

## SHORE PROTECTION AT THE PORT OF SOYO ANGOLA, SOYO

### SHORELINE & OFF-SHORE PROTECTION / SHORELINE PROTECTION

**Product:** Reno mattresses & Geotextiles

**Problem**

Soyo is located in North-West Angola close to the mouth of the Congo River. The Port of Soyo is situated on the petrochemical logistical supply base of Kwande. In 2004 the western section of the quay at the supply base was expanded to allow three additional berths. These berths were sized to accommodate supply Ulisse-type ships to the area.

The extension of the quay included the protection of approximately 7000m<sup>2</sup> of seabed material from the currents that would be generated by the forces of the propeller and bow thrusters during ship manoeuvring at the entrance and exit to the berth. The primary function of this protection was to prevent the formation of a scour trench that could cause the structural failure of the piled embankments.

Originally, riprap was specified for the protection works but as no rock was available on site and hence had to be imported at high cost, an alternative more economical solution was sought by the contractor.

**Solution**

The rip-rap was replaced with sand/cement filled 0,3m thick PVC coated Reno mattresses.

The mattresses were delivered to site, folded flat into bundles. The bundles were opened and assembled off-site. Panels of geotextile specifically manufactured from non woven staple filament, glazed and pre-cut were placed within each basket. The baskets were then filled with the in-situ estorial sands that had been premixed with cement to the correct ratio. The fill was then compacted before folding over and closing the "geotextile bag". The geotextile was then stapled closed by means of stainless steel staples and a pneumatic stapler.

Each geotextile bag measured 2m long, was 0,3m high and 0,33m wide with a total of 12 or 18 bags used per mattress.

Client name:

SONILS LDA

Main contractor name:

SAIPEM

Consultant:

SCOTT WILSON

Product used:

7000m<sup>2</sup> OF RENO MATTRESSES & 43000m<sup>2</sup> OF GEOTEXTILE

Construction info:

Construction date: JULY 2004

Completion date: APRIL 2005



Area of protection works

Aerial view of the Port of Soyo

Date: May 2004



Filling operation

Date: July 2004



Closing & stapling operation

Date: Jul 2004

After the mattress was filled with the sand-filled geotextile bags, the mattress lid was securely fastened into position and the whole unit stockpiled for use later.

The units were then lifted, with the aid of a crane, and placed underwater to depths up to 8m. For the protection works further away from the quay, the crane was secured aboard a barge. Once placed under water the sand/cement mixture solidified to form soilcrete. The average installation rate based on a 9½hr work day was calculated as 162m<sup>2</sup> per day, while the total time taken for the project included 81 days for the filling operations and 36 days for installation.

**Benefits**

- The use of Reno mattress meant thinner protection layers were required when compared to conventional rip-rap protection works. In this regard the protection layer was reduced approximately 2.5 times than that of an equivalent riprap layer, without compromising on performance, hence resulting in a significant cost saving.
- The introduction of sand/cement filled geotextile bags alleviated the need for importing rock, which resulted in a further cost saving. In this regard, the environmental cost of rehabilitating borrow areas was avoided.
- The use of geotextile, glazed externally, enhanced its abrasion resistance characteristics to minimise filament disentanglement when subjected to scouring forces.
- Specially manufactured steel formwork dividers facilitated rapid formation and filling of the geotextile bags.
- Depending on the use of a single or double divider, each Reno mattress contained 12 or 18 geotextile bags, which reduced the risk of complete mattress failure should one or more bags become damaged during installation.
- The concept of pre-filled mattresses and the provision of a steel lifting frame ensured quick and easy installation of the mattresses under water.



**Stockpiled mattresses ready for installation** Date: Aug 2004



**Lifting operations** Date: Sept 2004



**Lowering & installation** Date: Sept 2004

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