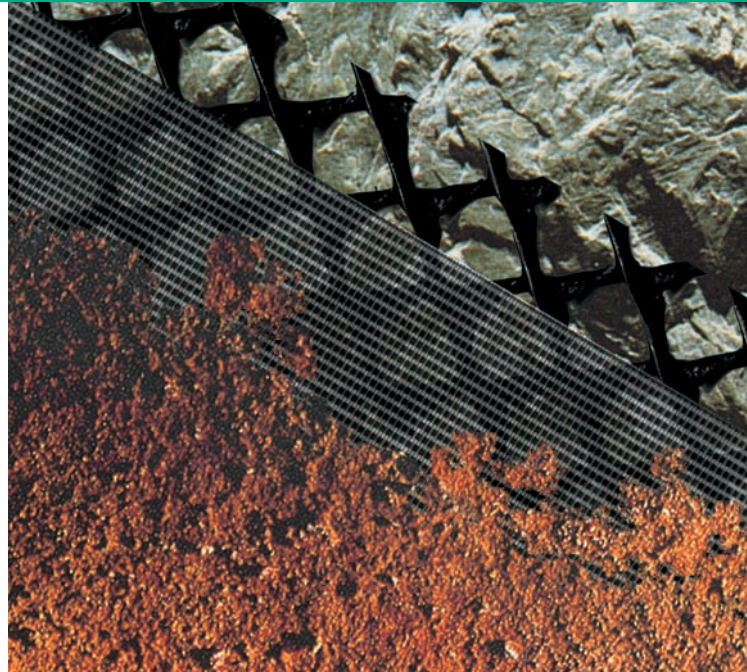


Geotechnics

Keyline supplies a comprehensive range of woven and non-woven sub-soil stabilisation mats and biaxial geogrids to reinforce granular sub bases. Gabion retaining walls are also available.



Lotrak

Lotrak geotextiles are manufactured, tested and marked in accordance with EN Standards, complying fully with the Construction Product Directive CPD 89/106/EEC (CE marking became mandatory on 1st October 2002 in most European countries).

Lotrak geotextiles are used for separation, filtration and reinforcement.

Separation

As a separation layer the geotextile prevents the loss of stone into subgrade.

Filtration

As a filtration layer the geotextile prevents soil fines entering the drainage media. A geotextile-wrapped drain has around twice the life expectancy of a conventional French drain.

Reinforcement

As a reinforcement layer the geotextile can save not only the initial loss of fill into the sub-grade but also offer a reduction in the overall construction thickness.

Over 90% of the damage on a geotextile usually occurs during construction. Lotrak has a high CBR puncture resistance and low cone drop penetration, which ensures that this damage is limited and the strength is retained.

Lotrak Grades Typical Uses

Standard Grade	1800	Basic Separation/Filtration
	2300	Filtration
	2800	Filtration
	4000	Coastal Protection
Reinforcement Grade	25R	Basic Reinforcement
	50R	Reinforcement on Soft Ground
	70R	Reinforcement on Very Soft Ground
Highflow Grade	HF550	High Water Application

Lotrak Geotextiles – One product, five functions

Separation

- Separates the sub-base and the sub-grade
- Prevents intermixing of construction layers and maintains construction thicknesses
- Keeps expensive aggregates apart from soft ground

Reinforcement

- Reinforces over weak sub-grades
- Absorbs stresses that occur when heavy loads pass over the road

Filtration

- Small enough to control soil particle movement
- Large enough to avoid clogging and maintain waterflow
- Creates bridging zone for effective filtration

Erosion Protection

- High resistance to static and dynamic puncture when placed in coastal corrosion protection works
- Effective anchorage in the construction attained through frictional interlock

Drainage

- Allows water to pass through into a filter drain without carrying fine soil particles with it

Lotrak Standard Grades

A range for separation and drainage applications that will cover the majority of site conditions. The number used in the standard grades represents the CBR puncture resistance of the geotextile.

Physical Properties of Lotrak (Standard Grade)

Test	Standard		Standard Grades				
			Advance	1800	2300	2800	4000
Tensile Strength (kN/m)	BS EN ISO 10319: 2002	Warp	12	12	20	23	35
		Weft	9	12	17	22	30
Elongation at Max. Load (%)	BS EN ISO 10319: 2002	Warp	28	28	28	28	30
		Weft	20	16	18	22	25
CBR Puncture Resistance (N)	BS EN ISO 12236: 2002		1650	1800	2500*	2800	4000
Cone Drop Penetration (mm)	BS EN ISO 918: 2002		17	15	12	12	9
Pore Size 90% Finer Than (microns)	BS EN ISO 12956: 2002		300	225	200	260	400
Water Permeability (m/sec)	BS EN ISO 11058: 2002		22x10 ⁻³	16x10 ⁻³	22x10 ⁻³	20x10 ⁻³	26x10 ⁻³
Effect of UV Light	The Polypropylene Used Contains a UV Inhibitor						
Weight (g/m ²)			80	95	110	135	205
Roll Size		Width	4.5	4.5	4.5	4.5	5.2
		Length	100	100	100	100	100

*Exception 2300

Lotrak Reinforcement Grades

A geotextile for use where the geotextile must separate and reinforce at the base construction.

Physical Properties of Lotrak (Reinforcement Grade)

Test		Reinforcing Grades		
		25R	50R	70R
Tensile Strength (kN/m)	Warp	25	52	72
	Weft	25	50	72
Tensile Strength@ 5% Extension (kN/m)	Warp	13	27	45
	Weft	16	45	58
Elongation at Max. Load (%)	Warp	11	12	9
	Weft	10	7	7
CBR Puncture Resistance (N)		3100	6000	8500
Cone Drop Penetration (mm)		12	8	5
Pore Size 90% Finer Than (microns)		250	250	225
Water Permeability (m/sec)		12×10^{-3}	16×10^{-3}	16×10^{-3}
Effect of UV Light	The Polypropylene Used Contains a UV Inhibitor			
Weight (g/m ²)		120	240	330
Roll Size	Width	5.0	5.0	5.0
	Length	100	100	100

Lotrak Highflow

A grade for use in more hydraulically demanding applications where a high waterflow and a closely controlled opening size are critical.

Physical Properties of Lotrak (Highflow Grade)

Test		Highflow Grades
		HF550
Tensile Strength (kN/m)	Warp	22
	Weft	19
Elongation at Max. Load (%)	Warp	28
	Weft	20
CBR Puncture Resistance (N)		2750
Cone Drop Penetration (mm)		14
Pore Size 90% Finer Than (microns)		550
Water Permeability (m/sec)		75×10^{-3}
Effect of UV Light	The Polypropylene Used Contains a UV Inhibitor	
Weight (g/m ²)		142
Roll Size	Width	4.5
	Length	100

Ten Cate Polyfelt Geotextiles

- Mechanically bonded continuous non-woven geotextiles made from 100% UV stabilised polypropylene
- The mechanical properties of Polyfelt TS geotextiles ensure extreme resistance to installation damage, excellent hydraulic properties and outstanding long term performance
- Product fully tested to BS EN Standards and holds relevant CE mark



Polyfelt TS geotextiles are mechanically bonded continuous filament non-wovens manufactured from 100% UV stabilised polypropylene. They are characterised by a high resistance to installation damage, high water permeability and increased UV resistance.

For many years Polyfelt TS60 has been employed as a non-woven protection fleece in a range of applications. Its continuous filament mechanically bonded structure gives high puncture resistance and tensile strength thereby providing excellent membrane protection performance in, for example, SUDS attenuation systems, pond and lagoon lining. Like all the Polyfelt TS range, TS60 is manufactured from UV stabilised virgin polypropylene under strict quality control to provide a reliable, consistent and durable product.



Physical Properties of Polyfelt Geotextiles

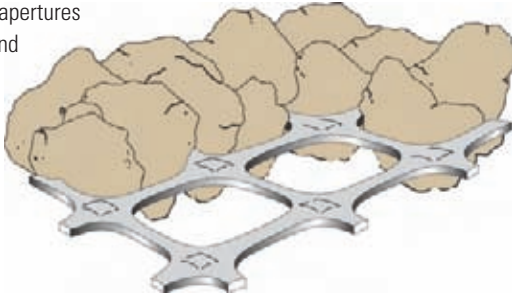
Properties (Standard)		Unit (4.01)	TS 10 (4.51)	TS 20 (4.01)	TS 30	TS 40	TS 50	TS 60	TS 65	TS 70	TS 80
Mechanical Properties											
Tensile Strength (BS EN ISO 10319)	MD	kN/m	7.5	9.0	11.5	13.5	15.0	19.0	21.5	24.0	28.0
	CD	kN/m	7.5	10.0	11.5	13.5	15.0	19.0	21.5	24.0	28.0
Elongation at Maximum Load (BS EN ISO 10319)	MD	%	90	90	90	100	100	100	100	100	100
	CD	%	75	65	75	40	40	40	40	40	40
Static Puncture Resistance (CBR-Test) (BS EN ISO 12236)		N	1200	1500	1750	2100	2350	2900	3300	3850	4250
Cone Drop Test (hole-Ø) (BS EN ISO 918)		mm	28	24	20	25	22	19	17	15	14
Hydraulic Properties											
Permeability Vertical (BS EN ISO 11058 ($\Delta h = 50\text{mm}$))		$\text{l/m}^2\text{s}$	130	115	100	100	90	80	70	60	55
Opening Size O90 (BS EN ISO 12956)		μm	105	105	100	100	100	95	95	90	90
Identification Properties											
Thickness (BS EN ISO 964-1)	2 kPa	mm	0.9	1.0	1.2	1.7	1.9	2.2	2.5	2.9	3.2
Mass per Unit Area (BS EN ISO 965)		g/m^2	105	125	155	180	200	250	285	325	385
Forms of Supply											
Width		m	2 / 4	4.5	2 / 4	2 / 4	2 / 4	2 / 4	2 / 4	2 / 4	2 / 4
Length		m	300	100	225	200	175	135	125	100	90

The values given are average values obtained in Polyfelt laboratories and in testing institutes. The right is reserved to make changes without notice at any time.

Tensor Biaxial Geogrids

How Do Tensor Geogrids Work?

Tensor geogrids can solve stabilisation problems because they interlock very efficiently with granular materials. When granular particles are compacted over these grids, they partially penetrate and project through the apertures to create a strong and positive interlock.



Tensor Geogrid Unique Features Include:

- High strength integral junctions
- Stiff ribs which present a thick square leading edge to the aggregate

What are the Benefits of Tensor Geogrids?

Tensor biaxial geogrids combine major cost savings with considerable performance benefits in granular capping and sub-base layers.

Tensor Geogrid Benefits Include:

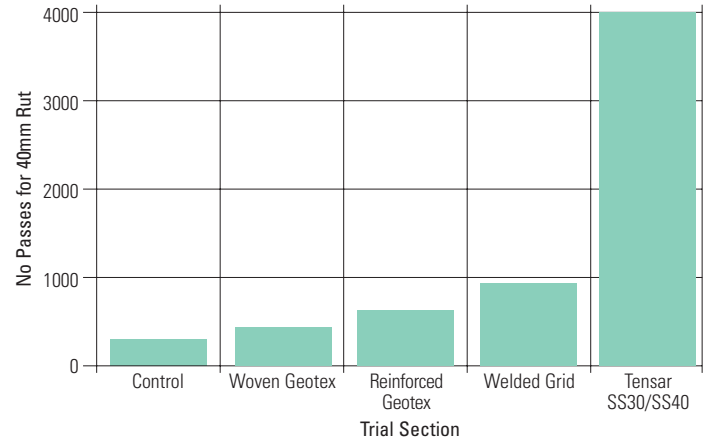
- Savings in granular thickness of up to 50% with no performance loss
- Increased design life by a factor of 3
- Reduction of excavated soil together with conservation of natural aggregates
- Reduced disturbance and weakening of sensitive subgrade formations
- Improved fill compaction
- Control of differential settlement
- Spanning of voids

TRL Pavement Trials (2000) - Relating Performance in Pavements to Geosynthetic Properties

In 2000, TRL carried out trafficking trials for sub-base reinforcement incorporating a variety of different geosynthetic materials. In this trial, the pavements consisted of 320mm of sub-base material over a clay subgrade with CBR = 1.5%. The pavement was trafficked by a 40kN double tyred wheel, representing one end of standard design axle passing along a fixed wheel path.

The Trial Section chart shows the number of passes per geosynthetic material before a rut depth of 40mm is generated.

A clear Tensar advantage and an indication that performances vary between different geogrid types.



Summary of Results

Control

This consisted of clay sub-grade with no reinforcement and therefore delivered the poorest performance.

Woven Geotextile

This has similar stiffness to Tensar SS40, yet provides negligible reinforcing benefit.

Reinforced Geotextile

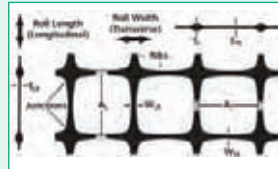
This has twice the stiffness of Tensar SS40, but provides very little improvement in performance.

Welded Grid

This consists of very thin polyester strips welded to form a grid shape, with similar stiffness to Tensar SS40. The thin strips do not interlock effectively with the aggregate and the improvement in pavement performance is less than 25% of that provided by Tensar SS40.

Tensar SS Geogrids

This comparison emphasises that the most important feature of a Tensar SS geogrid is its ability to interlock with the aggregate particles to create a mechanically stabilised layer.



Contact your local Keyline branch for information on cost saving through reducing the amount of aggregate involved in your pavement design.

Physical Properties of Tensar SS Geogrids

Property	Units	Tensar SS Geogrid (8) (9)		
		SS20	SS30	SS40
Keyline Code		989568	989569	989572
Polymer		Polypropylene		
Minimum Carbon Black (1)%	2	2	2	
Roll Width	m	4.0	4.0	4.0
Roll Length	m	75	50	30
Unit Weight	kg/m ²	0.22	0.33	0.53
Roll Weight	kg	68	67	65
Dimensions AL	mm	39	39	33
AT	mm	39	39	33
WLR	mm	2.2	2.3	2.2
WTR	mm	2.4	2.8	2.5
tJ	mm	4.1	5.0	5.8
tLR	mm	1.1	2.2	2.2
tTR	mm	0.8	1.3	1.4

Notes

- (1) Carbon black inhibits attack by UV light. Determined in accordance with BS EN ISO 2782:Part 4:Method 452B:1993.
- (2) Load transfer capability determined in accordance with GRI-GG2-87 and GRI-GG1-87 and expressed as a percentage of ultimate tensile strength.
- (3) In-plane torsional rigidity measured in accordance with U.S. Army Corps of Engineers Methodology for measurement of Torsional Rigidity, (Kinney, T.C. Aperture Stability Modulus rev 3.1.2000).
- (4) Tensile stiffness by tests carried out in accordance with BS EN ISO 10319:1996.
- (5) Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.

Property	Units	Tensar SS Geogrid (8) (9)		
		SS20	SS30	SS40
Mechanical				
Junction Efficiency (2)	% (min)	95	95	95
Aperture Stability (3)	kg-cm/deg (min)	4.1	9.1	13.6
Radial Stiffness at Low Strain (4)	kN/m@0.5%strain (min)	150	390	450
Durability				
Resistance of Chemical Degradation (5)	%	100	100	100
Resistance of UV Light and Weathering (6)	%	100	100	100
Resistance to Installation Damage (7)	%	>90	>90	>90

- (6) Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355.
- (7) Resistance to loss of load capacity or structural integrity when subjected to mechanical installation stress in crushed stone classified as poorly graded gravel (GP). The geogrid shall be sampled in accordance with BS EN ISO 8006:1995 and load capacity shall be determined in accordance with BS EN ISO 10319:1996.
- (8) Tensar SS geogrids are inert to all chemicals naturally found in soils and have no solvents at ambient temperature. They are not susceptible to hydrolysis and are resistant to aqueous solutions of salts, acids and alkalis and are non-biodegradable.
- (9) Tensar SS geogrids are manufactured in accordance with a quality management system which complies with the requirements of BS EN ISO 9001:2000. All quoted dimensions and values are typical unless stated otherwise.

Gabion Retaining Walls

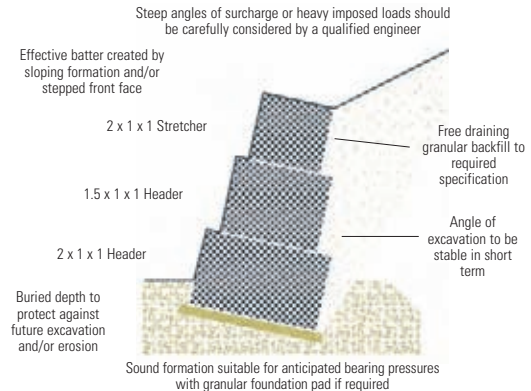
Gabion walls are 'gravity' walls that hold back the pressure from the retained soil by the weight and strength of the stone fill contained within them.

Each Gabion box consists of an arrangement of high strength, steel mesh panels which are linked together by lacing wire and clips. Considerable flexibility in size and configuration of walls is possible due to the extensive range of available sizes arranged either as stretchers (spanning along the length of the wall) or headers (spanning into the wall).

Product Range

A wide range of gabion boxes, gabion mattresses and Rock Netting - available in either triple-twisted hexagonal mesh or welded mesh.

Typical Section



Installation

- Gabions are supplied flat packed for ease of transportation, but are easily pulled into shape once in position
- Each unit is linked to adjacent gabions by a rapid clipping system
- Each unit is filled with 100-200mm crushed stone
- Backfilling proceeds with the completion of each course

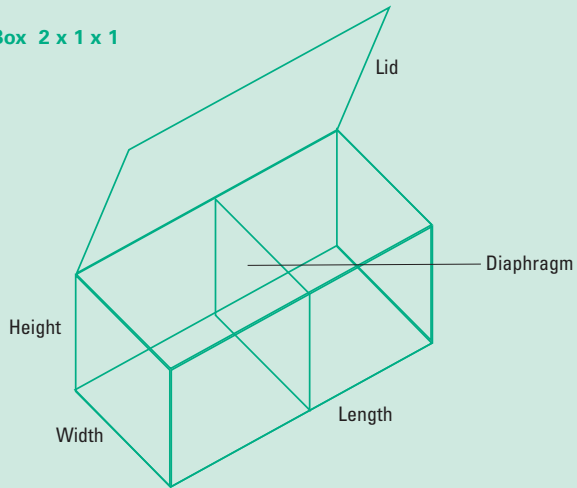
Finishes

Galvanised These products are galvanised to either BS 443 or BS 729. They are ideal for use in applications that are not subject to a corrosive environment or that are short term.

PVC These gabions are highly durable and consist of pre-galvanised wire which is then PVC coated. They are suitable for use on highways, water applications and other projects in mildly corrosive situations.

Zinc Coating An aluminium zinc coating providing up to four times the durability of galvanised wire.

Gabion Box 2 x 1 x 1



Sizes

Gabion Box Sizes			Gabion Mattress Sizes		
Length m	x Width m	x Height m	Length m	x Width m	x Height m
1.0	0.5	0.5	3.0	2.0	0.17
1.0	1.0	0.5	3.0	2.0	0.23
1.0	1.0	1.0	3.0	2.0	0.30
1.5	1.0	0.5	6.0	2.0	0.17
1.5	1.0	1.0	6.0	2.0	0.23
2.0	0.5	0.5	6.0	2.0	0.30
2.0	1.0	0.5			
2.0	1.0	1.0			
2.0	1.5	1.0			
3.0	1.0	0.5			
3.0	1.0	1.0			

Delivering Outstanding Service

Keyline is known for its civils and drainage expertise, offering you a total solution to all your requirements. With branches across the country, Keyline will provide the specialist civils products you need directly from stock.

- Branches nationwide
- A huge range and depth of materials always in stock
- Our staff are helpful, friendly and knowledgeable
- We provide a speedy, efficient and accurate service
- We get it right first time

