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BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

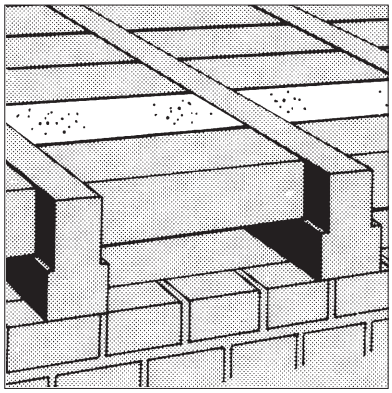
Rackham Housefloors Ltd

RACKHAM HOUSEFLOORS TYPE 175 PRESTRESSED CONCRETE JOISTS

Certificate No 85/1566

DETAIL SHEET 4

Product



- *THIS DETAIL SHEET REPLACES DETAIL SHEETS 2 AND 3 AND RELATES TO THE RACKHAM HOUSEFLOORS PRESTRESSED CONCRETE FLOOR JOISTS, TYPE 175, THE CODE OF PRACTICE OF THE CERTIFICATE HOLDER COVERING THE SPECIFICATION OF CONCRETE INFILL BLOCKS, FLOOR FINISHES TO BE USED WITH THE JOISTS AND THE INSTALLATION PROCEDURES FOR JOISTS, INFILL BLOCKS AND FLOOR FINISHES.*
- *The product is for use in:*

(a) suspended ground floors in dwellings or first floors in single occupancy dwellings, in conjunction with concrete infill blocks with screed, polystyrene/chipboard or mastic asphalt floor finishes;

(b) domestic garage floors, in conjunction with concrete infill blocks with reinforced screed finishes;

(c) compartment and separating floors in dwellings, in conjunction with concrete infill blocks of minimum density 1800 kgm^{-3} and an appropriate dense screed and resilient and floating layers or a soft covering.

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification *and the product's position regarding the Building Regulations, respectively.*

Technical Specification

1 Description

1.1 The Rackham Housefloors Type 175 system comprises types 2, 3, 4 and 5 prestressed concrete floor joists (see Figure 1), and the Rackham Housefloors Ltd's code of practice for incorporating the concrete infill blocks. The code of practice includes design criteria, typical installation details (see Figure 2), handling requirements for the concrete infill blocks and the installation requirements for screed, chipboard/polystyrene and mastic asphalt floor finishes.

1.2 The joists are designed in accordance with BS 8110: Parts 1 and 2 : 1985.

1.3 The joists are made of C60 (60 Nmm^{-2} at 28 days) concrete prestressed by means of 5 mm indented steel wire, to BS 5896 : 1980, having a minimum tensile strength of 1670 Nmm^{-2}. The type number of a joist denotes the number of prestressing wires (see Table 1).

1.4 The concrete is made with ordinary Portland cement (OPC) complying with BS 12 : 1989 and aggregates in accordance with BS 882 : 1983.

Table 1 Location of prestressing wires

Joist type	Distance from top surface (mm)	Number of wires
2	115	1
	132.5	1
3	80	1
	147.5	2
4	80	1
	115	1
	147.5	2
5	80	1
	115	1
	132.5	1
	147.5	2

1.5 The type 175 joists are made by casting concrete around prestressing wires in long steel moulds with individual joists being separated by polystyrene inserts. The wires are pretensioned over the full length of the mould and supported in position at intervals. When the concrete has achieved adequate strength the prestressing wires are cut and the joists removed from the moulds.

1.6 Quality control on the joists includes checks on:

quality of the materials
mix proportions
position of prestressing wires prior to casting
cover to prestressing wires after casting
concrete strength
visual appearance
dimensional accuracy
stiffness and strength of the finished joists.

2 Delivery and site handling

2.1 The joists are delivered to site stacked and supported on timber bearers.

2.2 Care must be taken in unloading, stacking and storing the joists to prevent damage. Joists should be lifted at points as near as possible to each end ensuring that they remain the correct way up at all times. On site, joists must be stored clear of the ground and, if stacked, timber bearers should be placed near the ends to separate them. The joists and bearers should be stacked vertically one above the other.

2.3 It is not necessary to protect the joists from the weather provided exposure will not exceed three months. In the event of longer periods, they should be stored under cover.

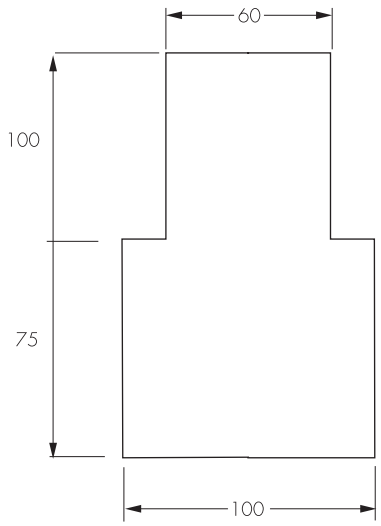
Figure 1 Rackham Housefloor joist cross-section and materials

175 Prestressed Rackham Housefloor Joist

prestressing wire — indented steel wire to BS 5896 : 1980
minimum tensile strength 1570 Nmm^{-2}

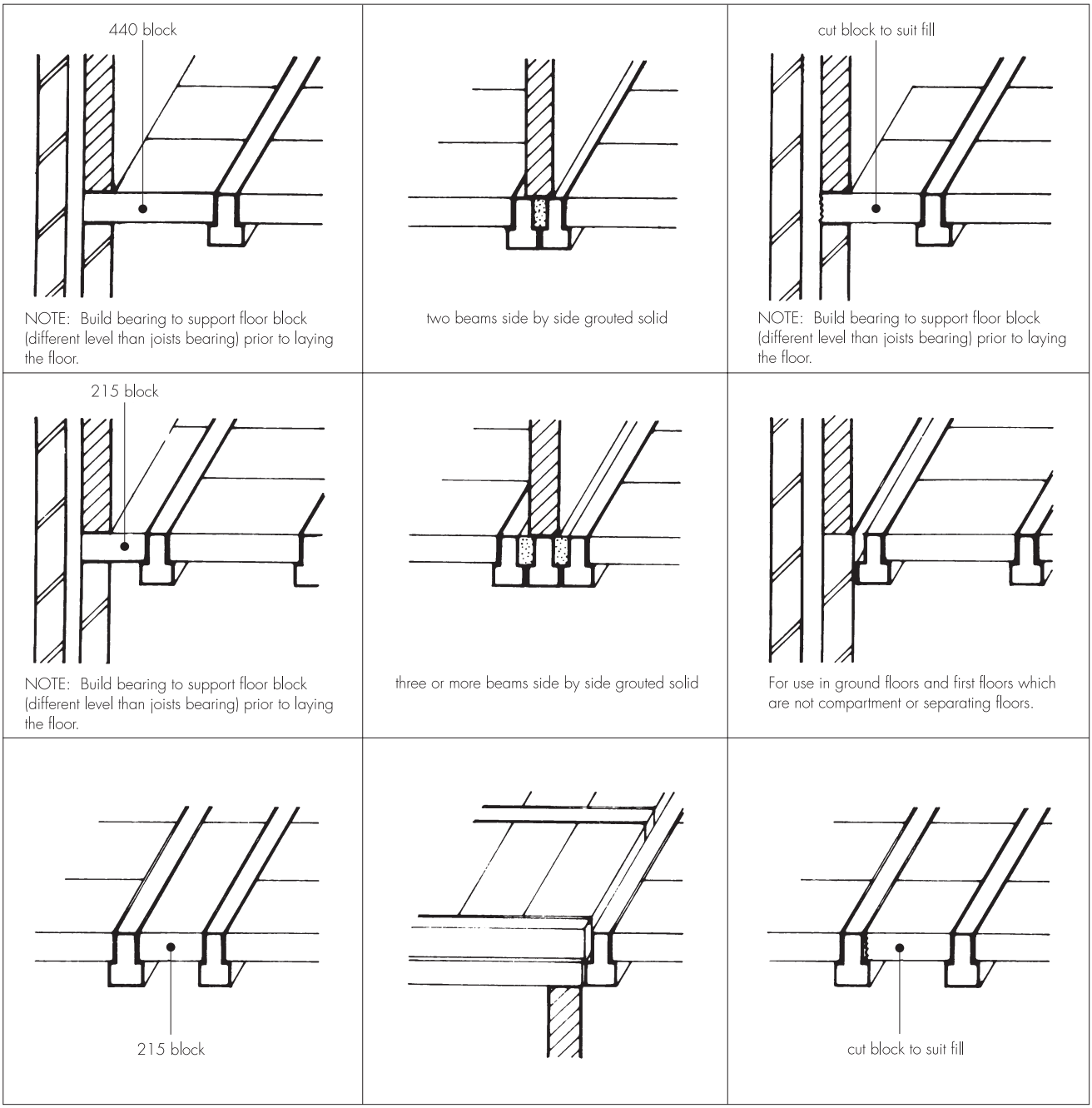
Type '2' — 2 wires
Type '3' — 3 wires
Type '4' — 4 wires
Type '5' — 5 wires

Nominal cover 25 mm



all dimensions in millimetres

Figure 2 Typical details of RH floors



Design Data

3 General

3.1 Rackham Housefloors Type 175 Prestressed Concrete Joists are suitable for use as floor joists in ground and intermediate floors when used in accordance with this Detail Sheet.

3.2 Rackham Housefloors Ltd's code of practice concerning the specification and use with the joists of concrete infill blocks, screed, chipboard/ polystyrene or mastic asphalt floor finishes have been assessed as suitable in providing satisfactory floors for the uses listed in the *Product* part of this Detail Sheet.

4 Structural performance

4.1 Allowable spans for floors incorporating Type 175 joists based on deflection, ultimate or serviceability requirements for a Class 2 structure should be determined in accordance with BS 8110 : Part 1 : 1985, Section 4, using the joist parameters given in Table 2. The joists should be assumed to be simply-supported and no account should be taken of any composite action between the joints and infill blocks or finishes.

Figure 3 Nomenclature of standard cases

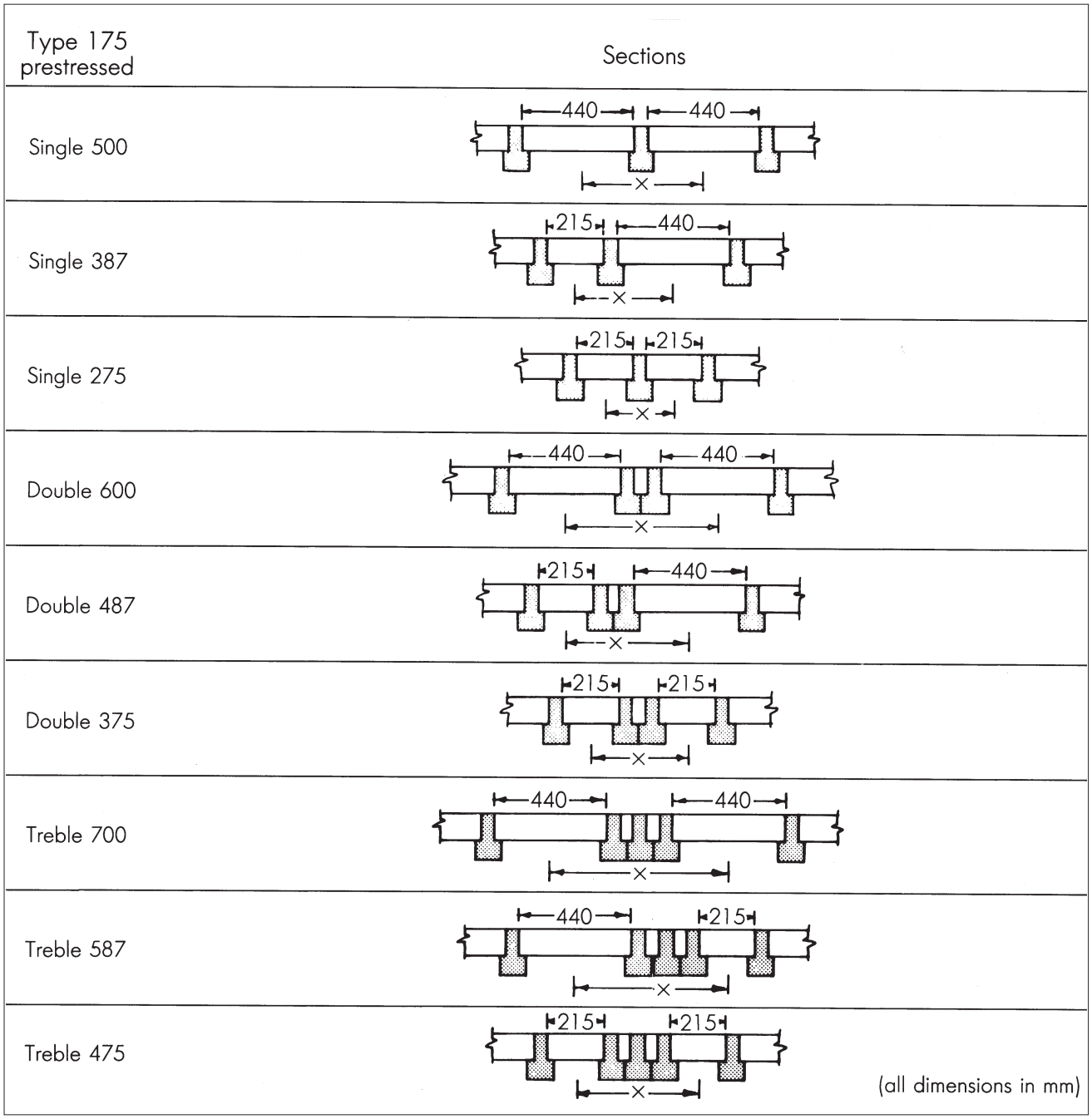


Table 2 Joist parameters

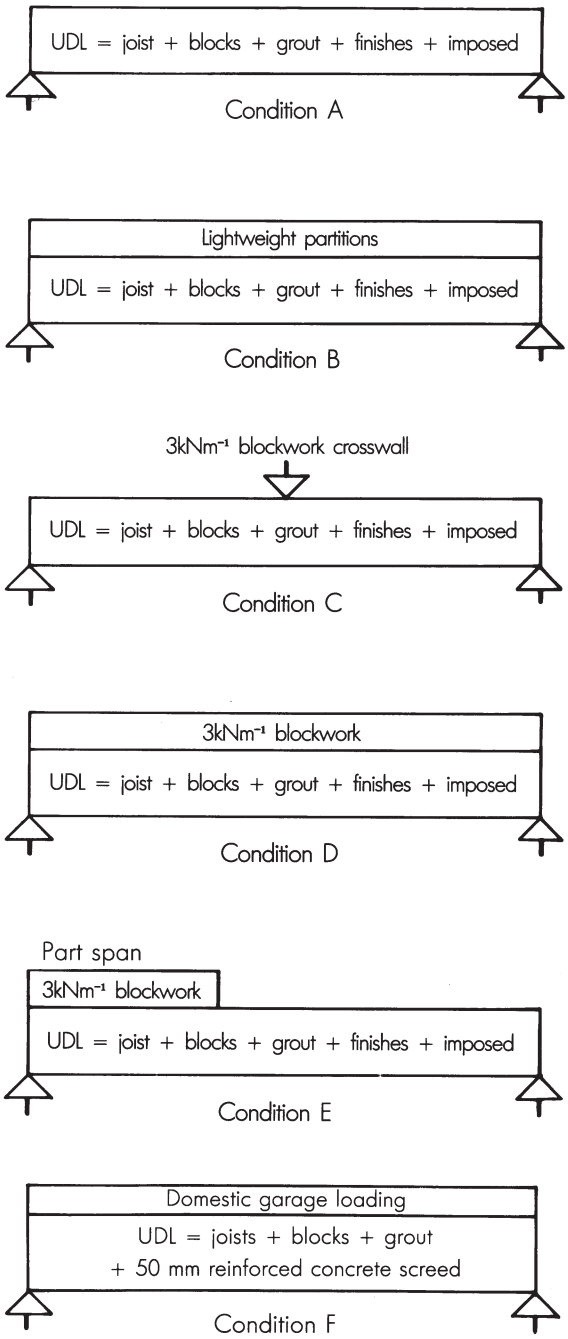
Parameter	Joist type 2	3	4	5
Service moment of resistance M_R (kNm)	3.85	4.91	5.67	6.61
Ultimate moment of resistance M_U (kNm)	6.00	7.76	8.94	10.08
Ultimate shear resistance (uncracked in flexure) V_{CO} (kN)	17.08	18.62	19.96	21.02
Design effective prestress in tendons after all losses as a proportion of characteristic strength of tendon $\frac{f_{pe}}{f_{pu}}$	0.609	0.582	0.560	0.532
Moment necessary to produce zero stress in concrete at extreme tension fibre M_O (kNm)	4.12	5.73	7.86	8.84

4.2 The dead load of the floor must include the weight of the joists, infill blocks, and both floor and ceiling finish if appropriate (see section 4.3). Domestic garage imposed loadings can be taken as a 2.5 kNm^{-2} distributed or 3 kN point load, other imposed loadings should be taken from BS 6399 : Part 1 : 1984, eg the uniform distributed load for domestic dwellings should be taken as 1.5 kNm^{-2} unless the actual loads are known and exceed those given.

4.3 The construction of compartment or separating floors has to satisfy the relevant Building Regulations requirements to resist the transmission of airborne sound. If this is achieved by using a superficial mass recommendation, the maximum clear span should be determined for an appropriate construction which gives the required mass (see section 15.6).

Figure 4 Standard conditions of loading

		Unit loads	
Joists		0.31 kNm^{-1}	
Blocks		0.12 kN each	(1275 kgm^{-3})
	or	0.17 kN each	(1800 Kgm^{-3})
Grout		0.02 KNm^{-1}	Single
		0.12 kNm^{-1}	Double
		0.22 $k'nm^{-1}$	Treble
Finishes		1.15 kNm^{-2}	50 mm sand/cement screed
		0.30 kNm^{-2}	Chipboard on polystyrene
		0.31 kNm^{-2}	15 mm mastic asphalt
		0.24 kNm^{-2}	Ceilings
Lightweight partitions		0.50 kNm^{-2}	
Imposed		1.50 kNm^{-2}	dist conc Domestic
	or	1.40 kN	
		250 $k'nm^{-2}$	dist conc Garage
	or	9.00 kN	



4.4 The bearing width of the joists must be determined in accordance with BS 8110 : Part 1 : 1985 or BS 5628 : Part 3 : 1985, for example, for joists less than 5 metres long the minimum nominal bearing should be 100 mm when supported on brickwork or masonry, and 75 mm when supported on steel. Support walls must be designed to carry the full dead and imposed loading.

4.5 Joists installed in the configurations shown in Figure 3 have adequate strength and stiffness to sustain the loadings given in Figure 4 over the spans given in Tables 3 and 4. Maximum spans over which the joists are capable of supporting other loadings (eg Condition E) are available from Rackham Housefloors Ltd. These should be confirmed in accordance with sections 4.1 and

4.2. Tables 3 and 4 have been determined in accordance with sections 4.1 and 4.2 and:

(a) The requirements for serviceability limit states of deflection as follows:

Limiting upward camber

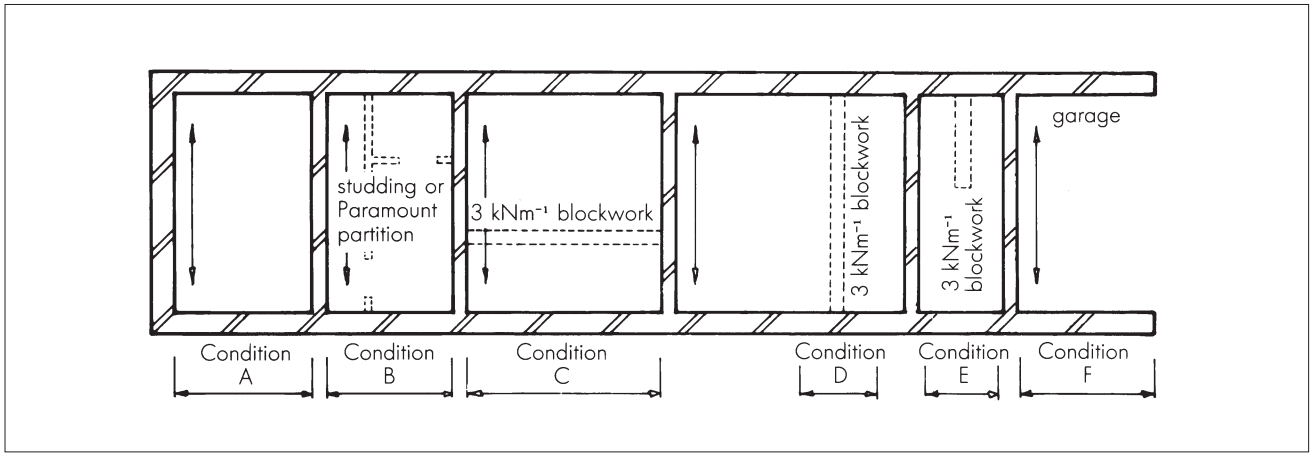
$$< \frac{\text{span}}{300}$$

Deflection below level of supports

$$< \frac{\text{span}}{250}$$

(assuming that the full imposed loads are not applied until three months after casting of the joists and that these loads will not be applied for periods in excess of three months).

Table 3 Maximum clear span (metres) type 175 prestressed concrete joints. Maximum density of blocks = 1275 kgm^{-3}



50 mm screed

Condition	A		B		C			D							E	F	
Case	Single 500	Single 387	Single 500	Single 387	Single 500	Single 387	Double 600	Single 500	Single 387	Single 275	Double 600	Treble 700	Treble 587	Treble 475	Dependent on length	Single 500	Single 275
Type															and position		
2	3.64	4.07	3.45	3.86	3.02	3.47	3.97	2.29	2.40	2.57	3.15	3.66	3.80	3.94	of blockwork	2.88	3.29
3	4.12	4.61	3.91	4.37	3.49	4.00	4.57	2.50	2.74	2.83	3.58	4.15	4.30	4.47	(see	3.43	3.95
4	4.43	4.96	4.21	4.70	3.81	4.35	4.95	2.68	2.94	3.06	3.85	4.46	4.63	4.84	section 4.5)	3.79	4.40
5	4.79	5.36	4.55	5.09	4.16	4.75	5.40	2.82	3.09	3.33	4.16	4.83	5.01	5.20		4.21	4.91

18 mm chipboard on polystyrene

Condition	A		B		C			D							E	F	
Case	Single 500	Single 387	Single 500	Single 387	Single 500	Single 387	Double 600	Single 500	Single 387	Single 275	Double 600	Treble 700	Treble 587	Treble 475	Dependent on length	Single 500	Single 275
Type															and position		
2	4.06	4.52	3.79	4.24	3.30	3.81	4.33	2.44	2.50	2.55	3.31	3.84	3.96	4.10	of blockwork		
3	4.59	5.12	4.29	4.80	3.83	4.40	4.99	2.76	2.87	2.92	3.75	4.35	4.48	4.65	(see	— not —	
4	4.94	5.51	4.62	5.17	4.17	4.79	5.42	2.96	3.10	3.16	4.03	4.68	4.82	4.99	section 4.5)	suitable	
5	5.34	5.96	5.00	5.59	4.57	5.23	5.91	3.12	3.36	3.44	4.36	5.06	5.22	5.40			

15 mm asphalt

Condition	A		B		C			D							E	F	
Case	Single 500	Single 387	Single 500	Single 387	Single 500	Single 387	Double 600	Single 500	Single 387	Single 275	Double 600	Treble 700	Treble 587	Treble 475	Dependent on length	Single 500	Single 275
Type															and position		
2	4.05	4.51	3.79	4.23	3.30	3.81	4.33	2.44	2.50	2.65	3.30	3.84	3.96	4.09	of blockwork		
3	4.59	5.11	4.29	4.79	3.82	4.40	4.99	2.61	2.86	2.92	3.74	4.35	4.48	4.63	(see	— not —	
4	4.94	5.50	4.62	5.16	4.16	4.78	5.41	2.90	3.10	3.16	4.03	4.68	4.82	4.98	section 4.5)	suitable	
5	5.34	5.94	4.99	5.58	4.56	5.22	5.90	3.16	3.36	3.44	4.36	5.06	5.22	5.38			

Deflection after the construction of partitions

$$< \frac{\text{span}}{350} \quad \text{or 20 mm, whichever is the lesser}$$

(assuming that not more than 25% of the imposed loads will be applied for periods in excess of three months).

Note: Joists supporting blockwork walls will exhibit long-term creep deflections which may cause minor cracking at doors and other openings.

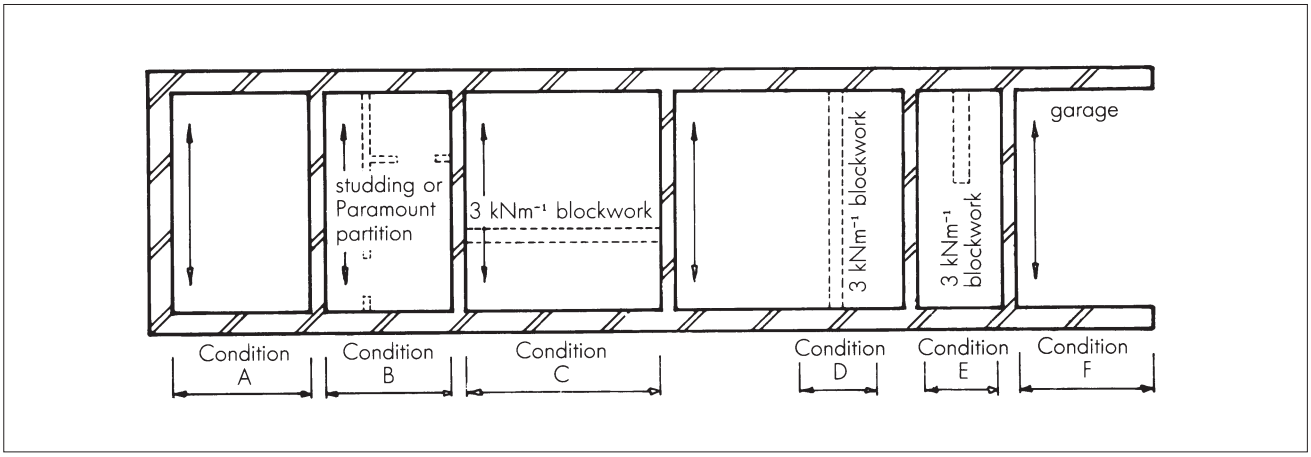
(b) The dead load considered from a non-loadbearing blockwork wall (conditions C, D and E) was taken as 3 kNm^{-1} including finishes. For 100 mm thick blocks in a partition wall 2.3 m high, this implies a maximum block density of 1000 kgm^{-3}.

(c) Where two or three joists placed side by side are used to support blockwork walls it is assumed that the spaces above the flanges are grouted to ensure unity of action.

5 Behaviour in relation to fire

The joists are non-combustible and the surfaces of the joists are classified as Class 0 as defined in Appendix A of Approved Document B to the Building Regulations 1991 (England and Wales), Appendix to Part D of the Technical Standards for compliance with the Building Standards (Scotland) Regulations 1990 and Regulation E15(1)(e) of the Building Regulations (Northern Ireland) 1990 (as amended 1991), and Class 1 as defined in BS 476 : Part 7 : 1971. When assessed according to BS 8110 :

Figure 4 Maximum clear span (metres) type 175 prestressed concrete joists. Maximum density of blocks = 1800 kgm^{-3}



50 mm screed + ceiling

Condition	A		B		C			D							E	F	
Case	Single 500	Single 387	Single 500	Single 387	Single 500	Single 387	Double 600	Single 500	Single 387	Single 275	Double 600	Treble 700	Treble 587	Treble 475	Dependent on length and position of blockwork (see section 4.5)	Single 500	Single 275
Type																	
2	3.37	3.74	3.21	3.62	2.84	3.23	3.73	2.15	2.33	2.42	3.04	3.55	3.69	3.86		2.69	3.15
3	3.82	4.30	3.64	4.10	3.28	3.76	4.29	2.35	2.60	2.77	3.45	4.05	4.18	4.38		3.19	3.77
4	4.12	4.62	3.92	4.41	3.57	4.09	4.66	2.51	2.79	3.00	3.71	4.33	4.50	4.71		3.52	4.18
5	4.45	5.00	4.24	4.77	3.90	4.46	5.08	2.65	2.93	3.27	4.02	4.69	4.87	5.09		3.90	4.63

18 mm chipboard on polystyrene + ceiling

Condition	A		B		C			D							E	F	
Case	Single 500	Single 387	Single 500	Single 387	Single 500	Single 387	Double 600	Single 500	Single 387	Single 275	Double 600	Treble 700	Treble 587	Treble 475	Dependent on length and position of blockwork (see section 4.5)	Single 500	Single 275
Type																	
2	3.70	4.06	3.50	3.93	3.06	3.46	4.03	2.36	2.40	2.50	3.18	3.72	3.86	4.00		— not — suitable	
3	4.19	4.70	3.96	4.45	3.69	4.07	4.64	2.57	2.75	2.86	3.60	4.21	4.37	4.54			
4	4.51	5.06	4.27	4.79	3.87	4.42	5.03	2.76	3.95	3.10	3.88	4.53	4.70	4.88			
5	4.88	5.45	4.62	5.18	4.23	4.83	5.49	2.91	3.10	3.37	4.20	4.90	5.08	5.28			

Part 2 : 1985 the joists have a fire resistance of half an hour. The fire resistance of floors constructed using the joists will be half an hour, or better, depending upon the soffit finish, if used (see section 15.8).

6 Condensation risk

The risk of condensation in ground floors constructed using the joists will be dependent on the type of infill blocks used, the floor finish and the temperature and relative humidity above the floor (see section 15.4). The mastic asphalt floor finish should not be used in areas where there is a risk of high humidity, such as kitchens, bathrooms, shower or utility rooms above infill blocks of densities greater than 1275 kgm^{-3} or where the joists are placed adjacent to each other without blocks.

7 Thermal transmittance

The thermal performance of ground floors constructed using the joists will be dependent on the type of infill blocks used, the floor finish and the area of the floor (see section 15.5).

8 Practicability of installation

The joists can be handled easily by methods commonly used in building practice. Longer joists can be placed in approximate position by mechanical means and then manhandled into final position.

9 Sound

Each Type 175 joist will contribute an equivalent mass of 32.4 kg per metre length of joist to the floor construction. The effective contribution to the overall floor construction will be dependent on the joist configurations used. The performance of the floor will also be dependent on the type of infill blocks and the floor finish used (see section 15.6).

10 Durability

The exposure condition beneath a suspended ground floor over a ventilated void and soil with no oversite concrete or other surface seal is considered to be 'moderate' in accordance with BS 8110 : Part 1 : 1985 (Table 3.2). The joists will have adequate durability for these exposure conditions provided they are used in accordance with this Detail Sheet.

11 Site preparation

11.1 The ground beneath the floor must be cleared of any surface soil and vegetable matter and the solum treated to prevent vegetable growth. No oversite concrete or other surface seal is required, but any uplifting to bring the solum to an even surface should be of hard, dry material.

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

11.3 A continuous damp-proof course should be laid along the support wall below the floor in accordance with CP 102 : 1973.

11.4 A void at least 75 mm deep must be provided between the underside of the floor and the ground surface. With heavy clay soil, the depth should be increased to 150 mm to prevent problems associated with heave. With good natural drainage or site drains provided to prevent water collecting and standing, the ground level beneath the floor does not need to be raised to the external ground level but where the levels differ the ability of the perimeter walls to act as retaining walls must be checked.

11.5 In Scotland it is considered good practice that the solum area beneath all suspended floors be brought up to at least the level of the adjoining ground, except where an arrangement of damp-proof membranes or damp-proof courses is installed to prevent the ingress of ground water to the solum set at a lower level.

11.6 Ventilation must be provided to the void beneath the floor by openings in all the external walls at not more than 3 metre centres which give a minimum open area per metre run of wall of 600 mm^2. In areas where there might be landfill gas or methane contamination the recommended minimum area of opening (from the BRE Guidance Document *Construction of new buildings on gas contaminated land*) of 1500 mm^2 per metre run of wall or 500 mm^2 per square metre of floor area, whichever is the greater, should be used. In areas where full radon precautions are required (see BRE Guidance Document *Radon : guidance on protective measures for new dwellings*) the minimum open area of 1500 mm^2 per metre run given in that document should be used and provision should be made for possible later addition of mechanical ventilation.

12 Floor installation

12.1 Some typical installation details are shown in Figure 2.

12.2 The bearings for Rackham Housefloor Type 175 joists must be level and clear of debris.

12.3 For masonry cavity wall construction the minimum bearing (see section 4.3) should be provided on the inner leaf and joists must not project into the cavity. Careful setting-out will be required when joists are built into cavity walls at either end.

12.4 No operation should be undertaken which is likely to impair the durability or strength of the joists (for example, drilling to attach services or cutting) without authorisation from Rackham Housefloors Ltd).

12.5 The joists are generally lifted into position by two operatives.

12.6 To comply with the company's code of practice, the joists must be used with either blocks covered by a valid BBA Certificate for use as floor infill blocks and used with the finishes detailed in that Certificate, or blocks of the following specification:

Solid concrete building blocks of nominal dimensions 440 by 215 by 100 mm, minimum compressive strength 3.5 Nmm^{-2}, and manufactured in accordance with BS 6073 : Part 1 : 1981. As with other beam and block floors, the blocks must have adequate strength. For use with the joists, the blocks, when simply-supported at either end, must be capable of sustaining a centrally applied load of 1.4 kN with a load factor in excess of 2.5 and must be approved by Rackham Housefloors Ltd.

12.7 Infill blocks should be placed between the ends of the joists as they are positioned to ensure correct spacing. The blocks must be provided with adequate bearing by clearing the joist flanges of debris and ensuring adjacent blocks are abutted as close as possible. The blocks must not be cut or drilled in such a way as to impair their structural performance.

12.8 A 1:3 cement/sand grout must be applied to the floor to fill voids between blocks. The floor must be thoroughly cleaned before application of the finish.

12.9 Care must be taken to avoid overloading the floor during construction. Planks should be laid across the joists before stacking materials as close as possible to the floor bearings. During construction the floor should only be used for short-term material storage and construction traffic.

13 Floor finishes

13.1 The following finishes, for use on ground and first floors, are covered in the Rackham Housefloors Ltd's code of practice and are the finishes referred to in section 15 of this Detail Sheet.

Screed

13.2 A 50 mm minimum thick lightweight cement/ sand screed in accordance with BS 8204 : Parts 1 and 2 : 1987, can be laid directly on the grouted floor and, unless it is to be particularly moisture sensitive (as described in CP 102 : 1973) a damp-proof membrane need not be laid over a ground floor. In areas where there might be landfill gas or methane and areas where full radon precautions are required, a gas-proof barrier must be used. Full details are given in BRE Guidance Documents, *Construction of new buildings on gas contaminated land* and *Radon : guidance on protective measures for new dwellings*. The membrane across the main floor area must be continuous with a cavity tray in the surround wall to form a complete gas-proof barrier. For compartment or separating floors the thickness and/or density of the screed may need to be increased in order to provide a concrete base that can accept a floating layer or soft covering in accordance with the appropriate Building Regulations (see sections 4.3 and 15.6).

Screed for domestic garages

13.3 For use in domestic garage floors, the screed should be a minimum 50 mm thick concrete of minimum compressive strength 20 Nmm^{-2} and reinforced with A98 steel mesh reinforcement to BS 4483 : 1985.

Chipboard and polystyrene — for use on ground floors

13.4 Tongue-and-groove chipboard type C4, 18 mm thick, to BS 5669 : Part 2 : 1989 is laid with staggered cross-joints on SD/N grade expanded polystyrene board to BS 3837 : Part 1 : 1986 between 25 mm and 50 mm thick, or on an appropriate polystyrene floor insulation covered by a current BBA Certificate and laid in accordance with that Certificate.

13.5 Floors constructed using joists and infill blocks complying with the code of practice in the company's technical manual are flat enough to accept the above insulation without the need for screeding or other finishing.

13.6 Before laying the polystyrene boards, preservative treated battens in accordance with BS 5268 : Part 5 : 1989 are fixed at doorways and to support partitions (adequate time should be allowed for CCA-based preservatives to be fixed, and the solvents from solvent-based preservatives to evaporate).

13.7 A vapour barrier consisting of 0.25 mm thick (1000 gauge) polythene sheet is laid between the polystyrene and the chipboard. The polythene sheet has 150 mm overlaps taped at the joints and is turned up 100 mm at the walls (see section 13.2)

13.8 An expansion gap between the chipboard and the perimeter walls should be provided at the rate of 2 mm per metre run or a minimum of 10 mm, whichever is the greater.

13.9 Where there are long, uninterrupted lengths of floor, eg corridors, proprietary expansion joints may be installed at intervals on the basis of a 2 mm gap per metre run of overlay.

13.10 As the chipboard is laid, either a PVA or mastic adhesive is applied continuously to the top and bottom of the joints, which are then interlocked.

13.11 Once the overlay is laid, temporary wedges are inserted between the walls and the floor to maintain tight joints until the adhesive has set.

13.12 A suitable compressible filler (eg pieces of expanded polystyrene) is fitted around the perimeter of the floor between the chipboard and the walls when the wedges are removed and before the skirting boards are affixed.

13.13 To limit the risk of damage from condensation and other sources of dampness, the chipboard should be laid only after the construction is glazed and/or substantially watertight. The chipboard must be protected from water spillage, plaster droppings, traffic, etc.

Mastic asphalt

13.14 A 15 mm thick mastic asphalt floor finish laid in accordance with CP 204 : Part 2 : 1970 to BS 6925 : 1988 and BS 6577 : 1985 can be laid directly on the grouted floor and, unless it is to be particularly moisture sensitive (as described in CP 102 : 1973) a damp-proof membrane need not be laid over a ground floor (see section 6).

14 Incorporation of services

14.1 Services must not be attached to joists or blocks in such a way as to impair their durability or strength.

14.2 Vertical services passing through floors must be wrapped in flexible materials or ducted, and any vapour barrier they pass through sealed.

14.3 In areas subject to landfill gas or methane and areas where full radon precautions are required, services should not pass through the floor if this is avoidable. Where this is unavoidable the services should be sealed against the gas-proof barrier as detailed in the BRE Guidance Documents, *Construction of new buildings on gas*

contaminated land and *Radon : guidance on protective measures for new dwellings.*

14.4 Vertical service pipes (other than gas pipes) passing through compartment or separating floors should be wrapped for their full height with at least 25 mm of mineral fibre and ducted both above and below the floor, the duct being cased with board material weighing at least 15 kgm^{-2} and sealed to prevent air leaks in accordance with:

(a) Approved Document E1/2/3 to the Building Regulations 1991 (England and Wales) section 2, or

(b) The *Provisions deemed to satisfy*, Part H of the Technical Standards for compliance with the Building Standards (Scotland) Regulations 1990, section 14 or 15, or

(c) Technical Booklet G to the Building Regulations (Northern Ireland) 1990 (as amended 1991) section 1.9 or 1.10.

14.5 Blocks must not be cut to accommodate horizontal services. Horizontal services may be installed within the floor finishes, where possible.

14.6 Water pipes must be pre-lagged.

Screeds and mastic asphalt

14.7 Provision must be made to prevent subsequent damage due to differential movement between the floors and services, eg wrapping in flexible materials.

Chipboard and polystyrene

14.8 The maximum continuous working temperature of expanded polystyrene is 80°C. It must not be used in direct contact with electrical heating cables or hot water pipes.

14.9 Electrical cables should be enclosed in a suitable conduit. In the case of hot pipes the polystyrene must be cut back to maintain an air space.

Technical Investigations

The following is a summary of the technical investigations carried out on Rackham Housefloors Type 175 Prestressed Concrete Joists and floors constructed using the joists in accordance with the company's code of practice.

15 Investigations

15.1 The structural calculations for the joist designs and the submitted load/span tables were verified in accordance with BS 8110 : Part 1 : 1985.

15.2 The results of tests on various makes of infill blocks subjected to static and impact loads were examined.

15.3 Existing data relating to the durability of the joists and components referred to in the company's code of practice, when used within the scope of the Certificate, were examined. It was concluded that the components (ie chipboard, polythene vapour barrier, mastic asphalt, concrete infill blocks and cement/sand screed) are standard building materials and will have a durability compatible with the joists.

15.4 An assessment was made of the likely condensation risk in ground floors constructed in accordance with the company's code of practice using the joists, infill blocks and the specified finishes. The assessment concluded that at ground-floor level over a ventilated void the extent of condensation forming on the surface of the floor will depend upon the finish adopted and its moisture permeability properties as follows:

Chipboard on a vapour barrier on polystyrene over:

(a) infill blocks of maximum density 1800 kgm^{-3} — the risk of condensation will be very low provided attention is paid to good jointing of the vapour barrier (ie 0.25 mm thick polythene sheets must have 150 mm taped laps or 300 mm loose laps and should be carried up 100 mm at the perimeter and at pipes penetrating through the floor)

(b) infill blocks of densities greater than 1800 kgm^{-3} and when joists are placed adjacent to each other without blocks — the relative humidity above the floor must be kept generally below 65% to avoid condensation

Cement/sand screed finish over infill blocks of densities:

(a) 1000 kgm^{-3} and below — condensation is unlikely to occur

(b) 1000 kgm^{-3} to 1275 kgm^{-3} — condensation is unlikely to be a problem unless an impermeable floor covering, eg vinyl tiles, is used in areas which are subsequently carpeted

(c) 1275 kgm^{-3} to 1800 kgm^{-3} — transient condensation may occur in some extreme circumstances and impermeable floor coverings should not be used

(d) greater than 1800 kgm^{-3} and when joists are placed adjacent to each other without blocks — the relative humidity above the floor must be kept generally below 65% to avoid condensation

Mastic asphalt finish over infill blocks of densities:

(a) 1000 kgm^{-3} and below — condensation is unlikely to occur except in some extreme circumstances

(b) 1000 kgm^{-3} to 1275 kgm^{-3} and when joist are placed adjacent to each other without blocks — provided the relative humidity above the floor is

kept generally below 65%, transient condensation will only occur in some extreme circumstances.

15.5 The thermal transmittances (U values) for ground floors constructed in accordance with the Certificate holder's code of practice were calculated for three typical floor areas with the joists in configuration single 500 and with the joists adjacent to each other. The values are given in Table 5, they were determined using the methods given in the CIBSE Guide A3 and are based on the following thermal conductivity (λ value) data:

1.83 $Wm^{-1}K^{-1}$ for the dense concrete of the beams
0.30 $Wm^{-1}K^{-1}$ for the 1000 kgm^{-3} infill blocks
0.43 $Wm^{-1}K^{-1}$ for the 1275 kgm^{-3} infill blocks
0.87 $Wm^{-1}K^{-1}$ for the 1800 kgm^{-3} infill blocks
1.63 $Wm^{-1}K^{-1}$ for the screed of density 2300 kgm^{-3}
(derived from the Jakob curve corresponding to 3% standard moisture content)
0.038 $Wm^{-1}K^{-1}$ for the SD/N grade expanded polystyrene
0.14 $Wm^{-1}K^{-1}$ for the chipboard
1.15 $Wm^{-1}K^{-1}$ for the mastic asphalt

and calculated for the following conditions:

a ventilated area of 600 mm^{-2} per metre
an external airflow of 1 ms^{-1}
the floor supported on a 300 mm thick solid masonry wall
all four edges exposed
an earth thermal conductivity of 1.4 $Wm^{-1}K^{-1}$.

Table 5 Thermal transmittance (U value) of typical ground floors ($Wm^{-2}K^{-1}$)

Floor finish	Infill block density (kgm^{-3})	Size of floor (m)		
		10 x 4	10 x 6	10 x 10
50 mm screed	1000	0.66	0.57	0.50
	1275	0.69	0.60	0.51
	1800	0.73	0.63	0.54
	no blocks*	0.74	0.64	0.54
18 mm chipboard on 25 mm SD/N EPS	1000	0.45	0.41	0.37
	1275	0.46	0.42	0.38
	1800	0.48	0.44	0.39
	no blocks*	0.49	0.44	0.39
18 mm chipboard on 50 mm SD/N EPS	1000	0.35	0.32	0.30
	1275	0.36	0.33	0.30
	1800	0.37	0.34	0.31
	no blocks*	0.37	0.34	0.31
15 mm mastic asphalt	1000	0.67	0.58	0.50
	1275	0.69	0.60	0.52
	1800	0.74	0.64	0.54
	no blocks*	0.75	0.64	0.54

*Beams placed adjacent to each other.

15.6 An assessment was made of the suitability of floors, constructed with the joists in accordance with the company's code of practice, for resisting the transmission of airborne and impact sound. It was found that:

(1) Where the joists are used in the single 500 configuration a floor incorporating blocks of minimum density 1800 kgm^{-3} and with the addition of 50 mm screed with a minimum density 1450 kgm^{-3} will have an equivalent mass greater than 300 kgm^{-2} and will provide a concrete base that can accept resilient and floating layers (screed or timber raft) in accordance with:

- Approved Document E to the Building Regulations 1991 (England and Wales), Section 2, Floor type 2, or
- The *Provisions deemed to satisfy*, Part H of the Technical Standards for compliance with the Building Regulations (Scotland) 1990, Section 15, Floor type 2, or
- Technical Booklet G to the Building Regulations (Northern Ireland) 1990 (as amended 1991), Section 1.10, Floor type 2.

(2) With the addition of 60 mm screed with a minimum density 2300 kgm^{-3} the floor will have an equivalent mass greater than 365 kgm^{-2} and will provide a concrete base that can accept a soft covering in accordance with:

- Approved Document E to the Building Regulations 1991 (England and Wales), Section 2, Floor type 1, E or
- The *Provisions deemed to satisfy*, Part H of the Technical Standards for compliance with the Building Regulations (Scotland) 1990, Section 15, Floor type 1, or
- Technical Booklet G to the Building Regulations (Northern Ireland) 1990 (as amended 1991) Section 1.10, Floor type 1.

Floors thus constructed will provide adequate resistance to the passage of sound when used with appropriate flanking constructions.

15.7 An assessment was made of the practicability of installation including laying the joists, installing the infill blocks and applying the finishes. It was found that the joists could be easily laid, installation of the infill blocks could be rapidly carried out and the finishes easily applied.

15.8 An assessment was made of the fire resistance of floors constructed from the joists in accordance with the company's code of practice. The assessment was carried out according to BS 8110 : Part 2 : 1985. The assessment concluded that:

(1) Floors constructed with the joists are capable of achieving a half-hour fire resistance rating excluding the effects due to any soffit finishes.

(2) Floors requiring longer fire resistance periods must have an appropriate soffit finish.

15.9 The manufacturing processes for the joist were examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

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