

## CASE HISTORY

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**SHORE PROTECTION WORK NEAR DANKA TEMPLE FROM DARIYA CHOWK TO EARTH BANK WITH TECHFAB METAL GABION MATTRESS AND TECHCELL GEOCELL AT KHAMBHAT, GUJARAT**  
NEAR ANAND, GUJARAT, INDIA



### Coastal Protection

Client:	Products used & Quantity Supplied:
PUBLIC WORKS DEPARTMENT, GUJARAT	• TECHFAB METAL GABION MATTRESS 6X8, ZN+PVC COATED (05X02X0.3)
Main contractor:	• TECHCELL GEOCELL TCI 445*100
H C PARMAR	• NONWOVEN GEOTEXTILE PR 20
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	JUNE 2020

### Project brief & Challenges:

Khambhat , also known as Khambat and Cambay, is a town and the surrounding urban agglomeration in Khambhat Taluka, Anand district in the Indian state of Gujarat. It was once an important trading centre, but its harbour gradually silted up, and the maritime trade moved elsewhere.

Scientists have found that these mudflats are experiencing severe erosion which is threatening nearby habitat. The researchers found that a total of about 28.66 Sq.km area of high tidal mudflats has got eroded within a span of just three and a half years - from March 2014 to September 2017. The erosion rate was observed to be very high at 3.5 to 4 km per year, according to results of the study recently published in journal Current Science.

The erosion is higher in winter and pre-monsoon seasons than during the summer monsoon. It appears to be because of high input of fresh water during the summer monsoon, which prevents strengthening of current velocity during high tide. Although high tidal mudflats are rarely flooded even under high tide conditions, extensively high erosion has been observed along the 20 km long stretch and about 3 km inside. The high rate of erosion has changed the shoreline.

The Gulf of Khambhat is a hotspot for major development activities, authority wanted a solution so that the mudflats are saved before they are destroyed totally. The site gets inundated during high tides and the department is looking for a solution which can effectively function as a barrier for the offshore and can prevent further inundation.

Main challenge was to work on site only few hours available in between low tide and high tide, working hours depends on tide timings. Otherwise site is clear and no issue to work.



Site condition before construction

## Solution:

After considering all data available, the solution was proposed i.e. construction of levee. A levee is simply a man-made embankment built to keep a river from overflowing its banks or to prevent ocean waves from washing into undesired areas. Levees of 2.5m height was proposed to prevent offshore against inundation.

- The Levee system with earthen core which is covered with geomembrane to avoid water percolation in the earthen core. A layer of nonwoven geotextile is provided as a separation/filteration layer.
- The slope of embankment towards sea side is more prone to erosion or scour due to wave action, where it was suggested to use Gabion Mattresses on top and beneath mattresses Geomembrane is suggested as Impermeable liner .
- A launching apron was provided towards sea facing for mitigating formation of scour hole near to the toe and thereby preventing the levee against toe erosion.
- Beach side slope which is not much exposed and faces mild surface erosion so it was suggested to use geocell (Techcell TCI – 445x100) for preventing surface erosion due to runoff and enabling a turf reinforcement cover by improving vegetation.

Proposed solution shown in the Figure -1

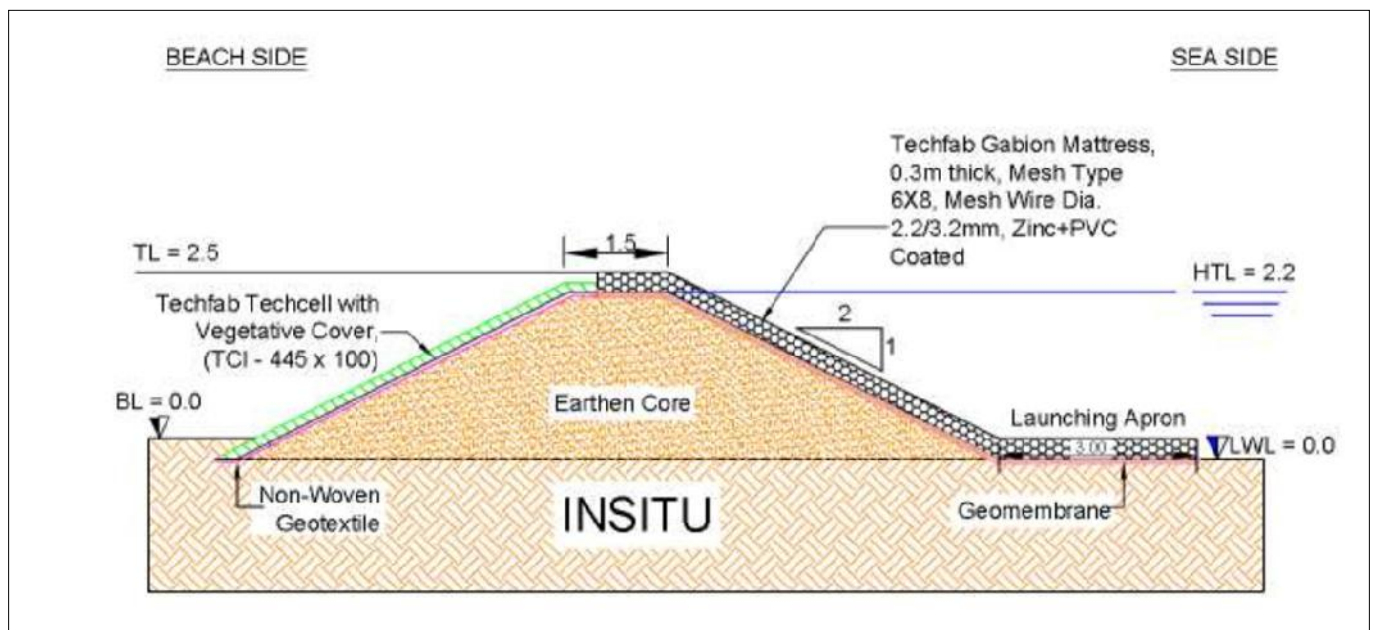


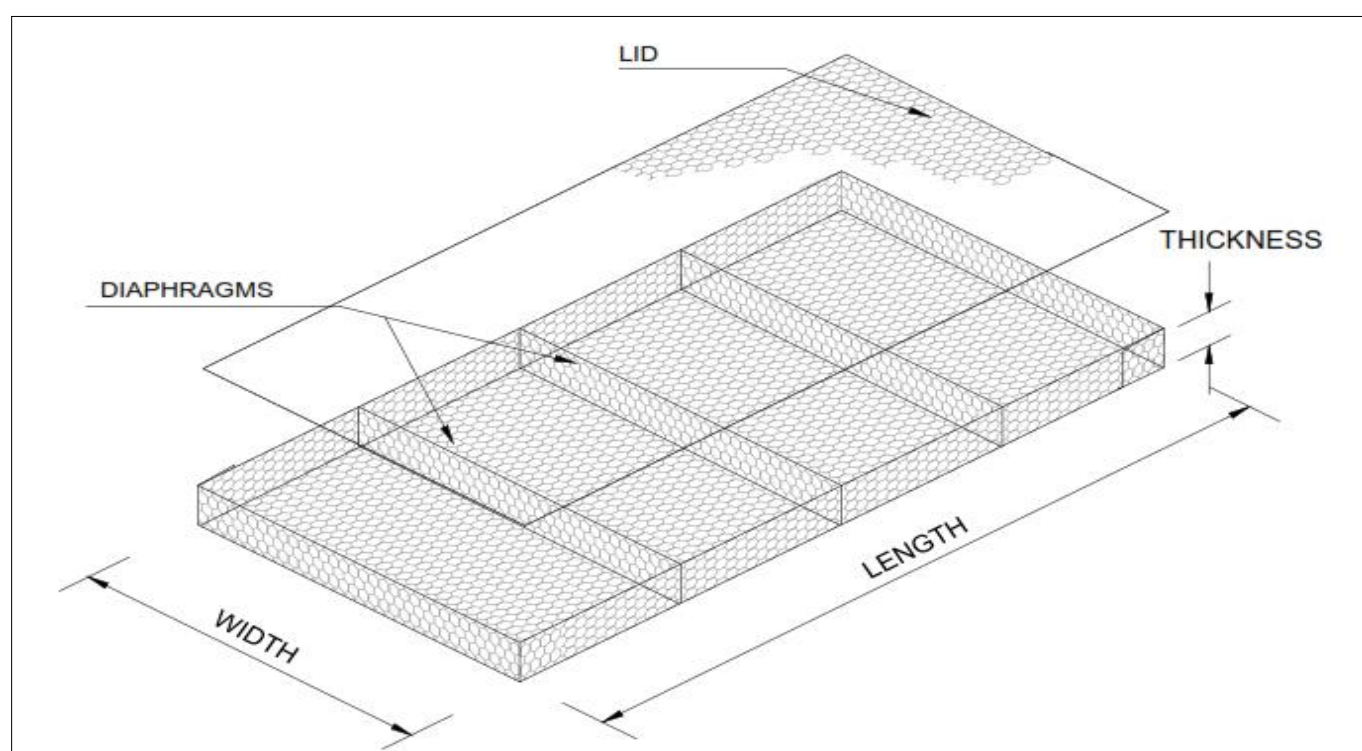
Figure 1 Showing Typical Schematic Section of Proposed levee

## Why Techcell Geocell ?

- A light weight yet strong 3 dimensional honeycomb like confinement system.
- The 3D confinement prevents movement and shearing of soil infill, soil erosion along steep slope.
- Techcell is perforated to allow water to pass thus dissipating water pressure and enhanced drainage.
- Installation is very easy and fast in all weather conditions.
- Techcell landscaping gives aesthetically pleasant view.

### Why TechFab Metal Gabion Mattresses ?

- Metal Gabion Mattresses structures are heavy monolithic flexible lining able to protect from erosion.
- For any given hydraulic condition the average size of stone fill needed for Gabion mattresses is half that required for a rip rap revetment.
- The condition of 'initial movement' for rip rap is a limit condition beyond which the lining is progressively destroyed as the separate elements are removed by the flow. However, in Gabion mattress after the 'initial movement' the containment offered by the mesh remains. A new situation of equilibrium with a deformed Gabion mattress is obtained, allowing it to withstand more severe conditions without compromising the resistance and without further deformation.



Gabion Mattress

### Why TechGeo Nonwoven geotextile ?

- When the infill and sub grade are different, or if the sub grade is very soft or wet. A layer geotextile can provide a useful separation function by keeping the infill from migrating out from under the geocell.
- The Geotextile is used to prevent soil beneath it from erosion due to water flowing over.
- TechGeo act as separation layer, filtration, and drainage layer to some extent.

### Execution at Site For embankment

- Prepare embankment with recommended type of soil with 2H:1V slope on either side as per given approved drawings.
- Remove the debris, kankars, unacceptable soil or garbage from the embankment slope.
- Both slopes are prepared and well compacted using plate compaction then a layer geomembrane is laid as specified in the drawing.
- As per drawing, installed the non-woven geotextile on the prepared well compacted slope, overlap should be provided as mentioned in the drawings or installation guidelines.
- Installation of Gabion mattresses towards the sea side done first to secure the Embankment.



Prepared Embankment with low tide

### Execution at site for slope on the sea side

- The ground surface over which the gabion mattresses are to be laid should be inspected for any irregularities or weak pockets. It is recommended that the surface over which the gabion mattresses and Geomembrane is placed should be even and firm.
- In case any irregularities or weak pockets are observed, they must be rectified by removing the weak soil and replacing by good soil and well compacted.
- For the purpose of easy transportation, the Gabion mattresses are bundled and packed in a flat folded manner. Each mattress was carefully opened out, laid flat and straightened out so that all the kinks and creases are removed. The sides and the diaphragm are then lifted vertical and laced together to form a mattress like structure. (Refer Fig.1).



**On the sea side slope - Gabion Mattress laying in progress**

- Gabion mattresses were laid on the slope and then laced together. The adjoining Gabion Mattresses were firmly wired together to give a continuous joint along all edges. The lacing should be continuous and not in individual loops. It is easy and recommended to lace the Gabion Mattresses when they were empty to ensure correct lacing.
- All adjoining empty gabion mattresses were laced along the perimeter of contact surfaces to obtain a monolithic structure.
- Before filling, the gabion mattresses was accurately placed in required position, tensioned and straightened to remove all kinks. The gabion mattress was hand packed. The stones were tightly packed so as to achieve maximum density and minimum voids.
- By using well graded stone fill and by hand packing of the stone fill. Also care was taken not to damage the mesh particularly due to sharp stones. The stones used for Gabion mattresses filling were as per guideline shared by TechFab India.
- The gabion mattresses were over filled by about 25 to 50mm before closing to allow for settlement. The lids were then stretched over the stone fill and laced down. The corners of the lids were secured first. Removing or redistributing of some stones on the top was required while closing of the lids. The lids were then laced down securely. Lace selvedge wire to selvedge wire using the same procedure as mentioned in the installation manual.

### Execution at site for slope on the beach side

- Position the Geocell section along the slope direction.
- Install J shaped anchors on the top with proper alignment to hold Techcell section in place on the slope.



**Geomembrane & Nonwoven geotextile layer is laid and Gabion Mattress installation in progress**



**Techcell Geocell installation in progress**

- Expand down the Techcell section on the slope as per the expandable dimension suggested for each techcell section and then fix Techcell by using J shaped anchors.
- Adjacent Techcell section must be leveled with each other and tie with each other using cable string supplied with Geocell.
- Install J hooks at specified distance as per the drawing to fix the Techcells .
- When Techcell has been laid in place properly, Techcell should be filled with specified material.
- To prevent possible damage, limit drop height of infill to not more than 1m.
- Infill should be delivered either to top of slope or bottom of slope using a loader.
- When using vegetative soil fills, overfill section by 25 to 50 mm to allow for settling and compaction.
- For vegetative slope, locally available vegetative soil should be utilized as infill. Vegetation grows naturally or local seeds can be implanted to ensure the fast vegetation growth.



Sea side slope with Metal Gabion Mattress

**Conclusion:**

Public works Department, Gujarat is happy as the work is completed within the given timeline and the structure is performing as per the client's requirement.

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