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Agrément Certificate

20/5775

Product Sheet 1

CREAGH CONCRETE

RAPIDRES

This Agrément Certificate Product Sheet⁽¹⁾ relates to Rapidres, an insulated precast concrete sandwich wall system. It is suitable for use as a load-bearing external wall in multi-storey residential and commercial buildings, subject to height restrictions.

(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 — walls constructed using the system, when designed in accordance with the appropriate standards, will have adequate strength and stability (see section 6).

Thermal performance — The system can contribute to a wall construction satisfying national Building Regulations (see section 7).

Condensation risk — walls constructed using the system can help minimise the risk of interstitial and surface condensation (see section 8).

Behaviour in relation to fire — the system can achieve a class A1 reaction to fire classification and has adequate resistance to fire and therefore can be used without height restriction. The use of some insulation components may be restricted (see section 9).

Weathertightness — walls constructed using the system can provide protection against rain and wind ingress (see section 11).

Durability — walls constructed from the system will have a design life of not less than 60 years (see section 15).

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 First issue: 1 July 2020

Hardy Giesler
Chief Executive Officer



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
Readers **MUST** check the validity and latest issue number 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 should not be relied upon.

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Regulations

In the opinion of the BBA, Rapidres, 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 permanent and imposed actions to the structural frame, supporting element or foundations. See section 6 of this Certificate.
Requirement:	A3	Disproportionate collapse
Comment:		The system has adequate strength to prevent disproportionate collapse. See section 6 of this Certificate.
Requirement:	B3(1)(2)(3)	Internal fire spread (structure)
Requirement:	B4(1)	External fire spread
Comment:		Walls formed using the system can satisfy these Requirements. See section 9 of this Certificate.
Requirement:	C2(a)	Resistance to moisture
Comment:		Walls formed using the system can adequately limit the risk of surface and interstitial condensation. See sections 8.1 and 8.2 of this Certificate.
Requirement:	C2(b)	Resistance to moisture
Comment:		The system can adequately limit the risk of moisture penetration from precipitation and wind-driven rain. See sections 11.1 to 11.3 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The system can contribute to a construction satisfying this Requirement. See section 7 of this Certificate.
Regulation:	7(1)	Materials and workmanship
Comment:		The system is acceptable. See section 15 and the <i>Installation</i> part of this Certificate.
Regulation:	7(2)	Materials and workmanship
Comment:		The system incorporating mineral wool or cellular glass insulation is not restricted by this Regulation. The system incorporating PIR insulation is restricted by this Regulation. See sections 9.1 to 9.3 of this Certificate.
Regulation:	26	CO₂ 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 energy efficiency rates for new dwellings (applicable to Wales only)
Comment:		The system can contribute to satisfying these Regulations. See section 7 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Durability, workmanship and fitness of materials
Comment:		The system can contribute to a construction satisfying this Regulation. See sections 14 and 15 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1	Structure

Comment:		The system can sustain and transmit permanent and imposed actions to the structural frame, supporting element or foundations. See section 6 of this Certificate.
Standard:	1.2	Disproportionate collapse
Comment:		The system has adequate strength to prevent disproportionate collapse. See section 6 of this Certificate.
Standard:	2.4	Cavities
Comment:		To limit the risk of fire spread, detailing should address the need for sealing cavities in fire-resistant materials at junctions and edges of openings. Fire barriers should completely seal the cavity, with reference to clauses 2.4.1 ⁽¹⁾⁽²⁾ , 2.4.2 ⁽¹⁾⁽²⁾ , 2.4.4 ⁽¹⁾⁽²⁾ to 2.4.7 ⁽¹⁾⁽²⁾ , 2.4.8 ⁽²⁾ and 2.4.9 ⁽²⁾ . See sections 9.1 to 9.4 of this Certificate.
Standard:	2.5	Internal linings
Comment:		The system can satisfy the reaction to fire required by this Standard, with reference to clause 2.5.1 ⁽¹⁾⁽²⁾ , provided the system is used in conjunction with suitable coatings or materials. See sections 9.1 to 9.3 of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		The system is regarded as 'low risk' and therefore can satisfy this Standard, with reference to clauses 2.6.4 ⁽¹⁾⁽²⁾ , 2.6.5 ⁽²⁾ and 2.6.6 ⁽²⁾ . See section 9 of this Certificate.
Standard:	2.7	Spread on external walls
Comment:		The system can satisfy the requirements of this Standard, with reference to clauses 2.7.1 ⁽¹⁾⁽²⁾ and 2.7.2 ⁽²⁾ . See section 9 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The system will contribute to a construction satisfying this Standard depending on the application, with reference to clauses 3.10.1 ⁽¹⁾⁽²⁾ and 3.10.6 ⁽¹⁾⁽²⁾ . See sections 11.1 to 11.3 of this Certificate
Standard:	3.15	Condensation
Comment:		The system can adequately limit the risk of surface and interstitial condensation to this Standard, with reference to clauses 3.15.1 ⁽¹⁾ to 3.15.4 ⁽¹⁾ . See sections 8.1 and 8.2 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The system can contribute to enabling a building to satisfy these Standards, with reference to clauses 6.1.1 ⁽¹⁾⁽²⁾ , 6.1.4 ⁽¹⁾ , 6.1.5 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾⁽²⁾ and 6.2.5 ⁽²⁾ . See section 7 of this Certificate.
Standard:	7.1(a)	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.
Regulation:	12	Building standards applicable to conversions
Comment:		Comments in relation to the system under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .
		(1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



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

Regulation:	23	Fitness of materials and workmanship
Comment:		The system is acceptable. See section 15 and the <i>Installation</i> part of this Certificate.
Regulation:	28(b)	Resistance to moisture and weather

Comment:		Walls formed using the system can adequately resist the ingress of rain. See sections 11.1 to 11.3 of this Certificate.
Regulation:	29	Condensation
Comment:		Walls formed using the system can adequately limit the risk of interstitial condensation. See section 8.2 of this Certificate.
Regulation:	30	Stability
Comment:		The system can sustain and transmit permanent and imposed actions to the structural frame, supporting element or foundations. See section 6 of this Certificate.
Regulation:	31	Disproportionate collapse
Comment:		The system has adequate strength to prevent disproportionate collapse. See section 6 of this Certificate.
Regulation:	34	Internal fire spread – linings
Regulation:	35	Internal fire spread – structure
Regulation:	36	External fire spread
Comment:		The system can satisfy or contribute to satisfying these Regulations. See section 9 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emissions rate
Comment:		The system can contribute to enabling a wall to satisfy these Regulations. See section 7 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 sections: 3 *Delivery and site handling* (3.1, 3.2 and 3.4), 14 *Maintenance and repair* (14.2), 17 *General* (17.2 and 17.3) and 18 *Procedures* of this Certificate.

Additional Information

CE marking

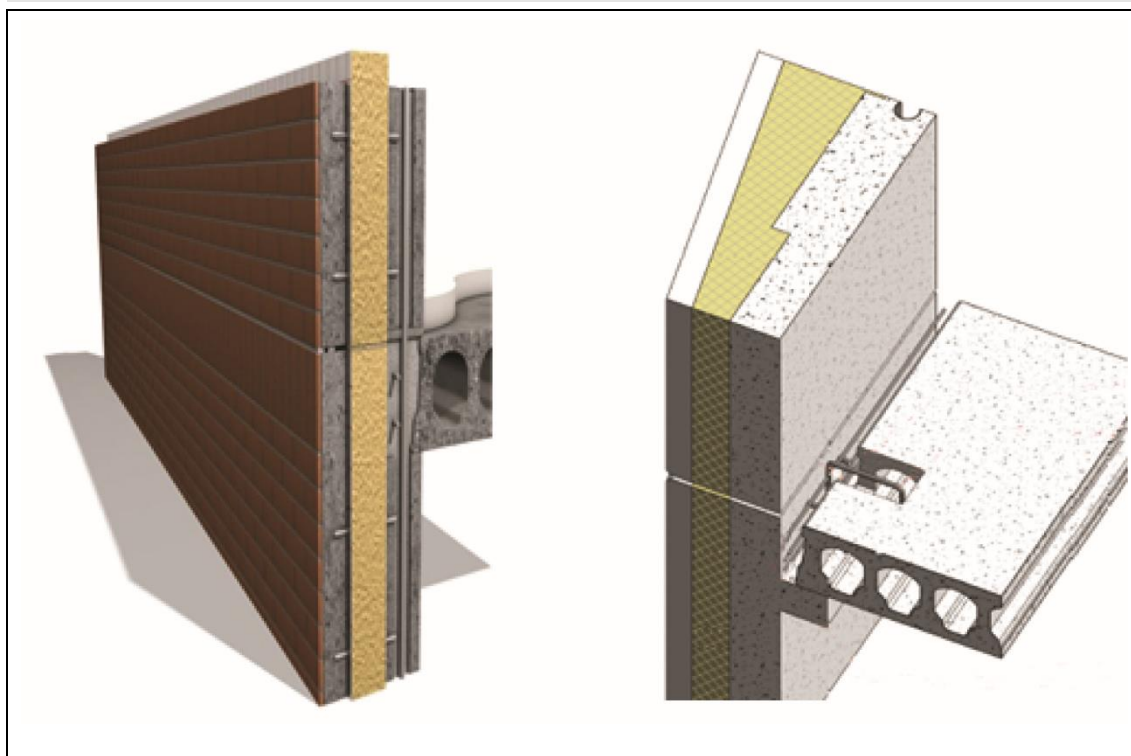
The Certificate holder has taken the responsibility of CE marking the system in accordance with harmonised European Standard BS EN 14992 : 2007.

Technical Specification

1 Description

1.1 Rapidres precast concrete sandwich walls are manufactured from precast concrete, reinforcing steel, insulation and glass-reinforced polymer connector pins, with an external finish, as shown in Figure 1, below.

Figure 1 Typical Rapidres wall section



1.2 Rapidres precast wall elements contain an inner and outer precast concrete panel joined by structural connector pins through the insulation layer. Inner panels are typically 150 to 200 mm thick. Outer panels are typically 80 to 120 mm thick. The overall dimension of the element is typically limited by transport and craneage considerations, up to a maximum of 13 metres long by 4.5 metres high. The concrete specification is given in Table 1.

Table 1 Specification of concrete and reinforcement

Description		Characteristic
Concrete	Strength class	C40/50 to BS EN 206 : 2013
	Minimum cement content	Minimum 360 kg.m ⁻³ in accordance with Table 6 of BS 8500-2 : 2015
	Cement and combination types	Appropriate cement and combination type must be selected for the following exposure classes: <ul style="list-style-type: none"> For exposure class XS1 from Table A.4 of BS 8500-1 : 2015 For exposure class XC3/4 from Table A.5 of BS 8500-1 : 2015
	Maximum w/c ratio	According to Table A.12 of BS 8500-1 : 2015, to suit the XS, XC and DC-Class
	Aggregate	Maximum aggregate size must be 10 mm; aggregate must comply with BS EN 12620 : 2002 Susceptible porous aggregate must not to be used in the concrete
	Admixture / super-plasticiser Pigment	As per manufacturer's instructions and BS EN 934-2 : 2009 Air-entraining admixture compatible with concrete composition must be used
	Minimum concrete cover to reinforcement	30 mm for exposure classes XC3, XC4 and XF1 45 mm for exposure class XS1 (external reinforced and prestressed concrete surfaces in coastal areas)
	Reaction to fire	Euroclass A1
	Finishes	Clay brick slips (to BS EN 771-1 : 2011, F2 classification) Smooth/polished concrete surface Etched / sandblasted concrete surface Exposed aggregate
Steel reinforcement		Steel reinforcement to BS 4449 : 2005 with a characteristic yield strength (f_{yk}) of 500 N·mm ⁻² and cut to BS 8666 : 2005
		Steel mesh to BS 4483 : 2005, with a characteristic yield strength (f_{yk}) of 500 N·mm ⁻² For diameters ≤ 12 mm, Grade B500A, Grade B500B or Grade B500C conforming to BS 4449 : 2005 must be used For diameters >12 mm, Grade B500B or Grade B500C conforming to BS 4449 : 2005 must be used

1.3 The outer concrete panel is finished to the building designer's specification. Available finishes include polished or etched concrete, exposed aggregate and clay brick slips (see Figure 2).

Figure 2 Outer leaf finishes



Brick faced sandwich panel with fair faced concrete finish



Creagh Aspen – Acid etched recon concrete finish






Brick faced sandwich panel with fair faced recon concrete finish



Creagh Porcelain Mix – Acid etched

1.4 The two concrete panels are joined by integral Thermomass connector pins, with the specification shown in Table 2, below.

Table 2 Specifications of Thermomass pins

Type	MC	Star	X-Series
Material	Glass-reinforced polymer (GRP)		
Tensile strength (design, per pin) (kN)	3.15	10.65	Not used, use MC or Star for tensile resistance
Shear strength (design, per pin) (kN)	0.85 (x-dir) 0.67 (y-dir)	8.5 to 8.9	25.0
Length (mm)	142 to 280	160 to 280	306 to 564
Section size- effective (mm)	10 x 5.7	Φ12	–
Minimum embedment (mm)	50	50	50
			

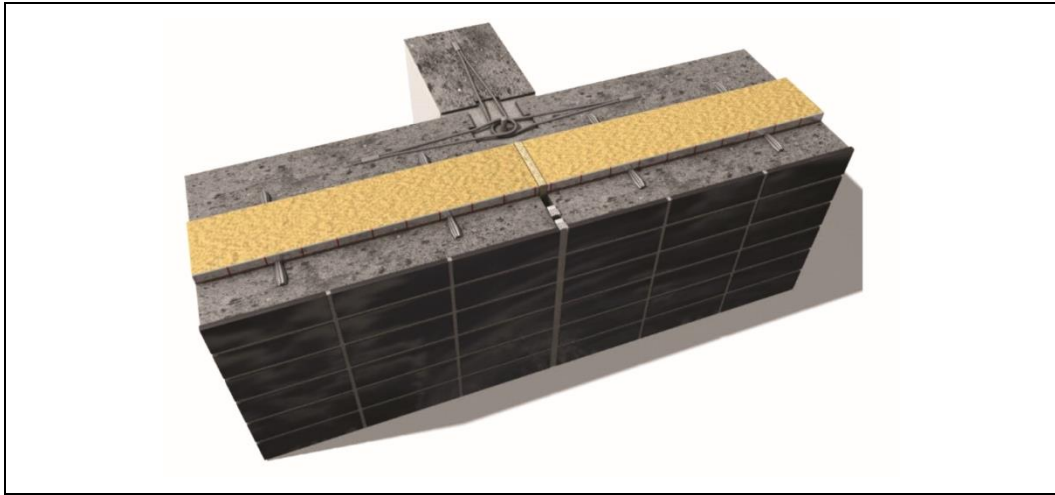
1.5 Rapidres walls are available with three insulation types, with the characteristics shown in Table 3. The insulation may be used in multiple layers (of the same type) to provide a total thickness up to 350 mm.

Table 3 Characteristics of insulation

Characteristic	PIR	Cellular glass	Mineral wool
Material	BS EN 13165	BS EN 13167	BS EN 13162
Standard	BS EN 13165	BS EN 13167	BS EN 13162
$\lambda_{90/90}$	0.022	0.038	0.038
Thickness (mm)	70 to 150	50 to 180	100, 120, 145 and 180
Facing	Tri-laminate foil	–	Glass tissue
Reaction to fire classification	F	A1	A1

1.6 Joints between horizontally adjacent wall elements are formed by wire-loop boxes, which are cast into the sides of the inner concrete panel. These are joined on site by steel dowels and the joint is sealed by structural grout, as shown in Figure 3. The wire loops are galvanized high-tensile steel with steel ferrule collars, set into galvanized steel profile casings, which are cast into the inner concrete leaves.

Figure 3 Wire loop box joint (3-way)



1.7 Ancillary items used in conjunction with the Rapidres wall elements but outside the scope of this Certificate:

- Structural grout – high-strength grout for filling voids, sealing connections
- Structural bedding mortar – providing a bedding surface for base elements
- Mastic-modified polymer sealant and backing rod – for sealing between the outer leaves of adjacent panels
- Lifting eyes – removable lifting attachments for handling the wall elements, removed after erection
- Temporary props – for maintaining stability and alignment during construction
- Dowels, pins and shims for aligning, levelling and joining the precast elements on-site
- Vapour control layer, with third party approval

2 Manufacture

2.1 The elements are manufactured from concrete, steel, insulation and polymer pins using conventional concrete casting techniques. The production, casting, curing and testing of concrete conforms to the requirements of BS EN 206 : 2013.

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 Creagh Concrete Products Limited has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by the BM TRADA (Certificate 3312).

3 Delivery and site handling

3.1 The precast elements are delivered to site on trucks, ready for lifting into place. Each element is marked with the mass of the element. The elements must be handled by crane using the cast-in lifting points.

3.2 Prior to delivery, the Certificate holder will prepare a lift plan and method statement for the erection of the wall elements, including the provision for temporary propping, if required.

3.3 When handling the elements, care must be taken to avoid scratching or damaging the surface or edges, in particular the external surface.

3.4 All works at height must be carried out using Mobile Elevating Work Platforms (MEWPs). A harness must be worn at all times as per health and safety regulations.

Assessment and Technical Investigations

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

Design Considerations

4 General

4.1 Rapidres is satisfactory for use as the external wall of multi-storey buildings where the walls are designed to resist the permanent and imposed actions. Rapidres elements are individually designed and manufactured according to geometric, structural and architectural requirements.

4.2 Rapidres is formed of two precast concrete wall leaves joined together by Thermomass pins and separated by insulation. The inner concrete leaf provides the structural strength and stability of the system and is load-bearing. The outer concrete leaf is non-load bearing and resists only its self-weight and imposed wind actions and transmits them back to the inner leaf via the Thermomass pins.

4.3 The Certificate holder undertakes a site-specific design of the system, including consideration of:

- adequate foundations for the system
- bearing of floors, roofs and staircases onto the inner concrete leaf
- eccentricity of vertical loading including construction tolerances for alignment and plumb
- the imposed wind action on the structure and individual elements
- lateral stability of the structure
- measures to mitigate the risk of accidental loading and disproportionate collapse, according to the building consequence classification
- stability of the structure in the temporary condition
- selection of the appropriate insulation type to meet the requirements of the national Building Regulations in relation to reaction to fire classification (see sections 1.5 and 9)

4.4 Temporary support, if required, must be adequate to resist the loads during installation and wind actions, and should be specified by a suitability qualified and experienced engineer. Props must not be removed until the bedding mortar and grouts have achieved their design strength.

5 Practicability of installation

The system should only be installed by installers who have been trained and approved by the Certificate holder.

6 Structural resistance



6.1 Walls formed using the system must be designed in accordance with the relevant parts of BS EN 1990 : 2002, BS EN 1991-1-1 : 2002, BS EN 1991-1-3 : 2003, BS EN 1991-1-4 : 2005, BS EN 1991-1-7 : 2006, BS EN 1992-1-1 : 2004 and BS EN 1992-1-2 : 2004 and their UK national annexes. The Certificate holder's design department provides structural solutions and determines the adequacy of the system design.

6.2 The BBA has assessed as satisfactory sample detailed designs and the design methodology of the Certificate holder, including that of a 23 storey building.

6.3 The inner concrete leaf provides the structural resistance and transmits loads to the element below or to a structural frame. Grouted dowels, placed into cast-in sleeves, provide continuity of reinforcement across vertical joints. Grouted wire loop boxes join and transfer loads between horizontally adjacent elements.

6.4 The outer concrete leaf is non-loadbearing and transmits its self-weight and wind actions to the inner leaf, which must be designed to resist these actions. Care should be taken to avoid details that may provide an unintended load path through the outer leaf (for example, by the omission of movement joints or poor site practice leading to material being left in joints). Loads are transferred to the inner leaf via Thermomass connectors, which must be designed and detailed accordingly. The Certificate holder determines the requirements for the number and spacing of the connectors according to the tensile and shear forces within the element.

6.5 Floors, staircases and roofs may bear on the inner concrete leaf, which must be designed accordingly. The bearing width must be the minimum of that required by the floor or roof element, or 65 mm, whichever is the greater. Due consideration must be given to provision of appropriate horizontal and vertical ties to provide lateral restraint and prevent disproportionate collapse. The strength of all connection details which tie walls constructed from the elements to other structural elements (such as other walls, foundations, floors, roofs, columns and shafts) must be evaluated and provide adequate stability for the overall building design.

6.6 For lifting the precast elements from the mould, for transportation and for installation into the building, appropriate anchors to resist the axial, angled, bending and shear loads during lifting must be used. An appropriate dynamic factor in respect of crane types, speed of lifting and location of sites and demoulding adhesion to formwork must be taken into account.

6.7 The size and number of the anchors required for axial and angled loads must be specified according to the weight of the elements. The manufacturer's specifications for any additional local reinforcement steel (grade B500 – refer to Table 1 of this Certificate) must also be met to provide sufficient pull-out resistance, paying particular attention to additional requirements where the lifting chains are angled greater than 15° from the vertical.

Disproportionate collapse

6.8 The system is satisfactory for use in buildings of consequence class 1, 2a, 2b and 3, subject to design by the Certificate holder.

6.9 Precast floor elements can be adequately tied to the elements using prestressing wire, in accordance with the requirements of BS EN 1991-1-7 : 2006. Alternatively, floors may be cast in place by incorporating steel starter or U-bars, placed and grouted into sleeves or voids in the precast elements. Continuity of reinforcement across wall-floor junctions and between adjacent elements must be provided.

6.10 The wire loop boxes have adequate strength to suspend and restrain a wall element and prevent disproportionate collapse if the below element is (notionally) removed. Surrounding elements must be designed to provide an adequate alternative load path.

7 Thermal performance



7.1 Calculations of the thermal transmittance (U value) of walls should be carried out in accordance with BS EN ISO 6946 : 2017, BRE Digest 465 : 2002 and BRE Report BR 443 : 2006.

7.2 The U-value of a complete wall will depend on the selected element and construction, insulation type and thickness, as well as the internal and external finishes. Example U-values for the system are detailed in Table 4.

Table 4 Example U-values

Element description	U-value ⁽¹⁾ (W.m ⁻² .K ⁻¹)
150 mm concrete inner leaf 70 mm PIR insulation 80 mm concrete outer leaf	0.31
150 mm concrete inner leaf 130 mm PIR insulation 80 mm concrete outer leaf	0.18
150 mm concrete inner leaf 110 mm cellular glass insulation 80 mm concrete outer leaf	0.32
150 mm concrete inner leaf 180 mm cellular glass insulation 80 mm concrete outer leaf	0.20

(1) U-value corrections: Thermomass pins – 5 per with square metre with 160.6 mm² cross-sectional area.

7.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

8 Condensation risk



8.1 Provided the system is installed correctly and follows the recommendations in section 11 of this Certificate, the risk of surface and interstitial condensation under normal domestic use will be minimal. Should a condensation risk analysis indicate the likelihood of interstitial condensation, an appropriate vapour control layer must be incorporated in the construction.



8.2 Walls will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and G.

8.3 The risk of interstitial condensation is greatest when the building is drying out after construction. Guidance on preventing condensation is given in BRE Digest 369 and BRE Report BR 262 : 2002.

9 Behaviour in relation to fire

Reaction to fire



9.1 The internal and external concrete leaves, steel reinforcement and clay brick slips have a reaction to fire classification of A1, in accordance with BS EN 13501-1 : 2018, and are not restricted in terms of building height or proximity to boundaries.

9.2 The cellular glass and mineral wool insulations have a reaction to fire classification of A1, in accordance with BS EN 13501-1 : 2018, and are not restricted in terms of building height or proximity to boundaries.

9.3 The PIR insulation has a reaction to fire classification of F, in accordance with BS EN 13501-1 : 2007, and may only be used on buildings with a storey height not more than 18 metres above ground level.

9.4 Building designers must take into consideration calculation of unprotected area.

Resistance to fire

9.5 When tested in accordance with BS EN 1363-1 : 2012 and BS EN 1364-1 : 2015, or BS 476-20 : 1987 and BS 476-21 : 1987, the wall elements achieved the classification given in Table 5, below.

Table 5 Fire resistance performance

Performance	Test method	Report Number	Construction
EI60	BS EN 1363-1 : 2012 and BS EN 1364-1 : 2015	EUI-19-B-000104	From the exposed face out: 80 mm concrete 200 mm cellular glass insulation 160 mm concrete (1200 x 1200 mm opening in specimen)
REI60	BS 476-20 : 1987 and BS 476-21 : 1987	EUI-19-B-0001	From the exposed face out: 80 mm concrete 50 mm PIR insulation 180 mm concrete 20 mm gap between adjacent elements filled with structural grout on exposed side Load: 11.9 kN per metre on exposed face

9.6 The fire resistance of constructions other than those described in Table 5 should be established by testing in accordance with BS EN 1363-1 : 2012, BS EN 1364-1 : 2015 and BS EN 1365-1 : 2012.

9.7 The fire resistance of the inner (load-bearing) leaf may be established by design in accordance with BS EN 1992-1-2 : 2004 and its UK National Annex. The appropriate element thickness and cover to reinforcement must be in accordance with Table 5.4 of this Standard.

9.8 The requirements of the national Building Regulations in respect of fire stopping around junctions, service penetrations and openings must be met using an appropriate detail.

10 Proximity of flues and appliances

When certain flue pipes and/or heat-producing appliances are installed in close proximity to the system, the relevant provisions of the national Building Regulations must be met.

11 Weathertightness



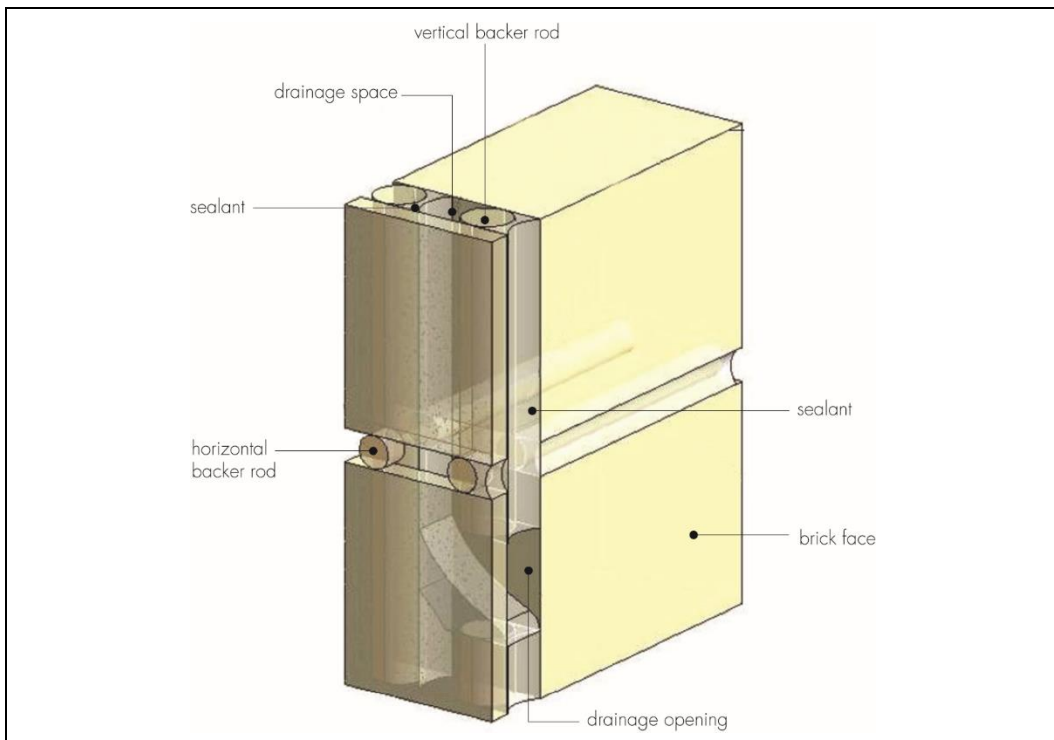
11.1 The horizontal and vertical joints between the elements must be sealed to ensure water is not able to enter the insulation layer by wind-driven rain.

11.2 Joints should be sealed with double layers of mastic sealant and polyethylene backing rods. Provision should be made at the base of elements for drainage of the area formed between the two layers of sealant. The Certificate holder can provide specific advice on correct detailing on a project-specific basis. A typical detail is shown in Figure 4.

11.3 Field tests for water penetration in accordance with CWCT (Centre for Window and Cladding Technology) methods indicate that the elements and joints have satisfactory resistance to water penetration.

11.4 The performance of windows and doors is outside the scope of this Certificate.

Figure 4 Sealant and drainage detail



12 Airtightness

12.1 Buildings can achieve adequate resistance to heat loss by air infiltration provided there is effective sealing around junctions between elements during site assembly.

12.2 In England, Wales and Northern Ireland, completed buildings are subject to pre-completion testing for airtightness in accordance with the requirements of:

England and Wales – Approved Document L1A (section 43) L2A (section 20B)

Northern Ireland – Technical Booklet F1 (Sections 2.59 to 2.69) and F2 (Sections 2.72 to 2.77).

12.3 In Scotland, completed dwellings are subject to testing air permeability in accordance with the requirements of Mandatory Standards 6.2 (clause 6.2.5). Alternatively, where a default design value of $15 \text{ m}^3 \cdot \text{h}^{-1} \cdot \text{m}^{-2}$ at 50 Pa is stated in demonstrating compliance under Mandatory Standards 6.1, testing is not required.

13 Sound insulation

13.1 Test results from in-situ testing conducted on a range of wall arrangements, for airborne sound insulation in accordance with BS EN ISO 140-4 : 1998, are given in Table 6.

13.2 Separating walls are subject to pre-completion testing in accordance with the documents supporting the national Building Regulations.

13.3 Good working practices should be adopted for sealing all joints. Relevant practices detailed within Robust Details, Part E *Resistance to the passage of sound* should be adopted.

Table 6 Airborne sound insulation (dB) – field test results

Construction	Decibel rating (dB) $D_{nT,w}$
160 mm thick Rapidres inner concrete leaf 250 mm precast hollowcore concrete floor planks 180 mm internal / cross walls	56

14 Maintenance and repair



14.1 Although maintenance is not envisaged for the elements, regular checks should be carried out on the finishes and seals to ensure that any damage is detected and repaired as soon as possible.

14.2 Checks should be carried out periodically to ensure that drainage pathways remain clear and seals remain intact.

14.3 Damaged seals must be repaired or replaced as soon as is practicable, in accordance with the Certificate holder's instructions and observing all necessary health and safety regulations.

15 Durability



15.1 Concrete walls constructed with the system will have a design life of not less than 60 years provided they are designed in accordance with section 6 of this Certificate.

15.2 Clay brick slips of classification F2 in accordance with BS EN 771-1 : 2011 will have adequate durability for a design life of not less than 60 years.

15.3 Mastic joints will have a service life of not less than 20 years.

16 Reuse and recyclability

The system contains concrete and steel, which can be recycled.

Installation

17 General

17.1 A pre-installation survey of the site must be carried out to determine suitability for installation, before installation of the elements. A specification is prepared for each elevation of the building indicating:

- detailing of fastening each element to the structure and/or adjacent element
- detailing around windows and doors, and at ground and roof level
- damp-proof course (dpc)
- exact position of movement joints, if required
- sealing between elements
- any provision for external plumbing, flues etc, where required.

17.2 Safe and adequate access around the working area must be provided for installation of the concrete elements. During delivery, erection and fixing of the elements, extra care must be taken to avoid marking and/or damaging the elements.

17.3 All works at height to be carried out using a Mobile Elevator Working Platform (MEWP). Appropriate Personal Protective Equipment (PPE) must be worn at all times as per the Certificate holder's risk assessment and method statement.

17.4 For typical assemblies of the elements at the base and typical details for fixing the elements to the structure and the floor, see Figures 5 to 9 of this Certificate.

Figure 5 Typical precast element assembly at the base

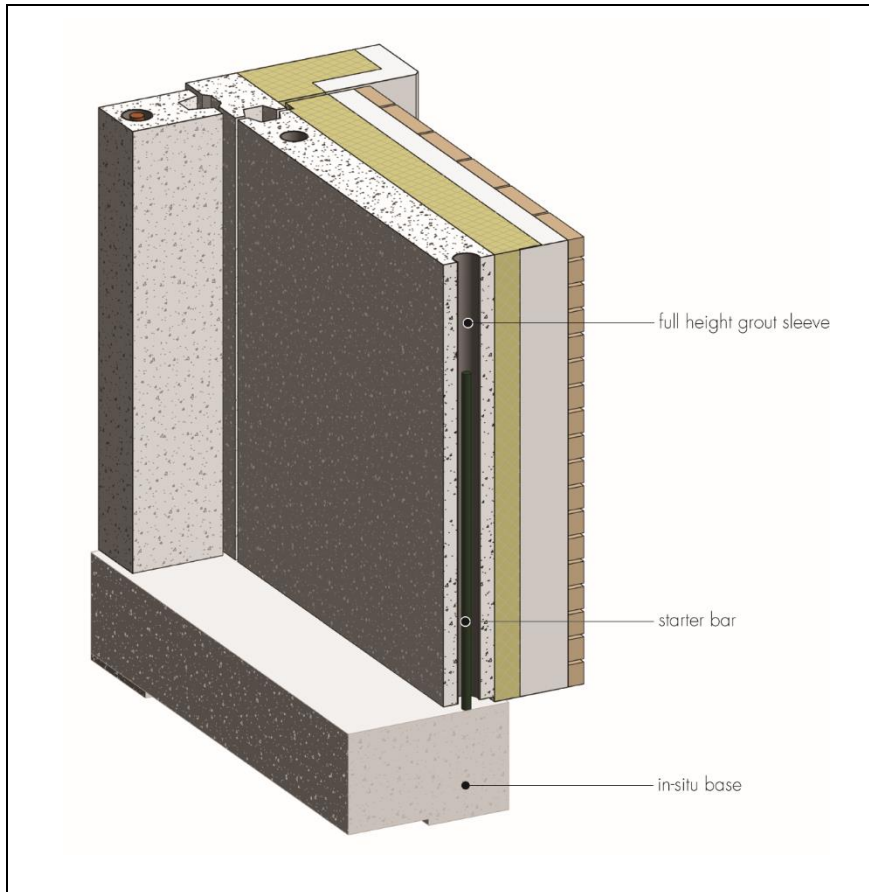


Figure 6 Connection to in-situ concrete

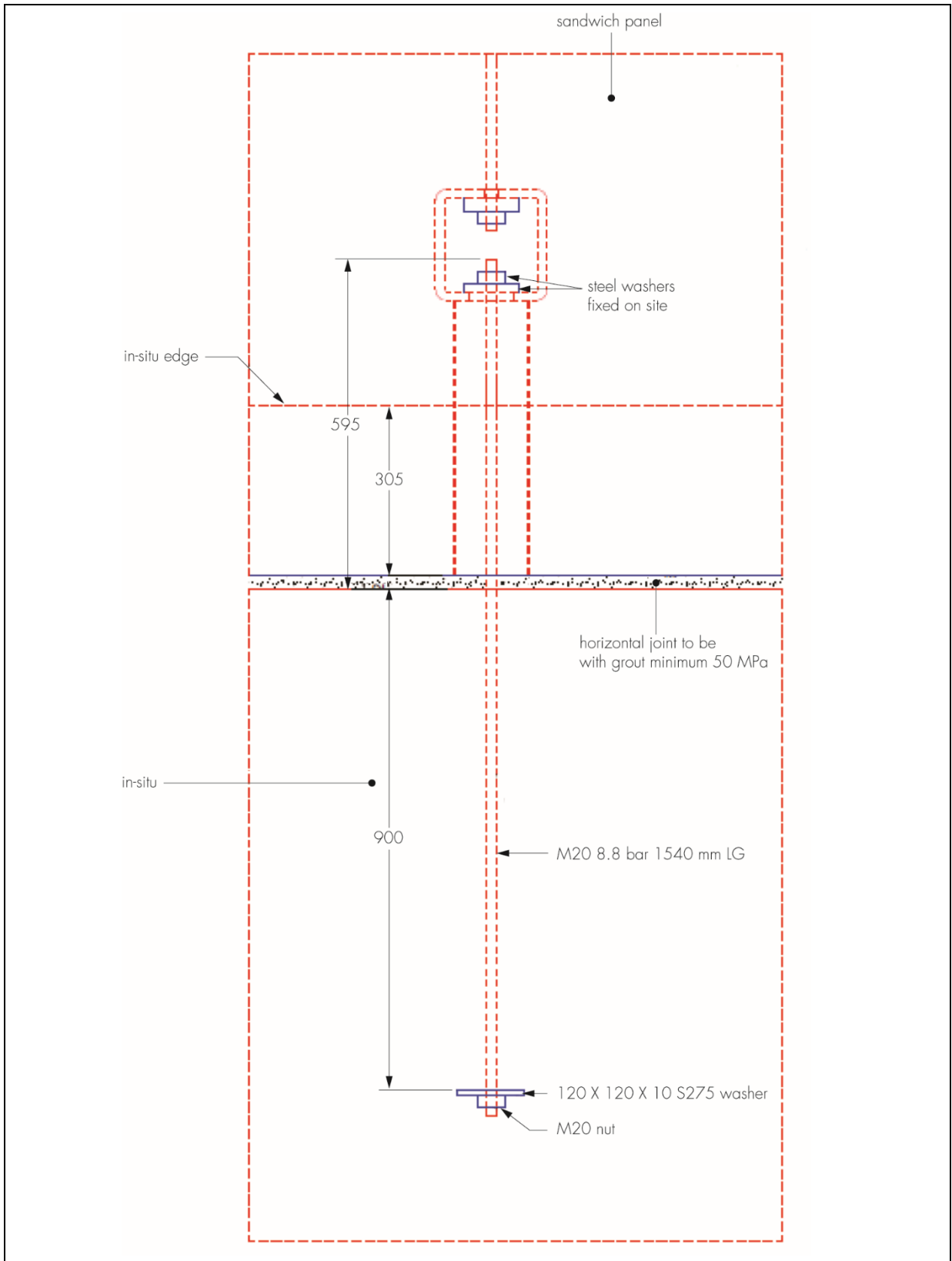


Figure 7 Typical precast element assembly at intermediate (precast) floor

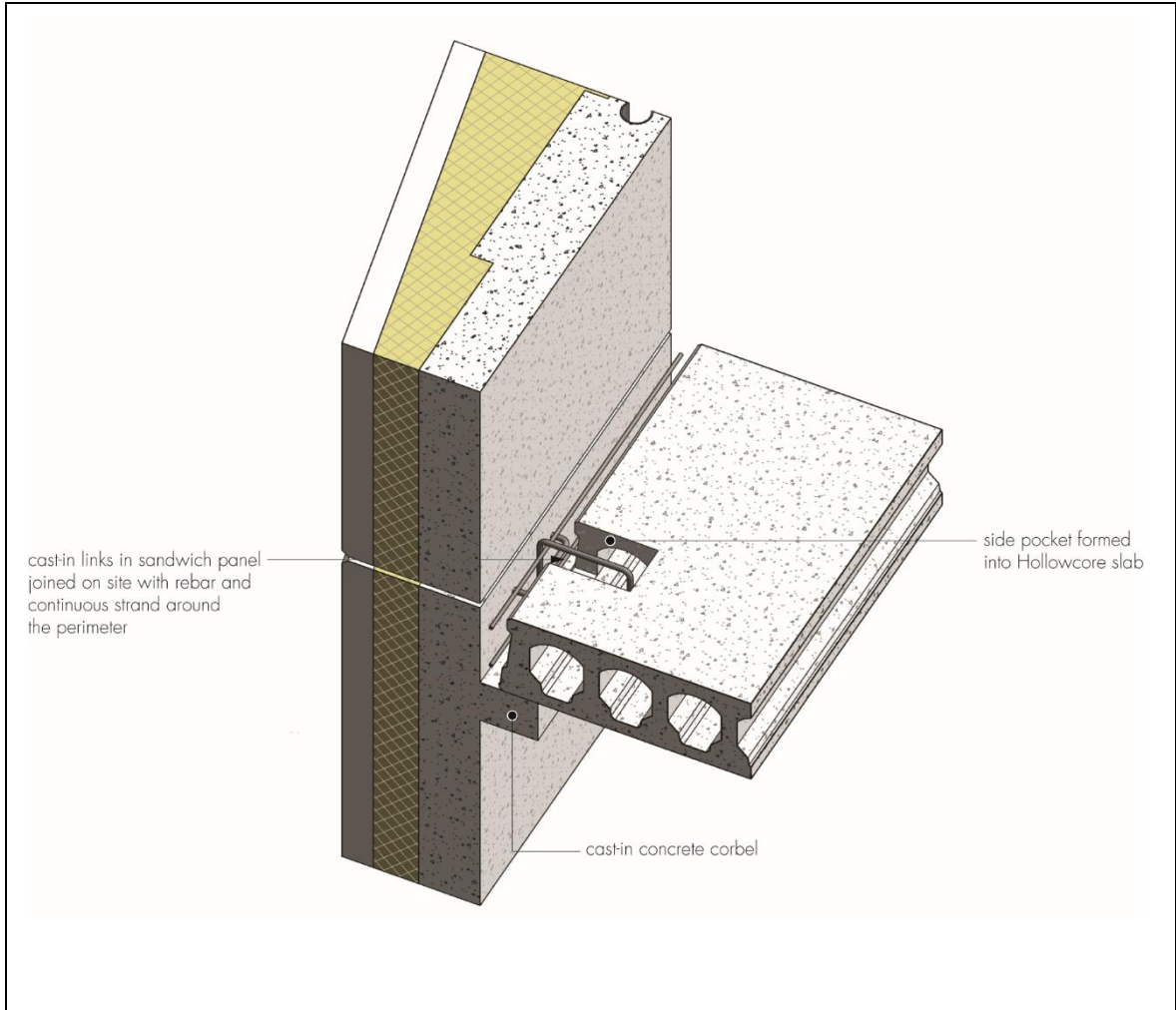


Figure 8 Typical precast element assembly at intermediate (precast) floor – side bearing detail

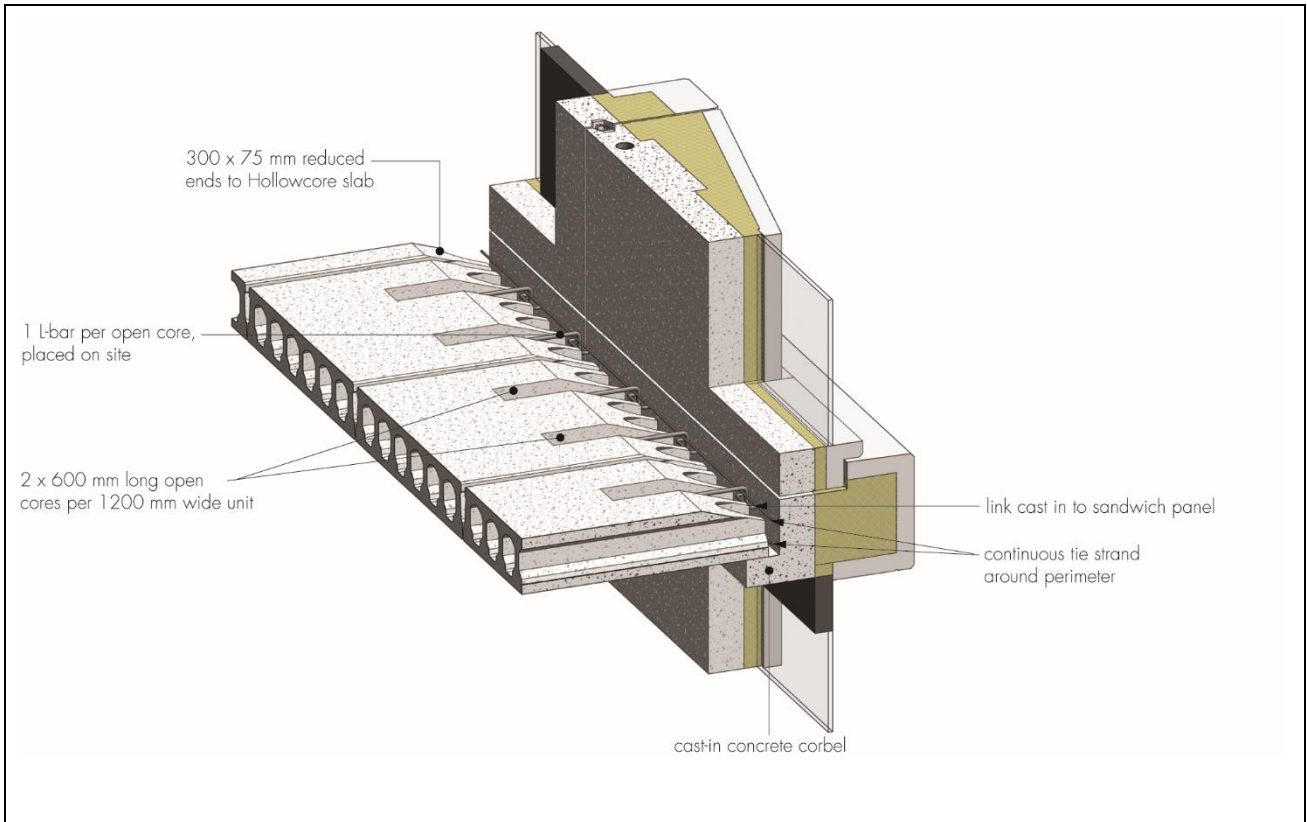
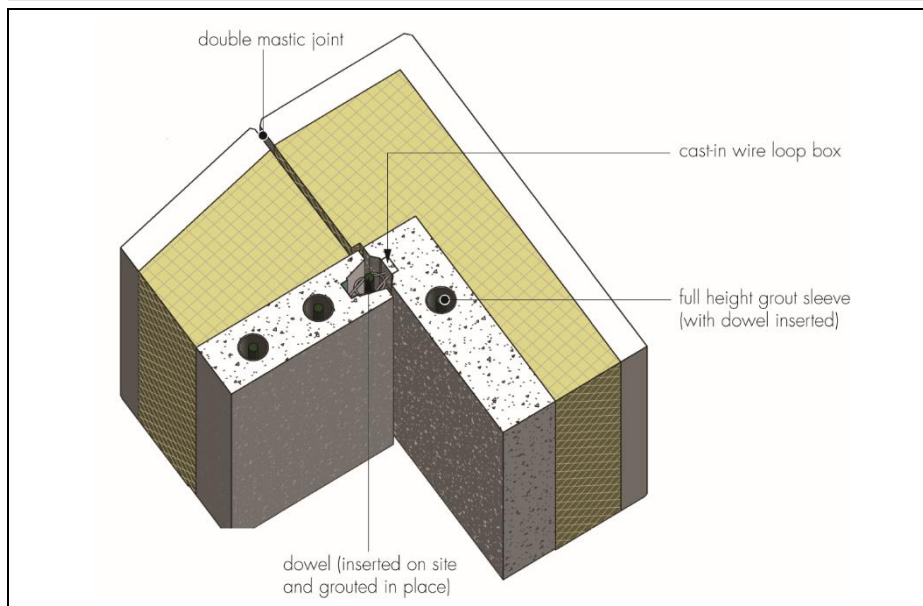


Figure 9 Typical precast element assembly at external and internal wall junction



18 Procedures

18.1 The quality of works must comply with the relevant requirements of the following Standards:

- BS EN 13670 : 2009
- BS 8000-0 : 2014
- BS 8000-2.2 : 1990.

18.2 The erection of the elements must be in accordance with the manufacturer’s installation recommendations, specifications laid down by a suitably qualified and experienced individual, the requirements of this Certificate, and guidance given in BS 5606 : 1990, BS EN 13670 : 2009 and the National Structural Concrete Specification.

18.3 The foundations must be cast, suitably level and square, and with provision for vertical starter bars which must align with the grout sleeves provided in the elements.

18.4 Datum levels are checked and suitable packing shims, if required, are placed to suit levels.

18.5 All structural propping, if required, should be adequately designed by a suitably qualified and experienced individual, for all the construction loads including wind actions.

18.6 The first level of elements are lifted into place, on a bed of structural mortar. The wire loop box junctions are completed using a steel dowel and structural grout, pumped from above. Grout is also pumped into the grout sleeves containing the starter bars.

18.7 Floor elements can then be placed, supported by the inner concrete leaf. Care should be taken to provide adequate bearing width. Floor elements should be anchored to the wall elements using prestressing wire or reinforcing bars, grouted in place, in accordance with the structural design. Vertical dowels must be placed from the top of each element, leaving sufficient length in each side for anchorage, and grouted in place.

18.8 Subsequent storeys may be erected in the same manner.

18.9 Vertical and horizontal joints between the external leaves must be filled with the mastic sealant and backing rod to form a double layered joint with provision for drainage. When applying the sealant, the instructions given in the Health and Safety Data Sheet of the sealant must be followed.

18.10 All window and door openings must be sealed strictly in accordance with the Certificate holder's installation instructions to ensure that they are weathertight.

18.11 Elements must not be altered on site without the permission of the Certificate holder, who will determine the suitability of proposed alterations in relation to the structural resistance and durability of the elements.

18.12 The panel finishes must be properly protected and consideration must be given to avoid any damage from other construction activity. Any cracks at the corner of openings must be repaired in accordance with Certificate holder's instructions.

18.13 Temporary props must not be removed until the mortar and grout has reached its design strength.

18.14 Appropriate tests (such as water penetration [static, dynamic, hose], acoustic and air permeability) are carried out on completion of the structure.

Technical Investigations

19 Investigations

19.1 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.

19.2 The practicability of installation and the effectiveness of detailing techniques were assessed.

19.3 An examination was made of existing data relating to the structural properties, thermal performance, behaviour in relation to fire, weathertightness, sound performance and durability of the system.

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20 Conditions

20.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

20.2 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.

20.3 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.

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

20.5 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.

20.6 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.