HAPAS

Tensar International Limited
2-4 Cunningham Court
Shadsworth Business Park
Blackburn BB1 2QX

Tel: 01254 262431 Fax: 01254 266868
e-mail: info@tensar-international.com
website: www.tensar-international.com

HAPAS Certificate
13/H201
Product Sheet 2

TENSAR RETAINING WALL SYSTEMS

TENSARTECH TW1 WALL SYSTEM FOR REINFORCED SOIL RETAINING WALLS AND BRIDGE ABUTMENTS

This HAPAS Certificate Product Sheet(1) is issued by the British Board of Agrément (BBA), supported by Highways England (HE) (acting on behalf of the Overseeing Organisations of the Department for Transport; Transport Scotland; the Welsh Government and the Department for Infrastructure, Northern Ireland), the Association of Directors of Environment, Economy, Planning and Transport (ADEPT), the Local Government Technical Advisers Group and industry bodies. HAPAS Certificates are normally each subject to a review every three years.

(1) Hereinafter referred to as 'Certificate'.

This Certificate relates to the TensarTech(1) TW1 Wall System for reinforced soil retaining walls and bridge abutments. The system comprises modular concrete block facing units, Tensar RE and RE500 Geogrids, high density polyethylene (HDPE) polymeric connector strips and compacted fill material.

(1) TensarTech 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

Mechanical properties — the method of connection between the geogrids and concrete block facing units has been assessed and long-term connection strength values determined for various wall heights and concrete block/geogrid combinations. The interface shear capacity between adjacent concrete block facing units in between layers of geogrid reinforcement has been assessed and is satisfactory (see section 7).

Performance of geogrids — the short- and long-term tensile strength of the geogrids, resistance to installation damage, weathering and environmental effects and soil/geogrid interaction have been assessed(1).

Durability — when designed and installed in accordance with the provisions of this Certificate, the system will have adequate durability for its intended use as a retaining wall or bridge abutment (see section 9).

(1) Data and reduction factors for use in design are given in Product Sheet 1 of this Certificate.

The BBA has awarded this Certificate to the company named above for the system described herein. This system 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: 29 July 2021

Originally certificated on 25 April 2014

Hardy Giesler
Chief Executive Officer

Requirements

In the opinion of the BBA, the TensarTech TW1 Wall System for reinforced soil retaining walls and bridge abutments, when designed and installed in accordance with the provisions of this Certificate, will satisfy the requirements of Highways England and local Highway Authorities for the design and construction of reinforced soil retaining walls and bridge abutments.

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), 3 *Delivery and site handling* (3.1 and 3.3), 12 *Procedure* (12.15) and the *Installation* part of this Certificate.

Additional Information

CE marking

The Certificate holder has taken the responsibility of CE marking the modular concrete block facing units in accordance with harmonised European Standard BS EN 771-3 : 2011 and the geogrids in accordance with harmonised European Standard BS EN 13251 : 2016.

Technical Specification

1 Description

1.1 The TensarTech TW1 Wall System for reinforced soil retaining walls and bridge abutments comprises:

- TW1 modular concrete block facing units
- Tensar RE and RE500 Geogrids(1)
- polymeric connectors
- fill material.

(1) Covered under Product Sheet 1 of this Certificate.

Concrete block facing units

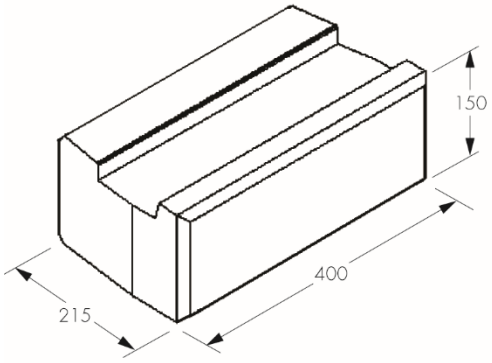
1.2 The concrete facing units covered by this Certificate are described in Table 1 and shown in Figure 1. All units are manufactured to the same specification. Non-structural coping units and right-angled corner units are also available, but are outside the scope of this Certificate.

Table 1 TW1 modular concrete block facing units

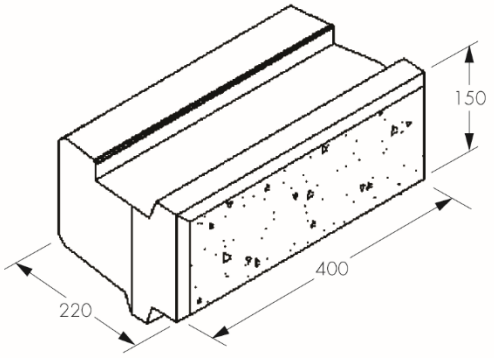
Block type	TW1 Base	TW1 Standard	TW1 Standard 'R'	TW1 Link	TW1 Standard 'ME'	TW1 Standard 'S'
Description/use	For base course only	86° Facing unit	86° Facing unit	Facing unit with slot to accept stainless steel wall tie, allowing non-structural cladding to wall[1]	86° Facing unit	86° Facing unit
Face finish	split	split	split	plain	split or plain	split
Dimensions (L x W x H) mm)	400 x 215 x 150	400 x 220 x 150	400 x 220 x 150	400 x 215 x 150	400 x 200 x 200	300 x 200 x 150
Nominal weight (kg)[2]	25	26	26	26	35	18

(1) Dimensions in mm unless shown otherwise.
(2) Nominal roll weight dependent on roll width selected.

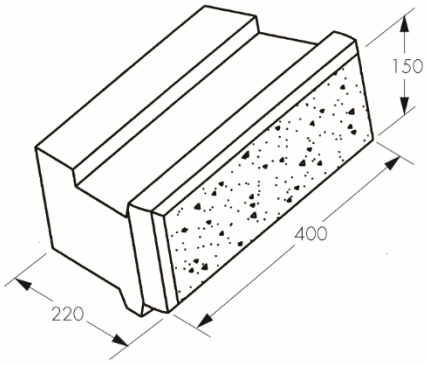
Figure 1 TW1 modular concrete block facing units



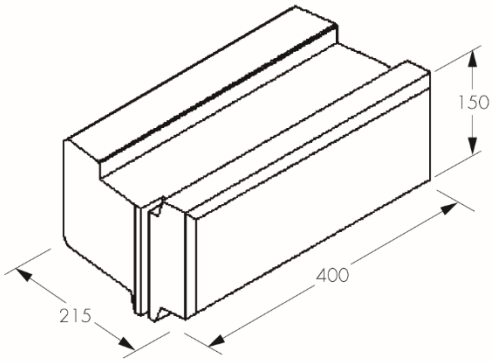
TW1 Base
(a)



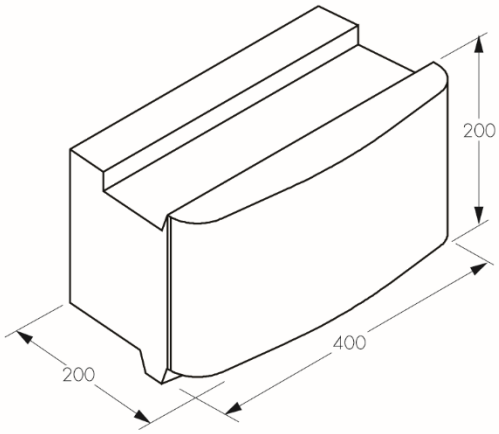
TW1 Standard
(b)



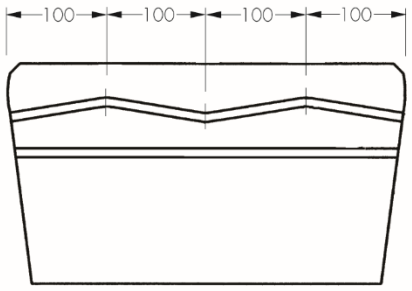
TW1 Standard 'R'
(c)



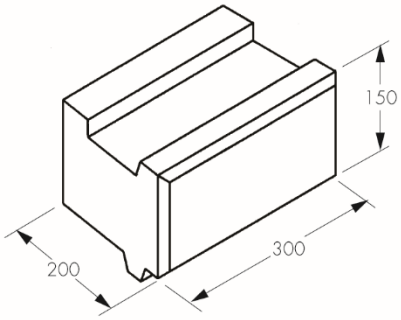
TW1 Link
(d)



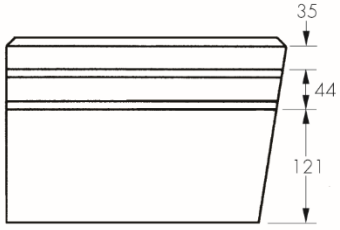
TW1 Standard 'ME'
(e)



base view of blocks (a) to (e)



TW1 Standard 'S'
(f)



base view of block (f)

1.3 The blocks are manufactured from concrete with a minimum 28 day compressive strength of 40 $N \cdot mm^{-2}$ and satisfy Highways England's requirements for durability of class XF2 exposure to BS 8500-1 : 2015.

1.4 The blocks conform to BS EN 771-3 : 2011. The essential characteristics given in Table 2 have been declared by the manufacturer.

Table 2 Essential characteristics in accordance with BS EN 771-3

Characteristic (unit)	Test method	Certificate holder's declared value
Dimensions (mm)	BS EN 771-3	As shown in Table 1
Dimensional tolerances		Category D2
Configuration		Group 1 to EN 1996-1-1
Compressive strength ($N \cdot mm^{-2}$)		40
Reaction to fire		Euroclass A1
Gross dry density ($kg \cdot m^{-3}$)		2100

1.5 All pigments used for the colouration of the concrete blocks comply with BS EN 12878 : 2014.

Geogrids

1.6 The following grades of Tensar RE And RE500 Geogrids(1) have been assessed by the BBA for use with the TensarTech TW1 Wall System and are also covered by this Certificate (see Table 3).

(1) Full product details are given in Product Sheet 1 of this Certificate.

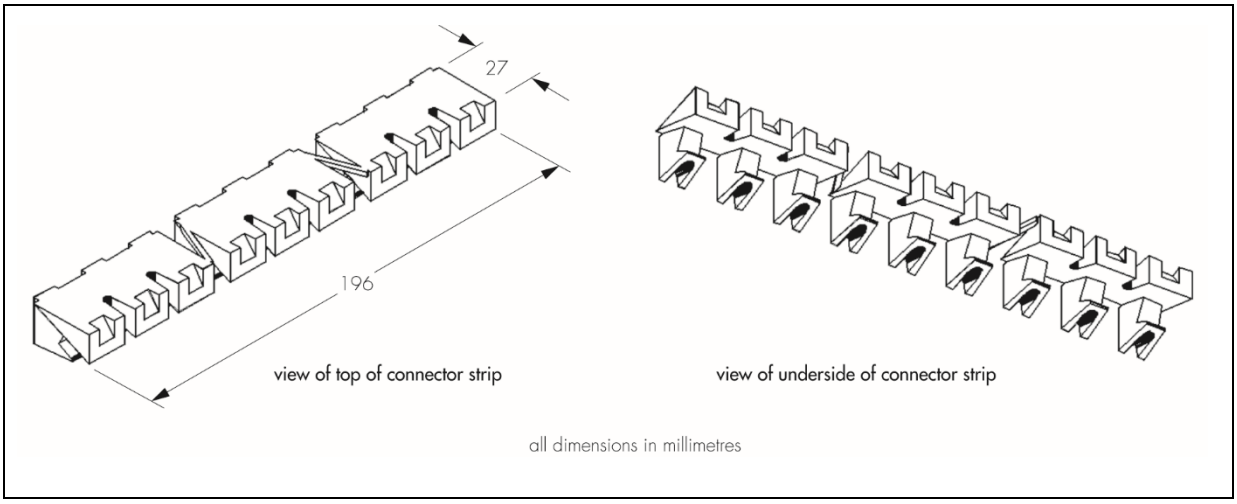
Table 3 Tensar RE and RE500 Georgrids

Product range	Grades
Tensar RE	40RE, 55RE, 80RE, 120RE
Tensar RE500	RE510, RE520, RE540, RE560, RE570, RE580

Polymeric connectors

1.7 The polymeric connectors are manufactured to the profile shown in Figure 2, from HDPE to one agreed specification.

Figure 2 Polymeric connectors



Fill material

1.8 Fill materials must comply with the requirements set out in BS 8006-1 : 2010 + A1 : 2016 and the *Manual of Contract Documents for Highways Works* (MCHW), Volume 1 *Specification for Highways Works* (SHW).

2 Manufacture

2.1 The concrete block facing units are manufactured to an agreed specification by the Certificate holder's nominated supplier. The blocks are moulded on block machines and compacted using mechanical vibratory compaction. Blocks with split face finishes are moulded in pairs and split after drying. Smooth finish blocks are moulded in individual moulds.

2.2 The geogrids are manufactured by the Certificate holder from sheet polyethylene, punched and stretched under temperature-controlled conditions. Further details are given in Product Sheet 1 of this Certificate.

2.3 The polymeric connectors are injection moulded from HDPE to an agreed specification by the Certificate holder's nominated subcontractors.

2.4 As part of the assessment and ongoing surveillance of the quality of the system components, the BBA has:

- agreed with the Certificate holder and respective manufacturers 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.

2.5 The manufacturer's management system for the geogrids has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 and BS EN 14001 : 2015 by BSI (Certificates Q05288 and EMS86463 respectively).

3 Delivery and site handling

Facing units

3.1 The facing units are delivered to site shrink-wrapped on pallets. Each pallet carries the manufacturer's label or marking identifying the product type and batch code. The loaded pallets should not be stacked more than two high.

3.2 To prevent damage, care should be taken in transit and handling. During prolonged periods of storage on site the units should remain covered on the pallets.

Geogrids

3.3 Tensar RE and RE500 Geogrids should be delivered, handled and stored as detailed in Product Sheet 1 of this Certificate.

Polymeric connectors

3.4 The polymeric connectors are delivered to site, packaged in multiples of 250 units. The packages are labelled identifying the manufacturer, product type and batch code. The connectors should remain in their packaging until ready for use, since any damage or dirt accumulation will compromise the structural integrity of the connection.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the TensarTech TW1 Wall System for reinforced soil retaining walls and bridge abutments.

Design Considerations

4 Use

4.1 When designed and installed in accordance with this Certificate, the system is suitable for the construction of reinforced soil retaining walls and bridge abutments as constrained by the long-term tensile strength at each layer of reinforcement, which satisfies the ultimate limit state (ULS) and the post construction creep strain serviceability limit state (SLS) design criteria defined in BS 8006-1 : 2010, and not exceeding the connection strength at the face as set out below in section 6.6, ie $T_j \leq TD_{conn}$.

4.2 Structural stability of the system is achieved through:

- interface shear capacity between adjacent rows of blocks
- the connection strength between the blocks and geogrid layers at each layer of geogrid
- the tensile strength of the geogrids, and
- the embedment and resistance to sliding and pull out of the geogrids from the fill material.

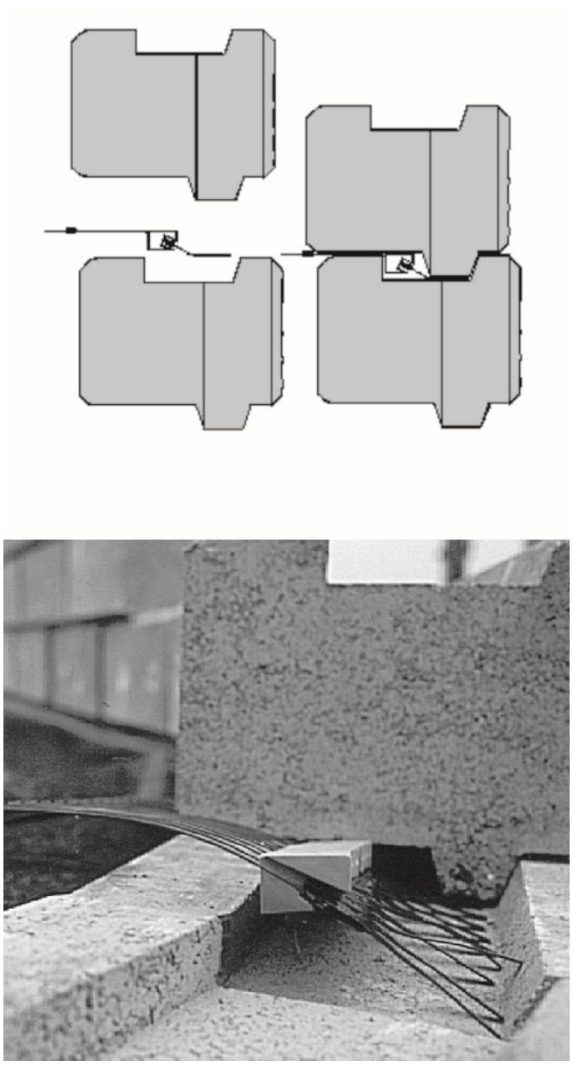
4.3 The connection between the geogrids and concrete block facing units is formed using the polymeric connector strip (see Figure 3).

4.4 Prior to the commencement of work, the designer must satisfy the design approval and certification procedures of the relevant Highway Authority.

4.5 The BBA has not assessed the structures for supporting parapet loading caused by vehicle collision at the top of the facing units.

4.6 Reinforced soil structures constructed using the system should be protected with suitable barriers, to protect the structure against potential damage from vehicle impact and vehicle fires.

Figure 3 Method of connecting geogrid to concrete block facing units



4.7 In addition to the factors covered in section 6, attention must also be paid in design to:

- site preparation
- fill material properties
- the specification for placing and compaction of the fill material
- drainage behind the wall
- protection of the geogrid against damage during installation.

4.8 It is considered that with correct design and workmanship, and by following the recommendations of this Certificate, normally accepted tolerances of line and level for the construction of retaining walls as defined in BS 8006-1 : 2010, Table 18, can be achieved. However, where the alignment of the vertical face is critical, consideration may be given to providing a brickwork skin, or similar, to the facing units (outside the scope of this Certificate).

4.9 Particular attention should be paid to changes in direction of walls where overlapping of the geogrids may occur. BS 8006-1 : 2010 also gives guidance on typical layout plans for the geogrids (reinforcing elements) in bridge abutments.

5 Practicability of installation

The system is designed to 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 Reinforced soil retaining walls and bridge abutments constructed using the system must be designed in accordance with BS 8006-1 : 2010 and the MCHW, Volume 1.

6.2 In accordance with BS 8006-1 : 2010, Annex B, the required design life for permanent walls and bridge abutments is 120 years.

6.3 To evaluate the overall stability of the system, it is necessary to consider:

- the design strength and length of embedment of the geogrid
- the connection strength between the geogrid and concrete block facing units
- the interface shear capacity of the blocks between layers of geogrid reinforcement.

Design strength of geogrids (ultimate limit state)

6.4 The designer must carry out design checks to ensure that the geogrids have adequate long-term tensile strength at each layer of reinforcement, to satisfy ultimate limit state (ULS) and serviceability limit state design criteria as defined in BS 8006-1 : 2010, and that they have sufficient length of embedment to prevent pull-out of the geogrid. Short- and long-term tensile strength values and material reduction factors for use in the design of the Tensar RE and RE500 Geogrids are given in Product Sheet 1 of this Certificate.

Connection strength between the geogrids and concrete block facing units

6.5 The design connection strength between the geogrids and concrete block facing units (T_{Dconn}) should be determined for the ULS and checks should be made to ensure that it is not exceeded by the design load (T_j) at each level, ie $T_j \leq T_{Dconn}$. Particular care should be taken during the design of bridge abutments to ensure that adequate reinforcement is provided and adequate connection strengths are achieved at the top of the wall and in front of bank seats.

6.6 The design connection strength (T_{Dconn}) is determined using the following formula:

$$T_{Dconn} = T_{conn}/f_m f_n$$

Where:

T_{conn} is the long-term connection strength derived from testing (see section 7)
f_m is the material safety factor for the geogrid (see section 7)
f_n is the partial factor for ramification of failure in accordance with BS 8006-1 : 2010, Table 9.

6.7 The minimum value of load factor used in determining the design load should be 1.5 for all designs using the system.

Interface shear capacity between concrete block facing units

6.8 The TW1 concrete block facing units have adequate interface shear capacity when designed and installed in accordance with this Certificate.

Specification of fill material

6.9 The designer should specify the relevant properties of the fill material for the reinforced soil structure deemed acceptable for the purposes of the design. Acceptable materials should satisfy the requirements of BS 8006-1 : 2010 and the MCHW, Volume 1, Series 600.

7 Mechanical properties

Geogrids

7.1 Short- and long-term strength values and reduction factors required for design of the geogrids are given in Product Sheet 1 of this Certificate. These include:

- characteristic short-term tensile strengths (T_{char})
- long-term creep rupture strengths (T_{CR})
- maximum permissible loads to limit post-construction creep strain (T_{CS})
- reduction factors for installation damage (RF_{ID}), weathering (RF_{W}) and environmental degradation (RF_{CH})
- factors of safety for extrapolation of data (f_s).

Connection strength between concrete block facing units block and geogrids

7.2 Long-term connection strength values (T_{conn}) for the system, have been derived from short-term tests in line with the National Concrete Masonry Association *Design Manual for Segmental Retaining Walls (Second edition 1977)* and ASTM D6638-07. Connection efficiencies determined from these tests have been applied to the long-term creep rupture strength (T_{CR}) values for the geogrids, to determine the relevant long-term connection strengths (T_{conn}). The results are shown in Tables 4 and 5 and can be used to determine the design connection strength (T_{Dconn}) as set out in section 6 of this Certificate.

Table 4 Long-term connection strength for Tensar RE geogrids (T_{conn})

Geogrid grades	T_{CR}[(1)] (kN·m^{-1})	Wall height above geogrid reinforcement (m)	T_{conn} (kN·m^{-1})
40RE	24.0	0.5 – 6.5	22.52
55RE	29.5	0.5 – 8.0	24.82
80RE	39.0	3.5 – 10.0	32.32
120RE[(2)]	63.1	5.0 – 8.0	51.26
		8.0 – 10.0	56.79

(1) For a design life of 120 years and a design temperature of 10°C.
(2) See section 7.3.

Table 5 Long-term connection strength for Tensar RE500 geogrids (T_{conn})

Geogrid grades	T_{CR}[(1)] (kN·m^{-1})	Wall height above geogrid reinforcement (m)	T_{conn} (kN·m^{-1})
RE510	20.7	0 – 2.0	17.02
		> 2.0	17.02
RE520	27.3	0 – 2.0	22.47
		> 2.0	22.47
RE540	33.4	0 – 2.0	27.45
		> 2.0	27.45
RE560	45.9	0 – 2.0	27.45
		> 2.0	37.75
RE570	61.3	0 – 2.0	27.45
		> 2.0	50.39
RE580	71.1	0 – 2.0	27.45
		> 2.0	58.44

(1) For a design life of 120 years and a design temperature of 10°C.

7.3 Tensar 120RE Geogrids may only be used within the top three metres of a structure if the vertical stress on the blocks is maintained at a minimum value of 60 kN·m^{-2}.

7.4 The following reduction factors and factors of safety (see Table 6) should be used to determine the material factor f_m required for calculation of the ULS design connection strength (T_{Dconn}).

Table 6 Reduction factors for determination of T_{Dconn}

Material factor	Factor for	Reduction Factor[1]
RF_{ID}	Installation damage	1.00[2]
RF_{W}	Weathering	1.00
RF_{CH}	Chemical/Environmental	pH 2 to 4 RF_{CH} = 1.05 pH 4 to 12 RF_{CH} = 1.00
f_s	Extrapolation of data	1.00

(1) For a design life of 120 years and a design temperature of 10°C and subject to installation conditions and restrictions given in Product Sheet 1 of this Certificate.

(2) A value of RF_{ID} = 1.0 can be used for all geogrid grades as installation damage is generally taken into account during the connection strength tests.

8 Maintenance

The exposed faces of the concrete block facing units may require periodic maintenance, to remove dirt build up, mould and moss growth. All other components of the system are confined within the wall and/or fill and do not require maintenance.

9 Durability

9.1 When designed and installed in accordance with this Certificate, the system will have adequate durability for the required 120 year design life of a retaining wall and bridge abutment in conditions encountered in the UK.

9.2 Where the blocks are to be embedded in potentially aggressive soils, the guidance given in BS 8500-1 : 2015 and BRE Special Digest 1 : 2005 should be followed.

10 Reuse and recyclability

The concrete facing units can be crushed and re-used as aggregate. The fill material can also be re-used.

Installation

11 General

Installation of the system should also comply with the requirements of BS 8006-1 : 2010 and BS EN 14475 : 2006.

12 Procedure

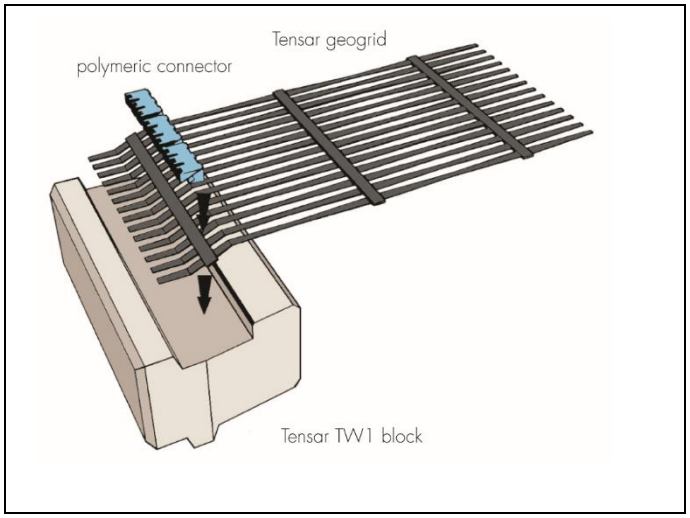
12.1 Formation levels are prepared and a suitable concrete foundation is laid to the correct level for the first course of facing units. The facing units for this course should always be of the base type and laid on a mortar bed. It is important that the first course of concrete block units is laid accurately to the correct line and level to avoid compounding errors in alignment as the wall is built.

12.2 Fill material is placed and compacted up to the top of the facing units allowing a minimum of 150 mm of free draining, granular material behind the face.

12.3 A suitable length of geogrid is cut from the roll. At one end the longitudinal ribs must be trimmed, by hand, to 50 mm of a transverse bar to ensure that when placed on the polymeric connector, the geogrid ribs do not protrude from the front face of the wall (see Figure 4).

12.4 Polymeric connectors are placed into the recess on the top of each concrete base facing unit. The correct orientation of the connectors is shown in Figure 4.

Figure 4 Placing of polymeric connectors



12.5 The layer of geogrid is attached to the connectors by locking them against the transverse bar of the grid. Any debris is removed from the connectors and concrete blocks and the next course of blocks is placed (of the type required by the construction drawings). The grid should be pulled taut at the back face of the blocks to make the end transverse bar of the grid bear directly onto the connectors. The geogrid is tensioned at right angles to the plane of the facing, within a tolerance of ±50 mm in a five-metre length, and is pulled tight to ensure that all slack is removed from the connections and joints.

12.6 To avoid problems with the level of the facing units, the geogrid should not be lapped when attached to the connectors. Adjacent strips of geogrids should be positioned to abut. The end ribs of the geogrid must be trimmed accurately, by hand, for the connection to perform as intended and to achieve the necessary fire resistance for the wall.

12.7 A further course of blocks should then be laid to ensure that a minimum of two block courses rests on the connected grid prior to compaction. Each aperture of the grid must be held by a connector.

12.8 Depending upon the design, up to four courses of facing units may be laid before inserting a further layer of geogrid.

12.9 To ease construction, it is acceptable to place up to four facing unit courses in advance of the fill. As a temporary measure, any connected layers of geogrid may be wrapped over the front of the facing units to allow access for the subsequent placing and compaction of the fill. Lengths of grid should not be left wrapped over the facing units for any significant period of time (eg overnight).

12.10 When fill has been placed and compacted to the level of a connected grid, the grid lengths should be positioned on the fill. Tensioning is carried out by placing the ends of the grid remote from the facing unit into a device similar to that shown in Figure 5, until the next layer of fill material has been placed. Fill should be placed by mechanical plant (avoiding any unprotected grid) with an opening bucket, and should cover the grid with reasonable uniformity.

12.11 To avoid excessive movement of the wall facing, heavy compaction plant should not be employed within two metres of the facing units, where the depth of fill before each pass may be less than 150 mm to suit the compaction method used see the MCHW, Volume 1, clause 622.7). Elsewhere, installation and compaction of the Tensar RE and RE500 Geogrids should be as described in the relevant section of Product Sheet 1 of this Certificate.

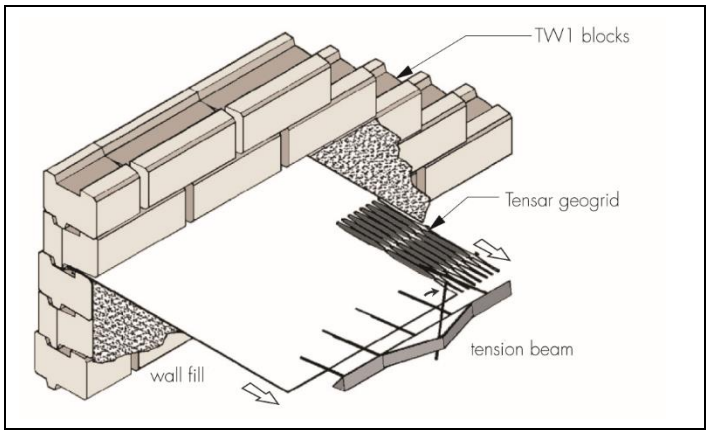
12.12 During construction it is particularly important to ensure that:

- fill is properly compacted, especially close to facing units
- at each stage of construction the level of the compacted fill coincides with the level of the facing unit connection to prevent the risk of voids occurring below the geogrid.

12.13 If non-structural cladding is to be applied to the structure, proprietary austenitic stainless steel wall ties, to clause 2411.1 of the MCHW, Volume 1 must be inserted into the cast in slots in the TW1 Link units. Cladding systems are outside the scope of this Certificate.

12.14 The general construction procedure is repeated until the required level for the coping facing unit is reached.

Figure 5 Tensioning the geogrid



12.15 Where accurate cutting of facing units is required on site, disc-cutting techniques may be used, for which appropriate precautions must be taken to mitigate against hazards associated with dust.

Technical Investigations

13 Tests

13.1 The manufacturing process for the concrete facing units and polymeric connectors was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

13.2 An examination was made of test data relating to:

- compressive strength and gross dry density of the concrete block facing units
- durability
- performance of the retaining wall system under fire test conditions
- assessment, including product specific testing, of the connection strength between the Tensar RE and RE500 Geogrids and facing units using the interlock connector.

13.3 Visits were made to installations in progress to assess the practicability and ease of construction of the system.

Bibliography

BRE Special Digest 1 : 2005 *Concrete in aggressive ground : Part C Assessing the aggressive chemical environment*

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

BS 8500-1 : 2015 + A1 : 2016 *Concrete — Complementary British Standard to BS EN 206-1 — Method of specifying and guidance for the specifier*

BS EN 771-3 : 2011 + A1 *Specification for masonry units— Aggregate concrete masonry units (Dense and light-weight aggregates)*

BS EN 12878 : 2014 *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test*

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 : 2015 *Quality management systems — Requirements*

BS EN ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*

ASTM D6638-07 *Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks)*

Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works,*

14 Conditions

14.1 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.

14.2 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.

14.3 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.

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

14.5 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.

14.6 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.