

PROJECT REPORT

1. PROJECT DETAILS:

Project Name	:	Flood Mitigation & River Bank Protection using Tech Geomattress along Brahmaputra River Bank, North Lakhimpur, Assam
Client	:	Water Resources Department, Assam
Chief Contractor	:	Star Constructions
Technology Service Provider	:	Techfab India Industries Limited
Geotextile Material Supplier	:	Techfab India Industries Limited
Project Location	:	North Lakhimpur, Lakhimpur, Assam
Project Coordinates	:	Latitude 27°11'15"N, Longitude 94°10'35"E

2. INTRODUCTION:

Floods are one of the most frequent natural calamities in India. India witnessed several riverine floods historically that affected millions of people, caused loss of lives, and damaged infrastructure and agriculture. An increasing number of flood cases in recent times has increased the importance of flood protection works and the raising of embankments in urban and rural plains. The excessive tractive shear stress of flowing water and migration of soil particles leads to the progressive erosion of river banks. The damage to the natural banks reduces the bund height and may let the flood water spill out of its banks which causes floods. The river Brahmaputra has been the lifeline of northeastern Indian states for ages. This mighty river runs for 2880 km through China, India, and Bangladesh. Every year the Northeastern state of Assam experiences huge losses due to devastating floods caused by the river Brahmaputra. Some northern plains of Assam like Dhemaji, North Lakhimpur, Dhakuakhana and a few places of Barak Valley experience significant damage due to floods in the Brahmaputra Basin very frequently. The high intensity of floods in the Brahmaputra River and the steep topography of the region makes the problem more complex and severe.

3. SITE DETAILS AND PROBLEMS DESCRIPTION

The project site is located at around 10 km motorable distance from the centre of the city North Lakhimpur in Assam. The site coordinates are Latitude 27°11'15"N and longitude 94°10'35"E. The project site is located at the straight reach of the river Subansiri/Brahmaputra. The river passing through North Lakhimpur is also known as River Subansiri and it drains into the mainstream Brahmaputra River after running for another 50 km downstream of North

Lakhimpur. The location lies in the Brahmaputra Basin and the flow in the river often experiences high discharge rate and flow velocity due to steep topography. The high velocity and depth of water induces tractive shear stress on the surface of river side slopes and river bed. When the induced shear stress exceeds the limits of permissible shear stress, the soil particles on the river bed and slopes start migrating from their position. This progressive phenomenon of migration of soil particles is known as soil erosion which damages the bed and banks of the river. To provide a safeguard against the frequent floods in the region, the banks of the river Brahmaputra near Lakhimpur were required to be protected at a few stretches while providing sustainable anti-erosion measures.

4. DESIGN OF RIVER BANK PROTECTION AT BRAHMAPUTRA RIVER, NORTH LAKHIMPUR, ASSAM

TECHFAB INDIA Industries Ltd designed a flexible solution for river bank protection with a 100mm thick sand-filled geotextile mattress on the side slope of the river. The work was carried out on the left bank of the Brahmaputra River for a total length of 700m (Approx.) where the river bank was dressed to a slope inclination of 2H:1V for the maximum protected bank height of 12.0m. The proposed cross-section of the gabion mattress protection system on the river bank is shown in Figure 1.

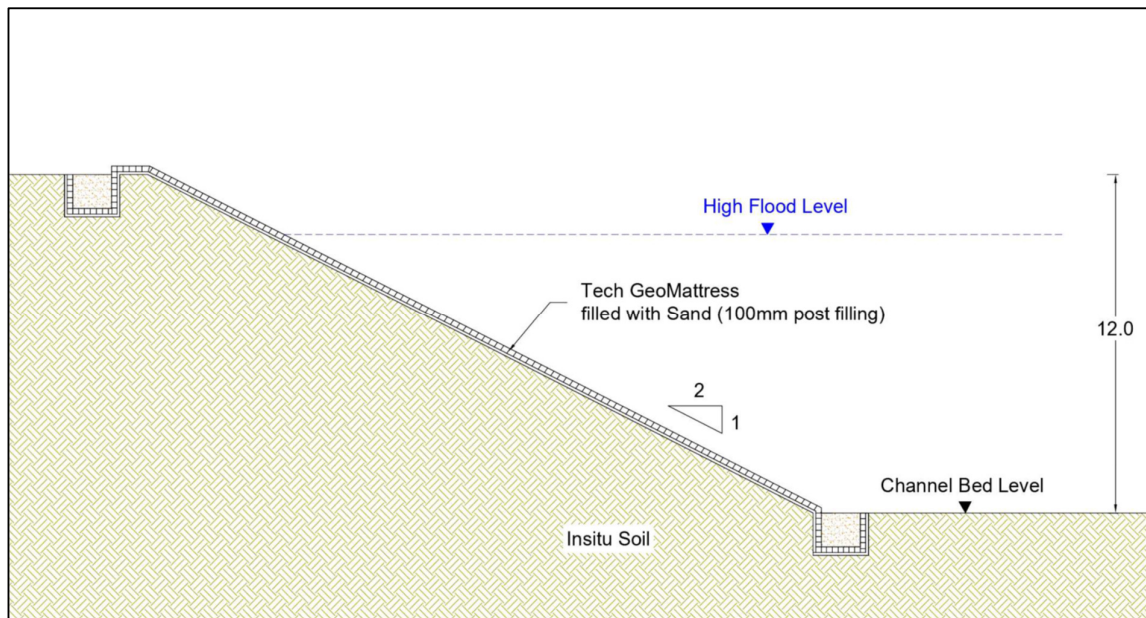


Figure 1: Proposed cross-section of river bank protection with Sand filled Geotextile Mattress on the levelled surface showing top trench and bottom trench

Whenever flood water passes through the river channel, it tends to scour the river bed and bank section. The scouring lowers the bed level of the river and creates instability in the bank protection system. Therefore, toe protection is also as critical and essential as the slope protection system in this project. A toe trench of size 1.0m x 0.75m is provided on the bottom of the side slope which also acts as a shear key. The geotextile mattress is wrapped in the toe trench and then it is filled with boulders and sand-filled geotextile bags. Apart from the toe trench, a top trench of the size 1.0m x 0.75m is also provided on the top of the embankment slope. This top trench provides stability against sliding and improves the positional stability of the protection system.

The filled thickness of the sand-filled geotextile mattress is 100mm and the tube attains a tubular shape after complete filling. The tubular shape helps to minimize the flow velocity at or near the bank area, which, in turn, reduces the risk of progressive erosion. The proposed section is checked for stability against tractive shear stress, bed scouring, sudden drawdown, and global failure and proved to be safe in all the design aspects. The picture showing the sand-filled geotextile mattress is shown in Figure 2

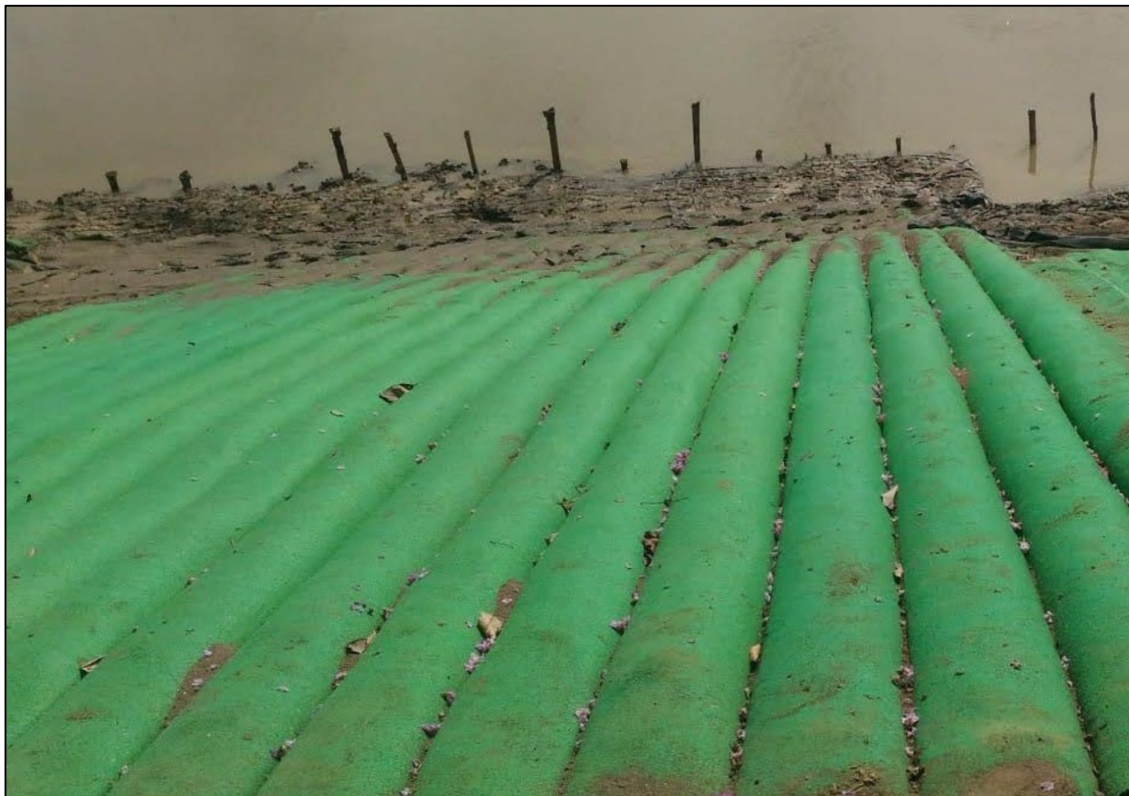


Figure 2: Installation of Sand-filled Geotextile Mattress

5. MATERIAL SPECIFICATIONS

Tech Geomattress

TECH GEOMATTRESS is a double-layered three-dimensional tubular green mattress that is used to form a protection system on the bed and side slopes of a water channel. Tech GeoMattress is a well-established eco-friendly flexible solution that can cater for the needs of various flood control applications. It is fabricated from two layers of geotextile; the upper layer is a green coloured composite fabric having green cut fiber on the top for UV protection and abrasion control and the bottom layer is made up of high-strength woven fabric which provides a base and adequate filter properties to the mattress system.

The attractive green fabric on the top blends with the surroundings and helps in developing vegetation growth by entrapping the sediments within the grooves of the sausages. The tubular shape of the mattress helps in dissipating the energy of the longitudinal currents and wave action of the streams which in turn controls the erosion and development of scour holes.

The infill soil should be preferably coarse sand and free from organic material. The materials available in the northern plains of the Brahmaputra River are sandy & silty soil, which often do not possess adequate cohesion and internal stability. However, these materials provide excellent filler properties to be used in Tech GeoMattress. Therefore, locally available soil was used as infill material.

The advantages of using a sand-filled geotextile mattress system are as follows-

- Tech GeoMattress is delivered in rolls which can be easily transported to the site.
- Tech GeoMattress systems utilize locally available sand for the construction of bank protection systems. Therefore, It is economical and environmentally friendly as compared to conventional solutions.
- Installation is quick and uses simple equipment. They can be rapidly mobilized for emergency work at the site.
- Tech GeoMattress system is economical and easy to install without the requirement of skilled labourers. They are ideal solutions for areas with poor accessibility.
- Tech GeoMattress is a flexible system. Hence it usually attains the shape of the surface irregularities which make it easier to install at the site.
- These fabrics are engineered to suit most site conditions in terms of mechanical strength. Its less Apparent opening size helps to retain the finer soil particles and its high permeability ensures quick dissipation of pore water pressure.

- It is an effective erosion protection solution for the long run with high robustness and durability of the composite geotextile fabric with excellent abrasion and UV resistance properties.

6. SITE INSTALLATION OF SAND-FILLED GEOTEXTILE MATTRESS

Tech GeoMattress is easy to install at the site and uses simple equipment without the requirement for skilled labour, installation can be done hydraulically, mechanically, or pneumatically. The following sequence was adopted for the installation of sand sand-filled geotextile mattress at the site-

- At first, prepare the slope surface as per approved drawings and project requirements. Remove debris, and rocks from the area where Tech GeoMattress is to be laid.
- Replace removed soil with acceptable soil and compact earthwork up to 95% dry density.
- Excavate the top and bottom trench according to approved drawings.
- Tech GeoMattress should be laid along the profiled slope from top to bottom. It enables easy filling of the mattress on site. In this direction, the seams between the tubes are under tension while filling which helps to achieve the desired thickness of the mattress after filling.

Figure 3 shows the laying of geotextile mattress on the dressed slope.



Figure 3: Laying of TechGeo Mattress on Dressed Slope

- Adjacent rolls of sand-filled mattresses are joined by seaming on-site. The width of the geotextile tube reduces after filling due to the formation of a sausage-like structure of the mattress. The reduction in the width depends upon the type of infill soil and pumping

pressure. Usually, 10-15% of the reduction is anticipated. Therefore, the adjacent units of the mattress are placed with sufficient overlapping.

- Sand-filled mattress is anchored in the trenches at the top and bottom of the slope in the trenches of size 1.00m x 0.75m.
- The mat should be placed by bending it into the trench. The trench can be filled with earthfill, boulders or Geobags.
- After placing the Tech GeoMattress properly as per the drawings, it should be filled with sand in slurry form preferably by hydraulic pumping. Figure 4 shows the final placement of sand-filled geotextile mattress on the river side slopes.



Figure 3: After Completion Photograph

7. CONCLUSION

The proposed design of the flexible protection system proved to be technically efficient and economical as compared to conventional rigid lining. Also, this system is a flexible system therefore it can sustain minor undulations at the site, if occurs any. One of the major advantages of the flexible protection system is that it always gives a workable warning before being damaged. The provision of top and bottom trenches also increases the positional stability and resistance against sliding.

The proposed design section has been checked for various failure criteria and passes the requirement of minimum factor safety. The site installation of the geotextile mattress was completed in year 2022 and the protection system has witnessed two flood seasons until August 2023. The protection system is working fine and meeting the performance expectations.