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**Agrement Certificate**

**11/4862**

Product Sheet 1

## CORDEK CELLULAR VOID FORMERS

### CELLCORE HX

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to Cellcore HX, an expanded polystyrene (EPS) cellular void former for use in limiting the pressure exerted on in-situ reinforced suspended concrete floors or piled ground beams by expansion of clay soils (clay heave) or ground recovery.

(1) Hereinafter referred to as 'Certificate'.

#### 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** — the safe-load and fail-load capacities of the product have been assessed. Each grade has adequate strength to support a specified depth of wet concrete during construction and will collapse under its specified fail-load, limiting the upward pressures experienced during periods of clay heave (see section 6).

**Durability** — the product will perform effectively as a void former for the life of the building (see section 9).



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

Brian Chamberlain  
Head of Technical Excellence

Claire Curtis-Thomas  
Chief Executive

Date of Second issue: 1 November 2016

Originally certificated on 30 August 2011

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](http://www.bbacerts.co.uk)

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## Regulations

In the opinion of the BBA, Cellcore HX, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



### The Building Regulations 2010 (England and Wales) (as amended)

|                     |           |  |
|---------------------|-----------|--|
| <b>Requirement:</b> | <b>A2</b> | <b>Ground movement</b>   |
| Comment:            |           | The product helps to prevent the stability of the building being impaired by expansion of clay soils. See section 4.1 of this Certificate. |
| <b>Regulation:</b>  | <b>7</b>  | <b>Materials and workmanship</b>   |
| Comment:            |           | The product is acceptable. See section 9 and the <i>Installation</i> part of this Certificate.   |



### The Building (Scotland) Regulations 2010 (as amended)

|                    |             |   |
|--------------------|-------------|---|
| <b>Regulation:</b> | <b>8(1)</b> | <b>Durability, workmanship and fitness of materials</b>   |
| Comment:           |             | The product can contribute to a construction satisfying this Regulation. See section 9 and the <i>Installation</i> part of this Certificate.  |
| <b>Regulation:</b> | <b>9</b>    | <b>Building standards applicable to construction</b>  |
| Standard:          | 1.1.(b)     | Structure   |
| Comment:           |             | The product contributes to meeting the relevant requirements of this Standard, with reference to clause 1.1.1 <sup>(1)(2)</sup> . See section 4.1 of this of this Certificate.  |
| Standard:          | 7.1(a)      | Statement of sustainability   |
| Comment:           |             | The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. |
| <b>Regulation:</b> | <b>12</b>   | <b>Building standards applicable to conversions</b>   |
| Comment:           |             | All comments given for the product under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1 <sup>(1)(2)</sup> and Schedule 6 <sup>(1)(2)</sup> .                             |

(1) Technical Handbook (Domestic).  
(2) Technical Handbook (Non-Domestic).



### The Building Regulations (Northern Ireland) 2012 (as amended)

|                    |           |  |
|--------------------|-----------|--|
| <b>Regulation:</b> | <b>23</b> | <b>Fitness of materials and workmanship</b>  |
| Comment:           |           | The product is acceptable. See section 9 and the <i>Installation</i> part of this Certificate.                           |
| <b>Regulation:</b> | <b>30</b> | <b>Stability</b>   |
| Comment:           |           | The product contributes to satisfying the relevant requirements of this Regulation. See section 4.1 of this Certificate. |

## 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 section: 3 *Delivery and site handling* (3.4) of this Certificate.

## Additional Information

### NHBC Standards 2016

NHBC accepts the use of Cellcore HX, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapters 4.2 (4.2.7 to 4.2.10) *Building near trees*, 4.3 *Strip and trench fill foundations* and 4.4 *Raft, pile, pier and beam foundations*.

## Technical Specification

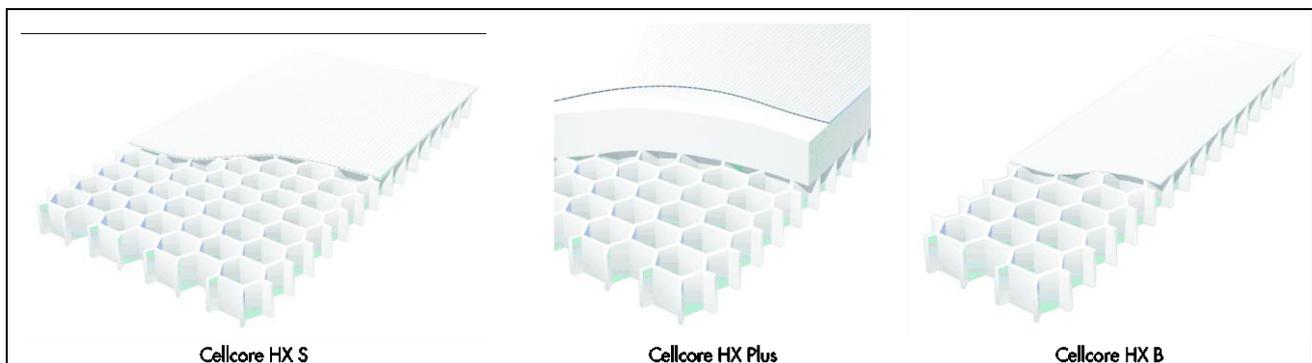
### 1 Description

1.1 Cellcore HX consists of a moulded hexagonal cellular EPS compressible base in a range of different grades and depths, with three different options for the integrally-bonded top (see Figure 1):

- Cellcore HX S — for use under reinforced concrete slabs, with a 10 mm thick top of twin-wall polypropylene sheet, and available in a standard size of 2400 mm by 1200 mm and in overall depths of 90, 160 and 225 mm
- Cellcore HX Plus — for use under reinforced concrete slabs, with a top comprising a 2 mm polypropylene sheet bonded to a 48 mm thick<sup>(1)</sup> EPS 100 insulation layer, which will contribute to the thermal insulation of the building, and available in a standard size of 2400 mm by 1200 mm and in overall depths of 130, 200 and 265 mm
- Cellcore HX B — for use under reinforced concrete ground beams, with a 5 mm thick top of twin-wall polypropylene sheet, and available in strips 2400 mm long and in widths from 300 mm to 1200 mm in increments of 25 mm to suit the associated beam, and in overall depths of 85, 155 and 220 mm.

(1) Minimum thickness; other thicknesses are available.

Figure 1 Cellcore HX cellular void formers



1.2 The product is available in four grades (see Table 1). Each grade is designed to support its specified safe-load for a period of 16 hours with compression limited to less than 5 mm, and to collapse by a specified amount dependent on the selected product depth under its specified fail-load (see section 6).

Table 1 Product grades and associated safe- and fail-loads

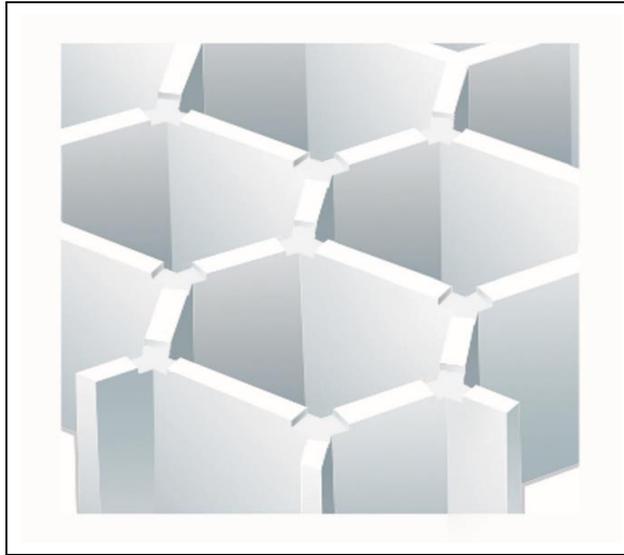
| Product grade       | Safe-load (kN·m <sup>-2</sup> ) | Fail-load (kN·m <sup>-2</sup> ) |
|---------------------|---------------------------------|---------------------------------|
| 7/10 <sup>(1)</sup> | 7                               | 10                              |
| 9/13                | 9                               | 13                              |
| 13/18               | 13                              | 18                              |
| 18/24               | 18                              | 24                              |

(1) In this grade, Cellcore HXB is not available as standard.

1.3 Drainage slots are incorporated in the cellular base of each panel, to allow water trapped within the cells to escape as the product compresses (see Figure 2). The shallowest panel depth incorporates drainage slots in the top face only of the cellular base. The two deeper panel depths include drainage slots in both faces of the cellular base.

1.4 Formwork sealing tape, typically 50 mm wide, is used to seal the joints between adjacent panels.

*Figure 2 Drainage slots*



## **2 Manufacture**

2.1 The product is manufactured from expanded polystyrene moulded into a hexagonal cellular compressible base.

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 being operated by the manufacturer are being maintained.

2.3 The management system of the manufacturer has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by ISOQAR (Certificate 10991-QMS EMS 001).

## **3 Delivery and site handling**

3.1 The product is normally delivered to site shrink-wrapped in polythene, but can be supplied unwrapped to order. Each unit carries a label bearing details of the product type, grade, length, width and overall depth, and the BBA logo incorporating the number of this Certificate. Site handling and installation instructions and health and safety data sheets are attached to each delivery ticket.

3.2 The panels must be stored flat and be protected from high winds and prolonged exposure to sunlight.

3.3 Contact with solvents and organic-based materials should be avoided.

3.4 Cellcore HX must not be exposed to flame or ignition. Careful consideration should also be given to the management of fire risk when in storage; detailed guidance is given in the health and safety data sheet packaged with the product.

## **Assessment and Technical Investigations**

The following is a summary of the assessment and technical investigations carried out on Cellcore HX.

### 4 Use



4.1 Cellcore HX is satisfactory for use either under reinforced concrete ground beams or under suspended reinforced concrete floor slabs, and is effective in limiting the pressure caused by expansion of clay soils (clay heave). The structural floor or beam must, in addition to normal design criteria, be designed to accommodate the maximum upward forces owing to clay heave (see sections 6.6 and 6.7).

4.2 The product must not be used on the vertical faces of concrete foundations.

4.3 Use of the product below the groundwater table, or on sites where hazardous gases such as methane or radon may be encountered, is outside the scope of this Certificate.

### 5 Practicability of installation

5.1 The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

5.2 Adequate supervision must be maintained to ensure correct installation (see section 11).

### 6 Design

6.1 The appropriate product for each project is specified by product type, product grade and product depth.

#### Product type

6.2 Selection of the appropriate panel type (Cellcore HX S, Cellcore HX Plus or Cellcore HX B) is selected according to the intended use and project specification (see section 1.1).

#### Product grade

6.3 The appropriate product grade is selected according to the maximum thickness of wet concrete that the product will be required to support during construction of the project (see Table 2).

*Table 2 Maximum permissible slab/beam thicknesses*

| Product grade | Maximum concrete thickness <sup>(1)</sup> (mm) |
|---------------|--|
| 7/10          | 220  |
| 9/13          | 300  |
| 13/18         | 460  |
| 18/24         | 660  |

(1) Calculation of the maximum concrete thickness includes an allowance of 1.5 kN-m<sup>2</sup> for imposed load including heaping.

6.4 It is normal for this type of product to experience some compression during concrete pouring. This will normally be less than 10 mm, dependent on the depth of the concrete and the method and rate of placement. Once the concrete has been poured, subsequent creep deflections will be minimal.

#### Product depth

6.5 The appropriate product depth is selected such that its specified compression under fail-load is equal to, or greater than, the maximum anticipated ground movement owing to clay heave as established from site investigations (see Table 3). Further guidance on predicted ground movements in shrinkable soils is given in Chapter 4.2 of *NHBC Standards 2016*.

**Table 3 Product depth and compression under failure load**

| NHBC volume change potential <sup>(1)</sup> | Void required (minimum product compression at fail-load) (mm) | Product depth |                  |               |
|---|---|---------------|------------------|---------------|
|   |   | Cellcore HX S | Cellcore HX Plus | Cellcore HX B |
| Low   | 50  | 90            | 130              | 85            |
| Medium                                      | 100   | 160           | 200              | 155           |
| High  | 150   | 225           | 265              | 220           |

(1) NHBC Standards, Chapter 4.2, Table 7.

**Upward pressure on slabs, beams and overall structure**

6.6 In addition to the normal downward-acting loads, the suspended floor slabs, the ground beams, the connection between the slab and ground beams and, where piles are used, the pile/ground beam connections, should be designed to take account of the upward pressure that will be transferred through the product during periods of clay heave.

6.7 The ultimate upward pressure to be resisted ( $P_{ult}$ ) should be determined as:

$$P_{ult} = (\gamma_Q \times PFL) - (\gamma_G \times G_k)$$

where:

- PFL is the product fail-load (see Table 1)
- $G_k$  is the self-weight of the slab or beam, including concrete blinding (when used)
- $\gamma_Q$  and  $\gamma_G$  are partial factors in accordance with BS EN 1992-1-1 : 2004 and BS EN 1990 : 2002 and their UK National Annexes, where  $\gamma_Q = 1.5$  and  $\gamma_G = 0.9$ .

**Temporary loads during construction**

6.8 Provided that the recommendations given in sections 11 and 12 are satisfied, Cellcore HX S and HX Plus panels will adequately resist normal foot traffic and other short-term loads normally associated with installation, and can be used without further protection.

6.9 Cellcore HX B panels should be covered with a 50 mm thickness of concrete blinding where heavy reinforcement is proposed, or where the reinforcement will be subjected to significant point loads from foot traffic or other imposed loading.

6.10 Reinforcement should be supported on proprietary spacers selected to have a base area of sufficient size, and positioned at appropriate centres, to ensure that the maximum imposed load beneath each spacer is appropriate to the grade of panel used.

**7 Thermal performance**

Although Cellcore HX Plus will contribute to the thermal insulation of the floor, it has not been assessed by the BBA for this purpose.

**8 Maintenance**

The product is confined within the structure of the floor and does not require maintenance.

**9 Durability**



The product is dimensionally stable under varying conditions of temperature and humidity. It is rot-proof and water-resistant and will continue to perform effectively as a void former for the life of the building.

## 10 Reuse and recyclability

The product contains EPS, which can be recycled.

## Installation

### 11 General

11.1 Adequate supervision must be maintained and, if required, the Certificate holder's specialists, experienced in site practice and installation of the material, will attend the site to provide demonstrations to ensure correct installation.

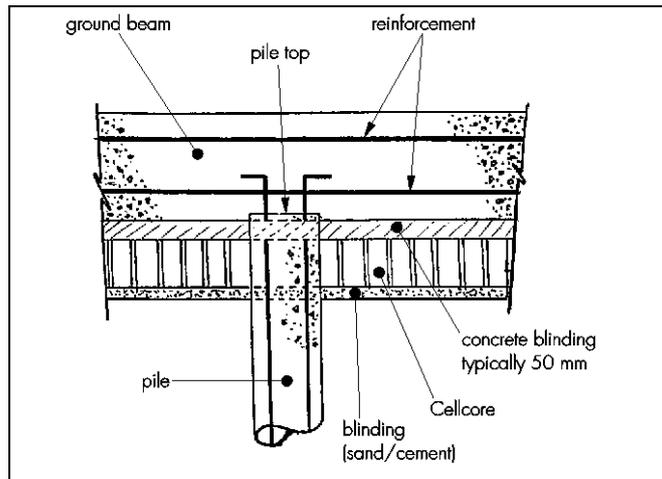
11.2 Normal precautions for handling EPS materials should be taken to avoid damaging the product during off-loading, storage, handling and installation. Any damaged areas should be repaired or replaced before pouring the concrete.

### 12 Procedure

12.1 Cellcore HX must be placed on a firm, level surface and the bottom of the excavation properly compacted and blinded with a layer of concrete or a sand/cement blinding.

12.2 For piled ground beams, the top of each pile should be trimmed so that it extends slightly above the proposed underside of the ground beam (see Figure 3). Each pile should penetrate the void former to allow for an approximate 50 mm thickness of concrete blinding on top where applicable, and a keying depth of approximately 25 mm into the ground beam.

Figure 3 Typical piled ground beam



12.3 When required, the product can be cut to shape with a fine-toothed saw. Care should be taken to ensure that, after cutting, exposed ends of the cellular stiffening ribs do not exceed a maximum length of 50 mm.

12.4 Joints between panels should be sealed with formwork tape supplied by the Certificate holder.

12.5 Reinforcement should be fixed and adequately supported to ensure that the correct depth of concrete cover is achieved, and to ensure that the maximum imposed load beneath each support is appropriate to the grade of panel being used (see section 6.9). The panels should be covered with a 50 mm thickness of concrete blinding where heavy reinforcement is proposed, or where the reinforcement will be subjected to significant point loads from foot traffic or other imposed loading.

12.6 During construction, spreader boards are recommended to reduce the imposed load transmitted to the panels.

12.7 Concrete should be placed with care to avoid overloading the panels.

### 13 Tests

Tests were conducted and the results assessed to determine:

- density
- dimensional accuracy
- ability to withstand short-term foot traffic loading, concentrated loads from rebar spacers and other anticipated short-term construction loads
- ability to withstand the design safe-load for 16 hours
- that, when the load is increased beyond the safe-load to fail-load, the product fails by compressing to the required amount within reasonable timescales
- transfer of load to the underside of the slab or beam when the product is compressed.

### 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 the practicability of installation, including site handling and storage.

14.3 An assessment was made of the performance characteristics and durability of the product.

## Bibliography

BS EN 1990 : 2002 + A1 : 2005 *Eurocode : Basis of structural design*

NA to BS EN 1990 : 2002 + A1 : 2005 UK National Annex to *Eurocode : Basis of structural design*

BS EN 1992-1-1 ; 2004 + A1 : 2014 *Eurocode 2: Design of concrete structures — General rules and rules for buildings*

NA + A2 : 14 to BS EN 1992-1-1 : 2004 + A1 : 2014 UK National Annex to *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

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

### 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 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.