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HAPAS Certificate
13/H203
Product Sheet 1 Issue 4

ALLAN BLOCK RETAINING WALL SYSTEM

AB MODULAR STACKABLE CONCRETE BLOCK WALL SYSTEM

This Product Sheet(1) is issued by the British Board of Agrément (BBA). The Highways Authorities Product Approval Scheme (HAPAS) is supported by National Highways (NH) (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.

(1) Hereinafter referred to as 'Certificate'.

This Certificate relates to the AB Modular Stackable Concrete Block Wall System for reinforced soil retaining walls and bridge abutments, comprising concrete block facing units, Fortrac T geogrids and compacted fill material in accordance with the MCHW, Volume 1 (SHW), Series 600, designated standards BS EN 13251 : 2016, BS 8006-1 : 2010, BS EN 14475 : 2006, BS 8500-1 : 2015, BS EN 771-3 : 2011 and BS EN 12878 : 2014, the National Concrete Masonry Association *Design Manual for Segmental Retaining Walls* (Third edition 2010) and *BRE Special Digest 1 : 2005*.

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 complying with the requirements of the BBA HAPAS Certification Scheme according to the assessments set out in this Certificate.

On behalf of the British Board of Agrément

Date of Fourth issue: 14 August 2025

Originally certified on 30 July 2013

Hardy Giesler
Chief Executive Officer

This BBA HAPAS Certificate is issued under the BBA's accreditation to ISO/IEC 17065 (UKAS accredited Certification Body Number 0113).

Clauses marked † are additional information outside the scope of accreditation.

Readers MUST check the validity and latest issue number of this BBA HAPAS Certificate by referring to the BBA website or contacting the BBA directly.

The Certificate should be read in full as it may be misleading to read clauses in isolation.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

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1 Product Description

1.1 The Certificate holder specifies the system under assessment, the AB Modular Stackable Concrete Block Wall System for reinforced soil retaining walls and bridge abutments, comprises concrete block facing units, Fortrac T geogrids and compacted fill material, in accordance with the MCHW (*Manual of Contract Documents for Highway Works)*, Volume 1 (SHW), Series 600, designated standards BS EN 13251 : 2016, BS 8006-1 : 2010, BS EN 14475 : 2006, BS 8500-1 : 2015, BS EN 771-3 : 2011 and BS EN 12878 : 2014, the National Concrete Masonry Association Design Manual for Segmental Retaining Walls (Third edition 2010) and BRE Special Digest 1 : 2005.

1.2 The AB Modular Stackable Concrete Block Wall System for reinforced soil retaining walls and bridge abutments comprises:

- AB Classic, AB Stones, AB One Degree and AB Vertical modular dry jointed, hollow concrete block facing units
- AB Capstone
- Fortrac T geogrids(1)
- compacted fill material.

(1) Covered under BBA Certificate 13/H197.

Concrete block facing units

1.3 The blocks are manufactured from concrete conforming to the following minimum specification, satisfying National Highways requirements for durability of class XF2 exposure to BS 8500-1 : 2015.

Table 1 Concrete characteristics

Characteristic (unit)	Value
Minimum concrete cube strength at 28 days ($N.mm^{-2}$)	40
Minimum cement content ($kg.m^{-3}$)	340
Maximum water/cement ratio	0.55

1.4 The concrete block facing units covered by this Certificate are shown in Table 2.

Figure 1 AB facing units and AB Capstone

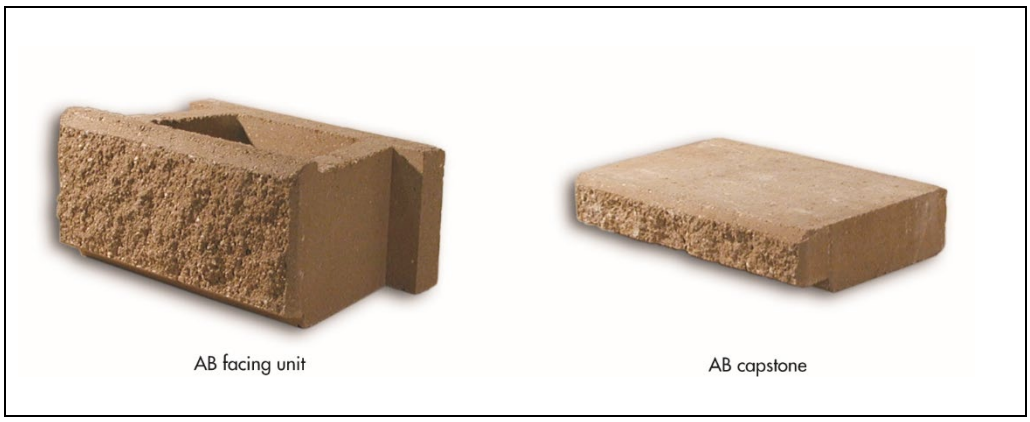


Table 2 AB facing units and AB Capstone

Unit type	Height (mm)	Depth (mm)	Width (mm)	Setback (°)	Mass(1) (kg)
AB Stones	200	300	450	12	35
AB Classic	200	300	450	6	35
AB Vertical	200	300	450	3	35
AB One Degree	200	300	450	1	35
AB Capstone	100	300	450	—	27

(1) For safety reasons, the item should be handled by two people, or special machinery should be used if required.

1.5 The concrete block facing units are available in a range of colours: Limestone Blend, Cinder Blend, Slate Blend, Abbey Blend, Pewter and Yorkstone. All pigments used for the coloration of the concrete units comply with BS EN 12878 : 2014.

Geogrids

1.6 Fortrac T geogrids are planar structures consisting of a regular open network of woven or knitted, integrally connected tensile elements of yarn, coated with a protective layer of black polymer. The yarn is manufactured from polyester fibres. The grades(1) covered by this Certificate are:

- Fortrac 35/20-20T
- Fortrac 55/30-20T
- Fortrac 80/30-20T
- Fortrac 110/30-20T.

(1) Full product details are given in BBA HAPAS Certificate 13/H197.

Wall rock fill material

1.7 Crushed coarse aggregate is used to infill the hollow cores of the concrete block facing units and a 300 mm wide layer immediately behind the wall. The aggregate must be well-graded granular fill ranging in diameter from 6 to 38 mm and with less than 10% passing the 0.075 mm sieve size. The specification for the infill aggregate should comply with drainage and permeability set out in BS 8006-1 : 2010 and MCHW, Volume 1.

Fill material

1.8 Fill material must comply with the requirements set out in BS 8006-1 : 2010 and the MCHW, Volume 1 *Specification for Highway Works* (SHW).

† 1.9 The Certificate holder recommends the use of a concrete lip with the system to prevent it sliding forward over the wall, but this material has not been assessed by the BBA and is outside the scope of this Certificate.

2 Requirements

Requirements for the system are outlined in the BBA HAPAS Certification Scheme and Technical Specifications Documents, and have been established from the following specification documents:

- MCHW(1), Volume 1, Series 600
- BS EN 13251 : 2016
- BS 8006-1 : 2010
- BS EN 14475 : 2006
- BS 8500-1 : 2015
- BS EN 771-3 : 2011
- the National Concrete Masonry Association *Design Manual for Segmental Retaining Walls* (Third edition 2010)
- BRE Special Digest 1 : 2005
- BS EN 12878 : 2014.

(1) The MCHW is operated by National Highways (NH) (acting on behalf of the Overseeing Organisations of the Department for Transport; Transport Scotland; the Welsh Government; and the Department for Infrastructure, Northern Ireland).

3 Summary of Product Assessment

The system was assessed on the basis of the following characteristics in accordance with HAPAS requirements.

3.1 Essential characteristics

Table 3 Essential characteristics for Allan Block Retaining Wall System

System assessed	Assessment method	Requirement	Result
Allan Block Retaining Wall System	BS 8500-1 : 2015	Exposure Class XF2	Pass
		Cement ≥ 340 kg·m^{-3}	Pass
		Water/cement ratio ≤ 0.55	Pass

The assessment showed that the system complies with the HAPAS requirements for these characteristics.

3.2 Compressive strength

Table 4 Compressive strength for Allan Block Retaining Wall System

System assessed	Assessment method	Requirement	Result
Allan Block Retaining Wall System	BS 8500-1 : 2015 Compressive strength to BS EN 12390-3 : 2009	Concrete strength at 28 days ≥ 40 N·mm^{-2}	Pass

The assessment showed that the system complies with the HAPAS requirements for this characteristic.

3.3 Density

Table 5 Density of Allan Block Retaining Wall System

System assessed	Assessment method	Requirement	Result
Allan Block Retaining Wall System	BS EN 771-3 : 2011 Density to BS EN 12390-7 : 2009	2100 kg·m^{-3}	Pass

The assessment showed that the system complies with the HAPAS requirements for this characteristic.

3.4 Dimensions

Table 6 Dimensions characteristics for Allan Block Retaining Wall System

System assessed	Assessment method	Requirement	Result
Allan Block Retaining Wall System	Dimensions and dimensional tolerances to BS EN 771-3 : 2011	As shown in Table 1 Category D2	Pass

The assessment showed that the system complies with the HAPAS requirements for this characteristic.

3.5 Long-term connection strength between the geogrids and concrete blocks

Table 7 Long-term connection strength between the geogrids and concrete blocks

Product assessed		Assessment method	Requirement	Result[2]
	Fortrac 35 T	Long-term connection strength values (Tconn) for the system have been derived from short-term tests in line with the *National Concrete Masonry Association Design Manual for Segmental Retaining Walls* (Third edition 2010) and ASTM D6638-18	T_{CR}[1] = 23.1 kN·m^{-1} Block height above geogrid layer =	
AB Stones			1.6 ≤ H < 3.6	T_{conn} = 8.4 kN·m^{-1}
AB Classic			3.6 ≤ H < 7.6	T_{conn} = 11.0 kN·m^{-1}
AB Vertical			7.6 ≤ H < 9.8	T_{conn} = 11.2 kN·m^{-1}
AB One Degree			H ≥ 9.8	T_{conn} = 12.1 kN·m^{-1}
	Fortrac 55 T		T_{CR}[1] = 36.3 kN·m^{-1} Block height above geogrid layer =	
AB Stones			1.6 ≤ H < 3.6	T_{conn} = 9.9 kN·m^{-1}
AB Classic			3.6 ≤ H < 7.6	T_{conn} = 13.8 kN·m^{-1}
AB Vertical			7.6 ≤ H < 9.8	T_{conn} = 15.4 kN·m^{-1}
AB One Degree			H ≥ 9.8	T_{conn} = 17.0 kN·m^{-1}
	Fortrac 80 T		T_{CR}[1] = 52.8 kN·m^{-1} Block height above geogrid layer =	
AB Stones			1.6 ≤ H < 3.6	T_{conn} = 11.4 kN·m^{-1}
AB Classic			3.6 ≤ H < 7.6	T_{conn} = 16.8 kN·m^{-1}
AB Vertical			7.6 ≤ H < 9.8	T_{conn} = 19.7 kN·m^{-1}
AB One Degree			H ≥ 9.8	T_{conn} = 23.8 kN·m^{-1}
	Fortrac 110 T		T_{CR}[1] = 72.6 kN·m^{-1} Block height above geogrid layer =	
AB Stones			1.6 ≤ H < 3.6	T_{conn} = 9.7 kN·m^{-1}
AB Classic			3.6 ≤ H < 7.6	T_{conn} = 14.1 kN·m^{-1}
AB Vertical			7.6 ≤ H < 9.8	T_{conn} = 22.6 kN·m^{-1}
AB One Degree			H ≥ 9.8	T_{conn} = 25.2 kN·m^{-1}

(1) Assumes a design life of 120 years and a design temperature of 20°C.

(2) Assumes a density of 1900 kg·m^{-3} of the fill in the hollow core of the AB units and the weight of the whole wall height above the connection.

3.6 Material factor for determination of ultimate limit state (ULS) design connection strength T_{Dconn}

The reduction factors given in Table 8 should be applied to the long-term connection strength values given in Table 7, to determine the design connection strength (T_{Dconn}) (see section 4.3.18).

Table 8 Reduction factors for determination of f_m

Material factor	Reduction factor and conditions of use/limitations
RF_{ID}	A value of 1.00 can be used for all grades of geogrid as short-term installation damage at the point of connection is already taken into account during the connection strength tests
RF_W, RF_{CH}, f_s	As set out in BBA HAPAS Certificate 13/H197, Product Sheet 3, according to geogrid specification selected and conditions of use[1]

(1) pH levels within and immediately behind the wall assumed to be the same as those in the main fill material.

3.7 Reuse and recyclability

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

3.8 Durability

3.8.1 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.

3.8.2 Where the units 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.

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

4 Summary of Process Assessment

Manufacturing process and quality control	Complies with HAPAS requirements
Delivery and site handling	Complies with HAPAS requirements
Installation	Complies with HAPAS requirements

4.1 Manufacture

4.1.1 The BBA has undertaken the following tasks for the assessment of product manufacture and has established that the manufacture complies with BBA HAPAS Certification Scheme requirements:

- the BBA has recorded and evaluated the manufacturer's documentation of the methods adopted for quality control procedures and product testing against HAPAS requirements
- the BBA has assessed the quality control operated over batches of incoming materials and formulations against HAPAS Requirements
- the BBA has evaluated the process for management of non-conforming work
- the BBA has audited the production process and verified that it is in accordance with the documented process
- the BBA has checked that equipment has been properly tested and calibrated.

4.1.2 The BBA has undertaken to review 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.

†4.1.3 The management system for the concrete block facing units has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by BBA (Certificate 19/Q062).

†4.1.4 The management system for the geogrids has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by SGS TUV SAAR (Certificate DE18/819943759).

4.2 Delivery and site handling

†4.2.1 The Certificate holder states that the concrete block facing units and capstones are tied together with steel straps and delivered to site on shrink-wrapped pallets. The pallets carry a manufacturer's label bearing the product type and batch code. Pallets should not be stacked more than two high.

4.2.2 To achieve the performance described in this Certificate, delivery and site handing must be performed in accordance with the Certificate holder's instructions and this Certificate, including:

- to avoid damage, care should be taken in transit and handling
- damaged materials must not be used
- during prolonged periods of storage on site, the blocks should remain covered on pallets.

4.2.3 The geogrids are delivered to site in 5 m wide rolls between 0.5 and 0.9 m, giving approximately 100 or 200 m of length.

4.2.4 Each roll is wrapped for transit and site protection in black polythene film and stacked/strapped in timber pallets for distribution.

4.2.5 Each bag is labelled with the geogrid grade and identification.

4.2.6 The ends of the rolls are sprayed with colour-coded paint to assist identification of a particular grade of geogrid on site in accordance with BS EN ISO 10320 : 2019.

4.2.7 The geogrids should be stored in clean, dry conditions and protected from mechanical or chemical damage, exposure to direct sunlight and extreme temperatures. When laid horizontally, the rolls may be stacked up to five high. No other loads should be stored on top of the stack. The packaging should not be removed until immediately prior to installation.

4.2.8 Toxic fumes are given off if the geogrids catch fire and, therefore, the necessary precautions should be taken, following the instructions of the material safety data sheet for the product.

4.3 Design

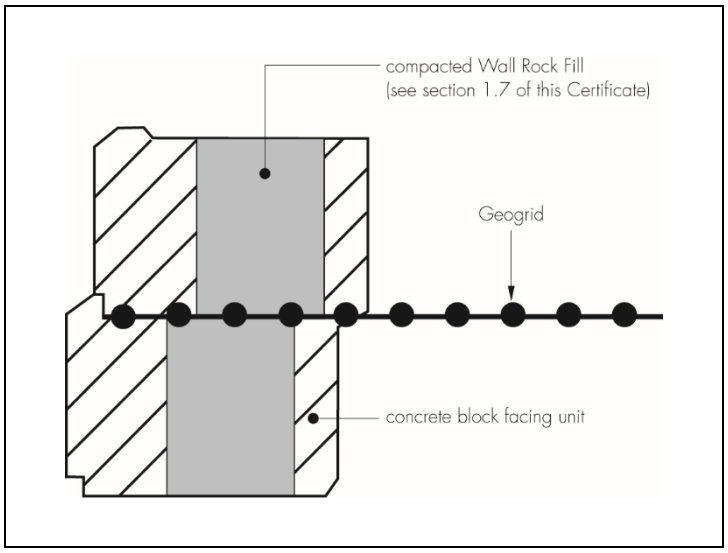
4.3.1 When designed and installed in accordance with this Certificate, the system is satisfactory for the construction of reinforced soil retaining walls and bridge abutments.

4.3.2 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 (see Figure 2) 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.

4.3.3 The connection between the geogrids and concrete block facing units is formed by the interaction between the geogrids and the wall rock fill material placed and compacted into the hollows of the concrete block facing units (see Figure 2). It is critical that construction of the connection is carried out carefully and is closely supervised (see the Installation part of this Certificate).

Figure 2 Connection of geogrids to concrete block facing units



4.3.4 Prior to commencement of work, the designer must satisfy the design approval, certification and (where live traffic is affected) the traffic management requirements of the relevant Highways Authority, and all similar requirements of adjacent landowners and stakeholders; temporary stability of excavations may need specific consideration.

4.3.5 The BBA has not assessed the structure for supporting loading from barriers or fences at the top of the wall. Separate and specific design consideration and approval of this aspect of design will be required.

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

4.3.7 Where there is risk of vehicle impact or other damage occurring, or the structure supports sensitive assets, or climbing of the wall is an identified risk, appropriate design measures must be implemented by an appropriately experienced and competent designer.

4.3.8 In addition to the factors covered in sections 4.3.1 to 4.3.7, attention must also be paid in the design to:

- site preparation
- fill material properties
- the specification for placing and compaction of the fill material
- drainage behind the wall (structural drainage must comply with current structural drainage requirements of Clause 513 of the MCHW)
- protection of the geogrid against damage during installation.

4.3.9 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 wall.

4.3.10 Particular attention should be paid to changes in direction of walls where overlapping of the geogrids may occur. Detailed guidance is given in the Certificate holder's technical literature. BS 8006-1 : 2010 also gives guidance on typical layout plans for the geogrids (reinforcing elements) in bridge abutments.

Design methodology

4.3.11 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.

4.3.12 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 concrete block facing units between layers of geogrid reinforcement.

Design strength of geogrids (serviceability limit state)

4.3.13 The serviceability limit state (SLS) design strength of the geogrid ($T_{D\ (SLS)}$), is calculated in accordance with the methodology set out in BS 8006-1 : 2010.

4.3.14 The prescribed maximum allowable post-construction creep strains allowed by BS 8006-1 : 2010 for the SLS of reinforced soil retaining walls and bridge abutments are shown in Table 9 of this Certificate.

Table 9 Serviceability limits on post-construction internal strains for bridge abutments and retaining walls

Structure	Strain (%)	Design period for the purposes of determining limiting strain
Bridge abutments and retaining walls with permanent structural loading	0.5	2 months – 120 years
Retaining walls, with no applied structural loading ie transient live loadings only	1.0	1 month – 120 years

4.3.15 Post-construction strain can be related to the average load in the reinforcement. The average SLS design loads (T_{avj}) that the geogrid must resist is to be calculated in accordance with BS 8006-1 : 2010. The average load in the *j*th level (T_{avj}), is related to the maximum load in the reinforcement (T_j) by a factor *k*, such that $T_{avj} = T_j/k$. The factor *k* has a minimum value of unity and generally falls in the range of 1 to 2. Where the distribution of tensile load along the loaded length of the reinforcement is not proven by field measurements, the factor *k* should be taken as unity. In all cases, $T_{avj} \leq T_{D(SLS)}$.

4.3.16 Isochronous curves, design values for T_{cs} and reduction factors for determination of $T_{D(SLS)}$, are given in sections 4.3.24 to 4.3.26.

Design of geogrids (determination of resistance to direct sliding and pull-out)

4.3.17 The design methodology for determination of resistance to pull-out and direct sliding, and therefore the required length of embedment of the geogrids, is given in BS 8006-1 : 2010 and in the design sections of BBA HAPAS Certificate 13/H197, Product Sheet 3.

Connection strength between the geogrids and concrete block facing units

4.3.18 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 (Tj) at each level, ie Tj ≤ 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. Refer to sections 3.5 and 3.6.

Interface shear capacity between concrete block facing units

4.3.19 The interface shear capacity between the concrete block facing units should be checked for the ULS and checks should be made to ensure that it is not exceeded by the design load (Tj) at each level (see section 4.3.23).

Specification of fill material

4.3.20 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.

4.3.21 Where concrete walls are to be embedded in potentially aggressive soils, the guidance given in BRE Special Digest 1 : 2005 should be followed.

4.3.22 Fill materials classified as 6I, 6J, 7B, 7C and 7D should comply with the limits of the MCHW, Volume 1, series 600, Table 6/3, regarding maximum water-soluble sulfate content and maximum oxidisable sulfides content.

Mechanical properties

ULS design strength of geogrids ($T_{D(ULS)}$)

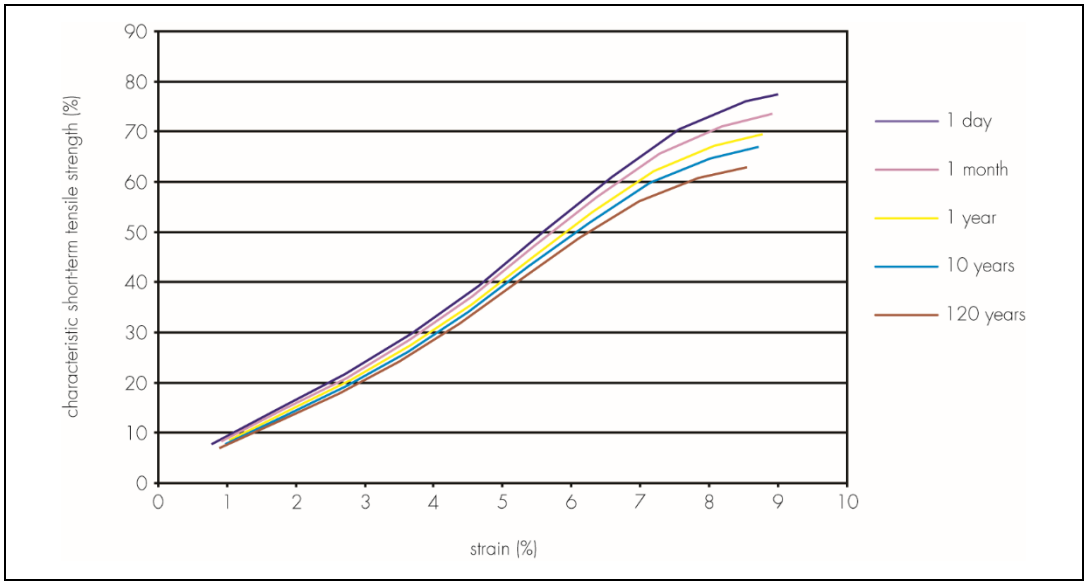
4.3.23 Short-term strength of geogrids ($T_{D(ULS)}$) values and reduction factors required for design of the geogrids are given in BBA HAPAS Certificate 13/H197, Product Sheet 3. These include:

- characteristic short-term tensile strengths (Tchar)
- the associated reduction factors for creep (RF_{CR})
- installation damage (RF_{ID})
- weathering (RF_{W})
- environmental degradation (RF_{CH})
- extrapolation of data (fs).

SLS design strength of geogrids (T_{CS})

4.3.24 Isochronous curves for Fortrac T geogrids have been derived from long-term creep strain tests and are shown in Figure 3.

Figure 3 Isochronous curves for Fortrac T geogrids



4.3.25 For Fortrac T geogrids, design values for T_{CS} are given in Table 10.

Table 10 Maximum tensile load inducing prescribed post-construction strain limits for Fortrac T geogrids

Geogrid grade	T_{CS} (kN·m^{-1})	
	Prescribed post-construction strain limits	
	0.5%	1.0%
Fortrac 35/20-20T	17.7	20.8
Fortrac 55/30-20T	27.8	32.7
Fortrac 80/30-20T	40.5	47.5
Fortrac 110/30-20T	55.7	65.3

4.3.26 Reduction factors for installation damage, weathering and environmental degradation (RF_{ID}, RF_W and RF_{CH}) and factors of safety for the extrapolation of data (fs) required for determination of the serviceability design strength of the geogrids ($T_{D(SLS)}$), are given in BBA HAPAS Certificate 13/H197, Product Sheet 3.

4.4 Installation

4.4.1 The Certificate holder's instructions for installation of the system were confirmed as meeting the BBA HAPAS Certification Scheme requirements.

4.4.2 To achieve the performance described in this Certificate, detailed information on installation of the AB Modular Stackable Concrete Block Wall System for reinforced soil retaining walls and bridge abutments can be found in the Certificate holder's Installation Guide.

4.4.3 To achieve the performance described in this Certificate, installation of the system should also comply with the requirements of BS 8006-1 : 2010 and BS EN 14475 : 2006.

4.4.4 Close supervision is required, particularly during construction of the geogrid to the concrete block facing unit connection.

4.4.5 Detailed guidance on forming curves and corners, including the placement of geogrids, can be found in the Certificate holder's Installation Guide.

4.4.6 Where accurate cutting of concrete block 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.

4.4.7 During construction it is particularly important to ensure that:

- fill is properly compacted, especially close to concrete block facing units
- at each construction stage, the level of the compacted fill coincides with the level of the concrete block facing unit connection to prevent the risk of voids occurring below the geogrid
- 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 the geogrid is pulled tight to ensure that all slack is removed
- regular checks are made to confirm the alignment of the face and to ensure that any disturbance from compaction process is promptly corrected.

†4.4.8 The Certificate holder's instructions advise the following:

4.4.8.1 The first row of concrete block facing units is laid on a levelling pad comprising either well-graded, good compactable material ranging in diameter from 6 to 38 mm, or a suitable concrete foundation laid to the correct level. It is important that the first course of concrete block facing units is laid accurately to the correct line and level, to avoid compounding errors in alignment as the wall is built.

4.4.8.2 Selected crushed coarse granular wall rock fill material (see section 1.7) is placed and compacted in the hollow cores of the concrete block facing units up to the top of the blocks and to a thickness of 300 mm width behind the blocks. Suitable fill soil is then placed and compacted behind the granular fill.

4.4.8.3 A drain pipe is installed at the back of the wall and should be vented to a daylight or a stormwater system. The drainage collection pipe must be a perforated or slotted PVC or corrugated HDPE pipe. The pipe and gravel fill may be wrapped with a geotextile that will function as a filter. The drain pipe must be designed and detailed by a suitably experienced and competent individual in accordance with the requirements of National Highways Regulations.

4.4.8.4 The compaction requirements for the main fill material depend on the fill type selected and can be found in the MCHW, Volume 1, Clause 612. Heavy plant exceeding one tonne should not be allowed within two metres of the face of the wall (the MCHW, Volume 1, Clause 622.7). A vibrating plate compactor of less than one tonne must carry out compaction within this zone.

4.4.8.5 The next course of concrete blocks facing units is laid, ensuring that the vertical seams are offset by at least 75 mm. The filling and compaction process is repeated as detailed in sections 4.4.8.2 and 4.4.8.4.

4.4.8.6 Geogrids are placed at the levels shown on the project construction drawings. A suitable length of geogrid is cut from the roll and laid with the cut edge tight against the back edge of the raised front lip of the concrete block facing units. The geogrid is placed with the machine direction perpendicular to the wall face and pulled back over the compacted area.

4.4.8.7 The next row of concrete block facing units is placed carefully into position on top of the geogrid, checking regularly that the geogrid remains in its correct position as each block is laid. Once the blocks are in place, the geogrid is pulled back, hand tight, to remove any slack and the corners staked in position. Further checks must be made at this stage, by observation through the hollows in the blocks to ensure that the geogrid is still correctly embedded within the blockwork wall.

4.4.8.8 Wall rock fill material is then placed into the hollow cores of the concrete block facing units up to the top of the blocks and to 300 mm width behind the blocks. Suitable compacted fill material soil is also placed behind the granular wall rock fill material. The fill should be placed by mechanical plant with an opening bucket, avoiding trafficking of unprotected grids, and should cover the grid reasonably uniformly.

4.4.8.9 The fill materials are compacted as detailed in section 4.4.4.4, starting with the wall rock fill material placed in the hollow cores of the concrete block facing units, so forming the geogrid/block connection and then behind the wall, working away from the wall.

4.4.8.10 The general construction procedure described is repeated until the required coping is reached.

4.4.8.11 The coping units include a concrete lip to prevent them sliding forward over the wall and can be additionally secured using a high grade, flexible, waterproof masonry adhesive (outside the scope of this Certificate).

4.4.9 To achieve the performance described in this Certificate, installation of the system must be carried out by operatives familiar with this type of system.

4.5 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.

5 Fulfilment of Requirements

5.1 The conclusion of this BBA assessment is that the AB Modular Stackable Concrete Block Wall System, when used in accordance with the provisions of this Certificate, complies with the BBA HAPAS Certification Scheme requirements.

5.2 In order for the system to continue to meet Scheme requirements, it must be installed, used and maintained as per the Certificate holder's instructions and as detailed in the Certificate.

6 Validity of Certificate

Continuing validity of this Certificate is dependent on the following factors:

- continuing compliance with product or process requirements, as described in the HAPAS Scheme document, and the specification documents referred to therein
- ongoing BBA surveillance of factory production control, to verify that the specifications and quality control being operated by the manufacturer are being maintained
- formal triennial Review of the Certificate, and Reissue for required technical or non-technical updates
- compliance with ongoing Certificate obligations by the Certificate holder and manufacturer(s).

†7 Additional 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.

CE marking

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

8 Bibliography

ASTM D6638-18 *Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks)*

BRE Special Digest 1 : 2005 *Concrete in aggressive ground*

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

BS 8500-1 : 2015 + A2 : 2019 *Concrete — Complementary British Standard to BS EN 206 — Method of specifying and guidance for the specifier*

BS EN 771-3 : 2011 + A1 : 2015 *Specification for masonry units — Aggregate concrete masonry units (dense and lightweight aggregates)*

BS EN 12390-3 : 2009 *Testing hardened concrete — Compressive strength of test specimens*
BS EN 12390-7 : 2009 *Testing hardened concrete — Density of hardened concrete*

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 10320 : 2019 *Geotextiles and geotextile-related products — Identification on site*

Manual of Contract Documents for Highway Works (MCHW), Volume 1 *Specification for Highway Works*, Series 0600, Earthworks (02/17)

National Concrete Masonry Association *Design Manual for Segmental Retaining Walls* (Third edition 2010) – Last amendments issued May 2018

9 Conditions of Certification

9.1 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.

9.2 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.

9.3 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.

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

9.5 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 UKCA marking and CE marking.

9.6 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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