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Influence of depth-limited waves on wave run-up over a smooth sloping structure

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Coastal structures in Sri Lanka are often subjected to depth-limited waves, particularly during design storms. In view of this, the present paper describes an experimental study carried out in a laboratory wave flume to examine the influence of depth-limited waves on the wave run-up over a smooth sloping structure. The run-up (R) measurements were carried out over practically important ranges of the wave steepness (gT^2/H_0, where, g is the gravitational acceleration, H_0 is the deep-water wave height, and T is the wave period), the relative water depth (d_s/H_0), the structure slope (α), and the foreshore slope (β).

The results indicate that the non-dimensional wave run-up (R/H_0) initially increases with the relative water depth at the toe of the structure, reaches a peak value at $d_s/H_0 \approx 1.2$, before beginning to fall and approach a nearly constant value for d_s/H_0 larger than about 2.5. Accordingly, the measurements indicate that shallow water effects are important for values of d_s/H_0 falling between 0.8 and 2 with the maximum effect occurring at $d_s/H_0 \approx 1.2$. As shown by Fig. 1, the maximum percentage increase in R/H_0 at shallow water depths with respect to the mean value in deep water ($d_s/H_0 > 2.5$) is about 20% for plunging breakers and is as much as 65% for surging breakers. These results therefore appear to suggest that the influence of depth-limited wave conditions could be significant in the design of the crest level of shallow water coastal structures.

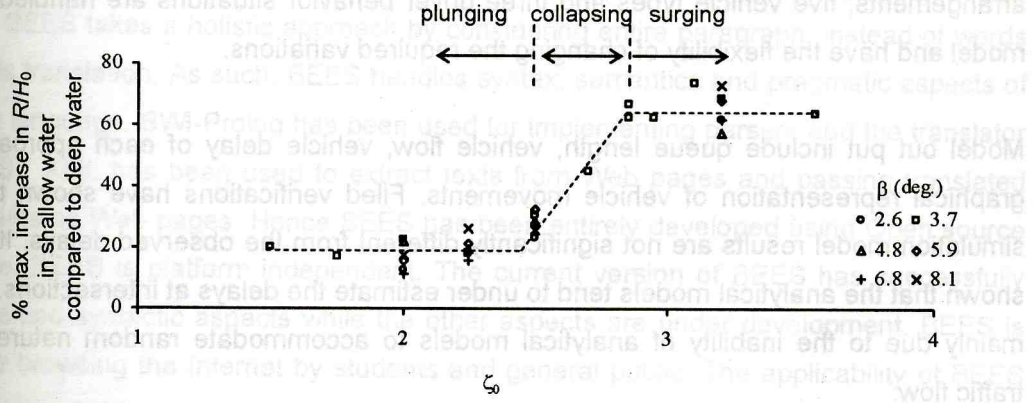

Fig. 1: Variation with ζ_0 of the maximum increase in R/H_0 in shallow water.

The measurements also seem to suggest that R/H_0 increases slightly by about 5% - 10% with unit increment of foreshore slope angle β in degrees to the horizontal, at least for 2.6 deg. < β < 8.1 deg.

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