Low Environmental Impact Solutions for beach nourishments protection

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Abstract

The development of waterfronts constitutes a highly topical issue that involves large as well as small urban areas facing the sea. Coastal areas represent the interfaces between the urban fabric and the sea, which is widely recognized as an engine for European economy. In order to exploit the potential that coastal areas offer, the planning and management strategies must be aimed at recovering the environmental quality which has seen its gradual decline, especially in recent years since the effects induced by climate changes exacerbate natural and anthropic pressures.

In such a context, the rehabilitation of coastal areas often translates into the creation of artificial nourishments, which require an accurate management plan aimed at defining the financial sustainability of the work, mainly linked to its life-time.

In the present work, an alternative approach for protecting sandy beach nourishment is proposed. The short term morphological evolution of beach nourishment profile under erosive wave conditions is investigated in presence of a mixed defence system composed by a drain pipe placed inside the beach in the swash zone, parallel to the shoreline, and a submerged rubble mound breakwater characterized by a high freeboard, namely equal to 90% of the offshore significant wave height below the mean water level.

A new experimental campaign is underway at the Coastal Engineering Laboratory of the Technical University of Bari (Bari, Italy). The tests on 2-D small scale physical model (according to Froude analogy, 1:10) have been conducted in both unprotected and protected conditions starting from the same initial profile up to equilibrium conditions (16-19 hours in model scale). The drainage system and the submerged breakwater have been tested firstly separately and then deployed together, in order to be able to separate the effects of each intervention on sediment transport. The experimental measurements have also allowed a preliminary calibration of the XBeach numerical model in reproducing the evolution of the nourishment profile in unprotected conditions.

Image

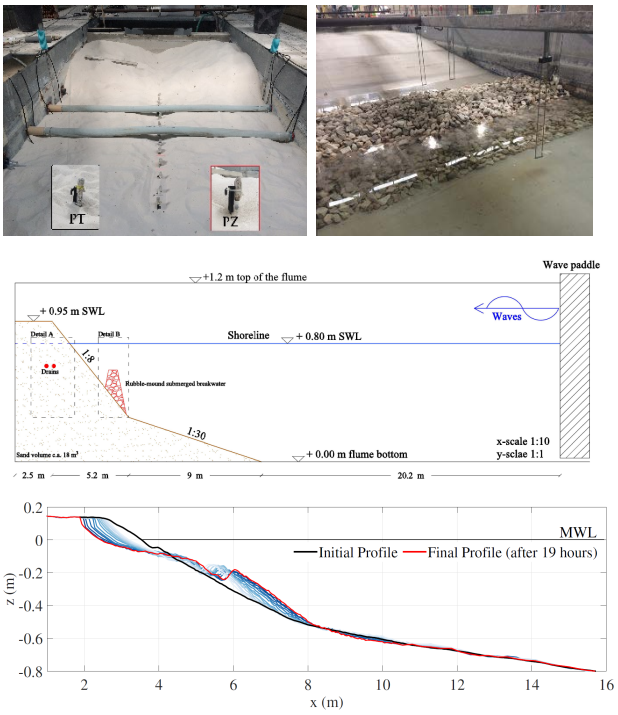


Figure 1- a) Geometry of the physical model; b) Cross-shore beach profile evolution in unprotected conditions.

Recent Publications

1. Berard, N. A., Mulligan, R. P., da Silva, A. M. F., Dibajnia, M. (2017). Evaluation of XBeach performance for the erosion of a laboratory sand dune. *Coastal Engineering*, 125, 70-80.
2. Roelvink, D., Reniers, A., Van Dongeren, A. P., de Vries, J. V. T., McCall, R., Lescinski, J. (2009). Modelling storm impacts on beaches, dunes and barrier islands. Coastal engineering, 56(11-12), 1133-1152
3. Saponieri, A., Damiani, L. (2015). Numerical analysis of infiltration in a drained beach. *International Journal of Sustainable Development and Planning*, 10(4), 467-486..
4. Saponieri, A., Valentini, N., Di Risio, M., Pasquali, D., Damiani, L. (2018). Laboratory Investigation on the Evolution of a Sandy Beach Nourishment Protected by a Mixed Soft–Hard System. *Water*, 10(9), 1171.
5. Malcangio, D., Donvito, C., Ungaro, N. (2018). Statistical analysis of bathing water quality in Puglia Region (Italy). *International Journal of Environmental Research and Public Earth*, 15(5), 1010.



Biography

Alessandra Saponieri is a Civil Hydraulic Engineer cum Laude at Technical University of Bari (Italy, 2008). She got a Ph. D in Coastal Engineering at University of Calabria (Italy, 2012) with a thesis titled *Hydrodynamic and Morphodynamic of a drained beach*. She was involved in several national and international research projects (e.g., Hydralab-III, Hydralab+), involving experimental activities at coastal research facilities. Scientific Research activities mainly deal with coastal environment monitoring, filtration processes in coastal environment, sediment transport, wave energy assessment, coastal risk analysis, coastal defence systems. To date, she is a researcher at Technical University of Bari (Italy). Author of about 40 scientific publications in national and international journals and contributions to conferences and reviewer for various scientific journals.

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