2,295 METRES OF

GUIDE BUND

ON THE ROHINI RIVER

Gabion Technologies India Ltd.

PROJECT:
RIVER TRAINING & EMBANKMENT PROTECTION – RAIL BRIDGE NO. 50

LOCATION:
MAHARAJGANJ, UTTAR PRADESH, INDIA

PROJECT CONTRACTOR:
ROCKEIRA ENGINEERING PVT. LTD.

CLIENT:
NORTH EASTERN RAILWAY
(ANANDNAGAR–GHUGHLI NEW BG LINE)

INTRODUCTION

The Rohini is a rain-fed tributary of the Rapti that drains the Nepal Terai before entering Uttar Pradesh. It runs on a mobile alluvial bed, changes course readily and delivers a sharp monsoon flood. North Eastern Railway is building a new broad-gauge line between Anandnagar and Ghughli via Maharajganj, and Bridge No. 50 (7 x 61.0 m, double-D type well foundation, double line, 25 T loading standard) carries that line across the Rohini at Ch. 36335.610. Rockeira Engineering Pvt. Ltd., Hyderabad is the construction contractor. Gabion Technologies India Ltd. was engaged as guide bund design consultant and technology provider for the river training and embankment protection works.

PROBLEM

A bridge alone does not fix a river. Left untrained, the Rohini could migrate across its floodplain, attack the new railway embankment on either bank and outflank the substructure. The design flood is 2,275 cumec at HFL 85.00 m, with a mean water current velocity of 3.0 m/sec.

The bed is fine alluvium with a silt factor of 0.68, which puts the design scour at 6.89 m below HFL. Any protection had to reach that depth, or be able to launch down to it. Rigid armour placed on freshly raised embankment fill would crack as the fill consolidated, and could not follow a scour hole once one opened at the toe.

GTI's scope covered site-specific design of the guide bunds and bank protection, supply of GTI make double twisted hexagonal woven mesh gabion mattresses and 200 GSM non-woven geotextile, and installation supervision and guidance at site.

PROJECT CHALLENGES:

- 2,295 m of guide bund across four arms — 990 m and 725 m upstream, 240 m and 340 m downstream.
- Design scour of 6.89 m below HFL in a shifting sand bed.
- Armour laid on newly raised embankment fill still liable to settle.
- Whole length to be protected inside one pre-monsoon working window.

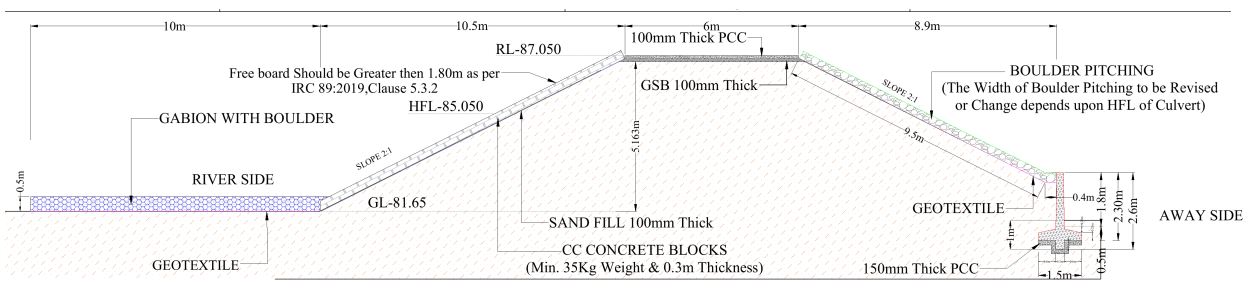
SOLUTION

GTI designed the works to IRC:89-2019, IS 10751:1994, IRC:SP:116-2018 and IS 16014:2018, and answered the scour problem with a flexible system rather than a rigid one. Guide bunds were laid out on both banks, upstream and downstream, with a curved mole head of 47 m radius and a river-face slope of 2H:1V, the shape fixed by model studies as required by IRC:89-2019.

A gabion mattress launching apron 10.0 m wide and 0.50 m thick was provided at the toe on the river side, over a 200 GSM non-woven geotextile filter. As the bed scours, the apron launches down the face of the scour hole and blankets it, so the protection renews itself instead of failing. The bund face above is armoured with M30 CC blocks over sand fill and geotextile, with boulder pitching on the away side, a freeboard of not less than 1.80 m above HFL, and a PCC crest road on GSB.

Global stability was checked in GEO5 by the Bishop method for the governing sections in both static and seismic design situations. The static case returned factors of safety of 2.76 to 3.35 against a required 1.30, and the seismic case 1.89 to 1.90 against a required 1.10. The design was proof-checked and approved by Dr. B. Hanumantha Rao, IIT Bhubaneswar.

GTI typical cross-section drawing is as follows



Section at A

2,275	85.00 m	3.00 m/s	6.89 m	10.0 m	2,295 m
CUMEC DESIGN FLOOD	DESIGN HFL	MEAN VELOCITY	SCOUR BELOW HFL	LAUNCHING APRON	GUIDE BUND

The typical section shows how the parts work together. On the river side the gabion mattress apron sits at bed level on geotextile, extending 10 m out from the toe; the 2H:1V face above it is armoured with M30 concrete blocks of minimum 35 kg over a 100 mm sand fill and geotextile; the crest carries a 100 mm PCC road on 100 mm GSB with freeboard above HFL 85.050; and the away-side slope is finished with boulder pitching down to a toe wall on 150 mm PCC.

The mattresses are GTI make mechanically woven double twisted hexagonal steel wire mesh, 6 x 8 cm mesh of 2.20/3.20 mm Zn+10% Al alloy and PVC coated wire, with diaphragms at 1.0 m centres, filled in three layers with hard angular stone of 150 mm to 250 mm and laced in single and double loops at 100 mm spacing. Units are founded a minimum of 1 m into prepared, levelled ground.

Because the apron is flexible and free-draining it accommodates the settlement of new embankment fill and the movement of the bed without cracking, and it can be built by local labour with minimal plant — which is what allowed the full 2,295 m of bund to be protected within the working season.

CONCLUSION

River training decides whether a new bridge survives its first big monsoon. On the Rohini, GTI gave North Eastern Railway and Rockeira Engineering a site-specific design that answers 6.89 m of scour with a launching apron rather than a rigid revetment, backed by GEO5 stability checks in static and seismic conditions and independently proof-checked at IIT Bhubaneswar. GTI supplied the gabion mattresses and the geotextile and supported installation at site, and 2,295 m of guide bund on both banks now holds the river to its designed course.

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