

CASE HISTORY

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REHABILITATION OF RAILWAY TRACK AT UDAIPUR STATION YARD IN AGARTALA - UDAIPUR - SABROOM NEW B.G. LINE AT UDAIPUR, TRIPURA UDAIPUR, TRIPURA, INDIA



Ground Improvement application

Client:	Products used:
THE RESEARCH DESIGNS & STANDARDS ORGANISATION (RDSO)	TECHDRAIN - PREFABRICATED VERTICAL DRAIN (PVD)
Main contractor:	Quantity supplied:
Manufacturer & Supplier:	Year of construction:
TECHFAB (INDIA) INDUSTRIES LTD.	2012

Project brief:

New Broad Gauge Railway embankment was being constructed between Agartala - Sabroom. Udaipur Station yard was situated on Agartala - Sabroom new railway line project at chainage 41-43. Earthwork for station yard started in Dec 2010, yard was located in marshy land and no ground improvement measures were adopted before constructing the embankment. Hence, failure of embankment had occurred at few locations in Sept 2011 and March 2012 respectively.



Figure 1 : Left and Right side of the Embankment



Figure 2 : Photographs of site locations

Challenges:

Railway station yard and Station building site are situated in low lying area previously known as Sukhsagar, consisting of poor quality soil up to 13.25m below ground. During monsoon the whole catchment area was filled up with water and water table was raised even by 3.0 to 4.0 m above the ground level. Constructed embankment divided low lying area in two parts. Water used to flow from upstream to downstream through openings provided in the embankment.

The drainage of nearby embankment was very poor. RDSO requested to suggest remedial measures in connection with failure of Railways embankment at Udaipur Station yard. After evaluating various ground improvement techniques; it was decided that Prefabricated Vertical Drain (PVD) is the best solution for accelerating consolidation and reducing pore pressure for the prevailing site conditions.

Ground Improvement by Installation of PVD:

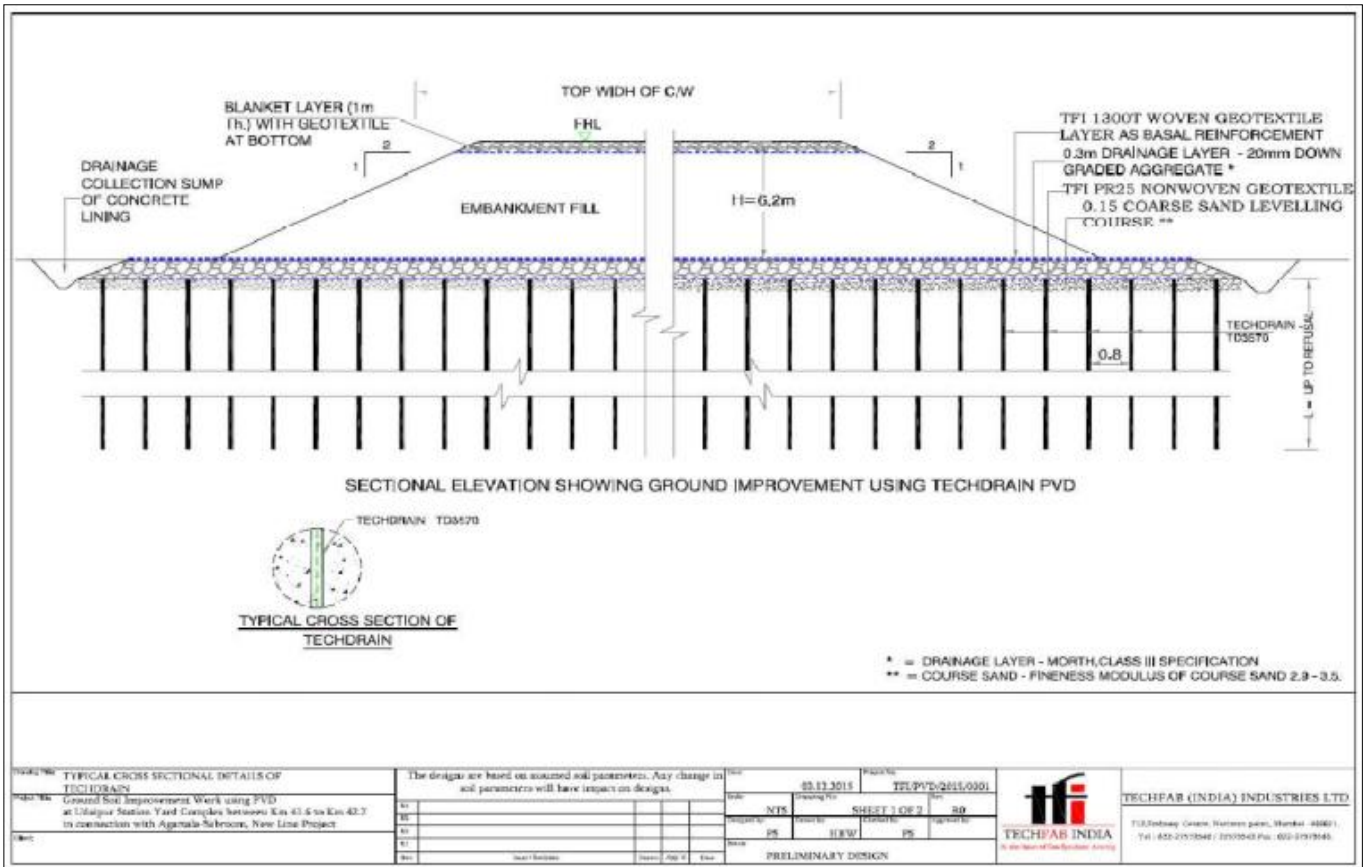
Soil had moderate swelling in nature and sub soil at depth below top of embankment had high swelling in nature. Therefore, consolidation of soil should be accelerated in order to reduce pore pressure and settlement.

Considering the project stretch, the depth of soft strata from bore log was considered up to 13.25m. For design and analysis, the soil was considered as fully submerged. For the stretches, where soft soil was encountered, 95% consolidation had to be achieved.

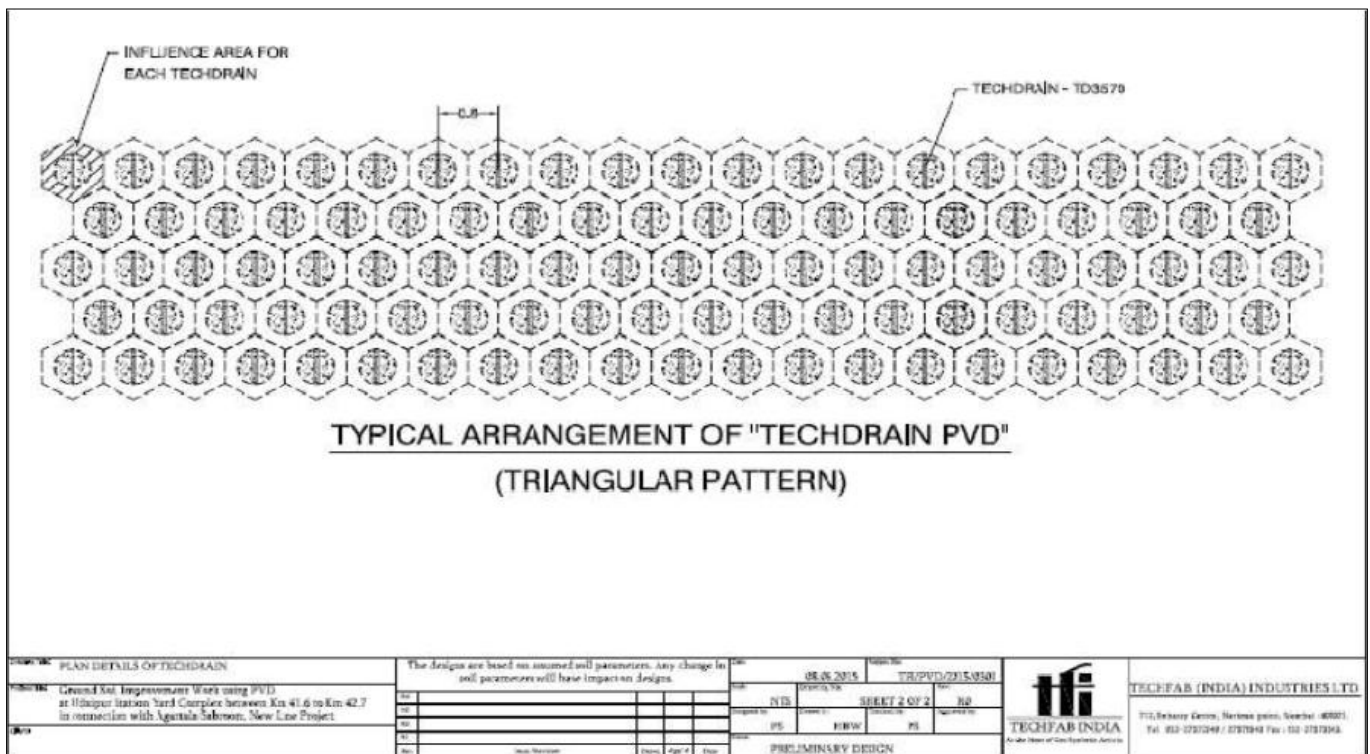


Installation of PVD

A woven geotextile was installed at base to increase the overall stability of the embankment. This will also act as a separator between embankment fill and drainage layer. The drainage layer was installed to be of 30cm along with an additional layer of non-woven geotextile as shown in the cross section. All layers starting with 15 cm of sand layer, layer of nonwoven geotextile, 30 cm thick drainage layer followed by layer of woven geotextile was proposed to be installed. It was decided to install settlement gauges and piezometers in order to monitor the consolidation process.



Sectional Details Submitted for the Ground Improvement with PVD



Typical arrangement of Techdrain PVD proposed

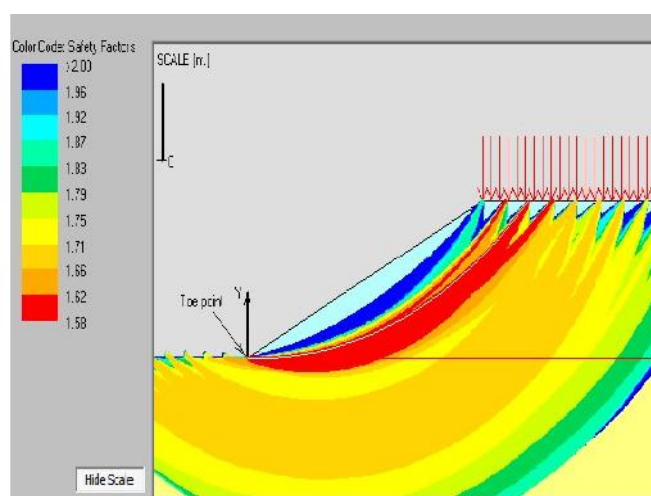
Consolidation of Soil:

As calculated, time required for 95% consolidation of foundation soil was 143 years; which is too long therefore needed to consider installation of Techdrain (PVD) to minimize time required for adequate consolidation. When it was considered provision of Techdrain PVD at 0.8m spacing, time required for 95% consolidation was reduced to 3.31 months (100 days).

Slope Stability Analysis : Slope stability analysis for side slope was carried out by Slope-W for effective ht of 6.2m, the factor of safety works out to be 1.47 which is more than required 1.4 as per 2.1 of Annexure III of “Guidelines for Earthwork in Railway Projects”, July 2003.

Rotational Stability Analysis: Rotational stability analysis was carried out for various critical circles and Factor of safety calculated was 1.58. Fig shows rotational stability analysis done by software.

Settlement Analysis of Sub Soil: Settlement analysis was carried out as per laboratory test results of GE lab RDSO. As per details of bore logs up to hard strata provided by client, 13.25m of compressible layer was considered and detailed calculation was carried out. Settlement of soft clay comes out to be 1.2m. When improved with PVD at 0.8m spacing, embankment constructed with rise of 0.6m at every stage. Stage wise Construction and corresponding estimated settlement was provided.



Conclusion:

As the embankment was constructed on weak soil and had already failed, it was understood to go for detailed geotechnical investigation and provided suitable ground improvement technique based on the report.

TechFab India had proposed ground improvement with PVDs and geotextiles - with detailed calculations, plan & section drawings and stage wise construction sequence with estimated settlement and SBC checks. The solution was scrutinized by IIT and accepted / approved.

The ground improvement was executed on site as per approved scheme along with proposed instrumentations and had performed successfully for the intended purpose with satisfactory results.

Therefore, it can be said that, for locations with very weak soft clay for higher depths, PVDs can be feasible and effective solution to reducing time required for consolidation and accelerate the settlement.

Advantages of Techdrain PVD

- Can withstand lateral displacement or buckling under vertical or horizontal soil movement.
- Decrease primary consolidation time from years to months.
- Decrease surcharge required for pre-compression.
- Economic competitiveness.
- Less soil disturbance.

Special Features of Techdrain PVD

- Product is customizable.
- Tech drain – PVD is a Joint less PVD (Core & Jacket Fabric)
- In-house manufactured PVD Fabric.
- 23 rolls on each pallet, which makes it easy for transportation.
- Production capacity -162 million linear meters.
- Well experienced PVD supplier with 24 hrs Support.
- Leading Star export house recognized by Indian Govt.

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