EFFECT OF RELATIVE WATER DEPTH ON WAVE RUN-UP OVER ROUGH SLOPES OF COASTAL STRUCTURES

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Wave run-up is the maximum level that water runs up along a slope when a wave interacts with a structure. The run-up is required to estimate the crest elevation of structures that are designed for no or little overtopping such as revetments, dikes and breakwaters. The wave run-up on a coastal structure depends on the incident wave properties as well as on the structure characteristics such as the slope angle, the surface roughness, the porosity, the water depth at the toe of the structure and the slope of the foreshore. Even though several laboratory studies have shed considerable light on the effect of the incident waves on the run-up over smooth and rough slopes, comparatively little, detailed information is available on the influence of the water depth on the run-up over rough slopes. Therefore, the primary objective of the present paper is to examine the effect of the water depth at the structure on the wave run-up over rough slopes of coastal structures for a range of the relevant parameters.

The experiments were carried out in a 2D flume for regular wave generation. A model structure consisting of an impermeable surface covered with a single layer of 20 mm median diameter angular granite chippings and fronted by a foreshore slope were placed at the far end of the flume. The wave parameters were obtained using a wave gauge whilst a digital video camera was used to record the wave run-up. Now, the dimensionless groups representing the wave run-up over a rough slope are: $R/H_0 = (d_s/H_0, \zeta_0, k/H_0, \tan\beta)$, where, d_s is the water depth at the toe of the structure, H_0 is the deep water wave height, R is the run-up, tan β is the foreshore slope, and ζ_0 is a breaker parameter.

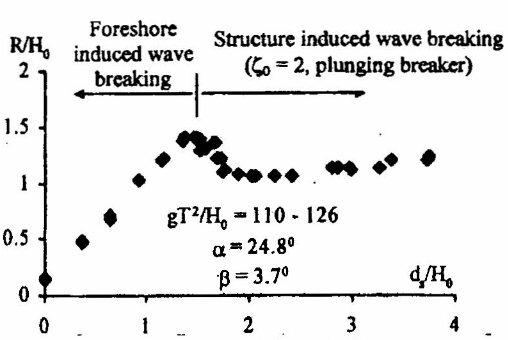

Fig. 1: Variation of R/H_0 with d_s/H_0.
(T = wave period, α = structure slope)

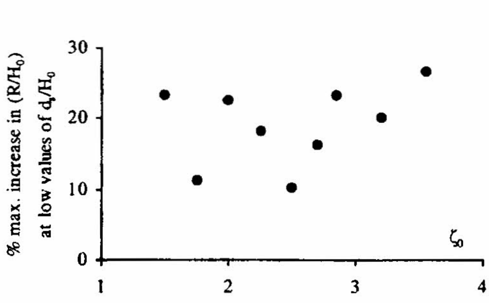

Fig. 2: Variation with ζ_0 of the maximum increase in R/H_0 at low values of d_s/H_0.

Fig. 1 shows an example of the way in which the non-dimensional run-up (R/H_0) varies with the non-dimensional water depth at the toe of the structure (d_s/H_0). We see that R/H_0 initially increases with d_s/H_0, reaches a peak value at $d_s/H_0 \approx 1.2$ - 1.6, before beginning to fall and approach a nearly constant value for d_s/H_0 larger than about 2. Fig. 2 suggests that the maximum percentage increase of R/H_0 at shallow water depths with respect to the mean value in deep water ($d_s/H_0 > 2$) is about 10% - 25%.