ABSTRACT

Detached breakwaters are shore-parallel structures constructed to serve as a shore protection measure, inducing either a salient or tombolo formation in the protected area. These structures can be either emergent or submergent, depending on the crest elevation. Often, they are designed with crest elevation close to mean sea level to reduce construction cost and the visual impact.

Because of the progressive increment in the use of these structures and the poor knowledge of the shoreline response to them, there exists the necessity to improve the present design criteria.

The main objective of this work is to develop a method to simulate the shoreline response behind low-crested detached breakwaters, using a one-line coastal evolution model. Thus, a specific module to simulate the effects of low crest structure, LCS, on wave conditions has been developed. The module uses the transmission coefficient, K_t, as a parameter to simulate the wave field. The employed K_t-model is that due to d'Angremont et al. (1996) although the method is general enough to be fed by any other K_t-expression.

The simulation of the wave field is based on the modification of wave height and angle calculated for a non-overtopped structures (and, in consequence, only affected by diffraction) in proportion of the associated Kt.

The main variable that controls wave transmission is the freeboard. For this reason, we have analyzed the effects of the freeboard on the medium-term shoreline response. Results show that under normal wave incidence, salient dimensions linearly decrease with the freeboard and for a relative freeboard of -0.25m, the salient dimension is about 70% of the one developed for a non-overtopped breakwater. However, under oblique waves salient dimensions do not linearly decrease with the freeboard and for the same relative freeboard the salient dimensions are about 50% of the one developed for a non-overtopped breakwater.

The developed model has been used to simulate the shoreline evolution under the influence of a detached breakwater in Altafulla, Tarragona. The results are acceptable since the model predicts the shape of the shoreline in spite of the uncertainty on important variables, such as the wave conditions. Also, we have analyzed the effect of the order of wave conditions in the shoreline response and the conclusion is that it has a profound impact. Therefore, in order to know the future evolution of the shoreline it is necessary to simulate the data of wave conditions and establish a range of error associated to this simulation.