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Designated by Government
to issue
European Technical
Approvals

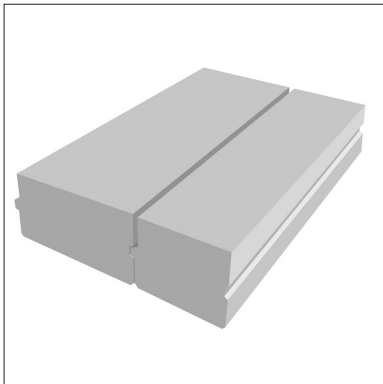
H+H CELCON REINFORCED AIRCRETE ELEMENTS


Panneaux en béton armé
Stahlbetonfelder

Product

• THIS CERTIFICATE RELATES TO H+H CELCON REINFORCED AIRCRETE FLOOR AND ROOF ELEMENTS.


• The elements are for use:
as floor elements in suspended
ground floors and
intermediate floors of
buildings,
as structural roof elements.


Regulations
1 The Building Regulations 2000 (as amended) (England and Wales)

 The Secretary of State has agreed with the British Board of Agrément the aspects of performance to be used by the BBA in assessing the compliance of floors and walls constructed from concrete elements with the Building Regulations. In the opinion of the BBA, H+H Celcon Reinforced Aircrete Elements, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements.

Requirement: A1	Loading
Requirement: A2	Ground movement
Requirement: A3	Disproportionate collapse
Comment:	Floors and roofs built from the elements will meet these Requirements provided design and construction are in accordance with sections 9.1 to 9.9 of this Certificate.
Requirement: B3(1)(3)	Internal fire spread (structure)
Comment:	The elements are non-combustible. See section 10.1 of this Certificate. Floors and roofs constructed with the elements have a fire resistance as detailed in section 10.2 of this Certificate.
Requirement: E2	Airborne sound (floors and stairs)
Requirement: E3	Impact sound (floors and stairs)
Comment:	Floors constructed using the elements can meet these Requirements provided the construction complies with the conditions set out in sections 13.1 and 13.2 of this Certificate.
Requirement: F2	Condensation in roofs
Comment:	A roof construction incorporating the elements can be designed to satisfy this Requirement. See section 12.2 of this Certificate.
Requirement: L1	Dwellings
Requirement: L2	Buildings other than dwellings
Comment:	The elements will enable, or contribute to enabling, a floor or roof to limit heat loss and meet these Requirements. See sections 11.1 to 11.3 of this Certificate.
Requirement: Regulation 7	Materials and workmanship
Comment:	The elements are acceptable. See section 15 of this Certificate.

2 The Building Standards (Scotland) Regulations 1990 (as amended)

 In the opinion of the BBA, H+H Celcon Reinforced Aircrete Elements, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Regulations and related Technical Standards as listed below.

Regulation: 10	Fitness of materials and workmanship
Standards: B2.1 and B2.2	Selection and use of materials, fittings, and components, and workmanship
Comment:	The elements are acceptable. See section 15 of this Certificate.
Regulation: 11	Structure
Standard: C2.1	Stability
Standard: C3.1	Disproportionate collapse
Comment:	Floors and roofs built with the elements can satisfy these Standards provided design and construction are in accordance with sections 9.1 to 9.9 of this Certificate.

continued

Regulation:	12	Structural fire precautions
Standards:	D2.1 and D2.2	Structural protection — Principles
Standard:	D2.3	Structural protection — Non-combustible materials
Standard:	D5.1	Separating walls and separating floors — Principles
Standard:	D5.2	Separating walls and separating floors — Building in purpose group 1
Standard:	D5.6	Separating walls and separating floors — Non-combustible materials
Comment:		The elements are non-combustible. See section 10.1 of this Certificate. Floors constructed with the elements will have the fire resistance detailed in section 10.2 of this Certificate.
Regulation:	18	Resistance to condensation
Standard:	G4.1	Condensation — Interstitial condensation
Standard:	G4.2	Condensation — Surface condensation
Comment:		Floors and roofs incorporating the elements can satisfy these Standards. See section 12.2 of this Certificate.
Regulation:	19	Resistance to transmission of sound
Standard:	H2.1	Walls and floors to resist sound transmission — Airborne sound
Regulation:	20	Resistance to transmission of sound
Standard:	H2.2	Walls and floors to resist sound transmission — Impact sound
Comment:		Floors constructed using the elements can meet these Standards provided the construction complies with the conditions set out in sections 13.1 and 13.2 of this Certificate.
Regulation:	22	Conservation of fuel and power
Standard:	J3.1	Buildings in purpose group 1 — Building fabric
Standard:	J8.1	Buildings in purpose groups 2 to 7
Comment:		The elements will enable, or contribute to enabling, a floor or roof to satisfy these Standards. See sections 11.1 to 11.3 of this Certificate.

3 The Building Regulations (Northern Ireland) 2000



In the opinion of the BBA, H+H Celcon Reinforced Aircrete Elements, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Building Regulations as listed below.

Regulation:	B2	Fitness of materials and workmanship
Comment:		The elements are acceptable. See section 15 of this Certificate.
Regulation:	C5	Condensation
Comment:		The roof or floor incorporating the elements can satisfy this Regulation. See section 12.2 of this Certificate.
Regulation:	D1	Stability
Regulation:	D2	Disproportionate collapse
Comment:		Floors and roofs built with the elements can satisfy these Regulations provided design and construction are in accordance with sections 9.1 to 9.9 of this Certificate.
Regulation:	E4	Internal fire spread — Structure
Comment:		The elements are non-combustible. See section 10.1 of this Certificate. Floors constructed with the elements have the fire resistance detailed in section 10.2 of this Certificate.
Regulation:	F2	Building fabric
Comment:		The elements will enable, or contribute to enabling, a floor or roof to limit heat loss and meet this Regulation. See sections 11.1 to 11.3 of this Certificate.
Regulation:	G2	Separating walls and separating floors
Comment:		Separating floors constructed using the elements can meet this Regulation provided the construction complies with conditions set out in sections 13.1 and 13.2 of this Certificate.

4 Construction (Design and Management) Regulations 1994 (as amended) Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

Information in this Certificate may assist the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

See sections: *6 Delivery and site handling, 8 Practicability of installation, 16 General, and 17 Procedure* of this Certificate.

Technical Specification

5 Description

5.1 H+H Celcon Reinforced Aircrete Elements (see Figure 1) are precast, autoclaved, aerated, concrete elements containing coated-steel reinforcement. There are two aircrete types, Standard and Solar, these are available in a range of sizes:

length (mm)	up to 6000 ± 10
width (mm)	450, 500, 600 ± 4
depth (mm)	200, 240, 300 ± 2
edge profile	tongue-and-groove

5.2 The raw materials used in the production are cement, lime, finely-ground sand and pulverized-fuel ash, the proportions of which may be varied. Aluminium powder is the aerating agent and the elements are formed by wire cutting and cured in high-pressure steam autoclaves to provide the physical and chemical stability.

5.3 The reinforcement consists of 8 mm and 10 mm diameter steel bars of either:
mild steel of minimum yield strength 250 Nmm⁻² manufactured to BS 4449 : 1997, or

high-yield steel of minimum yield strength 460 Nmm⁻² manufactured to BS 4483 : 1998.

5.4 The two aircrete types have the material characteristics given in Table 1.

Figure 1 Typical element detail

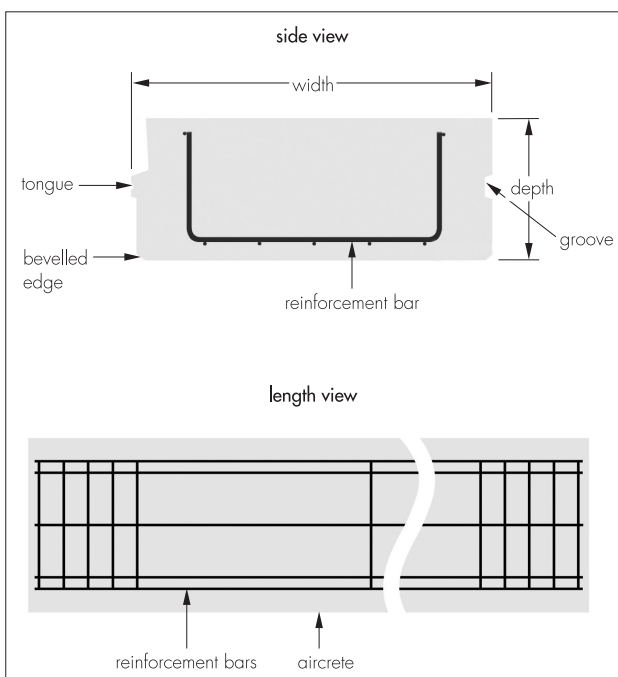


Table 1 Material characteristics

Characteristic (unit)	Element	
	Standard	Solar
nominal density (kgm ⁻³)	620	460
compressive strength (Nmm ⁻²)	3.5	3.0

5.5 Ancillary items used with the elements include:

Celfix — a pre-batched sand and cement mix joint mortar used between elements and available from the Certificate holder. Alternatively, a conventional cement mortar 1:4 (cement:sand) can be used.

6 Delivery and site handling

6.1 All elements and Celfix are supplied by the Certificate holder and can be delivered to site.

6.2 The elements are delivered on pallets and are marked with the product code. The number of elements in each pack will vary according to size.

6.3 The packs may be off-loaded by a hoist or crane, using straps or special clamps recommended by the Certificate holder. They should be stored on a firm level surface, clear of the ground and stacked horizontally on timber bearers, at approximately one metre centres for elements less than 3 metres in length and 1.5 metre centres for elements greater than 3 metres in length and, to a height of three to five elements depending on depth. Elements stored outside should be protected from rain and covered by tarpaulins or polythene sheeting.

Design Data

7 General

7.1 H+H Celcon Reinforced Aircrete Elements can be used in components in buildings as:

floor elements in suspended ground and upper floors of buildings

structural roof elements in buildings.

7.2 All design and detailing involving the use of the elements must be carried out by, or under the direct supervision of, chartered, structural or civil engineers, in accordance with UK practice, conditions and Building Regulations.

7.3 Site erection must be carried out by contractors with suitable experience of this product or, with the necessary instruction and under supervision of the Certificate holder.

7.4 The Certificate holder can provide a list of suitable engineers and contractors.

8 Practicability of installation

8.1 The floor elements can be installed where suspended timber floors, beam and block concrete floors or other precast floors are normally specified.

8.2 The roof elements can be installed in situations where standard roof constructions are normally specified.

9 Structural performance



9.1 Elements can be designed in accordance with prEN 12602 : 2001. Alternatively, suitably qualified engineers could be commissioned to design the elements in accordance with BS 8110-1 : 1997 and BS 8110-2 : 1985.

9.2 The characteristic material properties to be used in the design of the elements are given in Table 2.

Table 2 Characteristic material properties

Characteristic value (Nmm ⁻²)	Elements	
	Standard	Solar
Compressive strength (f_k)	3.5	3.0
Flexural strength (f_{kx})	0.22 x f_k	
Axial tensile strength	0.12 x f_k	
Modulus of elasticity	5 x (density - 150)	

9.3 The partial safety factors (γ_m) for materials should be taken as those specified in prEN 12602 : 2001, or as 1.5 for all designs relating to normal loading and in accordance with the loading criteria set out in BS 8110-1 : 1997.

9.4 Load-span values are given in Table 3.

Table 3 Load capacity⁽¹⁾ (kNm⁻²)

Element length (mm)	Overall thickness (mm)		
	200	240	300
4000 or less	5	5	5
4500	4	5	5
5000	3	5	5
5500	2	4	5
6000	—	2	5

(1) Load capacity is the maximum additional dead load due to floor and/or ceiling finishes, plus partition loads, plus the imposed load. Total long-term deflections are limited to span/250.

Note: Cover to main reinforcement 20 mm.

9.5 The elements are designed as individual members capable of resisting both ultimate and serviceability loads. The edge detail grout infill between elements will provide the shear resistance necessary to confirm that a completed floor will act as a diaphragm floor.

9.6 For design purposes on roofs, wind calculations should be carried out in accordance with BS 6399-2 : 1997.

9.7 The strength of all connection details which tie floors and roofs, comprising the elements, to other structural elements (walls, floors, roofs, columns) must be evaluated and provide adequate stability for the overall building design. The specifications and design calculations for these items must be determined by the engineer responsible for the stability of the building. Guidance on the design of connection details may be obtained from the Certificate holder and the fixings manufacturers.

9.8 Due consideration should be made to the requirements of anchorage of floor and roof

members in buildings of five or more storeys in accordance with BS 8110-1 : 1997.

9.9 Floors and roofs constructed from the elements should be tied using the various straps and anchors as recommended by BS 5628-3 : 2001. All straps and anchors should be fixed to the adjoining structural components using the fixings recommended by the Certificate holder to achieve the required lateral restraint and for the robustness of the whole building.

10 Behaviour in relation to fire



10.1 The elements are non-combustible and have been assessed as having a Class 0 surface spread of flame and rate of heat release classification as defined in the national Building Regulations.

10.2 Consideration of data in prEN 12602 : 2001, Annex C and BS 8110-1 : 1997 indicates that floor elements with a minimum thickness of 200 mm and a minimum cover to reinforcement of 20 mm, will have a minimum fire resistance of 60 minutes.

11 Thermal properties



11.1 When evaluating the contribution the elements will make to the thermal insulation of a floor or roof construction, the thermal resistance values given in Table 4 may be used in conjunction with the effect of thermal bridging through the reinforcing. To take account of thermal bridging through the slab elements, its resistance (in m²KW⁻¹) should be reduced by (0.00035 t - 0.01657) n + 0.08 for Solar elements and (0.000183 t - 0.0066) n + 0.05 for Standard elements, where t is the element thickness in mm and n is the number of vertical reinforcing 'U' sections per m² in the element that are within the floor or roof area. This estimate is the lower limit of resistance from the Combined Method.

Table 4 Thermal resistance values⁽¹⁾

Element thickness (mm)	Thermal resistance (m ² KW ⁻¹)	
	Standard	Solar
200	1.33	1.82
240	1.60	2.18
300	2.00	2.73

(1) These values are based on a material thermal conductivity of 0.15 Wm⁻¹K⁻¹ for Standard elements and 0.11 Wm⁻¹K⁻¹ for Solar elements at 3% moisture content by weight and the effect of thermal bridging through the reinforcement and grouted joints.

11.2 The U value of a floor construction should be calculated in accordance with BS EN ISO 13370 : 1998 and for a roof construction in accordance with BS EN ISO 6946 : 1997.

11.3 When the element joints are properly sealed the floor or roof will adequately limit unwanted air infiltration.

12 Condensation

12.1 Where elements are used to construct a ground floor, adequate ventilation should be provided beneath the floor elements.



12.2 Floors and roofs should incorporate a vapour control layer unless a calculation to BS 5250 : 2002 shows that it is not necessary.

13 Sound insulation



13.1 Field measurements of completed separating floor constructions to BS EN ISO 140-4 : 1998 and BS EN ISO 140-7 : 1998 show that the constructions shown in Figures 2 and 3 achieved airborne sound reduction:

$D_{nT,w}(C_i; C_{tr})$ of 58 (-5; -13) and 59 (-4; -10) dB and impact sound transmission:

$L'_{nT,w}$ of 52(2) and 47(1) dB respectively and can therefore meet, or satisfy the requirements of the national Building Regulations for limiting airborne and impact sound transmission for separating floors.

13.2 It is essential that separating floor constructions are installed and detailed strictly in accordance with the Certificate holder's installation instructions and good building practice for sound resisting elements. All joints and gaps must be fully sealed.

13.3 Where alternative details, not following the provisions outlined by this Certificate, are considered, the proposed construction will require reassessment, or a test for airborne sound and impact and flanking transmission, by a UKAS accredited test laboratory.

13.4 Laboratory measurements on a grouted, unfinished 200 mm deep, standard grade floor element show that an R_w in excess of 40 dB will be achieved.

Figure 2 Separating floor construction — detail A

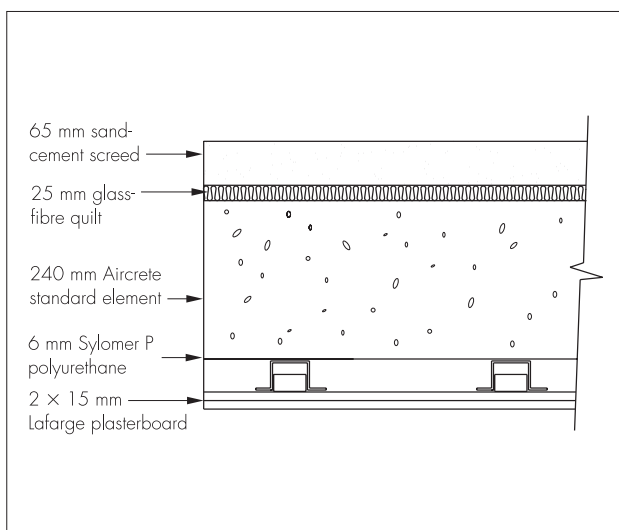
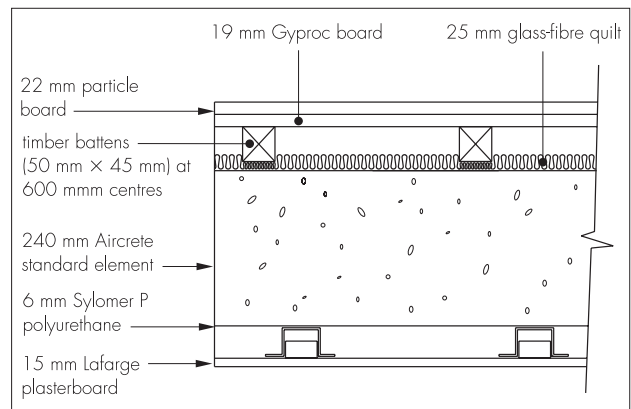


Figure 3 Separating floor construction — detail B



14 Weathertightness

14.1 In suspended ground floors, a minimum ventilated air space must be provided from the ground level to the underside of the elements.

14.2 Ventilation openings in opposing external walls supporting the ground-floor elements should be at least 600 mm² for each metre run of the wall. Where land gas is expected, ventilation openings should be increased to a minimum of 1500 mm² for each metre run of wall.

14.3 Roof panels must be covered with a suitable waterproofing finish.

15 Durability



Autoclaved, aerated, reinforced concrete is a durable material. Floors and roofs comprising the elements will retain their strength and insulating properties for a service life at least equivalent to that of beam and block concrete floors and conventional roof construction respectively.

Installation

16 General

16.1 Installation of H+H Celcon Reinforced Aircrete Elements must be carried out by contractors with suitable experience of this product or, with the necessary instruction and under supervision of the Certificate holder.

16.2 Erection of the elements must be carried out by using the appropriate tools and lifting equipment (eg assembly clamp and crane) details of which are available from the Certificate holder and in a planned sequence of events.

16.3 Before installation, the tongue-and-groove surface of each element must be free from dirt. Checks should be made to ensure that elements are free from damage and fully intact. Damaged elements must not be used unless approved for use by the Certificate holder.

16.4 The minimum bearing of the elements must be 80 mm on steel and 90 mm on masonry.

17 Procedure

Floors

17.1 Floor elements can be installed in situations where beam-and-block concrete floors are normally specified.

17.2 Information on the installation of floor elements can be found in the Certificate holder's instructions *The Jämera concept — An Introductory Guide*, June 2002.

17.3 Internal dimensions to supporting walls must be checked with site dimensions before installation of the elements and any discrepancies reported.

17.4 The supporting surface on the foundation wall must be level and even.

17.5 Where the elements are used with structural steelwork, it must be bedded on supporting walls using non-shrink mortar at least 24 hours before installation of the elements.

17.6 Once all the floor elements are positioned the joints are fully grouted, using Celfix or cement mortar (see section 5.5). Transverse joints wider than 20 mm may be filled with crushed aircrete prior to grouting, except where the elements bear on a solid separating wall.

17.7 In situations where shrinkable clay soils may be present, sufficient space must be left between the underside of the element and the ground.

Roofs

17.8 Roof elements can be installed in situations where standard roof construction is normally specified.

17.9 The elements are supported on masonry walls topped smooth with a bedding of sand-cement mortar. This will ensure that any irregularities between wall and roof are eliminated.

17.10 The first element is installed at the eaves or the bottom of the slope on the prepared wall and should be tied to the wall with roof pins or helical ties.

17.11 Typical examples of construction details for an externally insulated and internally insulated pitched roof are shown in Figures 4 and 5 respectively.

17.12 Once all roof elements are positioned the joints are fully grouted using the cement mortar. Transverse joints wider than 20 mm may be filled with crushed aircrete prior to grouting.

Figure 4 Typical roof detail — externally insulated

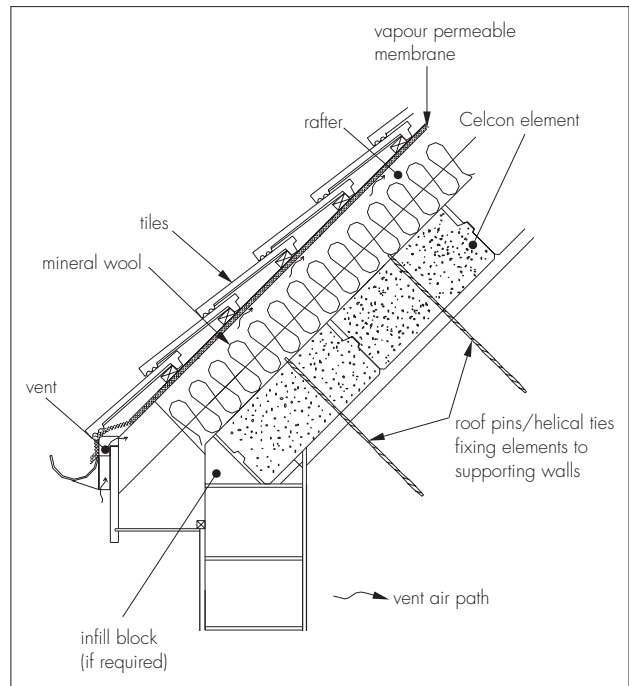
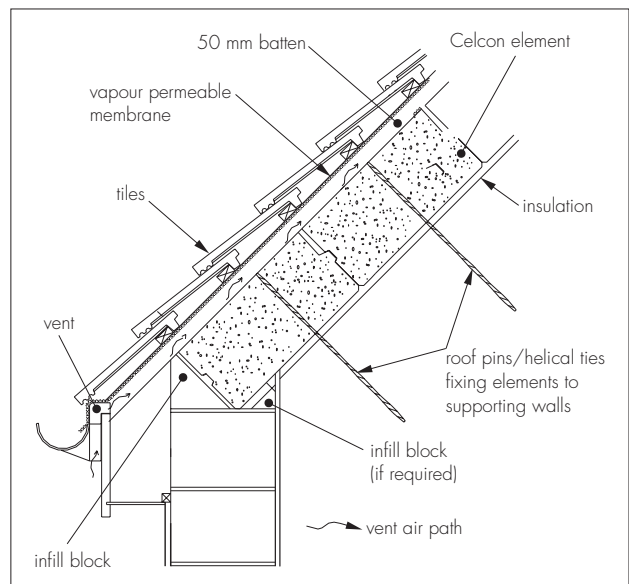


Figure 5 Typical roof detail — internally insulated



18 Provision for services/openings

18.1 Holes for services should be set out prior to installation. These holes should be made only in the non-reinforced area along the edge of the elements.

18.2 Openings with a width of up to 1200 mm may normally be made using a trimmer. Advice on openings should be sought from the Certificate holder.

19 Finishing

19.1 Any minor intrusions of the element (such as into cavity wall spaces) may be sawn off with the Certificate holder's consent. Any exposed reinforcement must be protected using appropriate sealant (eg bitumen tanking material) as soon as possible.

19.2 The grouted elements will normally develop full strength within one or two days, although this period is dictated by the curing time of the cement-mortar grout.

19.3 The elements should not be loaded for 12 hours after grouting unless suitably supported. This period may be reduced to four hours if Celfix is used.

Technical Investigations

The following is a summary of the technical investigations carried out on H+H Celcon Reinforced Aircrete Elements.

20 Investigations

20.1 An examination was made of existing data in relation to:

- physical characteristics of the materials
- durability of materials
- adequacy of anti-corrosion coating of the reinforcing bars
- thermal and acoustic properties of the elements
- fire resistance of the elements.

20.2 An investigation of the design procedures and material/component properties in relation to the structural performance of the floors were checked against the methods given in prEN 12602 : 2001.

20.3 Full-scale loading tests were carried out to verify the accuracy of the calculations.

20.4 Visits were made to UK sites where completed and partially-completed floors comprising the elements have been erected to establish the practicability of installation of the floor and wall elements under UK site conditions.

20.5 A factory inspection was carried out by BBA at the Certificate holder's factory in Pollington, Yorkshire, to ensure that quality is being maintained.

Bibliography

BS 4449 : 1997 *Specification for carbon steel bars for the reinforcement of concrete*

BS 4483 : 1998 *Steel fabric for the reinforcement of concrete*

BS 5250 : 2002 *Code of practice for control of condensation in buildings*

BS 5628-3 : 2001 *Code of practice for use of masonry — Materials and components, design and workmanship*

BS 6399-2 : 1997 *Loading for buildings — Code of practice for wind loads*

BS 8110-1 : 1997 *Structural use of concrete — Code of practice for design and construction*

BS 8110-2 : 1985 *Structural use of concrete — Code of practice for special circumstances*

BS EN ISO 140-4 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of airborne sound insulation between rooms*

BS EN ISO 140-7 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of impact sound insulation of floors*

BS EN ISO 6946 : 1997 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

BS EN ISO 13370 : 1998 *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

prEN 1745 : 1996 *Masonry and masonry products — Methods for determining design thermal values*

prEN 12602 : 2001 *Prefabricated reinforced components of autoclaved aerated concrete*

Conditions of Certification

21 Conditions

21.1 This Certificate:

- (a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (d) is copyright of the BBA.

21.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, shall be construed as references to such publication in the form in which it was current at the date of this Certificate.

21.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabricating process(es) thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked by the BBA or its agents; and

(c) are reviewed by the BBA as and when it considers appropriate.

21.4 In granting this Certificate, the BBA makes no representation as to:

- (a) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the nature of individual installations of the product, including methods and workmanship.

21.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, H+H Celcon Reinforced Aircrete Elements are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 03/4000 is accordingly awarded to H+H Celcon Ltd.

On behalf of the British Board of Agrément

A handwritten signature in black ink, appearing to read 'P. C. Newson'.

Date of issue: 24th January 2003

Chief Executive