

New Developments With Mega Sandcontainers Of Nonwoven Needle-Punched Geotextiles For The Construction Of Coastal Structures

by

HEERTEN, G., Dr.-Ing.

Naue Fasertechnik GmbH & Co. KG
Wartturmstraße 1
D-32312 Lübbecke
Germany
Fax: +49 5741 400883
email: gheerten@naue.com

JACKSON, L.A.

International Coastal Management
P.O. Box 7196
Gold Coast Mail Centre
Australia 9726
Fax: (07)55329147
email: jackson@onthenet.com.au

RESTALL, S.

Soil Filters Australia Pty Ltd
31 Activity Crescent Ernest Junction Q 4214
P.O. Box 727 Southport Q 4215
Australia
Fax: (07)55394027
email: sales@soilfilters.com.au

SAATHOFF, F., Dr.-Ing.

BBG Bauberatung Geokunststoffe GmbH & Co. KG
Alter Bahndamm 12
D-49448 Lemförde
Germany
Fax: +49 5443 995666
email: bbg@naue.com

The idea to contain sand in geotextile units and to use them as construction elements in coastal protection and thus a replacement of rock armour units and concrete elements is already more than 50 years old. With the increasing cost of the “conventional” construction materials, the use of sand filled geocontainers has increased. In addition, the application of large geocontainers has been encouraged in connection with the submerged deposition of contaminated dredged material from sea ports and estuaries.

The touristical use of beach areas all around the globe has played an important role, as well in the development of this technology to provide economical and user friendly structures. Depending on the value of tourism in beach areas, large investments may have to be made to protect or improve the beach areas and thus to make them more attractive to the tourists. This development in the coastal zone is comparable with winter sports areas established worldwide already with large expenditures on infrastructure such as attractive courses and ski lifts as well as enhancement such as snowmaking to provide more attractive and reliable conditions. Attractive and maintained beach areas to surfers will gain a similar importance as good courses in winter sports areas. For this reason, investments to maintain or to improve the conditions of sports activities might be necessary for an economically successful coastal tourism.

In Australia and in the United States where surfing is a popular recreational activity, some projects are already being implemented where surfing conditions are being improved by stabilising single beach sections by means of nearshore breakwaters designed as artificial surfing reefs. Some of these structures also provide protection of the beach from erosion. The design requirements of structures such as surfing reefs are much more stringent than conventional coastal protection structures.

The classic method of building such structures is an underwater riprap constructed by rock material. Based on the authors experiences with heavy nonwoven geotextiles, the construction of a surf reef with elements consisting of very large sandfilled geotextile containers (geocontainers) has been considered and designed right from the beginning to achieve the requirements for the surfing reef project at the Gold Coast in Australia. Three main advantages of usage are combined with this idea:

- ⊕ Able to meet design specifications
- ⊕ Much more safety to bathers and surfers (danger of injuries is considerably minimised)
- ⊕ Considerably reduced cost
- ⊕ Little toe scouring and erosion problems in the reef area.

The authors have gained experiences with various benchmark projects (Kirra, Sylt) in the development and use of sandfilled tubes at a length of several hundred metres and a diameter of 1 to 1.5 metres, as well as with big sand containers with a sand capacity of up to 20m³. Filling and placing methods have been developed for the installation. In case of the big units and tubes, hydraulic filling procedures have been preferably used. Thus, the surf reef design parameters and constraints at the Gold Coast in Australia required the existing technology to be developed further.

For the Gold Coast project, the authors have now tested the use of heavy nonwoven geotextiles for the production of mega sandcontainers to provide the required dimensions. Mega sandcontainers with a diameter of 3.0m, 3.5m and 4.8m and a length of 20m were hydraulically filled in the FAUCON hopper dredge by means of the vessel's dredging equipment. They were shipped to the planned position of installation and dropped accurately into place by opening the bottom of the hopper section in longitudinal direction. The mega sandcontainers were thus placed on the sea bed.

To achieve success with the mega sandcontainers various disciplines have needed to cooperate and special attention had to be paid to the seams and the prefabrications of the inlets and outlets for the filling process. Special threads and stitching methods were used to achieve a firm seam with sufficient flexibility however for the prefabrication of the mega sand bags. The selected heavy needle-punched nonwovens prevent stress risers in the geotextile due to their high plasticity. The fibre structure of the thick needle-punched nonwovens guarantees the high robustness and the coarse, open pore surface for the embedding of sand and the settlement of marine life. With the immigration of sand into the pore structure of the nonwoven, the nonwoven protects itself against abrasive attack of sand in the breakers zones.

Basically, the use of mega sandcontainers made of heavy needle-punched nonwoven geotextiles - prefabricated in the shape of tubes and filled in the hopper of a hopper dredge - provides a lot of new, not yet assessable possibilities for the construction of special purpose coastal engineering structures and also the useful deposition of contaminated dredging material.

The paper will report about the development of mega sandcontainers, the first successful installation trials with underwater placement (demonstrated at the beginning of 1998,99), of the up to 500 t mega sandcontainers. Until the conference in July 2000, the construction work of the surf reef at the Gold Coast in Australia should be finished, so that first results on the final design and efficiency of the construction can be reported. Based on the mentioned advantages, a successful completion of the construction works at the Gold Coast should be an example for a lot of subsequent projects.