WAVE RUN-UP ON SHALLOW WATER COASTAL STRUCTURES

J. J. WIJETUNGE*, A. RAJAMOHAN, S. THEVAKUMAR AND T. SIVAKANTHAN

Department of Civil Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya

Wave run-up is the upper limit of wave uprush above the still sea level. The run-up level is required to determine the crest height of coastal structures that are designed for no or only marginal overtopping. As most coastal structures in Sri Lanka are located in relatively shallow water, they are likely to be exposed to breaking and broken waves during design storms in addition to non-breaking waves. However, a little is known about the wave transformation and breaking due to the foreshore and the subsequent run-up of the breaking or broken waves on shallow water coastal structures. Therefore, the primary objective of the present paper is to study the effect on the wave run-up of depth-limited waves under foreshore induced breaking.

The run-up measurements were made in a wave flume over a smooth, impervious model structure fronted by a 3 m long foreshore. The slope angles of the structure and the foreshore were kept at 25 deg. and at 4 deg., respectively, from the horizontal, so as to be typical of most rubble-mound breakwaters in Sri Lanka. The wave parameters were recorded using a twin-wire probe whilst a video camera was employed to obtain the wave run-up on the slope. The run-up measurements were carried out over a range of wave steepness for three shallow water conditions: a) no foreshore induced breaking, i.e., non-breaking waves, b) with foreshore induced breaking, starting from a distance equal to one-third of the wave length (L) from the toe of the structure, and c) with foreshore induced breaking, starting from a distance $L/2$ from the toe of the structure.

The non-dimensional wave run-up over a smooth slope under the present conditions may be described by $R/H = \phi(d_s/H,\ gT^2/H)$, where, H is the deep water wave height, T is the wave period, d_s is the water depth at the toe of the structure, and g is the acceleration due to gravity.

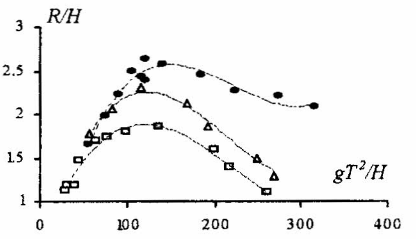

Fig.1. Variation of R/H with gT^2/H.

Fig. 1 shows the way in which R/H varies with gT^2/H for breaking waves, together with non-breaking data for comparison. We see that, under breaking waves, R/H initially increase with gT^2/H, reach peak values of about 2.2 and 1.8 at $gT^2/H = 120$ for $L/3$ and $L/2$ breaking conditions, respectively, before beginning to decrease more rapidly than in the case of non-breaking waves. On the whole, the run-up under breaking waves appears to be smaller than that under non-breaking waves: the reduction is about 15% and 30%, respectively, for $L/3$ and $L/2$ breaking conditions and for values of wave steepness between 75 – 150. This is not surprising because breaking waves dissipate part of their energy through the breaking process before reaching the structure, and consequently, less energy is available for run-up.