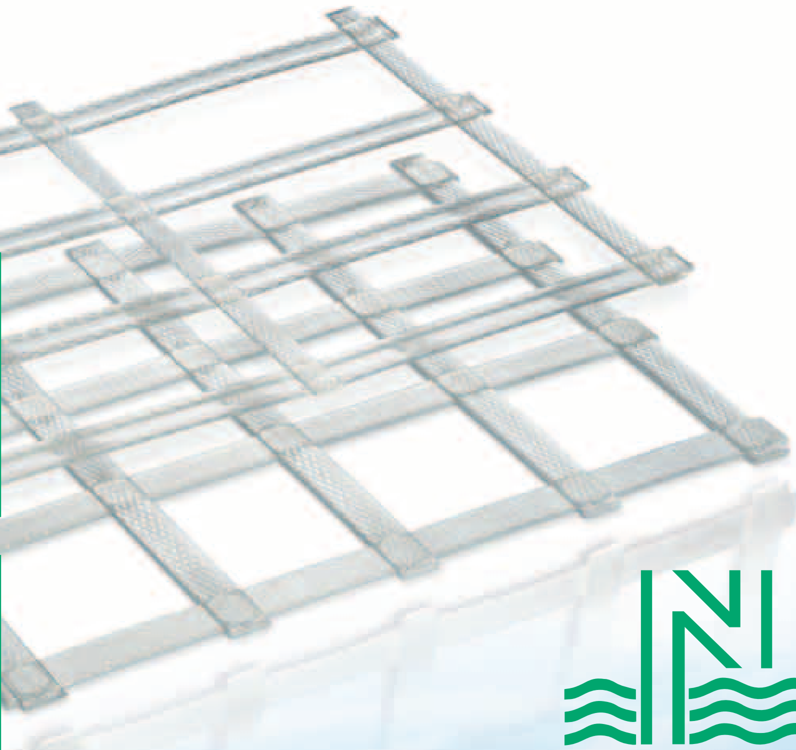
Advantages of PET/PP Secugrid®

- very high strength at low strains
- immediate interlocking effect
- low creep characteristics (PET)
- high angles of friction because of the structured geogrid surfaces
- high resistance against installation damage
- 4.75 m wide rolls
- made from uniformly extruded solid PET or PP bars
- high resistance against biological and chemical attack
- biaxial geogrid strengths up to 80 kN/m
- uniaxial geogrid strengths up to 400 kN/m
- BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No 06/R141 BBA certificate for reinforced slopes up to 70°
- available with bonded Secutex® nonwoven (Combigrid®)
- quick and easy to install
- ISO 9001 certified
- CE marked



NAUE

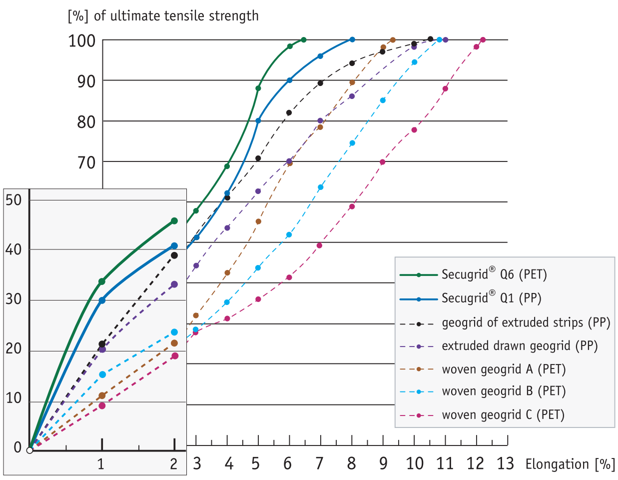
Secugrid®

Secugrid® geogrids are the next generation of geogrids produced with state of the art manufacturing technology, unlike any other geogrid on the marketplace today. The reinforcement element is a highly oriented polypropylene or polyester bar that is uniformly extruded and drawn to achieve a high modulus and strength at low elongations. This is combined with NAUE patented welding technology to provide a structurally sound and stable geogrid. Secugrid® geogrids are mainly used for base reinforcement, mechanically stabilised earth walls (MSE) construction including veneer stabilisation, the segmental retaining wall market, embankment reinforcement and pile cap platforms. Biaxial geogrids are primarily used in base reinforcement applications, while the uniaxial geogrids are often used in the other markets.

Advantage: Stress/strain behaviour

Geogrids are used wherever a high strength at low elongation is required. Stress/strain behaviour (also known as strength/elongation) is therefore decisive when selecting which type of geogrid is to be used/specified. Geogrids typically have a maximum elongation at break of 6 % to 15 %. However, the internal angle of friction of medium to densely compacted soils in realistic design conditions is reduced when the soil is subjected to an elongation of less than 2 %. It is necessary to align

Fig. 1
Stress/strain curves of Secugrid® and selected geogrids



the stress/strain behaviour of the installed geogrid to the uniaxial elongation behaviour of the soil. The performance of the geogrid at a stress/strain ratio in the range of 2 % is therefore important and here Secugrid® shows its strength. Secugrid® has excellent tensile strengths at low elongations (figure 1) and demonstrates its advantages in the critical elongation ranges.

Advantage: Interlocking

Secugrid® absorbs tensile forces induced into the soil and distributes the stresses through the high tensile strength bars. This transfer of forces takes place by two distinct modes: interlock of the granular soil into the grid apertures which physically restrains lateral movement of the granular base course material and frictional force transfer between the soil and the wide flat and structured bars of Secugrid®. The Secugrid® apertures allow for strike-through of the cover soil material which then interlocks with the ribs (flat bars) providing confinement of the overlaying granular/soil material due to the stiffness and strength of the ribs. This interlocking of the soil aggregate combined with the very high product modulus minimises soil deformation and ensures the integrity of the Secugrid® reinforced structure.

Fig. 2
Demonstration of the interlock effect with a car standing on a Secugrid® reinforced gravel column

Advantage: Resistance to installation damage

Secugrid® is considered as a very rigid geogrid with a very high modulus and therefore perfectly suited for soil reinforcement applications. This is proven also in the resistance to installation damage. This test is performed on geogrids to see what, if any, damage occurs to the geogrid during installation. In this test the geogrid is installed and covered with, typically, three types of cover material, exhumed and the geogrid strength is then tested on the exhumed material. These test results are compared to the original strength on the same material not buried and the percentage of retained strength is calculated. A reduction factor can then be calculated and taken into account by an engineer when designing with geogrids. Current Secugrid® installation damage results are listed in table 1 and are compared to published competitors values in the same test (e.g. SPRAGUE et al., Geosynthetics Conference 1999). The results show that Secugrid® is as durable if not better than other geogrids.

Fig. 3
Installation damage test results

	Secugrid® 20/20 Q1	Secugrid® 30/30 Q1	Extruded geogrids	Coated PET geogrids
Sand	98.6%	98%	83%	89% average
Sandy gravel	98.6%	91%	90%*	84% average
Coarse gravel	91.3%	90%	70%	82% average

* Clayey sand

A P P L I C A T I O N

MARBELLA HILL, SPAIN PROJECT

Quality building sites near the coast in Marbella, Spain, and the surrounding areas are becoming increasingly scarce, forcing any new holiday resorts to gradually locate in the surrounding steep, mountainous areas. One such situation involved an investor who was seeking a geosynthetic solution to develop a steep, inclined site (slope inclination between 1:1.5 and 1:2 (H:V)). Based on calculations addressing the internal, external and compound stability of the reinforced earth structures, five walls were designed.

The retaining walls were constructed with 60 cm thick compacted soil layers reinforced with Secugrid® 80/20 R6 polyester geogrid. Embedment lengths varied from

Fig. 4
Installation of natural rock blocks as facing for the geogrid reinforced soil structure

2.5 to 12 m. Secugrid® 200/40 R6 polyester geogrid was placed in areas where extremely high forces were expected, and were located between the 60 cm layer spacing of the 80/20 R6 Secugrid®. The highest wall section is composed of 40 individual layers of geogrid all constructed utilizing the "wrap-around" method. A part of the wall was clad with natural stone blocks, resulting in a more interesting and aesthetically appealing landscaping treatment. The installation of around 50,000 m² of geogrids and approximately 10,000 m² of geotextiles reinforced about 40,000 m³ of backfill material and converted a hillside into over 9,000 m² of buildable construction area.

BASE COURSE REINFORCEMENT IN PAWLOWICE

The heavily trafficked road 933 through Pawlowice, Poland, had to be reconstructed due to severe settlements and rutting which damaged the structure of the old road. Investigations brought up that the road was under-designed in the base and that it was built over very soft clayey subsoils. Various options were investigated for an improvement of the road and one main consideration was that solutions should be preferred which would extend the typical lifetime of the road. After an evaluation of several alternatives to the traditional solution - increasing the thickness of the base course layer to approx. 1.0 m - it was decided to support a geogrid reinforced base course. Just the cost savings occuring from the reduced amount of aggregate (0.65 m) for the base course and the savings of not having to dispose of additional excavation material on a landfill suggested that a road design with a geogrid reinforcement would be the most economic solution.

Fig. 5
Placing crushed aggregate on Secugrid®

The selection of Secugrid® 30/30 Q1 was based on the properties of the existing subsoil conditions. The overall robust and rigid performance of the Secugrid® bars and its junctions were as important as the high modulus and the high strength values achieved at low elongations. During the construction of the road the designer and the contractor inspected the installation of Secugrid® and convinced themselves that they made the right selection. This was based on the fact that the immediate interlocking of the base course aggregate

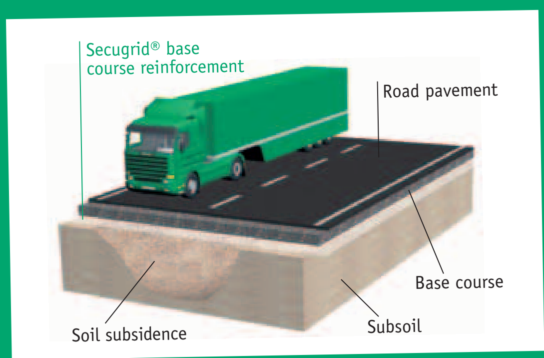
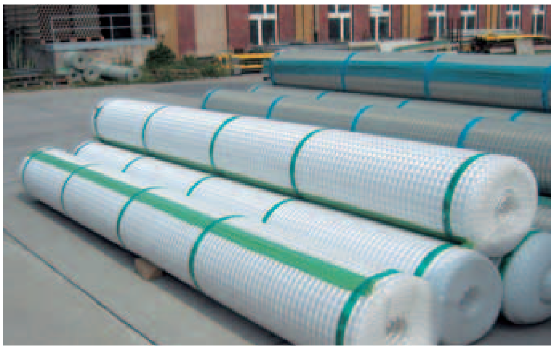


Fig. 6
Base course reinforcement above subsoil subsidences

allowed vehicles to drive over extremely soft subsoils without any recognizable rutting or aggregate movement. In areas with extremely soft and wet subgrade the designer additionally requested the installation of a Secutex® nonwoven for filtration and separation purposes.

INSTALLATION


Loading for transportation


Site storage


Unrolling of Secugrid®


Overlapping


Combination with Combigrid®


Cover soil placement


Interlocking of soil aggregate


Compaction of fill aggregate

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