Protecting and re-developing coastal beach profile by sustainable hollowed concrete low-crested structure

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Abstract

Coastal engineers and researcher granted that the end effect erosion is one of the major issues, where beaches with stabilizing structure eroded by the accumulation of wave energy. Lowing lying islands are the most suffering from these issues.

In recent years, the detached low-crested structures (LCS) are frequently employed to reduce wave energy, but limited information provided on the usage of sustainable hollowed rectangular concrete block. The purpose of this study is to examine the effect of detached hollowed rectangular concrete block on wave energy reduction and observing the sand movement around the LCS by depositing some volumes of sand as beach nourishment.

The 2D model tested on a King tide condition scaling by 1:10 in meters to get 0.3m water depth with reef flat of 15-meter length and about 1:7 of beach slope in a flume of 20 meters long, 0.8m depth and 0.5m width. The hollowed rectangular concrete of 0.4m length, 0.2m width and a height of 0.15m which is consisted of three rectangular holes inside roughly 1260 cm^3 is utilized in this experiment as an LCS. Six prototype wave periods (Tp) 2, 5, 6, 7,8 and 10 seconds used for generating regular waves. Amplitude 20 Vp-p used for Tp 2,5,6,7 and 8. The 10Vp-p utilized for Tp 10 only because the water splashed out from the flume when using 20Vp-p. Unfortunately, the results for Tp 7 and 8 seconds are unconsidered since they provide bad result even many trials done with different amplitude.

The conversion for wave energy concept simplifying to $1 = Kt^2 + Kr^2 + E_{loss}$ utilized for estimating the Energy loss through dissipation to the total incident wave energy, where K_t and K_r are the wave transmission coefficient and reflection coefficient, respectively, and their values estimated by using Compwave engineering software program. The effect of the LCS width (BW) for reducing wave energy is inversely proportional to the wave length (L), for the design BW > L. The observation confirms that the sedimentation budget is positive where the sand particles move to the onshore direction.