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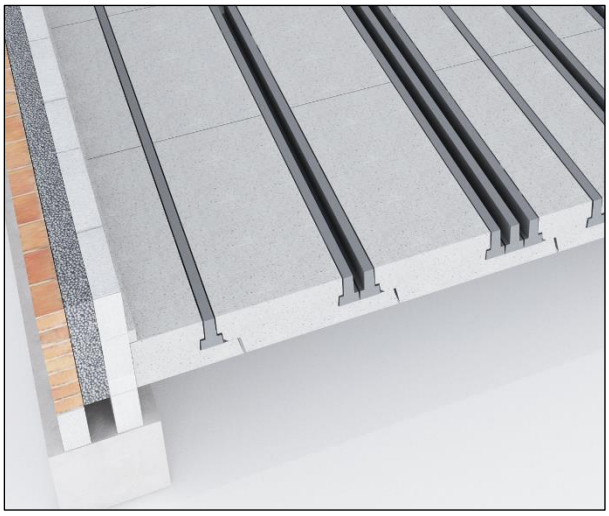
Agrément Certificate
07/4411
Product Sheet 1

SPRINGVALE FLOORING SYSTEMS

SPRINGVALE BEAMSHIELD PLUS AND PLATINUM BEAMSHIELD PLUS — EPS BLOCKS

This Agrément Certificate Product Sheet(1) relates to Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks, a range of expanded polystyrene (EPS) blocks for use as thermal insulation in conjunction with precast concrete beams, masonry closure and coursing blocks, and structural concrete toppings, as a suspended concrete ground floor system (over a sub floor void) in domestic, residential and commercial buildings.

(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

Structural performance — the system has adequate strength to resist the design loads and transmit the dead and imposed floor loads to the supporting masonry. The EPS blocks have adequate strength to carry the short-term loads likely to be encountered during construction of the floor but make no further load-bearing contribution once the structural concrete topping has reached full strength (see section 6).

Thermal performance — the EPS blocks can enable a floor to meet the design U values specified in the documents supporting the national Building Regulations (see section 7).

Condensation risk — the EPS blocks can contribute to minimising the risk of interstitial and surface condensation in floors (see section 8).

Durability — the system components, including the EPS blocks, concrete beam and concrete topping reinforced with steel mesh, or steel or polymer fibres, have adequate durability for the design life of the building (see section 10).

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: 2 November 2018

Originally certificated on 13 April 2007

Paul Valentine
Technical Excellence Director

Claire Curtis-Thomas
Chief Executive

This Certificate was amended on 22 May 2024 as part of a transition of The BBA Agrément Certificate scheme delivered under the BBA's ISO/IEC 17020 accreditation. This Certificate was issued originally under accreditation to ISO/ IEC 17065. Sections marked with the symbol † are not issued under accreditation. Full conversion to the ISO/IEC 17020 format will take place at the next Certificate review. The BBA is a UKAS accredited Inspection Body (No.4345). ***Readers MUST check the validity of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.*** *Any photographs are for illustrative purposes only, do not constitute advice and must not be relied upon.*

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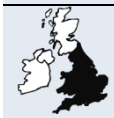
Regulations

In the opinion of the BBA, the Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks floor system, 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)

Requirement:	**A1(1)**	**Loading**
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground. See sections 6.2, 6.3 and 6.7 to 6.16 of this Certificate.
Requirement:	**C2(c)**	**Resistance to moisture**
Comment:		The system can contribute to limiting the risk of surface and interstitial condensation. See sections 8.1 and 8.4 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The system can contribute to satisfying this Requirement. See section 7.3 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The system is acceptable. See section 10 and the *Installation* part of this Certificate.
Regulation:	**26**	**CO_2 emission rates for new buildings**
Regulation:	**26A**	**Fabric energy efficiency rates for new dwellings (applicable to England only)**
Regulation:	**26A**	**Primary energy consumption rates for new buildings (applicable to Wales only)**
Regulation:	**26B**	**Fabric performance values for new dwellings (applicable to Wales only)**
Comment:		The blocks can contribute to satisfying these Regulations. See section 7.3 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)**	**Durability, workmanship and fitness of materials**
Comment:		The system can contribute to a construction meeting this Regulation. See section 10 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards in relation to construction**
Standard:	1.1(a)(b)	Structure
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground, with reference to clause 1.1.1(1). See sections 6.2, 6.3 and 6.7 to 6.16 of this Certificate
Standard:	3.15	Condensation
Comment:		The system can contribute to limiting the risk of surface and interstitial condensation, with reference to clauses 3.15.1(1)(2), 3.15.4(1)(2) and 3.15.5(1)(2). See sections 8.1 and 8.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The system can contribute to satisfying the requirements of this Standard, with reference to clauses 6.1.1(1), 6.1.2(2), 6.1.6(1), 6.1.10(2), 6.2.1(1)(2), 6.2.3(1), 6.2.4(2), 6.2.5(1), 6.2.9(1), 6.2.10(1), 6.2.11(2), 6.2.12(2) and 6.2.13(1). See section 7.3 of this Certificate.

Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system can contribute to satisfying 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. In addition, the blocks can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4[(1)(2)] [Aspects 1[(1)(2)] and 2[(1)]], 7.1.6[(1)(2)] [Aspects 1[(1)(2)] and 2[(1)]] and 7.1.7[(1)(2)] [Aspect 1[(1)(2)]]. See section 7.3 of this Certificate. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).

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

Regulation:	**23(a)(i)(iii)(b)**	**Fitness of materials and workmanship**
Comment:		The system is acceptable. See section 10 and the *Installation* part of this Certificate.
Regulation:	**29**	**Condensation**
Comment:		The system can contribute to limiting the risk of interstitial condensation. See section 8.1 of this Certificate.
Regulation:	**30**	**Stability**
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground. See sections 6.2, 6.3 and 6.7 to 6.16 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		The system can contribute to satisfying these Regulations. See section 7.3 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* (3.3) and the *Installation* part of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks with steel or macro-polymer fibre or steel mesh concrete toppings[(1)], if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapter 5.2 *Suspended ground floors*.

(1) NHBC do not accept micro-polymer-fibre-only structural concrete toppings.

CE marking

The Certificate holder has taken the responsibility of CE marking the EPS products in accordance with harmonised European Standard BS EN 15037-4 : 2010. An asterisk (*) appearing in this Certificate indicates that data shown is given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

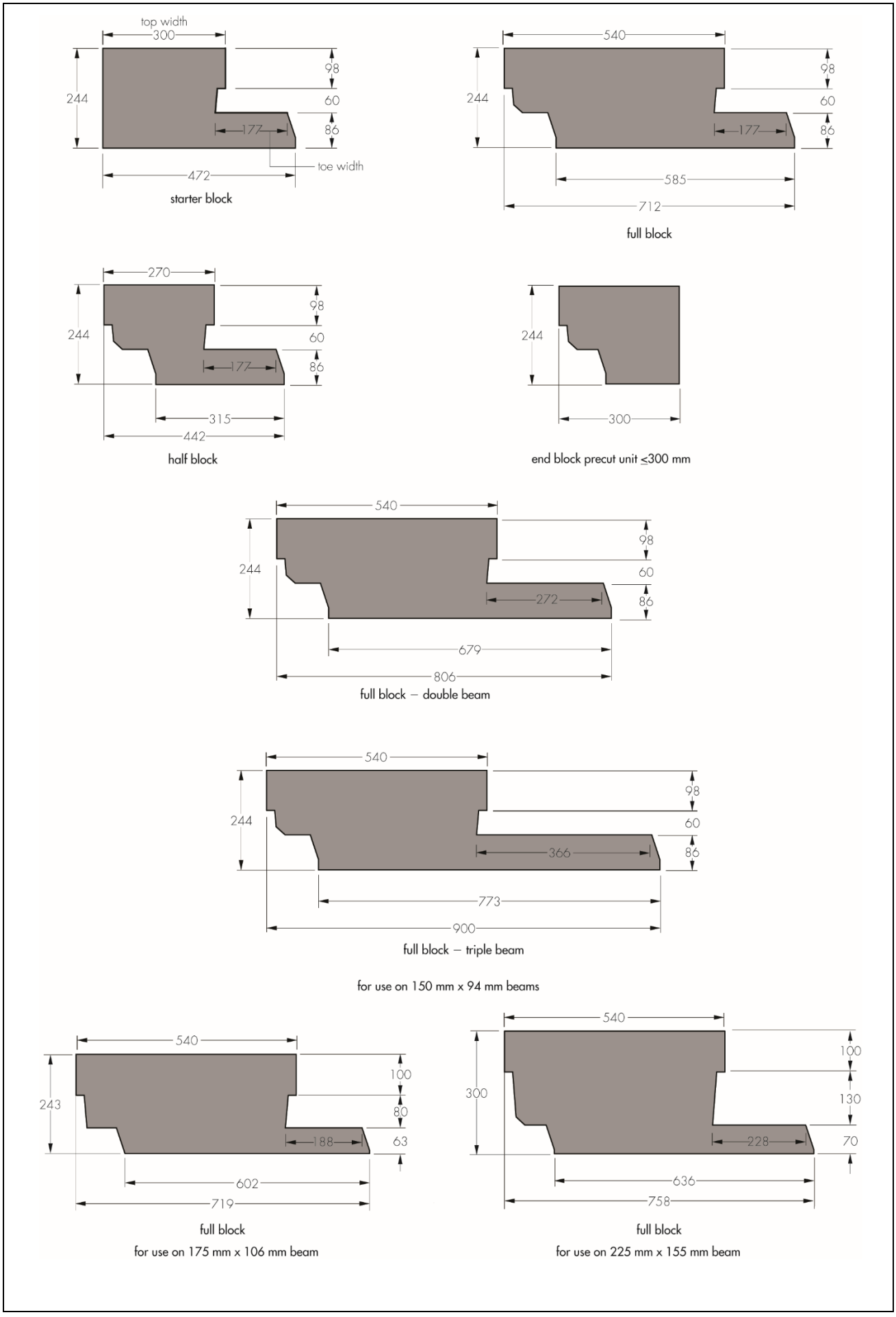
1.1 Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks comprise a range of white and grey grade EPS thermal insulation blocks, shaped to fit in-between and underneath precast concrete beams in suspended ground floors (see Figures 1 and 4 and Table 1 of this Certificate).

Table 1 EPS block properties

Property	Value
Length (mm)	1200
Top width(1) (mm) – full blocks	540
– half blocks	270
– starter blocks	≤300
– end blocks	≤300
Overall thickness range (mm)	228 to 450(2)
Toe thickness(3) (mm) – for use with 150 x 94 beams	70, 86, 124, 220
– for use with 175 x 106 beams	63, 118, 167, 198
– for use with 225 x 155 beams	70, 95, 170, 220
Declared thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$) λ_D value	
– Beamshield Plus	0.038* (white)
– Platinum Beamshield Plus	0.030* (grey)
Moisture diffusion coefficient (μ)	20 to 40
Mechanical resistance according to BS EN 15037-4 : 2010	1.5 kN*
Type and class of EPS according to BS EN 15037-4 : 2010	Type R1 and Class R1a*

(1) All available with toe widths to cover single, double and triple beams.
(2) Four standard thicknesses for each nominal beam size.
(3) Subject to order size, intermediate toe layer thicknesses can be supplied.

Figure 1 Example standard EPS block dimensions (all dimensions in millimetres)



1.2 Subject to order size, EPS blocks can be manufactured to suit different beam profiles from those shown in Figure 2 of this Certificate. The toe width of the EPS blocks must provide a close fit to ensure the toe gap due to tolerance of components is less than 6 mm.

1.3 The Certificate holder's specifications for ancillary items used in conjunction with the EPS blocks include the following:

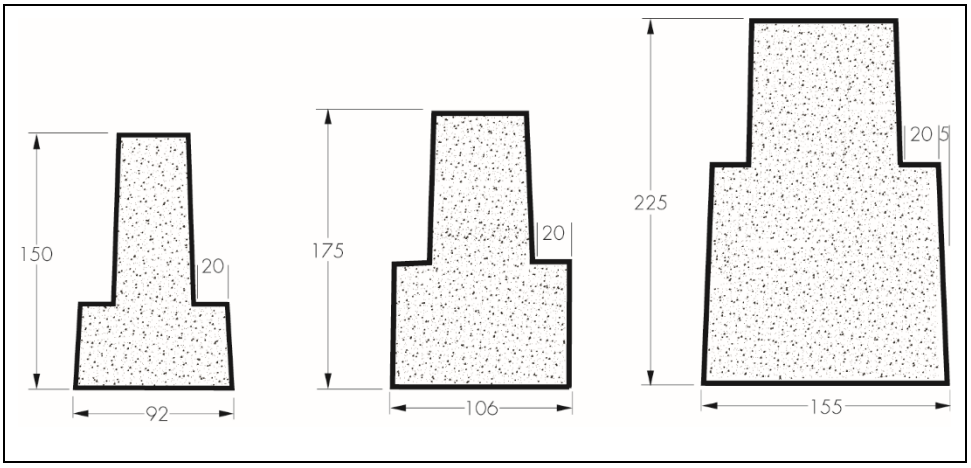
- insulation strips — for perimeter of structural concrete toppings
- concrete topping — normal or self-compacting concrete to the specifications given in Table 4 of this Certificate, depending on the proposed floor usage. The concrete topping to be reinforced with steel mesh, steel fibres, or macro-polymer or micro fibres must be designed in accordance with BS EN 1990 : 2002 and BS EN 1992-1-1 : 2004 (Eurocode 2) and their respective UK National Annex, or TR34, with a maximum aggregate size of 20 mm. See sections 6.7 to 6.10 of this Certificate
- concrete closure blocks — with a compressive strength equal to, or greater than, that of the blocks used to form the inner leaf of the wall.

1.4 Ancillary items outside the scope of this Certificate include:

- pre-stressed concrete beams — similar to the type and size shown in Figures 2 and 3 of this Certificate, CE marked and designed in accordance with BS EN 1992-1-1 : 2004 and its UK National Annex, BS EN 206 : 2013, BS 8500-1 : 2015 and BS 8500-2 : 2015. See sections 6.11 to 6.16 of this Certificate.
- gas barrier membranes(1) — where required, with third-party approval
- vapour control layer (VCL)(1) — where required, with third-party approval
- damp-proof membranes (dpm)(1) — where required, with third-party approval.

(1) Must be compatible with EPS.

Figure 2 Typical pre-cast concrete beams



2 Manufacture

2.1 The EPS blocks are manufactured from expanded polystyrene beads using conventional moulding techniques.

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

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

2.3 The management system of Springvale EPS Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by the BSI (Certificate FM13871) and BS EN ISO 14001 : 2015 by QMS International (Certificate GB 14130944).

3 Delivery and site handling

3.1 The EPS blocks are wrapped in polythene, but are otherwise unprotected. Therefore, reasonable care must be taken during transit and storage to avoid damage. Particular attention will be required for blocks with extended toe widths.

3.2 The blocks should be stacked on a flat base, clear of the ground, protected against prolonged direct sunlight and secured to avoid wind damage. Care must be taken to avoid contact with organic solvents.

3.3 The blocks must not be exposed to flame or ignition sources. Careful consideration should also be given to the management of fire risk when in storage.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks.

Design Considerations

4 General

4.1 Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks are satisfactory for use as thermal insulation as part of a suspended ground floor (over a sub floor void) in domestic, residential and commercial buildings.

4.2 An appropriately qualified engineer should perform a site-specific assessment/design to ensure that:

- the EPS blocks, concrete beams and structural concrete toppings are in accordance with recommendations in this Certificate and the relevant parts of BS EN 15037-1 : 2008 and BS EN 15037-4 : 2010
- the concrete beam meets the requirements of sections 1.4 and 6.13 of this Certificate
- the floor is not loaded by construction materials until the concrete topping has reached its design strength. The magnitude of the temporary load must not exceed the design load of the floor
- the natural frequency of the floor is greater than 4.0 Hz. Use of the system where vibration due to rhythmic activity (such as dancing) and external sources (eg building construction or rail traffic) may be encountered is outside the scope of this Certificate
- where required, lateral restraint is provided at ground floor level in accordance with the requirements of the national Building Regulations, BS EN 8103-1 : 2011 and NHBC Standards 2018.

4.3 A void of at least 150 mm deep for the system must be provided between the underside of the floor and the ground surface.

4.4 In locations where clay heave is anticipated, an additional void of up to 150 mm may be required to accommodate the possible expansion of the ground below the floor. In such cases where the risk of clay heave has been confirmed by geotechnical investigations, a total void of up to 300 mm may be required.

4.5 On sites which may be subject to emissions of gas or volatile organic compounds (VOCs), a suitably experienced and qualified person must assess the compatibility of the insulation with any potential emissions.

4.6 Electrical cables running within the EPS blocks should be enclosed in a suitable conduit, such as rigid PVC. The Certificate holder should be consulted for further advice.

4.7 The EPS blocks can be used in floors with suitable underfloor heating systems. Care must be taken to ensure that the minimum design thickness of structural concrete topping is maintained, eg above pipes.

4.8 The selected structural concrete topping must be designed and installed strictly in accordance with this Certificate and the Certificate holder's instructions (see section 6). The dosage rate for micro-, macro- and steel fibres must be in accordance with Table 4.

5 Practicability of installation

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

6 Structural performance

General

6.1 The design engineer must ensure that the concrete beams and structural topping are suitable for the intended application (see section 4.2 of this Certificate).

EPS blocks

6.2 The EPS blocks provide a permanent formwork to the structural concrete topping. They make no further contribution to the long-term structural performance of the floor, once the structural concrete topping has been placed and obtained its full design strength.

6.3 Subject to compliance with the design and installation requirements of this Certificate, the EPS blocks have adequate strength to carry the normal temporary loads expected during the construction phase of the floor system, including the weight of the structural concrete topping when poured.

6.4 EPS blocks may be cut to accommodate varying beam lengths and should be positioned at the floor edges, subject to a minimum cut length of 300 mm. Starter and end blocks should not be more than 300 mm wide at the top. See section 14.8 of this Certificate.

6.5 The blocks are designed to have a normal bearing of 20 mm, with a 5 mm allowance for misalignment and manufacturing tolerances in the straightness of the beam. A minimum bearing width of 15 mm must therefore be ensured.

6.6 Spacers for supporting steel mesh reinforcement should be located along the beams or on spreader plates over the EPS blocks. This will reduce the risk of accidental penetration of the EPS during the construction phase and the resulting misalignment of the reinforcement within the structural concrete topping depth.

Structural concrete toppings

6.7 The structural concrete topping should be in accordance with BS 8500-1 : 2015, BS 8500-2 : 2015 and BS EN 206 : 2013, manufactured in plants covered by the QSRMC scheme (Quality Scheme for Ready Mixed Concrete) or similar quality scheme for concrete suppliers and laid by personnel with the appropriate skills and experience.

6.8 The suitability of the reinforcement options and their method of verification, for the various loading categories, are summarised in Table 2 of this Certificate. For the characteristic loads associated with each load category, see Table 3.

6.9 The specification for each concrete must be in accordance with Table 4. Normal or self-compacting concrete is acceptable for all reinforcement types.

Table 2 Suitability of reinforced concrete toppings for various building types

Ref no.	Load category (See Table 3)				Method of verification
	Reinforcement	Single-family dwellings	Communal areas in blocks of flats	Commercial buildings	
1	Steel mesh (A142)	x	x		Full scale test and calculation to BS EN 1992-1-1
2	Durus S400 (macro-polymer fibre)	x	x		Full-scale test
3	Novomesh B&BA polymer (macro-polymer fibre)	x			Calculation to TR34 (4th Edition)
4	Novomesh B&BA steel (steel fibre)	x			Calculation to TR34 (4th Edition)
5	Durus Easy Finish (macro-polymer fibre)	x			Calculation to TR34 (4th Edition)
6	Adfil SF86 (steel fibre)	x			Calculation to TR34 (4th Edition)
7	Steel mesh (to the design engineer's specification)			x	Calculation to BS EN 1992-1-1
8	Fibrin X-T(1) (micro-polymer fibre)	x	x(2)		Full-scale test
9	Fibrin PC23(1) (micro-polymer fibre)	x	x(2)		Alternative acceptable micro-fibre
10	Fibrin PC-12(1) (micro-polymer fibre)	x	x(2)		Full-scale test

(1) Micro-fibre structural concrete toppings are not permitted on NHBC sites.
(2) For micro-fibre toppings, the maximum permitted loads must be as shown in Table 3.

Table 3 Imposed and partition loads for permitted building categories

Description	Characteristic value of loads for single-family dwellings	Characteristic value of loads for communal areas in blocks of flats	Characteristic value of loads for communal areas in blocks of flats – micro-fibre only	Commercial buildings
Imposed uniformly distributed load (UDL) ($kN \cdot m^{-2}$)(1)	1.5	3.0	1.5(2)	5.0
Imposed concentrated load (kN)(1)(3)	2.0	4.0	2.0	4.5
Line load partition, parallel and perpendicular to the beam ($kN \cdot m^{-1}$)(4)(5)	3.0(6)	5.0	1.0(2)	5.0
Allowance for moveable partition ($kN \cdot m^{-2}$)(4)(5)	1.0	1.0	1.0(2)	1.0
Finishes ($kN \cdot m^{-2}$)	0.5	0.5	0.5	0.5

(1) Imposed concentrated load must not be combined with the imposed UDL or other variable actions.
(2) The total imposed characteristic value of the UDL and moveable partition in communal areas in flats must not exceed 2.5 $kN \cdot m^{-2}$ for micro-fibre concrete toppings. Floors with concrete topping reinforced with micro-polymer fibres can resist a lightweight partition, eg stud wall, lighter or equal to 1 $kN \cdot m^{-1}$. Non-load bearing partition walls heavier than 1 $kN \cdot m^{-1}$, parallel to the beams, must be either supported by the foundation or bear directly on the concrete beams. Non-load bearing partitions of 3 kN m^{-1} parallel to the beams, if the total length of partition wall is less than 25% of the span, can be built off the floor.
(3) Imposed concentrated load is assumed to be applied over a square plate not less than 50 by 50 mm.
(4) Either the imposed load for lightweight moveable partitions or line load partition must be considered.
(5) Non-load bearing partition walls heavier than the permitted value, in any orientation to the concrete beams, must either be supported by a foundation or bear directly on the concrete beams designed to sustain the specific loading.
(6) Floors with concrete topping reinforced with micro-polymer fibres can resist only lightweight partitions, subject to the provisions of note (2) above.

Table 4 Structural concrete topping specifications[1][2][3]

Ref no.	Reinforcement specifications	Minimum depth of concrete above any services (mm)	Minimum concrete compressive strength class
1	One layer of A142 mesh to BS 4483 : 2005 with a characteristic yield strength of (f_{yk}) 500 N·mm^{-2}. Nominal cover to reinforcement steel must be 25 mm	65 75	C28/35 C25/30
2	Durus S400 polymer macro-fibre, dosage[4][5] of 4 kg·m^{-3} 45 mm long, 0.9 mm diameter, tensile strength 465 N·mm^{-2}, modulus of elasticity 3350 N·mm^{-2}	75	C25/30
3	Novomesh B&BA[4][5] (macro-polymer and micro-polyolefin fibre), dosage rate 3.84 kg·m^{-3}, shape of macro fibre continuously deformed, 60 mm long, 0.56 mm diameter, tensile strength 600 N·mm^{-2}, modulus of elasticity 7000 N·mm^{-2}	75	C28/35
4	Novomesh B&BA[5][6] (steel fibre), dosage rate 17.5 kg·m^{-3}, steel flat end, fibre length 50 mm, diameter 1.0 mm, tensile strength 1150 N·mm^{-2}	75	C28/35
5	Durus Easy Finish[4][(5] (macro-polymer fibre), dosage rate 3.00 kg·m^{-3}, 40 mm long, 0.7 mm equivalent diameter, tensile strength 470 N·mm^{-2}, modulus of elasticity 6000 N·mm^{-2}	75	C25/30
6	Adfil SF86 [5][6] (steel fibre), dosage rate 13.33 kg·m^{-3}, 60 mm long, diameter 0.75 mm, tensile strength 1225 N·mm^{-2}, modulus of elasticity 200000 N·mm^{-2}	75	C25/30
7	One layer of steel mesh to BS 4483 : 2005 to the design engineer's specification	75	C25/30
8	Fibrin X-T[7] (monofilament polypropylene micro fibre), minimum dosage rate 0.91 kg·m^{-3}, 13-19 mm long, 22 microns diameter, tensile strength 380 N·mm^{-2}	75	C25/30
9	Fibrin 23[7] (polypropylene micro-fibre), dosage rate 0.91 kg·m^{-3}, 12 mm long, 19.5 microns diameter, tensile strength 416 N·mm^{-2}	75	C25/30
10	Fibrin PC-12[7] (polypropylene micro-fibre), dosage rate 0.75 kg·m^{-3}, 12 mm long, 19.5 microns diameter, tensile strength 163 N·mm^{-2}	60	C28/35

(1) For standard concrete, the slump should be Class S3 (100 to 150 mm) or S4 (for spot samples taken from initial discharge, 140 to 230 mm).
(2) For self-compacting concrete, the slump flow class should be SF1 (550 to 650 mm) or SF2 (660 to 750 mm). The sand content should be greater than 45%.
(3) The aggregate for concrete must comply with BS EN 12620 : 2002.
(4) For fresh concrete, macro-polymer fibres content should be measured in accordance with BS EN 14488-7 : 2006
(5) The dosage rates of steel and polymer fibres for concrete reference numbers 3 to 6 include 15% additional fibres and are designed to give the minimum required residual flexural tensile strength of concrete toppings with steel and macro-polymer fibres including a tolerance for batching and fibre distribution. Dosage rates of fibres used in full-scale tests (Ref. 2 and 8-10) are approved with the as-tested dosage.
(6) For fresh and hardened concrete, steel fibres content should be measured in accordance with BS EN 14721 : 2005.
(7) Micro-polymer-fibre-only structural concrete toppings are not accepted on NHBC sites.

6.10 The concrete topping above the EPS starter and end blocks must be designed as a cantilevered slab and must not exceed 300 mm. The maximum distance of the concentrated load applied on the cantilevered section should not exceed 233 mm[1] from the top face of the concrete beam.

(1) Derived from length of cantilever slab (300 mm), minus width of plasterboard, skirting board and skim (42 mm), minus half-width of a 50 mm square plate. The imposed concentrated load is assumed to be applied over a square plate not less than 50 by 50 mm.

Pre-stressed concrete beam

6.11 The EPS blocks are for use with self-bearing pre-stressed concrete beams of normal weight concrete, which provides the final strength of the floor system independently of any other constituent of the floor system. The pre-stressed concrete beams are outside the scope of this Certificate and must be specified by a suitably qualified and experienced engineer; however, the following information is given for guidance.

6.12 The dimensions and specification of the pre-stressed concrete beam that was used in the full scale structural testing is shown in Figure 3 and Table 5 of this Certificate. Other beams may be used provided they meet the requirements of section 6.13.

Figure 3 Dimensions of pre-stressed concrete beam and position of wires

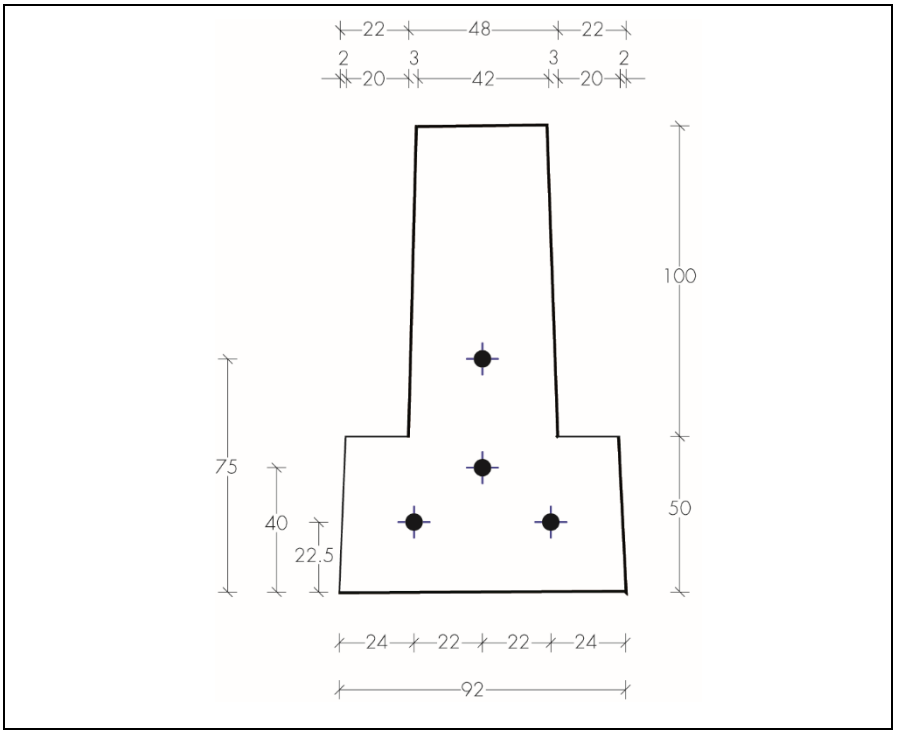


Table 5 Beam properties

Property	Value
Characteristic compressive strength of the concrete beam at 28 days — (f_{ck}) cube (N·mm^{-2})	55
Secant modulus of elasticity of concrete (E_{cm}) (N·mm^{-2})	36283
Second moment of area (I) (mm^4)	17,027,000
Aggregate	Granite
Number of 5 mm diameter wires(1)	4
Characteristic tensile strength of pre-stressing steel (f_{pk}) (N·mm^{-2})	1770
Characteristic tensile strength 0.1% proof stress of pre-stressing steel ($f_{p0,1k}$) (N·mm^{-2})	1556
Service moment resistance (kN·m)	5.311
Ultimate moment resistance (kN·m)	7.91
Ultimate shear resistance (kN)	15.699
Initial pre-stress force (kN)	104.24
Pre-stress force after losses (kN)	73.56
Eccentricity (mm)	21.85

(1) The indented pre-stressing steel wire must be in accordance with BS 5896 : 2012.

6.13 An appropriately qualified engineer must ensure that the following conditions for the concrete beam are met:

- the pre-stressed concrete beams must be designed in accordance with BS EN 1992-1-1 : 2004 (Eurocode 2) and its UK National Annex, by a qualified and experienced individual to ensure that the beams are adequate to resist the applied loading

- the proposed pre-stressed concrete beam must be CE marked, manufactured and designed in accordance with requirements of BS EN 15037-1 : 2008

- the serviceability deflection limit of the proposed concrete beam must be in accordance with BS EN 1992-1-1 : 2004, as summarised in Table 6 of this Certificate.

Table 6 Deflection limitation of pre-stressed concrete beams

Description	Limit for deflection
Camber at transfer (upward deflection) of pre-stressed force under the self-weight of the beam	span/250
Deflection at application of finishes – downward from the level of the bearings	span/250
Deflection for long-term under quasi-permanent loads (M_{QP})(1) after losses in pre-stress force and creep – measured below the level of the supports	span/250
Movement after application of finishes – increase in deflection due to pre-stress loss and creep	span/500

(1) M_{QP} is the moment under the quasi-permanent load combination (refer to equation 6.16a of BS EN 1990 : 2002).

- The concrete beam should have a natural frequency greater than 4 Hz when loaded with full dead load plus 0.1 x imposed load (UDL).

The natural frequency *(f)* of a simply supported concrete beam under UDL loading is determined using the following approximation:

$f = 18/\delta^{0.5}$

Where:
δ is the deflection of the concrete beam in mm for UDL, as defined in section 6.8.

- the imposed loads (UDL and concentrated load) must be in accordance with BS EN 1991-1-1: 2002 and its UK National Annex, and not exceeding the values shown in the Table 3 of this Certificate
- the minimum bearing width to support the concrete beam is 90 mm.

6.14 The maximum effective span of the concrete beam (assumed to be a simply supported and self-bearing beam) must be calculated using the equations from BS EN 1990 : 2002 (6.10 and 6.14a, or the less favourable equations, 6.10a, 6.10b and 6.14a). The lowest effective span obtained from these equations will be considered to be the maximum effective span of the concrete beam.

6.15 Where two or more concrete beams are placed side by side, eg beneath load bearing walls, the spaces between the beam webs should be in-filled with concrete with a minimum strength class of C25/30 to give unity of action.

6.16 The concrete beam is self-bearing and no account should be made for possible composite action between the beams and the EPS in-fill blocks or the concrete topping.

7 Thermal performance

7.1 The overall floor U value will depend significantly on the deck U value, the ratio of the exposed (and semi-exposed) floor perimeter length to floor area (p/a), the amount of underfloor ventilation and the ground thermal conductivity. Each floor U value should therefore be calculated to BS EN ISO 13370 : 2017 and BRE Report BR 443 : 2006.

7.2 A floor deck U value (from inside to the underfloor void) will depend significantly on the size and number of precast concrete beams, the EPS block type and toe thickness, and the width of any gap between adjacent EPS blocks in the toe layer. The U value of each beam and EPS block configuration should be numerically modelled to BS EN ISO 10211 : 2017 and BS EN 15037-4 : 2010, using a design toe gap width of 6 mm. The floor deck U value may then be taken as an area-weighted average, and the overall floor U value calculated as described in section 7.1.

7.3 Example floor U values are given in Table 7. These indicate that the EPS blocks can enable a floor to satisfy, or improve, the design floor U values of 0.15 to 0.25 $W \cdot m^{-2} \cdot K^{-1}$ specified in the documents supporting the national Building Regulations.

Table 7 Example U values[1] – for decks with two beam configurations (A and B)[2] (W·m^{-2}·K^{-1})

Beam size (in mm)	EPS block Type	p/a ratio	EPS block thickness (mm) with beam configuration (A and B)							
			228		244		282		378	
			A	B	A	B	A	B	A	B
150 x 94[3]	Beamshield Plus (white)	0.4	0.18	0.19	0.17	0.18	0.15	0.16	0.12	0.12
		0.6	0.19	0.21	0.18	0.19	0.15	0.16	0.12	0.13
		0.7	0.20	0.21	0.18	0.20	0.16	0.17	0.12	0.13
		0.9	0.20	0.22	0.19	0.20	0.16	0.17	0.12	0.13
	Platinum Beamshield Plus (grey)	0.4	0.16	0.17	0.14	0.16	0.13	0.13	0.10	0.10
		0.6	0.17	0.18	0.15	0.16	0.13	0.14	0.10	0.11
		0.7	0.17	0.18	0.15	0.17	0.13	0.14	0.10	0.11
		0.9	0.17	0.19	0.16	0.17	0.14	0.14	0.10	0.11
			243		298		347		378	
			A	B	A	B	A	B	A	B
175 x 106	Beamshield Plus (white)	0.4	0.19	0.20	0.15	0.16	0.13	0.13	0.12	0.12
		0.6	0.20	0.21	0.16	0.16	0.13	0.14	0.12	0.13
		0.7	0.21	0.22	0.16	0.17	0.13	0.14	0.12	0.13
		0.9	0.21	0.23	0.16	0.17	0.14	0.14	0.12	0.13
	Platinum Beamshield Plus (grey)	0.4	0.16	0.17	0.13	0.13	0.11	0.11	0.10	0.10
		0.6	0.17	0.19	0.13	0.14	0.11	0.12	0.10	0.10
		0.7	0.18	0.19	0.13	0.14	0.11	0.12	0.10	0.11
		0.9	0.18	0.19	0.14	0.14	0.11	0.12	0.10	0.11
			300		325		400		450	
			A	B	A	B	A	B	A	B
225 x 155	Beamshield Plus (white)	0.4	0.18	0.20	0.16	0.18	0.13	0.14	0.12	0.12
		0.6	0.20	0.22	0.17	0.19	0.14	0.14	0.12	0.13
		0.7	0.20	0.22	0.18	0.19	0.14	0.15	0.12	0.13
		0.9	0.21	0.23	0.18	0.20	0.14	0.15	0.12	0.13
	Platinum Beamshield Plus (grey)	0.4	0.16	0.18	0.14	0.15	0.11	0.12	0.10	0.10
		0.6	0.17	0.19	0.15	0.16	0.12	0.12	0.10	0.11
		0.7	0.17	0.19	0.15	0.17	0.12	0.12	0.10	0.11
		0.9	0.18	0.20	0.16	0.17	0.12	0.13	0.10	0.11

(1) These calculations are in accordance with sections 7.1 and 7.2 of this Certificate and assume:
- the beam dimensions shown in section 1.4[3] and beam straightness is <5 mm.
- the beam λ is 2.0 W·m^{-1}·K^{-1} and 60 mm concrete screed λ is 1.15 W·m^{-1}·K^{-1}
- a 300 mm thick perimeter wall with a U value of 0.35 W·m^{-2}·K^{-1}
- underfloor ventilation area is 0.0015 m^{2}·m^{-1}
- ground conductivity is 1.5 W·m^{-1}·K^{-1}
- all other parameters are default values from BRE Report BR 443 : 2006.

(2) Configuration A — 100% single beams at full centres, and Configuration B — 75% single beams at full centres and 25% of any combination of single or double beams at full or half centres.

(3) The indicated U values will not be exceeded when the beam flange width is 92 mm.

Junction ψ (psi) values

7.4 Care must be taken in the overall design and construction of junctions between the floor and external, internal and party walls, to limit excessive heat loss and air infiltration.

7.5 The junction ψ (psi) values given in Table 8 of this Certificate may be used in SAP and sBEM calculations. Alternatively, values can be modelled in accordance with the requirements and guidance in BRE Report 497 : 2007, BRE Information paper IP 1/06 and the provisions in the documents supporting the national Building Regulations relating to competency to perform calculations, determine robustness of design/construction and limiting heat loss by air infiltration.

Table 8 Junction psi values

Junction	Ψ (psi) value ($W \cdot m^{-1} \cdot K^{-1}$)
External wall	0.32(1)
Party wall	0.16(1)

(1) Conservative default values from SAP Conventions Document.

8 Condensation risk

8.1 Floors will adequately limit the risk of interstitial condensation when designed and constructed in accordance with BS 5250 : 2011 and this Certificate.

Interstitial condensation

8.2 To help minimise the risk of condensation, the void space beneath the lowest point of the floor construction should be at least 150 mm high, with provision for adequate through-ventilation in the form of ventilation openings provided in two opposing external walls. The ventilation openings should be sized at not less than 1500 mm^2 per metre run of external wall or 500 mm^2 per square metre of floor area, whichever is the greater. Where pipes are used to carry ventilating air, these should be at least 100 mm in diameter.

8.3 To minimise the risk of interstitial condensation at junctions with external walls, specifiers should ensure that wall insulation extends to at least 150 mm below the top of the EPS blocks.

Surface condensation

8.4 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 $W \cdot m^{-2} \cdot K^{-1}$ at any point and the junctions with walls are in accordance with the relevant requirements of *Limiting thermal bridging and air leakage : Robust construction details for dwellings and similar buildings* TSO 2002 or BRE Information Paper IP 1/06.

8.5 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2} \cdot K^{-1}$ at any point and when designed and constructed to BS 5250 : 2011. Additional guidance can be found in BRE Report BR 262 : 2002.

8.6 To minimise the risk of condensation at service penetrations, care should be taken to minimise gaps in the insulation layer, for example by filling with expanding foam insulation.

9 Maintenance

The system components are installed within the floor structure and, therefore, do not require maintenance.

10 Durability

10.1 The EPS blocks are protected in service from agents liable to cause deterioration and will be effective as insulation for the life of the building in which they are installed.

10.2 The exposure condition beneath a suspended ground floor over a ventilated void and soil is class XC3, in accordance with BS EN 1992-1-1 : 2004. The concrete beam will have adequate durability for this exposure condition.

10.3 The durability of concrete topping reinforced with polymer fibres will be at least equivalent to that of plain concrete of the same grade.

10.4 The concrete topping reinforced with steel mesh will have adequate durability for exposure class XC1.

11 Reuse and recyclability

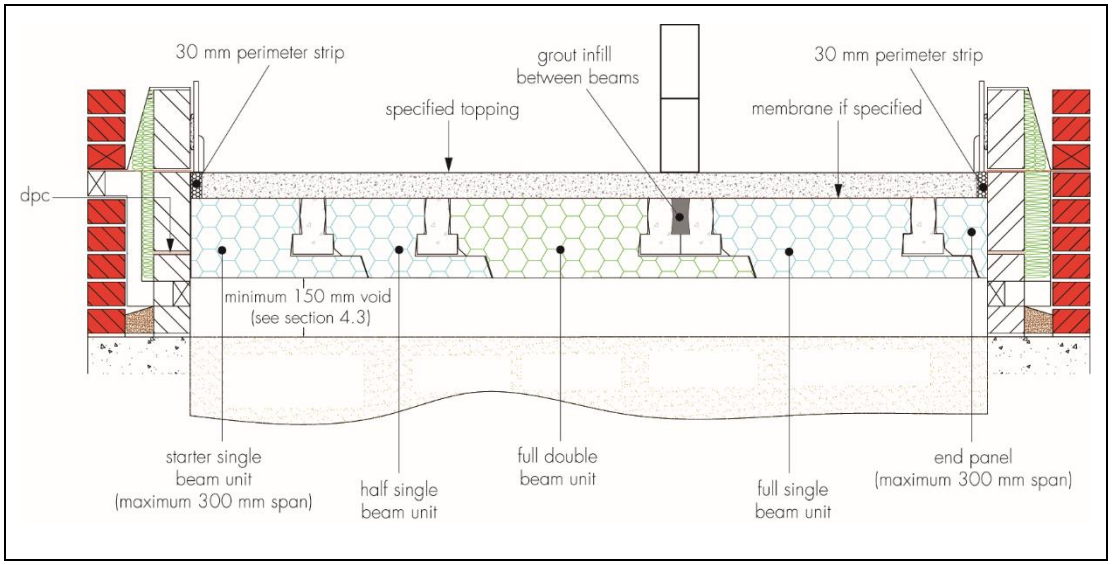
EPS material can be recycled if free from debris and contamination. The concrete and reinforcement steel can also be recycled.

Installation

12 General

Details of typical precast concrete beams and EPS block assemblies using Springvale Beamshield Plus and Platinum Beamshield Plus — EPS Blocks are shown in Figure 4.

Figure 4 Example beam and EPS block assemblies



13 Site preparation

13.1 Where clay soil of low-, medium- or high-volume change potential exists, the final minimum void depth should be increased appropriately to prevent problems associated with heave. With good natural drainage or where site drains are provided to prevent water collecting and standing, the ground level beneath the floor does not need to be raised to the external ground level.

13.2 The ground beneath the floor should be free of topsoil and vegetation. Oversite concrete or other surface seal is not required, but material added to bring the solum to an even surface must be hard and dry.

13.3 Damp-proofing and ventilation arrangements must be in accordance with normal good practice (for example, by the provision of damp-proof sleeves to ventilators and adequate drainage of the sub-floor).

13.4 A continuous damp-proof course should be laid along the support wall below the floor in accordance with BS 8102 : 2009.

13.5 Precast concrete beams must be laid out in accordance with the relevant drawings.

14 Procedure

14.1 Normal precautions for handling EPS materials should be taken to avoid damaging the blocks during offloading, storage, handling and installation. Any damaged blocks must be replaced before pouring the concrete.

14.2 Starter blocks are attached to the first beam. The beams and blocks are then positioned tightly against the wall. The beams are laid in the positions shown on the floor plan and each beam is manually ‘tightened’ up against the EPS blocks as each run of blocks is installed.

14.3 Where a block length has to be cut down to accommodate varying beam lengths, it should be located at the edge of the floor and extra care must be taken to avoid damage and foot traffic. Blocks should not be cut to a less than 300 mm long.

14.4 The EPS blocks are cut as appropriate to accommodate service penetrations, eg soil vent pipes, and the resulting gaps filled with expanding foam or other insulation to minimise local cold bridging and air infiltration.

14.5 Full and half blocks and subsequent beams are laid in the same manner as per the relevant drawing.

14.6 It is essential that the correct EPS blocks are used with the single and multiple beams to ensure that the vertical gap between an EPS block toe and the adjacent EPS block does not exceed 6 mm so that cold air does not by-pass the insulation and significantly reduce the thermal performance of the floor.

14.7 Prefabricated EPS end blocks (see Figure 1) can be supplied by the Certificate holder, or alternatively they can cut on site from a full or half block. The end block must not be more than 300 mm wide at the top.

14.8 Should any other cutting be required, the advice of the Certificate holder should be sought.

14.9 Closure blocks, coursing blocks and, if applicable, gas membranes should be installed in accordance with good practice.

14.10 Although they can withstand light foot traffic (see section 6.3), care should still be taken not to walk unnecessarily over the installed EPS blocks. If a temporary working platform is required, the blocks should be covered with a suitably rigid board. To avoid damage to the blocks, the structural concrete topping should be laid as soon as possible after the blocks have been installed.

14.11 Before pouring the structural concrete topping, it must be ensured that the blocks are centrally located between the beams, with a maximum gap of 5 mm between the polystyrene and beam face. These gaps may be due to normal construction or manufacturing tolerances.

14.12 Where greater gaps occur, concrete is placed along the edges of the polystyrene units to prevent displacement during the main concreting operation.

14.13 When using a concrete pump, truck or skip, concrete should not be discharged onto the polystyrene units from heights greater than 300 mm and concrete heaps must not be formed over 150 mm high.

14.14 When wheelbarrows are used, planks must be placed to spread the wheel load to the precast concrete beams. Spot boards must be used when tipping and shovelling.

14.15 The structural concrete topping is placed and compacted. Provision should be made for a suitable concrete finish to be achieved, preferably without standing on the blocks eg by the use of a self-compacting concrete topping.

Technical Investigations

15 Tests

15.1 A series of full scale tests were carried out to ensure the compatibility of the concrete topping with the maximum deflection of the concrete beams under service and ultimate loads. The tests were designed to create the maximum curvature of the beam using the macro/micro polymer fibre- and steel mesh-reinforced concrete toppings.

15.2 An evaluation was made of data to determine:

- resistance to construction loads
- practicability of installation
- thermal conductivity (λ_D *values*)
- dimensional accuracy
- durability
- fire risk.

16 Investigations

16.1 Floor deck U values, example floor U values and the risk of condensation were derived by calculation and modelling.

16.2 The manufacturing processes for the EPS blocks were evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

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BS 8500-1 : 2015 + A1 : 2016 *Concrete — Complementary British Standard to BS EN 206-1 — Method of specifying and guidance for the specifier*
BS 8500-2 : 2015 + A1 : 2016 *Concrete — Complementary British Standard to BS EN 206-1 — Specification for constituent materials and concrete*

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