptation measure to add a submerged low-crested structure in front of an existing (emerged) coastal structure has been studied. Between the two structures, structure-induced wave set-up occurs. This structure-induced wave set-up has been studied based on wave flume tests. The effects of structure-induced wave set-up on wave transmission at the low-crested structures and the effects on wave overtopping at the emerged coastal structure were also measured and analyzed.

Figure 1. Wave breaking on a submerged low-crested structure (LCS) (upper left) in front of an overtopped rubble mound breakwater with a crest wall (lower left and right).

To evaluate the performance of submerged low-crested structures Van Gent *et al* (2023) performed wave flume tests to examine wave transmission at various types of submerged low-crested structures, without an emerged structure behind the low-crested structures. For a submerged low-crested structure in front of an emerged coastal structure, the transmitted waves can be used as incident waves for estimates of wave overtopping at a rubble mound breakwater, using wave overtopping expressions described in Van Gent *et al* (2022). However, to verify whether the expressions for wave transmission and wave overtopping can be applied for submerged low-crested structures in front of rubble mound breakwaters, new physical model tests have been performed at Deltares. The new wave flume tests were performed with impermeable and permeable low-crested structures in front of impermeable and permeable emerged structures (see Figure 1 for permeable structure).

2 CONCLUSION

Figure 2 shows the predictions of wave overtopping discharges for various types of rubble mound breakwaters, including the results of the new tests. The conclusion of the analysis of the physical model tests is that the set of equations for wave transmission (Van Gent *et al*, 2023) and wave overtopping (Van Gent *et al*, 2022) can be applied for a low-crested structure in front of a rubble mound breakwater after taking into account structure-induced wave set-up.

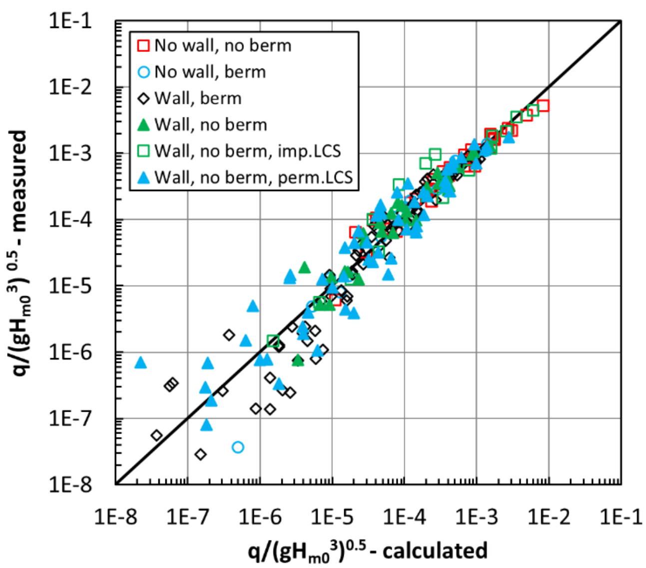

Figure 2. Measured versus calculated overtopping discharges for various structure configurations; Green open squares and blue filled triangles denote configurations with a low-crested structure (LCS) in front of the overtopped rubble mound breakwater.

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