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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
03/4065
Product Sheet 1

LINEAR COMPOSITES SOIL REINFORCEMENT PRODUCTS

PARALINK GEOCOMPOSITES

This Agrément Certificate Product Sheet[1] relates to Paralink[2] Geocomposites, comprising an open network of integrally connected straps of high tenacity polyester yarn coated with polyethylene, for use as basal reinforcement in embankment foundations.

(1) Hereinafter referred to as 'Certificate'.
(2) Paralink is a registered trademark.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Design — interaction between the soil and the geocomposites has been considered and coefficients relating to direct sliding and pull-out resistance are proposed (see section 6).

Mechanical properties — the short- and long-term tensile strength and elongation properties of the geocomposites and loss of strength owing to installation damage have been assessed and reduction factors established for use in design (see section 7).

Durability — the resistance of the geocomposites to the effects of hydrolysis, chemical and biological degradation, UV exposure and temperature conditions normally encountered in civil engineering practice has been assessed and reduction factors established for use in design (see sections 8 and 11).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Third issue: 16 March 2018	Paul Valentine	Claire Curtis-Thomas
Originally certificated on 3 December 2003	Technical Excellence Director	Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, the use of Paralink Geocomposites is not subject to the national Building Regulations.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 1 *Description* (1.2) and 3 *Delivery and site handling* (3.1, 3.3 and 3.4) of this Certificate.

Additional Information

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised European Standard BS EN 13251 : 2016. An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 Paralink Geocomposites are planar structures, consisting of a regular array of composite geosynthetic straps, nominally interconnected laterally to form soil reinforcement materials with high unidirectional strength. The main loadbearing geosynthetic straps comprise cores of polyester tendons encased in a polyethylene sheath.

1.2 The Paralink Geocomposites grades covered by this Certificate are listed in Table 1, and the associated performance characteristics are shown in Table 2. The configuration of the geocomposites is illustrated in Figure 1.

Figure 1 Paralink Geocomposites

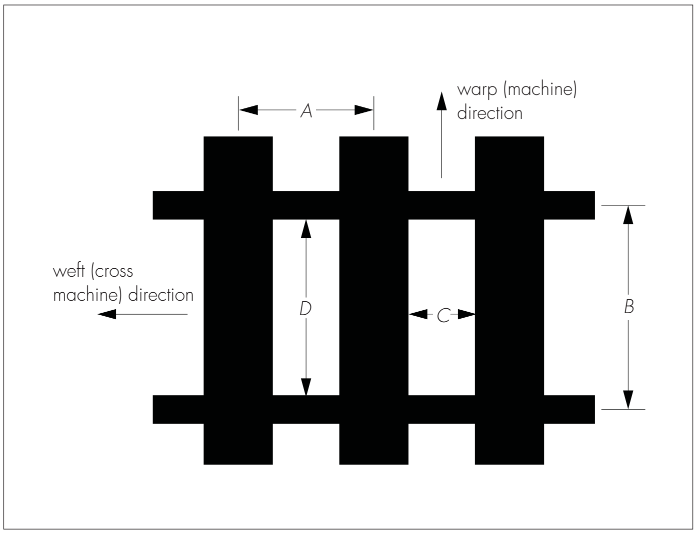


Table 1 General specifications

Grade	Nominal mass[(1)] (g·m^{-2})	Grid size[(2)] warp/weft *A x B* (mm)	Aperture size[(2)] warp/weft *C x D* (mm)	Nominal roll weight (for standard 4.5 m wide roll) (kg)	Standard roll[(3)] length (m)
100	425	180 x 1000	98 x 940	440	200
150	515	180 x 1000	95 x 940	520	200
200	590	180 x 1000	95 x 940	590	200
250	697	180 x 1000	95 x 940	690	200
300	789	180 x 1000	92 x 940	770	200
350	890	180 x 1000	91 x 940	660	150
400	1014	180 x 1000	90 x 940	750	150
450	1124	180 x 1000	90 x 940	720	130
500	1219	180 x 1000	90 x 940	780	130
550	1410	180 x 1000	90 x 940	700	100
600	1507	180 x 1000	90 x 940	750	100
650	1681	180 x 1000	89 x 940	830	100
700	1835	180 x 1000	89 x 940	480	50
750	1970	150 x 1000	59 x 940	510	50
800	2135	150 x 1000	59 x 940	550	50
850	2221	125 x 1000	34 x 940	570	50
900	2351	125 x 1000	34 x 940	600	50
950	2543	125 x 1000	34 x 940	640	50
1000	2616	125 x 1000	34 x 940	660	50
1050	2695	100 x 1000	9 x 940	680	50
1100	2829	100 x 1000	9 x 940	710	50
1150	3018	100 x 1000	9 x 940	750	50
1200	3171	100 x 1000	9 x 940	790	50
1250	3254	100 x 1000	9 x 940	800	50
1300	3475	100 x 1000	9 x 940	860	50
1350	3674	100 x 1000	9 x 940	900	50
1500	3785	100 x 1000	9 x 940	930	50
1600	4005	100 x 1000	9 x 940	980	50

(1) Mass/unit area measured in accordance with BS EN ISO 9864 : 2005.

(2) Mean measured dimensions (see Figure 1 for reference).

(3) Non-standard lengths can be produced on request.

Table 2 Performance characteristics — machine direction (MD)

Grade	Performance values declared on the Certificate holder's CE Marking Declarations of Performance			Values used for design	
	Short-term tensile strength[1] (kN per metre width)		Mean strain at maximum tensile strength[1] (%) (*)	Characteristic strength (T_{char})[2] (kN per metre width)	Nominal strain at T_{char} load (%)
	Mean value (*)	Tolerance (*)			
100	103	−2.4	10.5 (±1)	100	9.5
150	154	−3.2	10.5 (±1)	150	9.5
200	206	−4.9	10.5 (±1)	201	9.5
250	257	−5.6	10.5 (±1)	251	9.5
300	309	−7.4	10.5 (±1)	301	9.5
350	360	−8.1	10.5 (±1)	351	9.5
400	412	−9.8	10.5 (±1)	402	9.5
450	463	−10.5	10.5 (±1)	452	9.5
500	515	−12.3	10.5 (±1)	502	9.5
550	566	−13.0	10.5 (±1)	553	9.5
600	612	−8.8	10.5 (±1)	603	9.5
650	669	−15.5	10.5 (±1)	653	9.5
700	721	−17.2	10.5 (±1)	703	9.5
750	772	−18.0	10.5 (±1)	754	9.5
800	826	−21.7	10.5 (±1)	804	9.5
850	875	−20.5	10.5 (±1)	854	9.5
900	927	−22.1	10.5 (±1)	904	9.5
950	980	−23.4	10.5 (±1)	956	9.5
1000	1038	−24.8	10.5 (±1)	1013	9.5
1050	1081	−25.4	10.5 (±1)	1055	9.5
1100	1133	−27.1	10.5 (±1)	1105	9.5
1150	1184	−27.8	10.5 (±1)	1156	9.5
1200	1236	−29.5	10.5 (±1)	1206	9.5
1250	1287	−30.0	10.5 (±1)	1257	9.5
1300	1339	−32.0	10.5 (±1)	1307	9.5
1350	1390	−32.8	10.5 (±1)	1357	9.5
1500	1545	−36.9	10.5 (±1)	1508	9.5
1600	1648	−39.4	10.5 (±1)	1608	9.5

(1) Values derived from short-term tests in accordance with BS EN ISO 10319 : 2015.

(2) The characteristic short-term tensile strength (T_{char}) values are the mean short-term tensile strength minus 1 x the tolerance value in accordance with BS EN 13251 : 2016.

2 Manufacture

2.1 The product comprises an open array of main loadbearing geocomposite straps, nominally interconnected laterally at specified centres by pressure and heat bonding to lighter, unreinforced straps, to give the required performance characteristics. The main loadbearing straps are made from tendons of high tenacity polyester (PET) yarn coated in polyethylene using a vacuum die-coating process, then passed through rollers to give a knurled finish on the sheath. An impressed mark denoting the product grade is applied on one side of the straps at intervals of approximately 180 mm.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

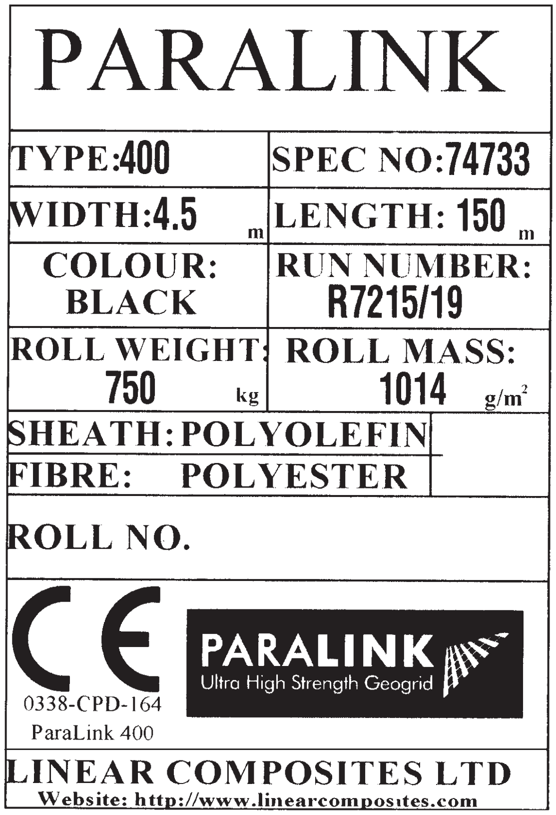
2.3 The management system of the Certificate holder has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by Lloyd's Register Quality Assurance (Certificate LRQ 0902157).

3 Delivery and site handling

3.1 Paralink Geocomposites are delivered to site in rolls nominally 4.5 m wide(1) (edge to edge of roll) and approximately 4.6 m wide (end to end of the central lifting tube). Each roll is wrapped in a black polythene bag for transit and site protection, and labelled with the grade and identification. The packaging should not be removed until immediately prior to installation. Each roll has the product grade printed at regular intervals.

(1) Other sizes are available on request.

Figure 2 Label



3.2 To prevent damage, care should be taken in the handling and lifting of the rolls. The weight of the rolls is such that mechanical lifting arrangements are necessary (see Table 1).

3.3 Rolls should be stored in clean, dry conditions and protected from mechanical or chemical damage and site temperatures in excess of 30°C. When laid horizontally, the rolls may be stacked up to three high. Other loads must not be stored on top of the stack.

3.4 Toxic fumes are given off if the geocomposites catch fire and, therefore, the necessary precautions should be taken, according to the instructions of the material safety data sheet for the product.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Paralink Geocomposites.

Design Considerations

4 Use

4.1 Paralink Geocomposites are satisfactory for use as basal reinforcement in embankment foundations where the following foundation conditions exist. They must be designed and installed in accordance with BS 8006-1 : 2010, BS EN 14475 : 2006 and the provisions of this Certificate:

- soft foundation soils
- piled foundations
- areas prone to subsidence.

4.2 During the design process, particular attention should be given to:

- site preparation and foundation construction
- fill material properties
- specification for placing and compacting the fill

- drainage
- protection of the geocomposites against damage during installation
- stability of existing adjacent structures.

4.3 The construction drawings should show the correct orientation of the geocomposites.

4.4 This Certificate does not cover the use of the geocomposites in embankments within the foundation zone of a building.

5 Practicability of installation

The product must be installed by trained contractors in accordance with the specifications and construction drawings (see the *Installation* part of this Certificate).

6 Design

Design methodology

6.1 Design of basal reinforcements must be in accordance with BS 8006-1 : 2010.

Strength of geocomposites

6.2 In accordance with the methodology set out in BS 8006-1 : 2010, Annex 3, the design strength of the geocomposite reinforcement (T_D) is calculated as:

- for ultimate limit state (ULS): $T_{D(ULS)} = T_{CR}/(f_n \times f_m)$
- for serviceability limit state (SLS): $T_{D(SLS)} = T_{CS}/f_m$

where:

T_{CR} is the long-term tensile creep rupture strength of the reinforcement at the specified design life and design temperature

T_{CS} is the maximum allowable tensile load to ensure that the prescribed limiting strain specified for the SLS is not exceeded

f_n is the partial factor for ramification of failure in accordance with BS 8006-1 : 2010, Table 9

f_m is the material safety factor to allow for the strength reducing effects of installation damage, weathering (including exposure to sunlight), chemical and other environmental effects and to allow for the extrapolation of data required to establish the above reduction factors.

6.3 For the ULS, the long-term tensile creep rupture strength (T_{CR}) for each grade of geocomposite is calculated using the formula:

$T_{CR} = T_{char}/RF_{CR}$

where:

T_{char} is the characteristic short-term strength taken from Table 2

RF_{CR} is the reduction factor for creep (see section 7).

6.4 Values for T_{CS} appropriate to each grade of geocomposites are determined as described in section 7.5.

6.5 The material safety factor (f_m) used in determining $T_{D(ULS)}$ and $T_{D(SLS)}$ is calculated as:

$f_m = RF_{ID} \times RF_W \times RF_{CH} \times f_S$

where:

RF_{ID} is the reduction factor for installation damage

RF_W is the reduction factor for weathering, including exposure to ultraviolet light

RF_{CH} is the reduction factor for chemical/environmental effects

f_S is the factor of safety for the extrapolation of data.

6.6 Recommended values for RF_{CR}, RF_{ID}, RF_W, RF_{CH} and f_S are given in sections 7, 8 and 9. Conditions of use outside the scope for which the reduction factors are defined are not covered by this Certificate, and advice should be sought from the Certificate holder.

Soil/geocomposite interaction

6.7 There are two modes of interaction between the soil and the reinforcement that need to be considered during the design:

- direct sliding — in which the soil above the layer of reinforcement can slide over the reinforcement
- pull-out — in which the layer of reinforcement pulls out of the soil, after it has mobilised the maximum available bond stresses.

6.8 CIRIA SP123 : 1996, Sections 4.5 and 4.6, describes the following methods for determining resistance to direct sliding and maximum available bond, to which the appropriate partial factors should be applied in accordance with BS 8006-1 : 2010.

Direct sliding

6.9 The theoretical expression for the coefficient for resistance to direct sliding is:

$f_{ds} \times \tan \phi'$

where:

f_{ds} is the coefficient of direct sliding

$\tan \phi'$ is the shearing resistance of the soil

ϕ' is the angle of shearing resistance for the soil.

6.10 The coefficient of direct sliding (f_{ds}) is calculated as:

$f_{ds} = \alpha_s \times (\tan \delta/\tan \phi') + (1 - \alpha_s)$

where:

α_s is the proportion of plane sliding area that is solid

δ is the angle of skin friction, soil on planar reinforcement surface

$\tan \delta/\tan \phi'$ is the coefficient of skin friction between the soil and geocomposite material.

6.11 For initial design purposes, the coefficient of skin friction ($\tan \delta/\tan \phi'$) for determining the resistance to direct sliding may be conservatively taken as 0.7 when buried in compacted granular fill (ϕ' = 30°) and 0.4 when buried in compacted cohesive fill (ϕ' = 15°). Values for the proportion of plane sliding area that is solid (α_s) are given in Table 3.

Table 3 Soil geocomposite interaction parameters for Paralink Geocomposites

Grade	α_s[1]	Ratio of bearing[2] surface to plan area $\alpha_b \times B/2S$
100	0.49	0.00022
150	0.50	0.00021
200	0.50	0.00021
250	0.50	0.00021
300	0.52	0.00020
350	0.52	0.00020
400	0.53	0.00020
450	0.53	0.00020
500	0.53	0.00020
550	0.53	0.00020
600	0.53	0.00020
650	0.54	0.00020
700	0.54	0.00020
750	0.63	0.00016
800	0.63	0.00016
850	0.74	0.00011
900	0.74	0.00011
950	0.74	0.00011
1000	0.74	0.00011
1050	0.92	0.00004
1100	0.92	0.00004
1150	0.92	0.00004
1200	0.92	0.00004
1250	0.92	0.00004
1300	0.92	0.00004
1350	0.92	0.00004
1500	0.92	0.00004
1600	0.92	0.00004

(1) α_s is the proportion of the plane sliding area that is solid and is required for the calculation of the bond coefficient (f_b) and the direct sliding coefficient (f_{ds}) (see sections 6.10 and 6.14).

(2) The ratio of bearing surface to plan area is required to calculate the bond coefficient (f_b) in accordance with CIRIA SP123 : 1996 (see section 6.14 of this Certificate):

- αb is the proportion of the grid width available for bearing
- *B* is the thickness of a transverse member of a grid taking bearing
- *S* is the spacing between transverse members taking bearing.

6.12 For detailed design, the resistance to direct sliding should be determined from soil and geocomposite specific shear box testing.

Bond

6.13 The theoretical expression for the coefficient for bond shearing resistance is:

$f_b \times \tan \phi'$

where:

f_b is the bond coefficient

$\tan \phi'$ is the shearing resistance of the soil

ϕ' is the angle of shearing resistance for the soil.

6.14 The bond coefficient may be calculated as:

$f_b = \alpha_s \times (\tan \delta/\tan \phi') + (\sigma'_b/\sigma'_n) \times (\alpha_b \times B/2S) \times (1/\tan \phi')$

where:

α_s is the proportion of plane sliding area that is solid

$\tan \delta/\tan \phi'$ is the coefficient of skin friction between the soil and geocomposite material

σ'_b/σ_n is the bearing stress ratio

$\alpha_b \times B/2S$ is the ratio of bearing surface to plan area

ϕ' is the angle of shearing resistance in terms of effective stress

δ is the angle of skin friction, soil on planar reinforcement surface

σ'_b is the effective bearing stress on the reinforcement

σ'_n is the normal effective stress.

6.15 For initial design purposes, the coefficient of skin friction ($\tan \delta/\tan \phi'$) for determining bond when buried in compacted granular fill may be conservatively taken as 0.7 ($\phi' = 30°$) and 0.4 when buried in compacted cohesive fill ($\phi' = 15°$). Values for the ratio of bearing surface to plan area ($\alpha_b \times B/2S$) are given in Table 3. Typical values for the bearing stress ratio (σ'_b/σ'_n) are given in CIRIA SP123 : 1996, Table 4.1.

6.16 The BBA recommends that site specific pull-out tests are carried out to confirm the value of bond coefficient (f_b) used in the final design. Values of fsf>1.0 have been reported based on site and soil specific testing.

Fill material

6.17 Fill material must satisfy the requirements of BS 8006-1 : 2010.

7 Mechanical properties

Tensile strength — short-term

7.1 Characteristic short-term tensile strength (T_{char}) and strain values for the product range are given in Table 2. A typical short-term stress/strain curve is shown in Figure 3. Short-term strain at varying percentages of characteristic strength are given in Table 4.

Figure 3 Typical short-term stress/strain curve for Paralink Geocomposites

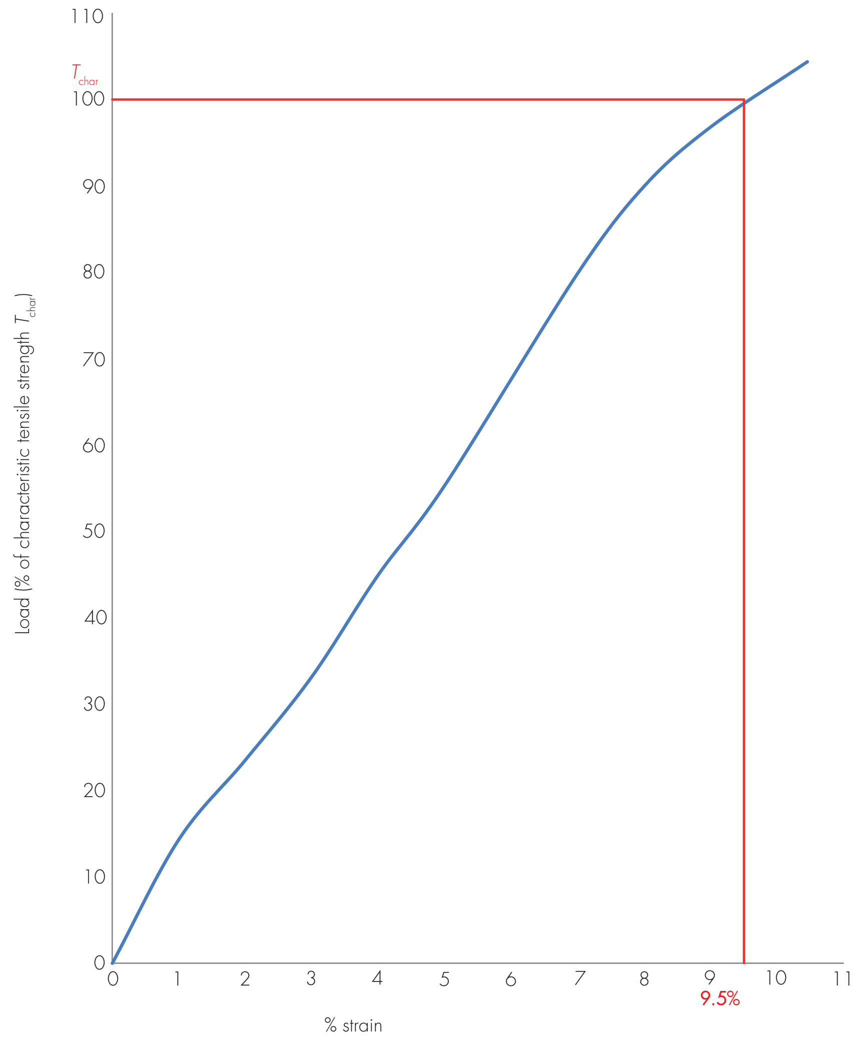


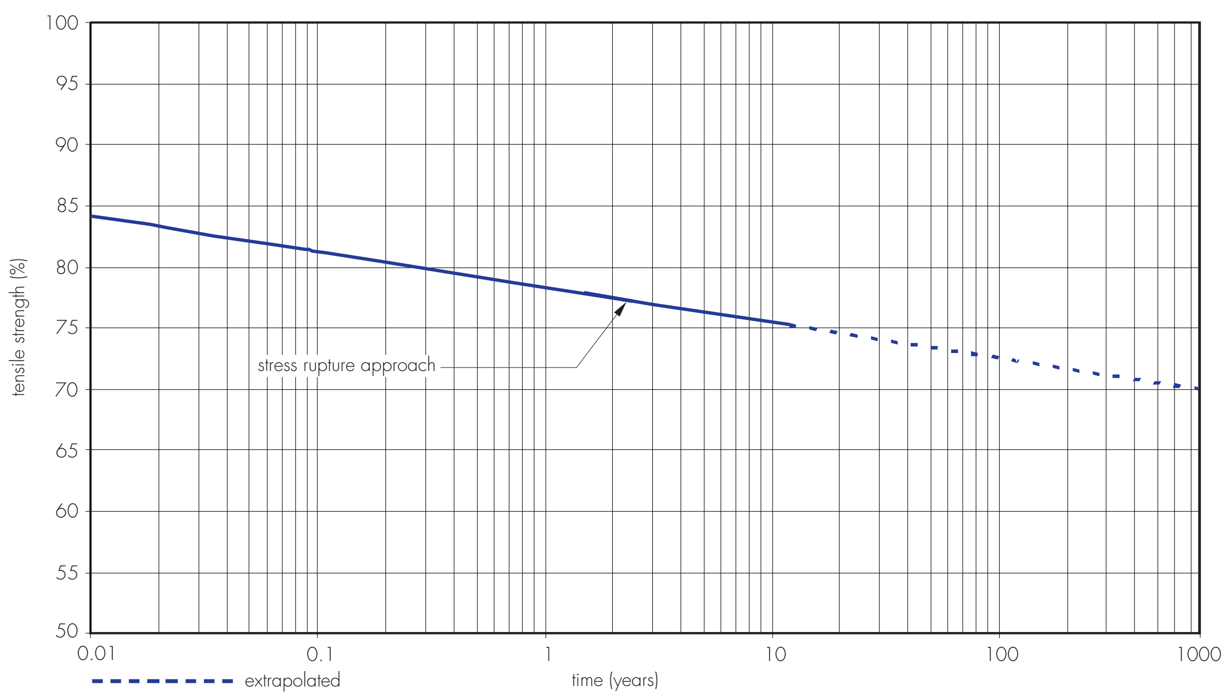
Table 4 Typical short-term strain against load (as percentage of the T_{char})

Strain	% of T_{char}
At 2%	23
At 3%	34
At 4%	45
At 5%	55
At 6%	69

Tensile strength — long-term

7.2 The long-term tensile creep rupture strength performance of Paralink Geocomposites has been determined in accordance with the principles of PD ISO/TR 20432 : 2007. A stress rupture line (see Figure 4) has been determined using conventional long-term creep rupture test data (up to 41,945 hours) and time-shifted stepped isothermal method (SIM) test data (up to 7.8×10^6 hours) for a design temperature of 20°C. From this graph, the value of the tensile creep rupture strength (T_{CR}) can be determined for the appropriate design life. By applying temperature-shift factors determined for Paralink Geocomposites, tensile creep rupture strength values (T_{CR}) can be determined for other design temperatures.

Figure 4 Regression line for life expectancy at constant stress defined by percentage of characteristic short-term strength at 20°C



7.3 Long-term tensile strength (T_{CR}) for Paralink Geocomposites can be derived for 2-, 60- and 120-year design lives and design temperatures of 0°C, 20°C, 25°C, 30°C and 40°C, using the formula given in section 6.4 and the long-term creep reduction factors (RF_{CR}) shown in Table 5.

Table 5 Long-term creep reduction factors (RF_{CR}) for Paralink Geocomposites at various temperatures and design lives

Design temperature (°C)	Creep reduction factor (RF_{CR})		
	2-year design life	60-year design life	120-year design life
0	1.22	1.28	1.30
20	1.29	1.37	1.38
25	1.31	1.39	1.40
30	1.33	1.41	1.43
40	1.37	1.46	1.48

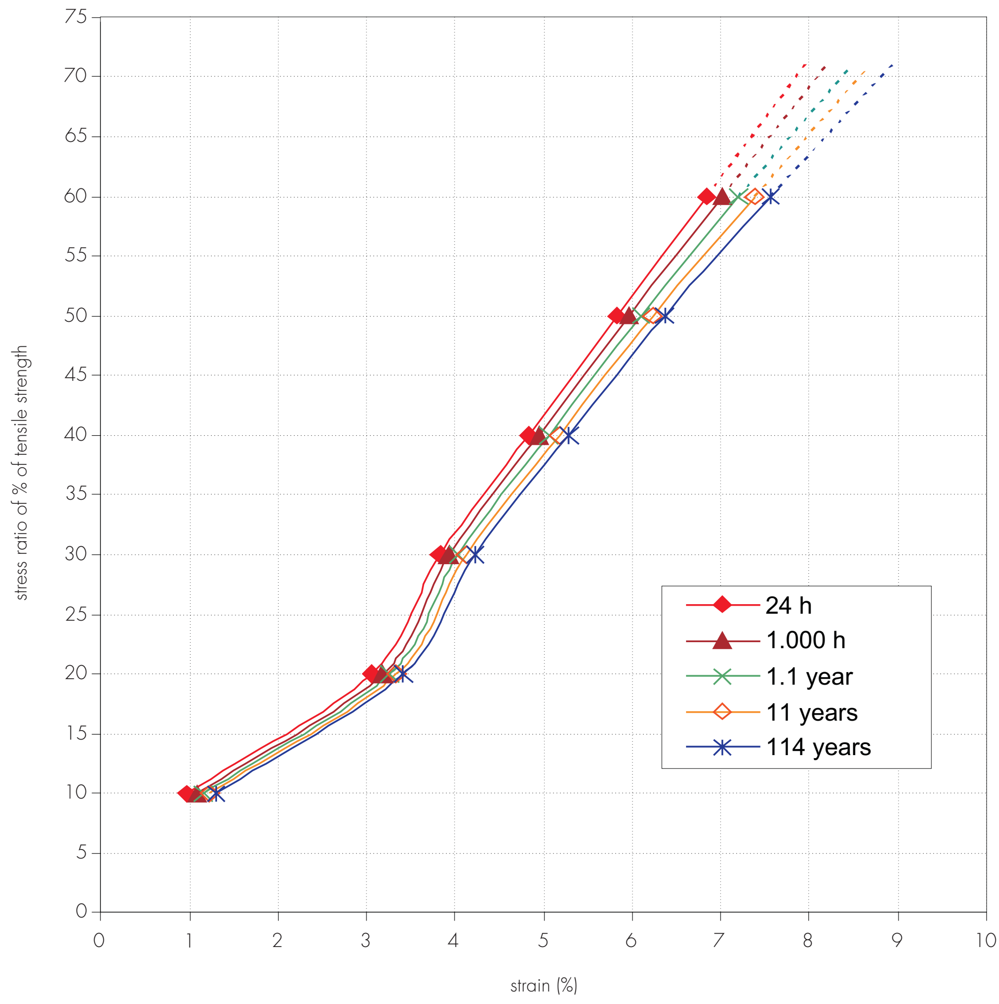
Serviceability limit strain

7.4 Detailed guidance on maximum allowable SLS creep strains for basal reinforcement is given in BS 8006-1 : 2010.

7.5 The maximum allowable tensile load for the SLS design check and the post construction creep strain for the Paralink Geocomposites product range may be calculated from the isochronous curves given in Figure 5. The curves are for a design temperature of 20°C.

7.6 The stress ratio is read off for the specified design life and prescribed limiting strain. T_{CS} is determined by multiplying the stress ratio and appropriate short-term characteristic tensile strength value (T_{char}) given in Table 2. The SLS design strength $T_{D(SLS)}$ is then calculated as detailed in section 6.2.

Figure 5 Stress/strain isochronous curves for Paralink Geocomposites



Installation damage (RF_{ID})

7.7 To allow for loss of strength owing to mechanical damage that might be sustained during installation, the appropriate value for RF_{ID} may be selected from Table 6. These reduction factors have been established from full-scale installation damage tests using a range of materials, the gradings of which can be seen in Figure 6. For soils not covered by Table 6, appropriate values of RF_{ID} should be determined from site specific trials.

Table 6 Reduction factor – installation damage (RF_{ID})

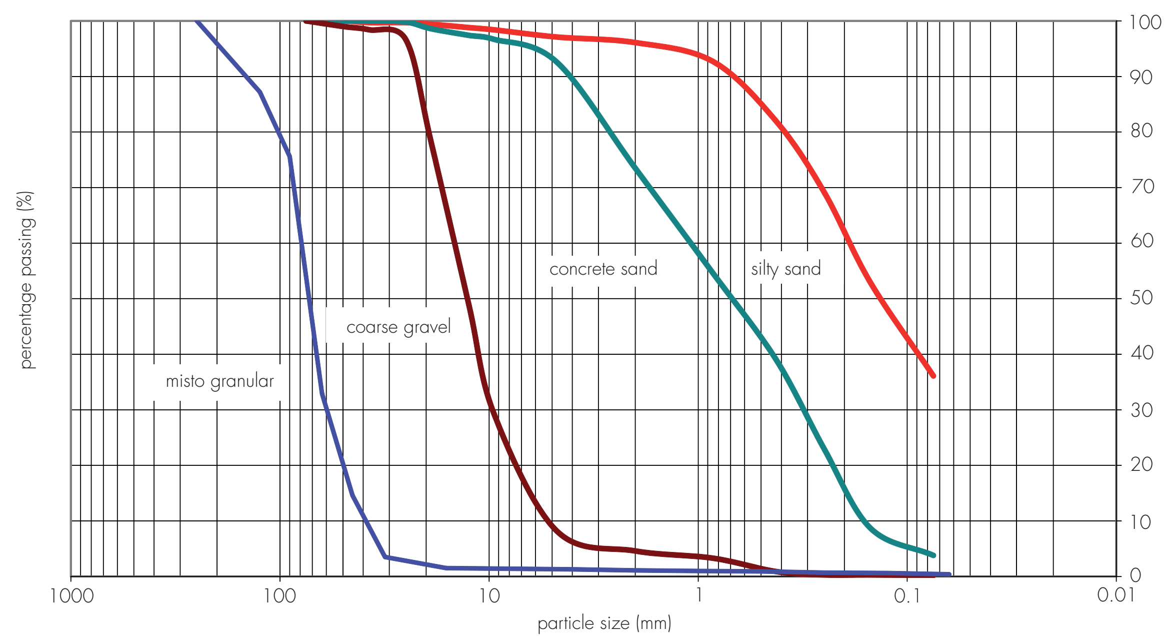
Soil type	D_{50} particle size[1] (mm)	D_{90} particle size[1] (mm)	Paralink grade	Reduction factor (RF_{ID})
Silty sand[2]	0.15	0.7	300 – 450	1.01
			500 – 650	1.01
			700 – 1600	1.00
Concrete sand[2]	1	4	300 – 450	1.02
			500 – 650	1.02
			700 – 1600	1.01
Coarse gravel[2]	13	23	300 – 450	1.05
			500 – 650	1.03
			700 – 1600	1.02
Misto granular[3]	75	150	300 – 450	1.25
			500 – 650	1.05
			700 – 1600	1.01

(1) Detailed particle size distributions are shown in Figure 5.

(2) Depth of soil layer before compacting: 200 mm; weight of vibrating roll: 1600 kg·m^{-1}; number of passes: 8.

(3) Depth of soil layer before compacting: 500 mm; weight of vibrating roll: 3240 kg·m^{-1}; number of passes: 6 (2 times without vibration, 4 with).

Figure 6 Particle size distributions of fills used in installation damage testing



7.9 For Paralink Geocomposites range 100 to 250 installed beneath silty sands, concrete sand and coarse gravel as defined in Figure 6, a cautionary value of at least 1.10 should be applied in the absence of test data.

8 Effects of environmental conditions

Weathering (including exposure to ultraviolet light)

8.1 A reduction factor (RF_W) of 1.00 may be used for design provided the geocomposites are protected from exposure to sunlight in accordance with the recommendations of this Certificate and provided the periods of exposure are limited to a maximum of one month. Further investigation is required for exposure periods exceeding one month.

Chemical/environmental effects

8.2 The polyethylene sheath used on Paralink Geocomposites acts as a chemical barrier which, if not broken or damaged, will reduce the risk of chemical attack on the polyester fibres. It should be noted that the most aggressive fills are usually of fine particle sizes which cause little or no damage to the polyethylene sheath. Compaction can reduce the high pH level of a fill. Tests have shown that, 48 hours after the compaction stage, the pH level of a soil–lime mix can reduce from 12.5 to 11. Where appropriate, site and soil specific testing should be carried out to verify the reduction in the pH of the soil.

8.3 The geocomposites are highly resistant to microbial attack.

8.4 To account for environmental conditions, the appropriate reduction factors (RF_{CH}) should be selected from Table 7.

Table 7 Reduction factors RF_{CH} according to service life and pH of the soil

Design temp °C	Reduction Factors (RF_{CH})								
	2 year service life			60 year service life			120 year service life		
	4<pH<9	9.1<pH<9.5	9.6<pH<11	4<pH<9	9.1<pH<9.5	9.6<pH<11	4<pH<9	9.1<pH<9.5	9.6<pH<11
20	1.00	1.00	1.01	1.02	1.03	1.07	1.03	1.05	1.12
25	1.00	1.00	1.01	1.03	1.05	1.09	1.07	1.09	1.15
30	1.01	1.01	1.02	1.06	1.10	1.14	1.15	1.17	1.25

9 Factor of safety for the extrapolation of data (f_s)

9.1 For Paralink Geocomposites, the factors of safety for the extrapolation of data (f_s) are given in Table 8.

Table 8 Factors of safety for extrapolation of data

Design life (years)	f_s
2	1.00
60	1.02
120	1.05

9.2 The values given in Table 8 have been calculated in accordance with PD ISO/TR 20432 : 2007, using the R_1 and R_2 values given in Table 9.

Table 9 R_1 and R_2 values for determination of f_s

Factor	Taking account of:	Design life (years)		
		2	60	120
R_1	Extrapolation of creep rupture data	1.00	1.00	1.00
R_2	Extrapolation of chemical data	1.00	1.02	1.05

10 Maintenance

As the product is confined within the soil and has suitable durability, maintenance is not required.

11 Durability

When designed and installed in accordance with the requirements of BS 8006-1 : 2010, BS EN 14475 : 2006 and this Certificate, Paralink Geocomposites will have a service life of up to 120 years.

Installation

12 General

12.1 Installation of Paralink Geocomposites reinforced soil structures must be carried out in accordance with BS EN 14475 : 2006 and the details shown on the construction drawings for the project.

12.2 Care should be taken to ensure that the geocomposites are laid with the longitudinal direction parallel to the direction of principal stress. Design drawings should indicate the orientation of the product.

12.3 Rolls should be placed on the formation in the position where the length of Paralink Geocomposites is required to start and with the roll as close as possible at right angles to the line of the run. Accurate alignment at the start is essential to ensure a satisfactory positioning of the laid material.

12.4 To ease the laying and proper performance of the run, the formation on which it is to be laid should be flat without ruts and sharp undulations.

13 Procedure

13.1 The roll is unwound a small amount by pushing the roll in the direction of the run. The loose end of the product now exposed is secured by weighting or pinning to the formation. The roll is unwound carefully, avoiding slack or undulations wherever possible; laying must not continue until corrections are made. When the roll is completely unwound, the free end of the product is hand tensioned and secured by weighting or pinning.

13.2 The run of Paralink Geocomposites must be straight and all strip elements flat and untwisted. Undulations should not be evident.

13.3 Where the product is to be used in two layers at right angles to each other, the edge joints will normally be simple butt joints. The drawings must be consulted to verify this, as certain circumstances may dictate otherwise.

13.4 Where a number of rolls are to be laid at one time, rolls are arranged in a slightly staggered formation, to avoid the lifting tubes interfering with one another.

13.5 Fill material in immediate contact with the Paralink Geocomposites must be placed and spread in the longitudinal direction only. If this results in some undulations of the product, the secured end must be released and the undulations removed by pulling the free end.

13.6 Site vehicles should not be allowed to traffic over the laid, unprotected Paralink Geocomposites.

13.7 The product is a structural material and, where joints are necessary in its longitudinal direction, these should be full structural joints capable of carrying the full design tensile force. This will normally be shown as a full anchorage bond length on the drawings. The anchorage bond length depends on the depth of cover and type and characteristics of the fill in which the product is being used. Where pile caps are spanned, this length is unlikely to be less than the distance across three pile caps. Where the product is being used to span subsidence voids, the length will depend upon the size of the void anticipated by the designer.

Technical Investigations

14 Investigations

14.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

14.2 An assessment was made of data relating to:

- evaluation of long- and short-term tensile properties

- chemical resistance including hydrolysis
- resistance to biological attack
- resistance to weathering
- effects of temperature
- site damage trials and resistance to mechanical damage
- soil/geocomposites interaction.

14.3 Calculations were made to establish the plane sliding area that is solid and the ratio of bearing surface to plane area.

14.4 The practicability of installation and ease of handling were assessed.

Bibliography

BS 8006-1 : 2010 + A1 : 2016 *Code of practice for strengthened/reinforced soils and other fills*

BS EN 13251 : 2016 *Geotextiles and geotextile-related products — Characteristics required for use in earthworks, foundations and retaining structures*

BS EN 14475 : 2006 *Execution of special geotechnical works — Reinforced fill*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

BS EN ISO 9864 : 2005 *Geosynthetics — Test method for the determination of mass per unit area of geotextiles and geotextile-related products*

BS EN ISO 10319 : 2015 *Geosynthetics — Wide-width tensile test*

CIRIA SP123 : 1996 *Soil Reinforcement with Geotextiles, Jewell R.A*

PD ISO/TR 20432 : 2007 *Guidelines for the determination of the long-term strength of geosynthetics for soil reinforcement*

15 Conditions

15.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

15.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

15.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

15.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

15.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

15.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

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