

# Alternative Coastal Protection and Amenity Provision Using Multi Function Sand Filled Geo-Containers

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## INTRODUCTION

Sand filled Geo-containers can prove a cost effective and functional alternative to conventional rock and concrete coastal protection structures. Several Geo-container coastal protection works have been constructed or are in the planning stage for the protection of the coast of the United Arab Emirates as well as elsewhere in the world. Geo-containers have advantages over the traditional rock structures, as they are a cost effective, rapid, and easily reversible construction method. They further provide a habitat for marine life and have less visual impact than high-level rock structures. Additionally, they negate the need for rocks which are often in short supply in Indian Ocean island communities such as the Maldives.

Large geo-containers known as Geotubes have been used in the Gulf Region for creating artificially reclaimed islands, protection of embankments etc. In Dubai geo-containers have been used, or are expected to be used in the near future, for the following works: protection of structures and community facilities from coastal erosion; geotube structures used for wave overtopping protection and; a submerged multi-function artificial reef. In addition to providing shore protection and an attractive habitat for marine life such reefs provide controlled wave breaking for surfing and other water recreation activities.

## COASTAL EROSION PROTECTION

In order to protect private and public properties from undermining and storm wave runoff 2 to 5 tonne geo-containers are used at several sites along the Dubai coastline. Figure 1 depicts the situation at the central embayment of the Jumeirah Open Beach prior and after installation of geotextile SoftRock® containers. The area is the primary public beach in Dubai - the central area of the embayment has been subject to coastal

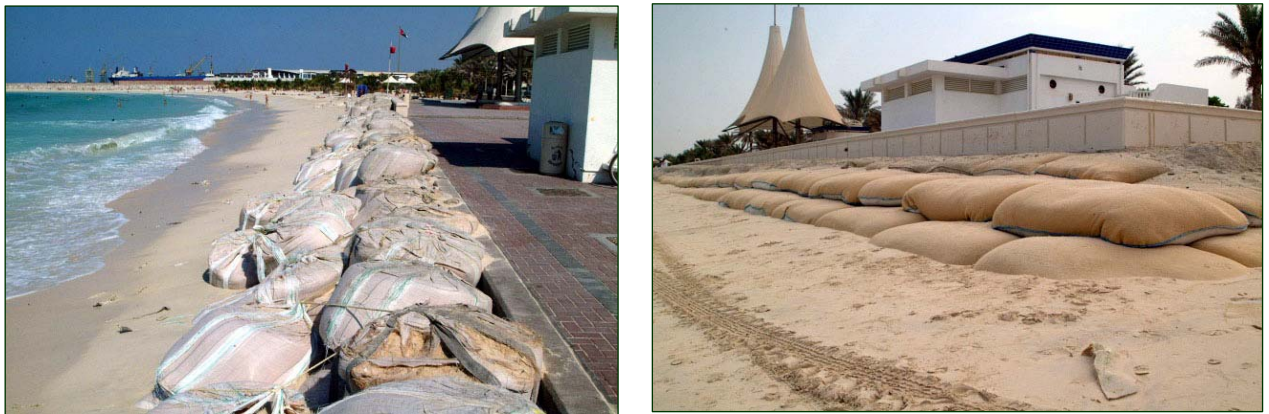


Figure 1: Sand-filled grain bags were originally used to provide temporary coastal protection (left) at Jumeirah Open Beach. These have been replaced with Softrock® containers that have minimal maintenance requirements and blend in well.

erosion and has been the subject of intensive study to come up with an acceptable permanent solution (ref Ward et al., 2003). Temporary protection to the structures situated in the central area of the embayment has previously been provided using grain bags filled with sand. These deteriorated quickly, usually requiring yearly replacement and were visually extremely unappealing. The use of sand-coloured SoftRock® bags to provide protection have improved the situation markedly. Maintenance requirements are minimal and the containers blend in well with the surrounding beach. The containers are barely visible under normal conditions, but come into play during *shamal* (storm) conditions when beach erosion may occur.

## MULTI-FUNCTION ARTIFICIAL REEF

Significant research and development work has gone into the design of a multi-functional artificial reef proposed to be constructed off the coast of Dubai. The structure was designed with three main purposes in mind: providing a surfing amenity by improving wave breaking conditions; providing a recreational amenity for divers and swimmers through attraction of marine life and; providing coastal protection.

The reef design (Figure 2) is discussed in Smit and Mocke (2005). An important objective of the design was to ensure limited environmental impacts, in particular as relates to the safety of beach users and swimmers. The artificial reef was identified as an option that could satisfy the above requirements, whilst also providing an attractive amenity. Although this would be primarily a surfing amenity value the expected attraction of marine life to the structure, as has been found at the Narrowneck reef, was considered as a further benefit during the frequent calm wave periods prevailing in the Arabian Gulf.

Physical and numerical modelling studies undertaken as part of the design have shown that the structure is likely to perform well both as a surfing amenity and for coastal protection. Figure 3 shows an example of 1:30 movable bed physical model test results for the reef structure. The salient behind the structure develops rapidly within the first five hours of testing and then remains stable thereafter. Figure 4 depicts video grabs used as part of the surfing functionality investigation, which demonstrated that the reef provided high performance conditions.

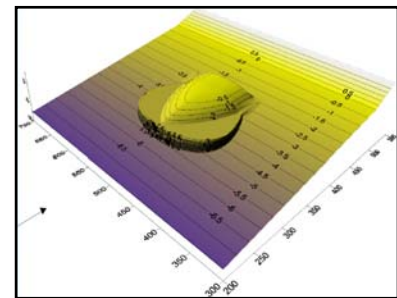


Figure 2: Shape of Dubai artificial reef reef.

## REFERENCES

- Smit, F. and Mocke, G.P., 2005. Physical and Numerical Modelling of Morphological and Surf Parameter Response to an Artificial Reef, 4<sup>th</sup> *Artificial Surfing Reef Symposium Proceedings*.  
Ward, S., Mocke, G.P. and Caporilli, M., 2003. Engineering the Coastal Environment - Jumeirah Beach, Dubai, *Proc. COPEDEC 2003*.



Figure 3: Basin images at beginning and end of Test 1.



Figure 4: Extracted images from oblique and overhead video showing wave transformation suitable for surfing over the reef.