CASE HISTORY

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PROTECTION & RECLAMATION WORK USING GEOTEXTILE TUBE (TECH TUBE) AT KATTUPALLI, TAMILNADU

KATTUPALLI, TAMIL NADU, INDIA

TECHFAB INDIA

Coastal Protection

Client:	Products used & Quantity supplied:
	HIGH PERFORMANCE GEOTEXTILE TUBE (TECHTUBE 03m & 01m DIA & 20m LONG) - 217 NOS
Main Contractor:	
ITD CEMENTATION INDIA LTD.	
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2020

Brief Project Information:

Kattupalli is located north of Ennore Port, about 40 km from Chennai, a major manufacturing and services hub of India. One of the facilities in the eastern coast of India, they have a captive jetty protected by breakwaters. Client wanted to Protect the shoreline from erosion as well as reclaim the land which was eroded over the period of time.

Problem:

M/s. ITD Cementation had approached us to design an economical solution for the protection of 620 m long stretch of proposed reclamation work. The initial proposal of construction of bund using rock armour was expensive & time consuming. If the reclamation work were to be undertaken in the open sea by the construction of a bund to protect the fill material being washed away, then this would have consequently damaged the ecological balance of the coastline.

It was confirmed from the soil investigation report that there would be a possibility for the development of pore water pressure and differential settlement due to very fine silty/sandy soil with clayey pockets. There were possibilities for failure due to differential settlement in case of construction of gravity structure (Rock Armor).

Solution:

After a site visit with the client, many parameters including the bed profile & wave pattern of the region was examined & understood. The requirement of the project was to raise the beach level to a height of + 6m from (-) 1m bed level. The tidal range that pertains to this region was +1.5m above (MSL) 7 (-) 1m below (MSL) as low tide, which is not very significant to affect the stability of the Geotextile tube.

We proposed using TechFab Geotextile tubes (Techtube), which were made of engineered high strength woven fabric, have had been thought of as an effective solution to the problem due to its capability of controlling the shore erosion caused by strong wave action on the one hand and facilitating the natural deposition of the sand layer behind them in longer-term.

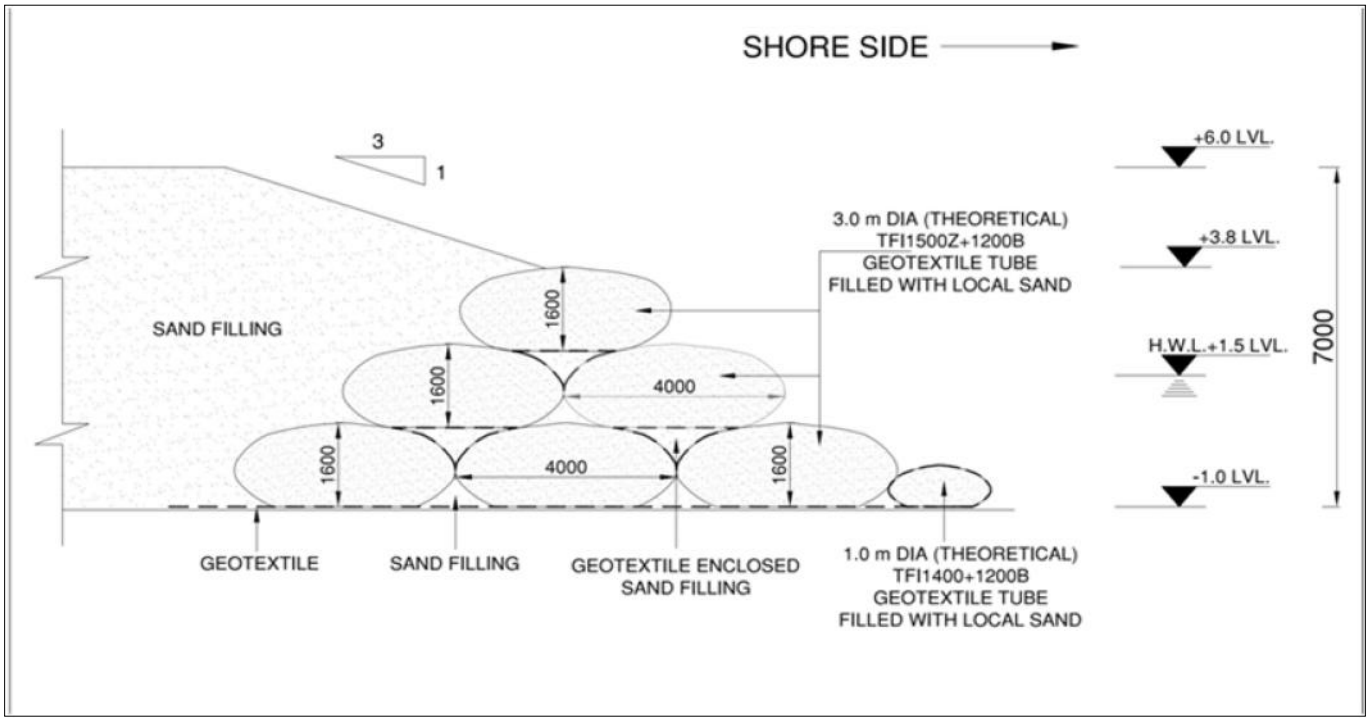
The Geotextile tubes are sustainable since being manufactured from high-quality Virgin Polypropylene material can offer the function of containment, filter, and reinforce soil. The permeability of the soil fill and geotextile has a significant influence on the tube structure. The geotextile for tube manufacturing has been selected based on the performance requirement parameters like strength; filter (AoS); type of infill soil material; seam strength & durability parameters, etc.

Advantages of using Goetextile Tubes over rock structure

- The force of waves is reduced as it hits the sand-filled Geotextile tubes. Conversely, the rock structure was unable to suppress higher energy scouring the toe.
- Monolithic, Versatile and Flexible in nature.
- Even though there may be a differential settlement, the geotextile tube will adjust with the soil bed profile because of the flexibility and porous nature.
- Ease in the Installation, hence the time consumed is less. It is much faster than the rock structure works.
- The system posed characteristics of sustainability and Eco-Friendliness.
- Economical a compared to rock structure
- Beach formation.

The Geotextile tube embankment as shown in the drawing has been analyzed for internal & external factors affecting the stability of the geotextile tube structure. The toe of the main structure of 3+2+1 is provided with Toe tube to ensure protection from scour. Since Geotextile tube embankment will remain in exposed condition (as no armour layer would be given) the durability of the structure has further been improved by manufacturing tube in black colour (carbon black) & an additional sacrificial layer of Geotextile covering 60% of the exposed portion of the tube.

The schematic diagram of the proposed solution is shown here.



Installation Method:

Before the start of Geotextile tube bund construction, the alignment was fixed with respect to shoreline & reclamation profile. A small tug-boat was used to fix alignment by fixing the Bamboo stick & floats in the sea. A temporary bund was created near the shoreline to store the entire quantity of dredged material. The necessary arrangement of pipe & 4-5 suction/sand pumps (min 10 Hp) mounted on pontoon had been installed to facilitate the filling operation of geotextile tube. Sand would be dredged from the area adjacent to the geotextile tubes at a distance of about 50 meters in the water. Owing to restriction in pumping distance of the sand pumps the piping length of the sand pump maintained at about 50 meters to avoid the drop in pressure. Approximately 32000 cubic meters of sand would be required to fill 186 numbers of geo tubes and 31 numbers of toe tubes.

Initially, the empty anchor's tube (toe tube) had been aligned on a relatively levelled bed prepared with pontoon mounted excavator & set finally by the external loops provided at the periphery of the Geotextile tube using a bamboo stick. The Non-woven Geotextile was placed on the prepared bed with suitable anchoring. Each tube has been provided with a filling port every 5m c/c. The Sand /water mixture has been pumped inside the geotextile toe tube port by adjusting the pressure (reducer) and length of the pipe for efficient filling of the tube. The filling of the Geotextile tube has been done sequentially & checked for any concentration or bye-pass of fines through the Geotextile tube, the partially filled Geotextile tube was allowed to settle down the fines by stopping the pumping for few hours. The pressure & filling time has been monitored throughout the complete filling of the tube. This procedure would be continued till the tubes were full with sand. The filling quality has been monitored for correct shape; Seam intactness, etc., then filling port would be closed down once the toe tube is filled with sand, the next toe tube will be placed and the reducer will be connected to the toe tube inlets and dredging shall be continued in a similar way till the entire 620 m is covered.

Geotextile Tube filling is in progress

Filled first layer of Geotextile Tube

Aligning of 3rd Geotextile Tube in base layer is in progress

After complete laying Geotextile Tube in base layer and in middle layer (3+2)

The main Geotextile tube structure of embankment having arrangement 3+2+1m having each tube theoretical diameter of 3m dia. & 20 m long has been filled up with similar procedure by placing one tube at a time adjacent to already filled tube, the pumping operation was monitored & completed sequentially for Bottom layer with the seaside tube for all project stretch followed by middle and beachside geotextile tube; First layer & Top layer. No need to worry about the stability single layer of geotextile tube laid on the seaside as after complete filling, Geotextile tube would weigh after filling more than 150T. Due to heavyweight, a single Geotextile tube has no chance of any type of displacement in wave run-up and run-down condition.

Reclamation: The quantity accumulated in the temporary bund will be pushed in the newly formed area behind the Geotextile tube embankment structure with the help of dozers and excavators. The dried dredged soil will be levelled using an excavator/dozer by maintaining a slope of 1:3.

Conclusion: .The client appreciated technical support provided by TechFab not only in the design of protection bund but also during the installation of geotextile tubes till the completion of the project. The client was very happy with the quality of material and the timely supply of material provided by TechFab India.

This system has been successfully installed in this project. The geotextile tubes that have been proven as an effective alternative to conventional methods for this project and helped in shore protection, erosion control, and reclamation.

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