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CASE STUDY

Techgrid Geogrid Reinforced Soil Walls with Welded Wire Mesh Facing to Retain the Approaches to a Flyover

Project : Construction of DND - Mayur Vihar Link Road Phase I & II
Owner : Noida Toll Bridge Company Ltd. (NTBCL)
Contractor : K R Anand, Delhi
Consultant : M/s Halcrow Consulting India Ltd.
Completion : December, 2007

Salient Features of the Reinforced Soil Walls

Wall facing area	: 1600 SQM
Wall height	: 14.0 to 15.0 m on Mayur Vihar end and 9.0 to 10.0 m on DND end :
Soil reinforcement	Techgrid knitted & PVC coated polyester geogrids with tensile strength of 40 to 200 kN/m
Facing	: Geogrid wrapped face supported by galvanized welded wire mesh panels with random rubble backing with batter of 5º)
Fill material	: Sand from Yamuna River
Design Methodology	: FHWA-NHI-00-043
TFIIL's scope of work	: Detailed engineering design and drawings; supply of geogrids, welded wire mesh panels and geotextile; supervision of construction
Proof checking	: Designs and drawings were proof-checked by IIT Delhi

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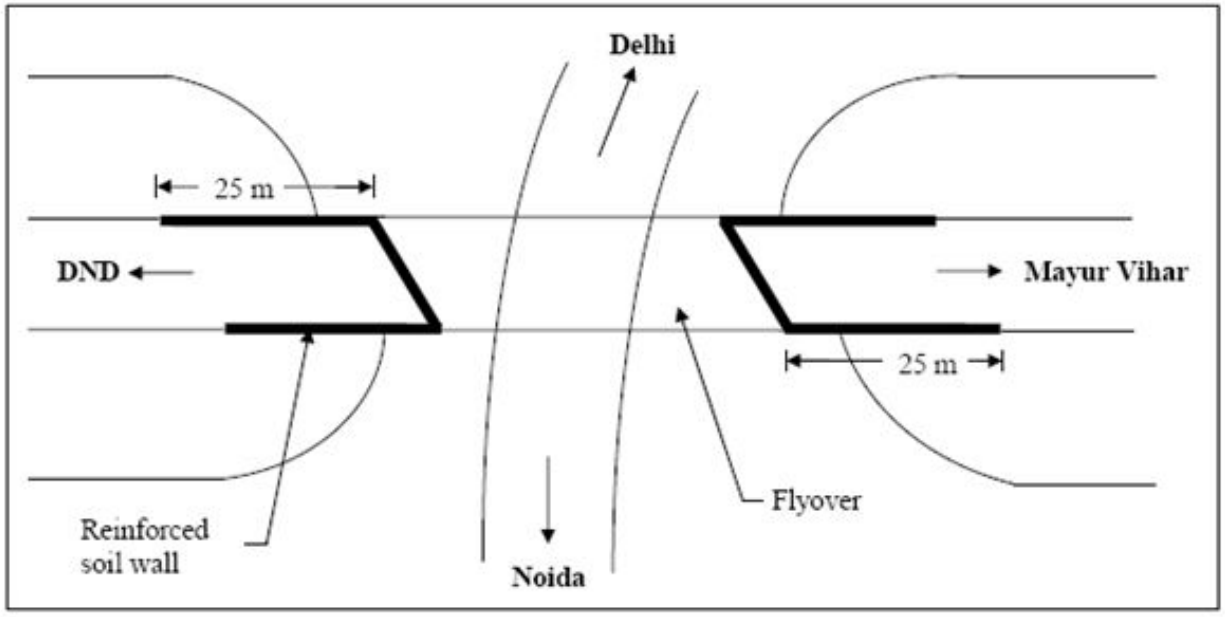
The Project

The Noida Toll Bridge Company Ltd. (NTBCL) has been promoted by Infrastructure Leasing and Financial Services Ltd. (IL&FS) as a special purpose vehicle to develop, construct, operate and maintain the eight lane DND Flyway (including a bridge across the Yamuna river) connecting South Delhi to Noida on a Build Own Operate Transfer (BOOT) basis. The company's principal source of revenue is from the levy of tolls on commuters on this facility. NTBCL constructed a DND-Mayur Vihar Link Road to attract the large population living in the Trans-Yamuna area of Mayur Vihar to use DND Flyway to increase its revenue.

This DND-Mayur Vihar Link Road required the construction of a flyover, whose approach embankments had a maximum height of 9.0 on the DND end and 14.0 m on the Mayur Vihar End. Since there was no constraint with respect to right-of-way, the approaches consisted of normal embankments. However, retaining walls were to be constructed as closure walls behind the abutment piers and 25 m long return walls at both ends of the flyover.



NTBCL decided to use reinforced soil technology for the construction of retaining walls in view of their proven performance and cost economy. The design of the walls involved several technical difficulties and the construction had to be completed within a short time. After a rigorous evaluation of various aspects, NTBCL accepted the geogrid reinforced soil wall with a welded wire mesh facing proposed by Techfab India as best suited to the project and site requirements and awarded the work to Techfab India with the following scope of work:

- Detailed engineering of the reinforced soil walls and ground improvement including design, material specifications, construction drawings and construction methodology.
- Supply of Techgrid geogrids, galvanized welded wire mesh panels and nonwoven geotexile
- Supervision of construction

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The Reinforced Soil Wall System

The Challenge

The design of the walls involved several challenges:

- The maximum height of the wall was about 15.0 m on the Mayur Vihar end of the flyover.
- Because the alignment of the flyover was in skew, the closure and return walls were not perpendicular to each other. There were acute angle corners with interior angle between closure wall and return wall of 42º on the DND end and 58º on the Mayur Vihar end. The design and detailing of the soil reinforcement for the acute angle corners, presents several difficulties.
- The facing batter of the closure walls had to be kept as low as possible, to avoid any problems with respect to the design of approach slabs.
- The upper most strata of the ground comprised a 2 to 5 mm thick layer of sandy clayey silts / sandy silts with relatively loose consistency (N = 2 - 5).

The Solution

After a careful evaluation of the project requirements and site conditions a geogrid reinforced soil wall with a welded wire mesh supported wrapped face was finalized as the most optimum solution.

Techgrid knitted and PVC coated polyester geogrids, manufactured by Techfab India at their state-of-theart ISO 9001:2000 certified plant in Silvassa, were used as the soil reinforcement. Techgrid geogrids are manufactured from select grades of high tenacity, high molecular weight polyester yarns using an advanced weft insertion warp knitting process and coated with a specially formulated PVC plastisol. The high performance characteristics of these world-class geogrids, enabled the walls as high as 15 m, to be designed safely and economically.

The facing comprised a geogrid wrapped face supported by L shaped galvanized welded wire mesh panels with galvanized steel ties at 500 mm spacing. A 350 mm thick random rubble packing was provided to enhance the rigidity of the facing and to protect the fill material. A nonwoven geotextile filter was used behind the rubble to contain the fill material, which was a fine sand. The overall inward batter of the facing was approximately 5º.

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Ability to accommodate appreciable amounts of differential settlements was one of the major reasons for adopting this type of facing.

The fill material was a relatively fine-grained sand dredged from the Yamuna river. The design angle of shearing resistance of the compacted sand was 35º.

The ground treatment consisted of the partial excavation and removal of the upper layer of the loose sandy clayey silt / silt sand and replacement with a compacted layer of sand reinforced with Techgrid TGB-90 biaxial geogrids with a tensile strength of 90 kN/m in both machine and crossmachine directions.

The design of the walls was carried out using the FHWA-NHI-00-043 guidelines and comprised checks for external, internal and global stability under static and seismic conditions. The design calculations and construction drawings were proof-checked by Indian Institute of Technology Delhi.

Construction of the wall was carried out under the supervision of Techfab India's supervision.

The project was successfully completed in December 207

15 m high wall at Mayur Vihar End nearing completion

About Techfab India Industries Ltd.

Techfab India was founded in 2003 with the objective of providing world class geosynthetic products and services to serve the needs of infrastructure development in India. From a modest beginning with the setting up of a manufacturing facility for woven geotextiles at Silvassa, we have rapidly grown to become the largest manufacturer of geosynthetics in India. Today we manufacture a wide range of products at our factories in Silvassa - TFI 5000 series of Woven polypropylene slit-film/fibrillated tape geotextiles, TFI 1000 series of woven polypropylene multifilament geotextiles, TFI 3000 series of woven polyester geotextiles, Techrid knitted and PVC coated polyester geogrids, Polymer Gabions, Geotextile bags and tubes, and TechDrain™ Prefabricated Vertical Drains. We also regularly export many of our products to Europe and USA.

Techfab India was converted to a limited company on April 1, 2008. Techfab India is now Techfab India Industries Ltd.

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