

# PROJECT REPORT

## 1. PROJECT DETAILS:

|                             |   |                                                                                |
|-----------------------------|---|--------------------------------------------------------------------------------|
| Project Name                | : | Strengthening of River Bank on the Left Side, Sharda River, Vishakhapatnam, AP |
| Project Proponent           | : | Asian Paints Limited                                                           |
| Design Build Contractor     | : | Ambuja Cements Foundations                                                     |
| Project Consultant          | : | Tata Consulting Engineers                                                      |
| Technology Service Provider | : | Techfab India Industries Limited                                               |
| Project Location            | : | Vishakhapatnam, Andhra Pradesh, India                                          |
| Project Coordinates         | : | Latitude 17°36'55.46"N, Longitude 82°54'53.26"E                                |

## 2. INTRODUCTION:

This project targets the strengthening of the left side river bank of the Sharda River near Vishakhapatnam in Andhra Pradesh. Sharda River runs eastwards for 122 KM and drains into the Bay of Bengal. In the monsoon season, the river catchment area receives heavy rainfall and the river gets flood water as high as 2500 m<sup>3</sup>/sec. At the site location, the floodwater overtops the river banks and damages agricultural fields and crops. There is a weir formation named AS Peta Dam located 1.30 KM downstream of the project location which stores the water up to its crest height. Due to the storage of dam water, the river area gets submerged and maintains a certain height of water for most of the time in the year. This water storage helps to saturate the soil mass in the area. The release of the dam water downstream often tends to suddenly decrease the water level which also creates the instability of the left side bank of the river.

## 3. SITE DETAILS AND PROBLEM DESCRIPTION

The project site is located at around 50 km motorable distance from the centre of the city Vishakhapatnam in Andhra Pradesh. The site coordinates are Latitude 17°36'55.46"N, Longitude 82°54'53.26"E. The project site is located at the meandering portion of the river (Curved portion of the river).

The already existing bank protection work consisting of RCC columns, beams and pile foundation was in operation from August 2022. The water in the river was flowing at full level due to the close of the dam gate on the downstream side. On 26<sup>th</sup> Jan 2023, the gates of the dam were opened fully and the water level dropped suddenly. The first crack was seen on 27<sup>th</sup> Jan

2023 and the left bank of the river slowly settled down till 29 Jan 2023. Riverside embankment settled about 5 feet depth from the top level and RCC /retaining wall was broken and damaged. Figure-1 shows the site photograph of the damaged portion of the river bank immediately after the subsidence of the bank portion. The major damage occurred for about 230m in length.



Figure 1: Damaged left side river bank on the Sharda River as of 29<sup>th</sup> January 2023

As per the site inspection by the concerned authorities on 18<sup>th</sup> Feb 2023, it was observed that the major cause of the damage was the sudden drawdown of water level, poor compaction of the embankment fill and poor designing of the toe protection. Figure-2 shows the site photograph of the inspection day.



Figure 2: Site Inspection by Authorities of the Damaged left side river bank on the Sharda River as of 18<sup>th</sup> Feb 2023

The RCC structures are considered a rigid protection system and they do not give any warning when failed. Therefore, it was decided to provide a flexible protection system by the project consultant. TECHFAB INDIA Industries Ltd was approached for the design of the river bank protection system on the left bank of the Sharda River.

#### 4. DESIGN OF RIVER BANK PROTECTION AT SHARDA RIVER BANK, VISHAKHAPATNAM

Some critical design parameters are as follows-

Design Discharge as 2580.00 m<sup>3</sup>/sec, High Flood Level (H.F.L.) as +15.50m, Top of Bund Level (T.B.L.) as +17.00m, River Bed Level (R.B.L.) as +6.00m, Maximum Velocity of flow (m/s) as 5.10 m/s, Longitudinal Slope of the river as 1 in 600, Manning's Roughness Coefficient as 0.025, River Cross-Section/Geometry, embankment soil parameters, and river bed soil parameters etc.

TECHFAB INDIA Industries Ltd designed a flexible solution for river bank protection with a 500mm thick gabion mattress on the side slope and the bed of the river at the toe of the slope. The nonwoven geotextile was proposed to place on the interface of the gabion mattress and soil which will act as a filter and a separator that prevents the migration of the soil particles from the embankment soil towards the gabion mattress system and vice versa but it allows the flow of water in the direction perpendicular to the direction of the laying. The river bank protection is proposed throughout the length of 230m damaged portion along the river course. The proposed cross-section of the gabion mattress protection system on the river bank is shown in figure-3.

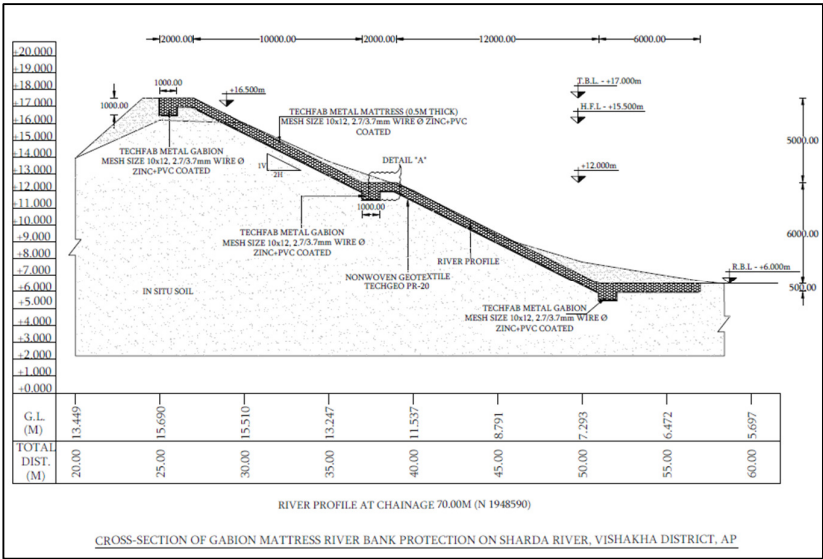


Figure 3: Proposed cross-section of river bank protection on the left bank of Sharda River, Vizag showing the side slope of protected slope as 2 Horizontal:1 Vertical with a 2m wide intermediate berm

Whenever heavy flood water flows through the river channel at a higher velocity, it tends to scour the river bed and bank section during the flood. 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. The toe protection in this project is designed in the form of a 6.0m wide launching apron placed throughout the protected length of 230m along the river channel. Also, an intermediate berm of 2.0m is provided on the slope at 5.0m below the top of the embankment level. The provision of a berm provides stability to the embankment against global wedge failure. Three trenches named top trench, intermediate trench, and toe trench of size 1.0 m x 1.0m are provided in the proposed section for the additional positional stability of the system. Gabion boxes of 1.0m x 1.0 filled with specific sizes of boulders will be installed in the trenches. The trenches will run for 230m along the river course on the left bank. 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.

## **5. MATERIAL SPECIFICATIONS**

### *Metal Gabion*

The Gabions are metal wire crates filled with boulders of a specific dimension. The thickness of the gabion mattress varies from 300mm to 500mm and the thickness of the gabion box is usually 1.0m. The gabion mattress is made up of hexagonal double-twisted steel wire mesh which is usually coated with Zinc and Poly Vinyl Chloride for the prevention against corrosion and severe environmental conditions. The row diameter and coated diameter of the steel wire mesh are 2.7mm and 3.7mm respectively. The steel wire meshes are tied with thin lacing wires with the thicker selvedge wires that are placed on the edges of the gabion box so that the shape of the gabion box remains intact. The mesh type is indicated in the form of A\*B where “A” represents the horizontal dimension of the hexagonal opening in centimetres. The least lateral dimension of the infill rock should range from  $1.5*A$  to  $2.5*A$ . In the proposed solution, as shown in Figure-3, 10\*12 type mesh was used, therefore the size of the rockfill inside the gabion should range from 150mm to 250mm. The specific gravity of the infill stone varies from 2.60 to 2.70. Details of the 500mm thick gabion mattress are shown in Figure 4.

### *Nonwoven Geotextile*

Geotextiles are the technical textiles used for various engineering applications such as reinforcement, containment, filtration, and separation. Geotextiles are commonly either woven or nonwoven and are manufactured using polymer fibres such as polypropylene (PP), polyester

(PET), polyamide, polyvinyl chloride etc. However, PP and PET are most used for the manufacturing of geotextiles. Nonwoven geotextiles used in the proposed design solution of the river bank protection are the staple fiber needle-punched nonwoven geotextiles manufactured from 100% PP fibers. The thickness of the Techgeo PR-20 is 1.6mm under standard conditions and is highly resistant to chemical action and ultraviolet degradation.

The placement of the nonwoven geotextile is shown in figure-4.

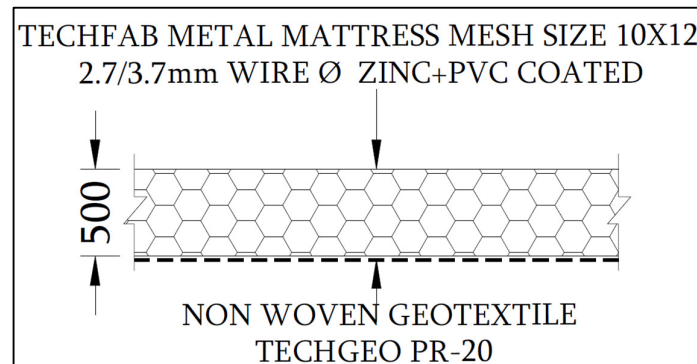


Figure 4: Typical representation of 500mm thick gabion mattress and nonwoven geotextile at the interface of soil and gabion mattress system

## 6. CONCLUSION

The proposed design is technically efficient and economical as compared to conventional solutions such as Reinforced Cement Concrete (RCC) Structures. Also, the gabion mattress 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 the launching apron at the toe in the form of a 500mm thick gabion mattress provides stability to the system against bed scouring. At the time of bed scouring the 500mm thick apron is expected to attain the shape of the bed undulation and prevent the development of scour holes on the river bed.

The proposed design section of the gabion mattress slope protection has been checked for various failure criteria. The proposed design had undergone several rounds of technical scrutiny from the client's consultant M/s Tata Consulting Engineers. The detailed design has passed the technical clearance and the detailed cost of the project has been estimated including material and labour cost in the project. The site work is expected to start after the monsoon season in September.