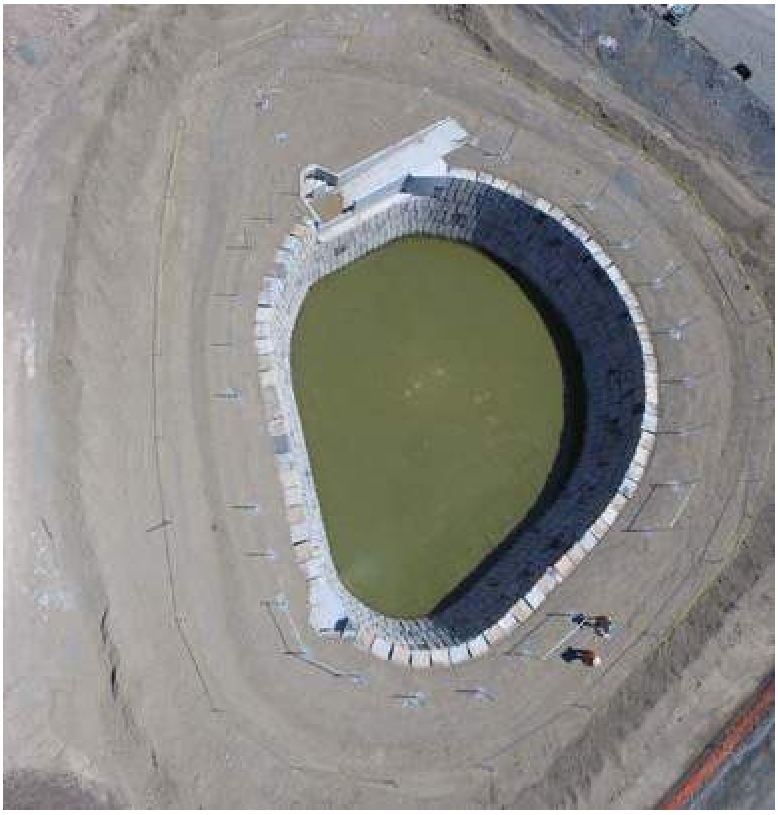
TerraGrid® HSG Biaxial

PET High Strength Coated Geogrid



TerraGrid® HSG are manufactured from high tenacity polyester (PET) yarns, knitted to form a structured grid.

DESIGNED FOR CIVIL ENGINEERING APPLICATIONS:

- ✓ Reinforcement of granular soils
- ✓ Embankment reinforcement
- ✓ Retaining structures
- ✓ Basal reinforcement
- ✓ Piling platforms
- ✓ Subgrade improvement

Product strength and stiffness are affected both by temperature and by rate or duration of loading. For these reason it's important that standard methods of tensile testing are used, so that temperature and strain rate are defined.

TerraGrid® HSG, quality control (QC) tensile testing is carried out using the method given in International Standard BS EN ISO10319:1996. This is a wide width method with specimen width of 200mm. Strain rate is 20% per minute and test temperature is 20°C.

Properties	SYM	UNIT	TerraGrid® (H) PET High Strength Coated Geogrids Biaxial Range												
			40/ 40	60/ 60	80/ 80	100/ 100	150/ 150	200/ 200	300/ 300	400/ 400	600/ 600	700/ 700	800/ 800	1000/ 1000	1200/ 1200
Aperture Size		mm	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25
Elongation (+/- 2%)		%	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ultimate Tensile Strength MD/CD	T_u	kN/m	40/40	60/60	80/80	100/100	150/150	200/200	300/300	400/400	600/600	700/700	800/800	1000/1000	1200/1200
Characteristic tensile creep rupture strength @ 120 years (MD)	T_{cr}	kN/m	27.6	41.4	55.2	69.0	103.4	137.9	206.9	275.9	413.8	482.8	551.7	689.7	827.6
Characteristic initial tensile strength with maximum 5% strain in MD (40% of Tu)	T_{cs}	kN/m	16.0	24.0	32.0	40.0	60.0	80.0	120.0	160.0	240.0	280.0	320.0	400.0	480.0

Consult Polyfabrics Australasia or a certified Engineer for site specific installation instructions. Polyfabrics Australasia reserves the right to change its product specification at any time. It is the responsibility of the specifier and purchaser to ensure that product specifications used for design and procurement purposes are current and consistent with the products used in each instance.

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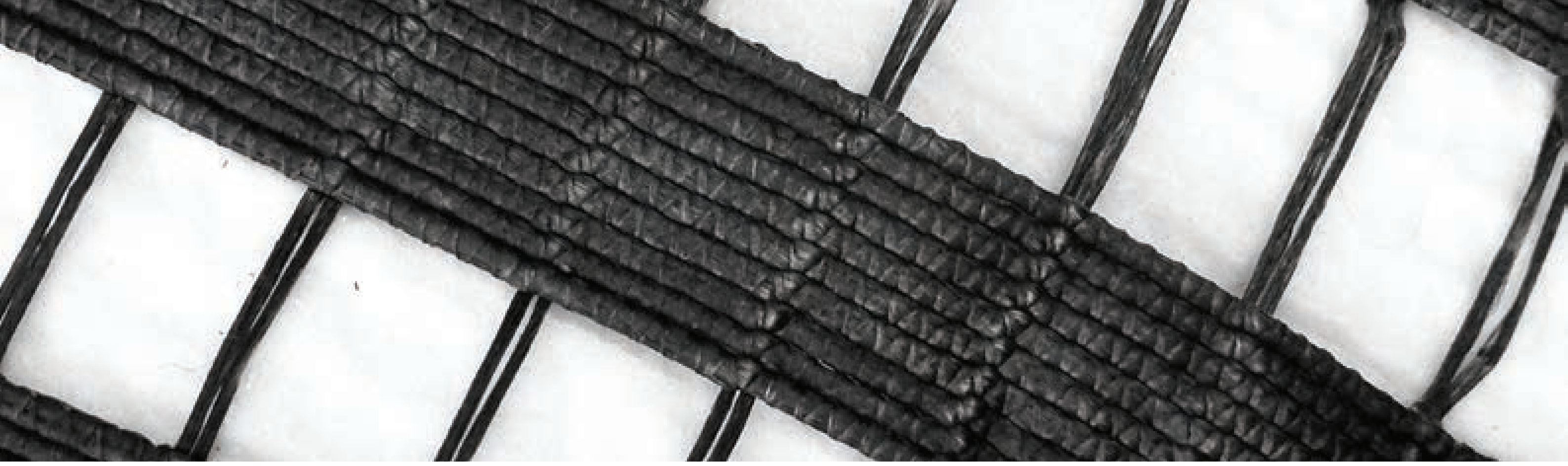

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DESIGN FACTORS

Main Roads Departments and engineers derive their design strengths of geosynthetic reinforcement in accordance with Section 5.3.3, Annexure A and Annexure D of BS 8006. Taking into account the following requirements in BS 8006: (A) Determining strength reduction factors and in calculating design strengths of geosynthetics; (B) Comply with the following requirements in Section 5.3.3 and Annexure A of BS 8006.

1. Determining strength reduction factors:

- Long term creep and durability (e.g. hydrolysis).
- Creep and creep rupture tests must be carried out in accordance with ISO 13431 or equivalent.
- Stress rupture characteristics.
- Chemical effects due to ground water and the type of fill.
- Temperature.
- Construction site installation damage.
- Deviations from the manufacturer's quality control strength.
- Pull out strength interaction values; and Connection strengths.

2. Comply with the following requirements in Section 5.3.3 and Annexure A of BS 8006:

- Maximum operating temperature must not be less than 20°C.
- Maximum creep strain must not exceed 1% over a design life of 100 years at the maximum operation temperature in the derivation of T_{cs}.

A summary of the Partial Material Factors are listed in Table 1.
Furthermore, the long term design strength of the connections (if required) in the longitudinal direction must be higher than the reinforcement.

The factors and design parameters given here after represent a help/tool for pre-designing structures. These parameters and results are based on our experience and research. For each project, specific parameters must be evaluated with specific soil conditions and real project parameters by the official design office of the project, or a specific design office mandated.
Durability of the **TerraGrid®HSG** have been tested throughout the past years. This evaluation is based on different raw results and data from official laboratory tests and official standards.

Partial Factors		
Partial factor for - Material manufacture consistency & variations	f_{m11}	f_{m1}
Partial factor for - Extrapolation of test data to design life	f_{m12}	
Partial factor for - Susceptibility to damage during installation	f_{m21}	f_{m2}
Partial factor for - Environmental or chemical effects	f_{m22}	
Reinforcement material factor (f_m) = (f_{m11} x f_{m12}) x (f_{m21} x f_{m22})		f_m

Table 1. PARTIAL MATERIAL FACTORS FOR REINFORCEMENTS

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CREEP RUPTURE

Creep Rupture properties were determined by independent testing authorities performing conventional creep tests to DIN EN ISO 13431-11.1999 and accelerated SIM tests to ASTM D 6992- 2009 and ISO/TR 20432-12.2007 on a variety of PET products.
A summary of the Creep Reduction Factors RFcr are listed in table 2. The ratio of Tu from a direct Tensile Test to Limit 5% at 100 years is 32.8%. This is the maximum tension allowed in the **TerraGrid® HSG** to limit deformation to 5% in 100 years.

Service Life	Test Tensile Creep Rupture	Reduction factor RF_{creep}
< 5 years		1.36
< 10 years	Linear Regression MD = 73.5%	1.36
< 25 years	Linear Regression MD = 73.0%	1.37
< 50 years	Linear Regression MD = 71.9%	1.39
< 120 years	Linear Regression MD = 68.9%	1.45

Table 2. CREEP REDUCTION FACTORS

INSTALLATION DAMAGE

Factors are derived from independent field and large scale laboratory tests. Values of fm21 for **TerraGrid® HSG** placed on differing soils are listed in the Table.

Fine material Sand < 2mm	Gravel 0 - 100mm	Gravel 0 -300mm
1.10	1.15	1.30

Table 3. INSTALLATION DAMAGE

DURABILITY - CHEMICAL RESISTANCE

TerraGrid® HSG Hydrolysis ageing test was carried out to standard ISO/EN12447: 2001.
Principle of test: Both test and control specimens are immersed in hot water for 28 days at 95 °C. The properties of the specimens are determined after immersion.
Number of specimens: Five test specimens and five control specimens are tested and the results are expressed as a percentage of retained strength or elongation, compared to the reference specimens.

pH range	Design lifetime (years)	Max temp. (°C)	Durability
2 to 4	120	25	1.30
4 to 9	120	25	1.10
9 to 11	120	25	1.30

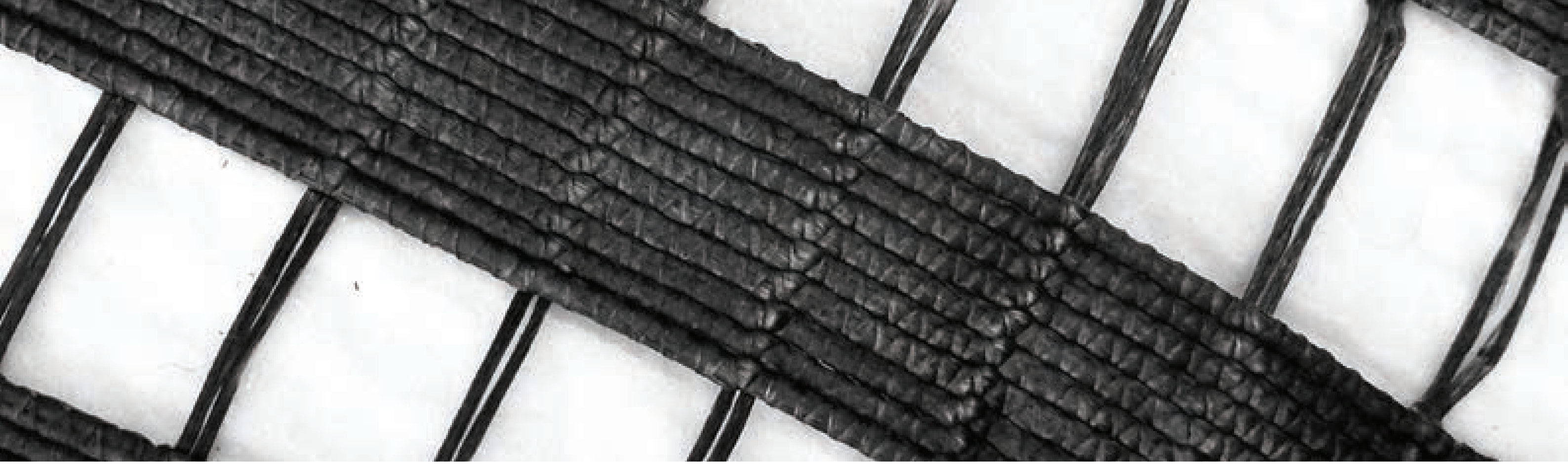
Table 4. CHEMICAL RESISTANCE

FRICTION

TerraGrid® HSG grades have been tested for friction properties with different soils to official standards. The properties are listed in Table 5.

Type of soil	Type of geosynthetic	Tan phi.soil-Grid/Tan phi.Soil
For starting	"all grades"	0.70
Sand < 2mm	"light grades" < 150 kN/m	0.80
Sand < 2mm	"heavy grades" > 150 kN/m	0.85
Gravel 0/100mm	"light grades" < 150 kN/m	0.85
Gravel 0/100mm	"heavy grades" > 150 kN/m	0.90

Table 5. TYPICAL FRICTION PROPERTIES



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STORAGE ,HANDLING, PLACEMENT, OVERLAPPING AND INSTALLATION

a) STORAGE

To conserve their initial properties, **TerraGrid® HSG**:

- Must not be exposed to the weather
- Avoid tearing and perforation to their plastic wrapping
- Stored on pallets (not in contact with water) and protected from ultraviolet rays by an opaque wrapping.

b) HANDLING

TerraGrid® HSG are generally supplied in rolls 50m -100m lengths and 5.0m -5.3m widths. Roll weights vary from 100kg to 1500kg. While some can therefore be manhandled, others will require transport and lifting equipment. Rolls incorporate a core suitable for lifting by simple site handling equipmen. In the case of products with non structural core special dispensers are available to assist installation.

c) PLACEMENT

TerraGrid® HSG are placed in formation levels previously compacted and levelled that contain no projections likely to damage the geogrid layer. They are reeled off the roll by hand or using plant, and are cut to length as required.
Check that the laying direction matches the design, for the strength of products is often greater in the roll direction (direction of production, as wound onto spools).

d) OVERLAPPING

Overlaping rolls in the transverse direction to transfer high strength is **not** achieved by overlapping. Length of overlap in MD may be calculated by the design engineer for certain applications. Typical cross overlaps is 0.3m to 1.0m.

e) INSTALLATION

As fill is placed on **TerraGrid® HSG** it is recommended that it should be laid flat and wrinkle free, stabilised by pinning or placement of soil heaps to prevent movement from wind and installation equipment
Typical sequence of work could be as follows:
Fill to be used is graded and compacted, before **TerraGrid® HSG** is placed.
The **TerraGrid® HSG** is placed and held taught by pinning and or fill placement.
New fill layer graded, placed and compacted on the **TerraGrid® HSG**.
Compaction of soil should be conducted in accordance to specification.