

Stabilization of a road embankment on very soft clay soil, for the construction of a new Expressway in Bangkok, Thailand.

Location:	Bangkok, Thailand
Owner:	Expressway and Rapid transit Authority of Thailand - Bangkok Expressway Co. Ltd.
Designers:	Freeman Fox Intercon Consultant Ltd. Bangkok
Contractors:	Kumagai Gumi Co. Ltd. (Japan) BBCE Joint Venture: (Bilfinger + Berger Bauaktiengesellschaft (Germany) Ch. Karnchang Co. Ltd. (Thailand) Expert transport Co. Ltd. (Thailand)
Product:	TENAX LBO 302 SAMP bi-oriented geogrids



The Problem

The new Bangkok Expressway was crossing a marshy area with a very soft soil consisting of normal consolidated Bangkok clays, 20 m deep.

The site investigations showed that the bearing capacity of the foundation soil was too low to support a "traditional" highway embankment.

The first idea was therefore to widen the embankment base with large berms, in order to distribute the load on a wider area, thus involving deeper soil layers and therefore increasing the global bearing capacity.

It appeared fundamental to provide the enlarged base with a sufficient stiffness, in order to decrease both the vertical stresses and the differential settlements.

In addition to the above considerations, a high stiffness was required for the initial construction phase to allow the heavy plant to operate on site without sinking into the extremely soft soil that was often waterlogged.

Photo 1: Road section on marshy soil (unconsolidated soft clay)

Photo 2: Geogrid installation with 0.2 m overlapping.

Photo 3: Two geogrid layers with 0.3 m vertical spacing.

Photo 4: The geogrid apertures allow the soil interlock and full transfer of high tensile forces.

013100745

The Solution

The design required four horizontal layers of biaxially oriented geogrids for stabilizing this embankment. The geogrids were installed at 300 mm vertical spacing. The design engineers, considering the fundamental structural function performed by the geogrids, issued very stringent specifications for the reinforcement. The geogrid manufacturer was required to provide evidence that a professional quality control procedure would be implemented during the production process and that a certificate of conformity for the specific product would be issued for this project, including:

- Testing certificates by independent laboratories;
- Tensile creep test results, adequate to determine the design tensile strength of the geogrids for a design of 1 year under constant load (1 year was the anticipated time for the consolidation of the clay soil under the embankment);
- Tensile secant modulus at 2% and 5% elongation;
- Proof of UV stabilization.

The geogrids chosen by the Contractor, with the full approval of the design engineers, were **TENAX LBO 302 SAMP** bi-oriented geogrids. The TENAX engineers were able to produce a proper answer to all the project requirements. In addition, the whole production lot for the Bangkok Expressway (about 150.000 m² of geogrids) were tested and certified by SGS (Société Générale de Surveillance), a specialised international QC/QA firm.

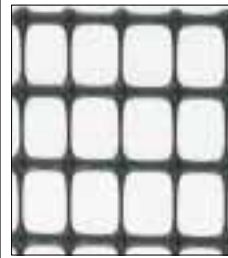
Conclusions

TENAX geogrids in this project, as well as in many others, have proven to be a product with the highest technical characteristics and with guaranteed properties.

TENAX LBO 302 SAMP passed severe controls before being utilized as a structural element for the stabilization of an embankment on very soft soil. The ease of installation of TENAX geogrids allowed the Contractor to maintain high installation rates and allowed to use an innovative technology for stabilizing the embankment, thus obtaining consistent savings over traditional solutions.

TENAX LBO SAMP bioriented geogrids are specifically designed for the stabilization and the reinforcement of soil. The geogrids are manufactured from polypropylene (PP), produced by a patented extrusion method and successively biaxially drawn to increase their tensile characteristics. **TENAX LBO SAMP** geogrids have an elevated tensile modulus and optimal construction damage resistance during installation. Interlocking of the aggregate within the apertures allows for the effective confinement and reinforcement of the soil.

**TENAX
LBO 302 SAMP**
bioriented geogrids



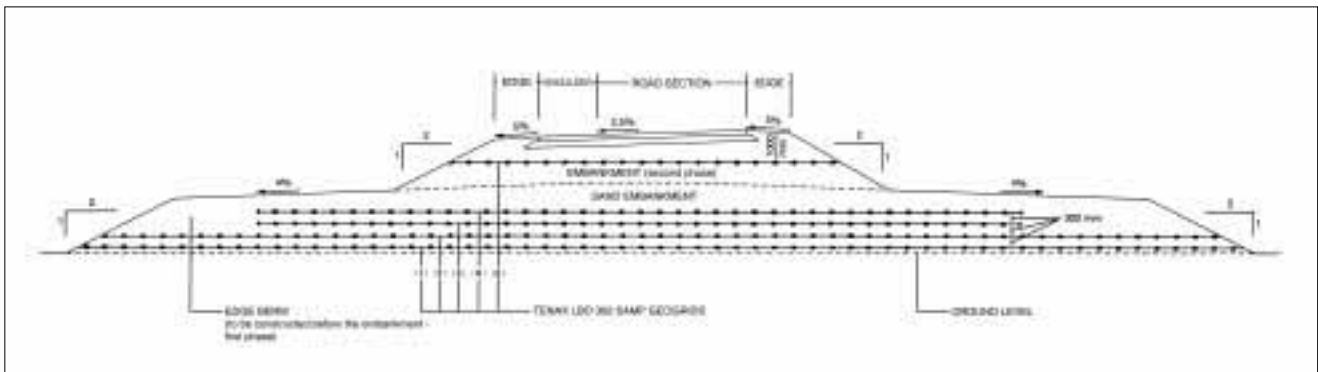
DIMENSIONAL CHARACTERISTICS:

Mass per unit area:	360 g/m ²
Roll width:	4.00 m
Roll length:	50 m

TECHNICAL CHARACTERISTICS:

Test method ISO 10319

Peak tensile strength:	
Longitudinal:	19.5 kN/m
Transversal:	31.5 kN/m
Yield point elongation:	
Longitudinal:	12.0%
Transversal:	11.0%



Cross section of the reinforced embankment using **TENAX LBO 302 SAMP** geogrids (drawing not to scale).



The TENAX Quality System is certified in accordance with the ISO UNI EN 9002 Standard.



TENAX International B.V. • Geosynthetics Division

Via Ferruccio Pelli, 14 • CH-6900 Lugano SWITZERLAND
Tel. (+41) +91 9242485 • Fax (+41) +91 9242489
<http://www.tenax.net> • e-mail: geo@tenax.ch