TENAX

GEOSYNTHETICS

TENAX T-BLOCK

RETAINING WALL SYSTEM FOR GEOGRID REINFORCED BLOCK WALLS

T-BLOCK SYSTEM: THE SOLUTION FOR REINFORCED WALLS

The reinforced soil technique is a construction method that is thousands of years old and has in the past used different types of soil reinforcing materials. Today's geosynthetics, in particular the use of geogrids and the structures designed to use them, are the subject of well researched mathematical solutions.

Several types of construction systems utilise the concepts of soil reinforcement. Amongst them, are soil reinforced block wall systems that make use of concrete blocks at the face and incorporate geogrids as reinforcing elements. These systems have proven to be extremely viable from technical, aesthetic and economic standpoints.

The **T-BLOCK Retaining Wall System** is unique and can be considered as a state of the art system, developed from the joint cooperation between two of the most experienced and qualified companies in the market: **TENAX** and **Geoblock**.

The cooperation between the two companies has allowed the development of a unique system that delivers the maximum possible benefits and advantages when combining the use of geogrid reinforcement with concrete block components.

The **T-BLOCK Retaining Wall System** offers the best block, the best geogrid and the best connection system, fully supported by a comprehensive professional design approach.

- **The T-BLOCK unit design (by Geoblock) utilised by the system has been successful and proven since 1990 in a variety of wall applications from bridge abutments wing walls, railway platform extensions, water facing walls and many other applications, all further demonstrating its versatility.**

- **The integrated mono-oriented geogrid (by TENAX) is manufactured in a continuous process with cross directional bars homogeneously connected to the high tensile longitudinal strands to form a monolithic structure.**

- **Finally, a 100% mechanical connection technology delivered by the simple TENAX patented T-CLIP connector, attaches securely to the TENAX geogrid and is locked into place between the blocks.**

1

Photo 1: St. Petersburg ringroad, Russia

Photo 2: Korean car park development, Seoul

2

T-BLOCK SYSTEM: THE BENEFITS

The **T-BLOCK Retaining Wall System** offers many advantages to clients, specifiers and contractors when compared with traditional methods such as reinforced concrete in retaining wall applications:

- **Proven and recognised reinforced soil technique with numerous worldwide successful projects;**
- **Possibility of using site-won backfill, therefore providing further savings;**
- **Fast and easy to construct;**
- **Area behind wall can be trafficked straight away;**
- **Structures designed for 120 years life;**
- **No practical height limitations;**
- **Simple construction method that requires no specialist skills;**
- **Large cost savings over traditional reinforced concrete solutions;**
- **Can be designed for all surcharge loading applications;**
- **Variety of facing types to suit client requirements;**
- **Better resistance to dynamic effects arising from seismic activity.**

Integrating T-Block

Photo 1: Built with green slope.
Photo 2: Curved walls.
Photo 3: Built with ramp.
Photo 4: Built with fence.
Photo 5: Built with steps.
Photo 6: Built with reinforced slopes.
Photo 7: Built with concrete structure.

THE COMPONENTS OF **T-BLOCK SYSTEM**

The **T-BLOCK Retaining Wall System** features a modular precast concrete block facing unit, a polymeric **T-CLIP connector** and layers of **TENAX TT** geogrid reinforcement material.

The reinforcing elements:

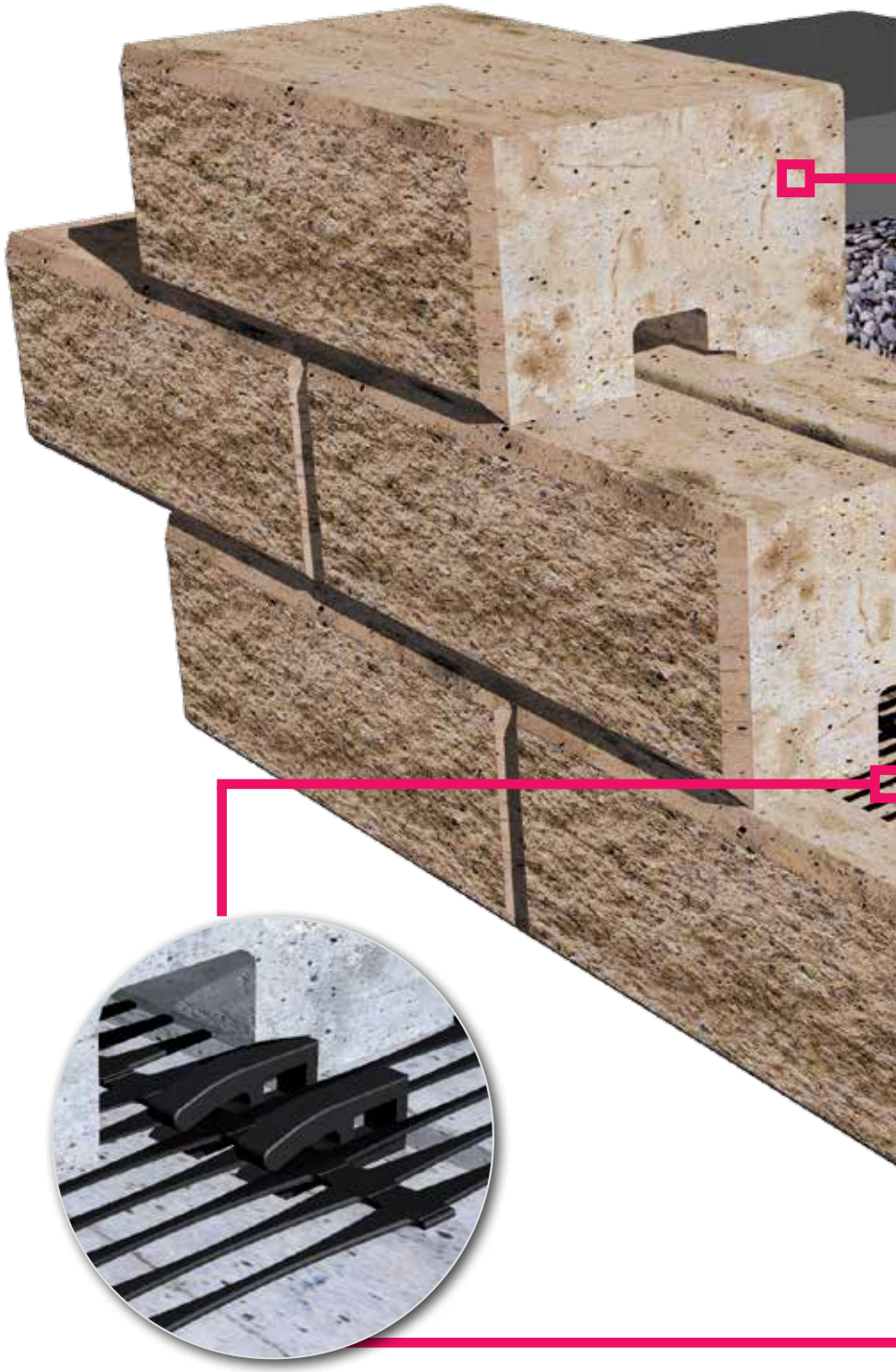
TENAX TT MONO-ORIENTED GEOGRIDS

The **TENAX TT** mono-oriented geogrids are two-dimensional polymer structures manufactured from HDPE (High Density Polyethylene) by a process of extrusion and mono-directional drawing.

The geogrids are certified for the reinforcement of the soil mass behind the wall by major international organisations.

Soil and aggregate interlock within the geogrid openings, which confine the soil, limit its relative displacements and increase the soil's shear stress resistance.

The soil/geogrid structure integrates the fill soil's high compressive strength with the geogrid's tensile strength, thus creating a material having greater rigidity and stability and improving the structure's resistance to static and dynamic loads.



Connection strength

The design of the **T-BLOCK** connection system is the result of seventeen years experience of making mechanical connections between HDPE geogrids and segmental concrete blocks. This experience with loose connectors, grids and blocks led to increasing the simplicity by making smaller connectors which clip onto the geogrids thus making two parts into one. This enables the grid with the connectors to be laid on the blocks and secured in position with the next layer of blocks very easily.

The mechanical connection is important as it allows the system to be used in seismic areas and optimises the design by allowing the full long term strength of the geogrids to be used in the geotechnical design of the structure. By using a straight through path for the geogrids the blocks sit level on the geogrids and so eliminates rotation of the wall units common with some other systems.

TENAX TT GEOGRIDS CONNECTION STRENGTH

Characteristics	UNITS	TT045	TT060	TT090	TT120	TT160
Connection Efficiency*	%	>100	>100	>100	>100	>100
Long Term Design Strength	kN/m	21.2	28.3	42.4	56.5	75,4

(*) At confining pressure of 100kPa, compared to the long term design strength

The T-Block wall units:

The T-BLOCK units are high strength pre-cast concrete modular facing units with a compressive strength of minimum 20 MPa. Each T-Block unit has a face area of 0,06 m2 (150 x 400 mm x 240 mm thickness) and consists of a groove formed in the bottom of the block and a locating rib (or tongue) formed in the top of the unit.

This "tongue and groove" connection allows many T-BLOCK units to be securely inter-connected, thereby forming a locked vertical face.

The concrete units have a minimum compressive strength of 20 MPa. Moisture absorption is less then 5%. Pigments used in the concrete are pure iron oxides or, if green or blue, chrome oxides. Plasticizers and water proofer may be used, but sodium accelerants are not recommended. Aimed at satisfying the most demanding markets worldwide aesthetically and technically, it's possible to deliver a range of existing blocks or custom-design blocks for specific market needs.

Wall details

T-Clip Connectors

One of the most critical areas for retaining wall structures is the connection strength between the geogrid reinforcement and the block wall facing units.

The TENAX patented **T-Clip connectors** deliver a 100% effective mechanical connection with the geogrids and the T-BLOCK units to form a totally integrated system.

The fill material

Typically constructed using compacted granular backfill, selected site-won or imported material. There is also the opportunity to use carefully selected recycled or stabilized backfills within the reinforced soil mass, thereby dealing with environmental pressures concerning the use of natural resources.

CONSTRUCTION SEQUENCE

A fully detailed construction sequence is available on request. However, a brief summary is provided below:

Excavation

- The subgrade shall be excavated vertically to the plan elevation and horizontally to the designed geogrid lengths.
- Over excavated and filled areas shall be compacted to a minimum of 95% Standard Proctor Dry Density.
- Excavated materials that are used for backfilling the reinforcement zone shall be protected from the weather.

Foundation

- The wall is built on a simple shallow concrete levelling strip or compacted stone foundation below the wall face.
- The reinforced zone and levelling pad foundation soils shall be inspected by an engineer to ensure the proper bearing strength.

Wall construction

- The first course of blocks is then laid accurately to line and level on a thin bed of mortar.
- A perforated drainage pipe is installed at the base and surrounded by a gravel drainage layer.
- Following courses are laid by placing blocks and sliding the block into position.
- The first layer of selected fill material is then placed and compacted in accordance with the specification, ensuring that any heavy rollers are kept away from the wall face.
- Fill within 2 m of the wall face is compacted with a small roller or vibrating plate.
- At specific design levels, TENAX geogrid reinforcement is cut to length and positioned with T-CLIP connectors inserted to anchor the geogrid between the T-BLOCK units.
- Construction of the wall continues, placing fill, geogrids and facing blocks, progressively to the top.

Health & Safety

- When working at height, a suitable guard rail must be installed to ensure the safety of the work force.

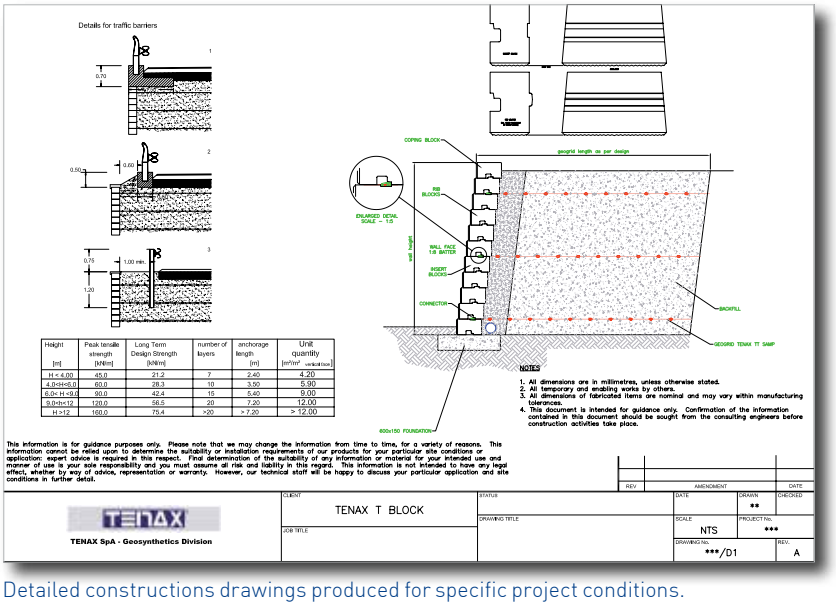
Photo 1: Foundation with curb.
Photo 2: Geogrids Cut to Length.
Photo 3: fit clips into geogrids.
Photo 4: Block placement on geogrids.
Photo 5: Block laying.
Photo 6: Alignment check.
Photo 7: Drainage material behind blocks.

TENAX T-BLOCK: DESIGN SERVICE

Whether your project is an embankment, a landfill, a highway or a retaining wall, TENAX carries out feasibility studies and application suggestions with the assistance of clients and consultants. TENAX is recognised as a world leader in this field, and the best solution for geotechnical and environmental problems.
In order to solve engineering problems, the TENAX Geosynthetics Technical Office (GTO) will assist you in selecting, designing and developing technically appropriate and cost effective solutions. TENAX GTO can assist Engineers in their assessment of the proposed structure ensuring consideration is given to the drainage pathways in and around the structure; any additionally applied external loads and the overall global stability of the structure.The TENAX Geosynthetics Division provides field and laboratory testing, construction, quality control and engineering analysis.
Another important factor to be considered is that TENAX offers local support and services through its worldwide office network.

TENAX has built up a worldwide reputation for its excellence in the following areas:

- state-of-the-art geotechnical engineering services from field and laboratory testing to engineering analysis and construction procedures;
- engineers, geologists and environmental experts provide a balanced solution to any environmental project;
- educational seminars, design workshops and customized "in-house" training;
- specific software for designing Civil Engineering applications with TENAX geosynthetics; the flexibility of the software allows our Design Engineers to determine the most cost-effective dimensions, vertical spacing and grade of reinforcement required to produce a safe, economical structure.



Detailed constructions drawings produced for specific project conditions.


St. Petersburg ringroad, Russia: Geogrid reinforced wing wall.

Chunsugyo, South Corea
Saebeari Highway: Geoblock segmental retaining wall System.

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TENAX is an international group which manufactures and supplies a wide range of geosynthetics certified by the major international technical organisations and used in projects of all sizes and complexities throughout the world.

Here are a few examples of uses of geosynthetics:

- **ground stabilisation** - TENAX geogrids can provide solutions for stabilisation applications over weak ground thereby improving the bearing capacity. A reduced excavation and potential savings in granular thicknesses of up to 40% are among the most common benefits attributed to TENAX geogrids (TENAX 3D GRIDS LBO, LBO HM, GT);
- **drainage** TENAX products are used for the safe transport of fluids and gases and are frequently used in underground structures, retaining walls, road foundations and landfill applications (TENAX CE, GNT, TENDRAIN, SD, TDP, NDP);
- **reinforcement of slopes and walls** TENAX's mono-oriented range of geogrids provide solutions for reinforcing steep slopes, retaining walls with either a vegetated surface or pre-fabricated concrete blocks (TENAX TT, RIVEL SYSTEM, T-BLOCK SYSTEM);
- **erosion control** TENAX's erosion control systems assist in the development of natural vegetation in challenging environments such as on steep slopes, reinforced embankments, river banks, ditches flood bunds or over soil nailed cuttings (TENAX TENWEB, MULTIMAT).

Specialised technicians provide prompt, individual assistance from design through to construction, working with you to choose the right solutions for civil engineering and environmental problems.

SGS ITALY Certificate no. IT93/0008a
SGS U.K. Certificate no. IT93/2568.1

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ISTITUTO PER LE TECNOLOGIE DELLA COSTRUZIONE
First issued: May 9,1994

TENAX geogrids have obtained the I.T.C. Certification.
I.T.C. is the Independent Institute in Italy and a member of the UEAtc.
UEAtc is the European network of Independent Institutes formed by each country (ITC for Italy, BBA for UK, DIBt for Germany, ect), and engaged in the issue of Technical Approvals for innovative construction products or systems.

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