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5.0 Introduction

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5.0.1 Background

Noise is unwelcome sound. Noise transmitted to *dwellings* can detract from people's quality of life by disrupting sleep, causing annoyance, or disturbing everyday activities. In particular, sleep deprivation can lead to stress-related illness and affect performance at school or work.

Noise transmission between *dwellings* is a common cause of tension between neighbours. The 1996 Scottish House Condition Survey by Scottish Homes found that 19% of households (403,000) were bothered by noise when indoors. The most common sources of noise were traffic and people outside, but a great many people complained of noise transmission through *separating walls* or *separating floors*.

The guidance in this section relates to the reduction of noise transmission to *dwellings* by controlling *building construction* and offers guidance on alternative approaches to design in the form of specified *constructions,* performance testing or, for new *buildings* only, the scheme operated by Robust Details Ltd. (see clause 5.1.13). There are requirements for *separating walls* and *separating floors* between a *dwelling* and other parts of the same *building* or adjoining *buildings,* for flanking *constructions*, and for some walkways or accessible roofs above *dwellings.*

5.0.2 Aims

The purpose of section 5 is to protect the residents of a *dwelling* from noise in other areas of the same *building* or an attached *building*. Recurrent noise can adversely affect the health of residents and inconvenience them by disrupting their everyday activities. In view of this, measures should be incorporated to reduce the transmission of the sounds of normal conversation, television, radio, music and domestic activities.

It is important to recognise that following the guidance in this section will not guarantee freedom from the transmission of all types of disturbing noise. Firstly, it does not address sound transmission between parts of the same *dwelling*. Secondly, it does not suggest that the *construction* should insulate against excessive noise from sources such as power drills, saws, or sanders, noise from a hi-fi system inconsiderately played at full volume, or wall-mounted 'surround sound' flat panel loudspeakers. Lastly, it does not address external sources of noise, such as aircraft, railways, road traffic, or industry.

Noise transmission to *buildings* or parts of *buildings* other than *dwellings* is not controlled by the Scottish building regulations.

www.scotland.gov.uk/about/Planning/

Although noise transmission from external sources into a *dwelling* is not controlled by the Scottish building regulations, it may be managed through the land use planning system. Advice can be found in PAN 56 'Planning Advice Note: Planning and Noise', 1999.

Detailed guidance on noise issues relating to *construction sites* can be found in BS 5228 'Noise control on construction and open sites.'

www.scotland.gov.uk/library3/environment/

Advice to consumers on dealing with noise problems is given in 'Sound advice on Noise: don't suffer in silence', 2001.

www.bpc.napier.ac.uk/sound/hsi

The Building Performance Centre at Napier University publishes guidance on good practice in improving sound insulation 'Housing and sound insulation: Improving existing attached dwellings and designing for conversions', 2006.

5.0.3 Latest changes

There have been no technical changes to this section between 1st May 2006 and 30th April 2007. However, some minor formatting which has not been listed has been carried out.

5.0.4 Relevant legislation

Listed below are some items of legislation that may be relevant to those using the guidance in this section.

Construction (Design and Management) Regulations 1994

Designers and specifiers should consider the health and safety implications of using mass to limit sound transmission.

Manual Handling Operations Regulations 1992

Buildings should be designed to avoid repetitive manual handling of excessively heavy blocks and boards. HSE advises on the assessment of manual handling operations.

5.0.5 Annexes

There are three annexes to this section:

Annex 5.A gives procedures to calculate the mass of materials for the specified *constructions* described in clauses 5.1.4-5.1.6 and 5.1.8-5.1.9.

Annex 5.B gives methods for the selection of resilient materials used in the specified *constructions* for *separating floors* described in 5.1.8 and 5.1.10.

Annex 5.C gives test procedures for the field sound tests referred to in 5.1.12.

5.1 Resisting sound transmission to dwellings

contents

standard

5.1

mandatory

Every *building* must be designed and *constructed* in such a way that each wall and floor separating one *dwelling* from another, or one *dwelling* from another part of the *building*, or one *dwelling* from a *building* other than a *dwelling*, will limit the transmission of noise to the *dwelling* to a level that will not threaten the health of the occupants of the *dwelling* or inconvenience them in the course of normal domestic activities provided the source noise is not in excess of that from normal domestic activities.

Limitation

This standard does not apply to:

(a) fully detached *houses*; or

(b) roofs or walkways with access solely for maintenance, or solely for the use, of the residents of the *dwelling* below.

5.1.0 Introduction

There are requirements for appropriate sound insulation to apply to *separating walls* and *separating floors* between *dwellings*, between a *dwelling* and other parts of the same *building* and between *dwellings* and other adjoining *buildings*. Other internal and *external walls* are controlled, but only to the extent necessary to reduce flanking sound transmission. *Dwellings* directly below a walkway or a roof that is accessible other than for maintenance should be protected by sound resisting *construction*.

Some terms relating to noise that are used in this section only are explained below:

Explanation of terms

Airborne sound is sound which is propagated from a noise source through the medium of air. An example of this is speech.

Airborne sound transmission is direct transmission of airborne sound through *separating walls* or *separating floors*. When sound energy is created in a *room*, for instance by conversation, some of the energy is reflected or absorbed by *room* surfaces but some may set up vibrations in the walls and floor. Depending on both the amount of energy and the type of *construction*, this can result in sound being transmitted to adjacent *dwellings*.

An **air path** is a void in *construction* elements, which adversely affects the performance of sound resisting *construction*. Examples of air paths include incomplete mortar joints, porous *building* materials, gaps round pipes and shrinkage cracks.

Direct transmission refers to the path of either airborne or impact sound through a separating element of *construction* (see the diagrams to clause 5.1.1). Only direct transmission is measured in laboratory tests.

Flanking transmission refers to the path of either airborne or impact sound through adjacent *construction* (see the diagrams to clause 5.1.2). Field tests measure both direct and flanking sound transmission.

Impact sound is sound which is spread from a noise source in direct contact with a *building* element. An example of this is footsteps.

Isolation is a strategy to limit the number and type of rigid connections in a sound resisting element of *construction*.

Mass is a physical quantity that expresses the amount of matter in a body. Walls and floors may be described in terms of the surface density (mass per unit area, kg/m^2) of the wall face or the floor surface, which is the sum of the surface densities of each component of the *construction*. The density of materials is expressed as mass per unit volume, kg/m^3.

Measures to reduce the transmission of sound

Measures to reduce the transmission of sound vary according to the type of *construction* and its reaction to sound energy. The most important factors which affect the behaviour of *separating walls* and *separating floors* are mass, cavities, isolation, and absorption.

More energy is required to set up vibrations in a dense structure than in a light one, making a massive structure less likely to transmit sound. Mass is particularly important in limiting the transmission of low frequency airborne sound, such as bass notes from a music system, but the interaction of linings and structure is also significant. The mass of a masonry *construction* depends on the mass and thickness of components and the jointing between them. The mass of a lighter weight structure, for instance timber floors, can be increased by deafening (or pugging), the process of filling between joists with high density material such as sand or gypsum based board.

Cavities aid the reduction of sound transmission, in part by isolating the components of elements of *construction*. The level of sound transmitted is reduced at each interface in a cavity wall and the wider the cavity, the greater the reduction in transmission. Very small cavities can create an unwelcome 'drum effect'. Any structural coupling of the leaves increases transfer by vibration: fewer and less stiff connections reduce sound transmission. Isolation is one of the means to reduce the transmission of mid to higher frequency sound, such as speech and the noise of domestic appliances.

Components which absorb sound energy by friction reduce sound transmission through the structure. For instance, absorptive material may be hung in a wall cavity.

Relationship to other sections

Consideration should be given to guidance in other sections which can influence the performance of sound resisting *construction*, including:

Section 1: Structure: can affect the isolation of constituent parts of sound resisting *construction*
Section 2: Fire: can affect the isolation of constituent parts of sound-resisting *construction* and absorption by internal surfaces
Section 6: Energy: can affect the mass of sound resisting *construction* at junctions with exterior walls.

Alternative approaches to design

The guidance gives three alternative approaches to the design of sound resisting *construction* for *separating walls* and *separating floors*. These are:

- specified *constructions* (clauses 5.1.3 – 5.1.11);
- performance testing (clause 5.1.12);
- scheme operated by Robust Details Ltd. (see clause 5.1.13).

Specified *construction* and performance testing may be used for new *construction*, alterations or *conversions*. The Robust Standards Details Scheme only covers new *buildings*.

In addition to the guidance given here, there may be other approaches. For instance, if an identical block of *dwellings* has been tested and shown to meet the performance values, a building warrant can be given on that evidence. Care should be taken to ensure that the test results are equally applicable and that the critical aspects of the design are replicated, including specification, room size, shape, and relationships between *dwellings*. For instance, a *construction* giving good results in a stepped elevation or a staggered plan may not perform well in a straight terrace block of *dwellings*, due to flanking transmission. Also, checks should be made to ensure that the blocks are *built* to the same standards of workmanship as the block tested.

Conversion

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

5.1.1 General application to *dwellings*

Section 5 applies to *dwellings* other than those that are totally detached.

When determining how the guidance for resistance to transmission of sound applies to other types of *dwelling* configurations, recognition should be given to the following:

a. airborne sound resisting *separating walls* and *separating floors* should be provided between *dwellings*. Each *dwelling* is to be protected from noise emanating from the other one.
b. airborne sound resisting *separating walls* and *separating floors* should be provided between *dwellings* and non-domestic *buildings*. The *dwelling* is to be protected from noise emanating from the non-domestic *building*.
c. airborne sound resisting *separating walls* and *separating floors* should be provided between *dwellings* and other parts of a *building*. The *dwelling* is to be protected from noise emanating from the other parts, such as common stair enclosures and passages, solid waste disposal chutes, lift shafts, plant rooms, communal lounges, and car parking garages.
d. impact sound resisting *separating floors* should be provided between *dwellings*. The lower *dwelling* should be protected from sound emanating from the upper *dwelling*.
e. impact sound resisting *separating floors* should be provided between a *dwelling* and other parts of a *building* that contains *dwellings*. The *dwelling* below should be protected from sound emanating from other parts of the *building* above.
f. impact sound resisting *construction* should be provided between a *dwelling* and a roof that acts as a floor or a walkway directly above the *dwelling*. The *dwelling* below is to be protected from sound emanating from the roof or walkway above. Examples of roofs that act as floors are *access decks*, car parking, *escape routes* and roof gardens.

Additional guidance relating to specific situations

The guidance given in a. to f. above is summarised in the following diagrams. It should be read in conjunction with additional guidance that relates to specific situations:

- where 2 *houses* are linked only by an imperforate *separating wall* between their ancillary garages, it is not necessary for the wall to be airborne sound resisting;
- where the wall between a *dwelling* and another part of the *building* is substantially open to the external air, it is not necessary for the wall to resist airborne sound transmission; an example of this would be the wall between a *dwelling* and an *access deck*;
- where the wall between a *dwelling* and another part of the *building* incorporates a *fire door*, it is not necessary for the door to be airborne sound resisting;
- when a roof or walkway is providing access solely for the purpose of maintenance or is solely for the use of the residents of the *dwelling* directly below, it is not necessary to provide impact sound resisting *construction*;
- in the case of a *separating wall* or *separating floor* between a *dwelling* and a private garage or a private waste storage area which is ancillary to the same *dwelling*, it is not necessary for the wall or floor to be airborne or impact sound resisting.

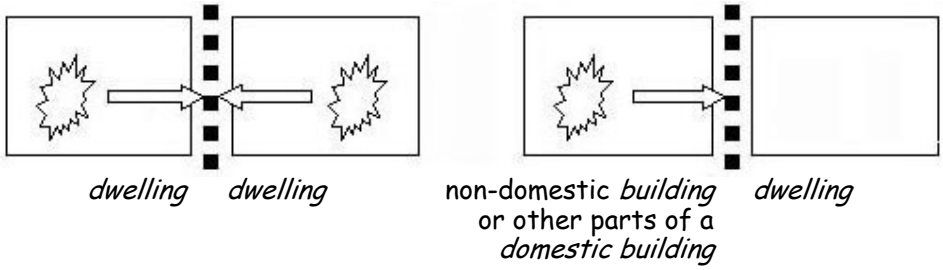
Additional guidance to *building* owners and tenants

While floor coverings are not part of the building regulations, it should be noted that panelled floor finishes, including laminated flooring, may severely reduce the impact sound insulation for *separating floors*, and specialist advice should be considered.

The following diagrams show only direct transmission paths. Flanking transmission is also an important consideration. (see clause 5.1.2)

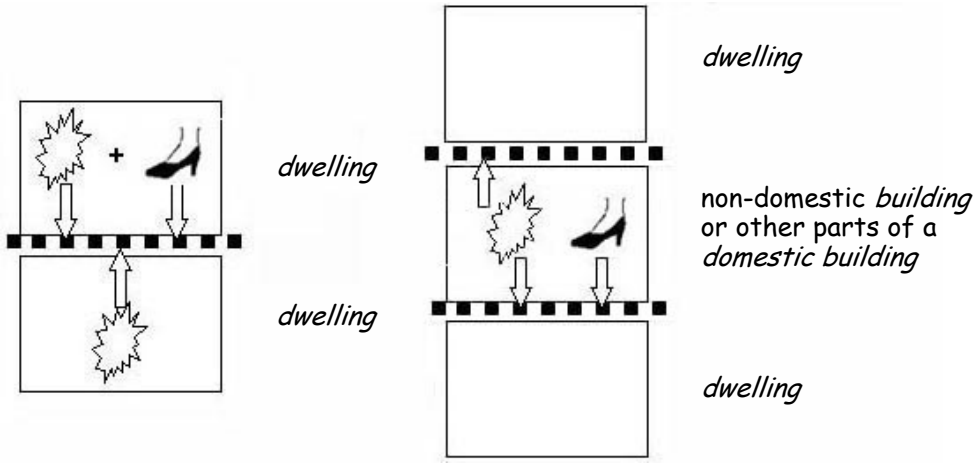
Airborne sound: *separating walls*

(viewed in plan or section)



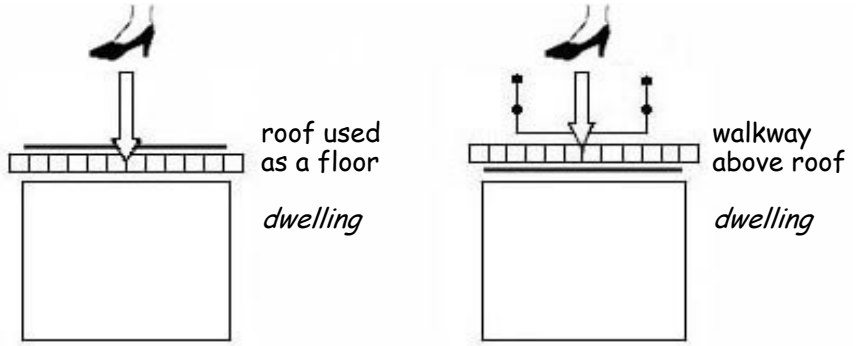
Airborne and impact sound: *separating floors*

(viewed in section)

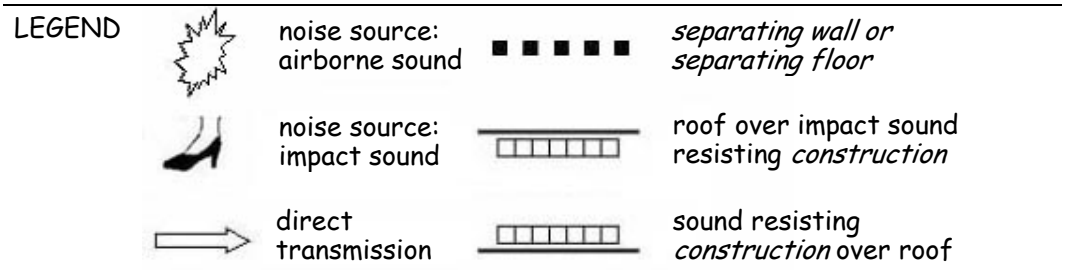


Impact sound: roofs and walkways over *dwellings*

(viewed in section)



Sound resisting *construction* is not necessary if the roof or walkway only provides access for maintenance or is solely for the use of the residents of the *dwelling* directly below.



5.1.2 Flanking transmission

A specification for a sound resisting *separating wall* or *separating floor* is incomplete without measures to avoid flanking transmission.

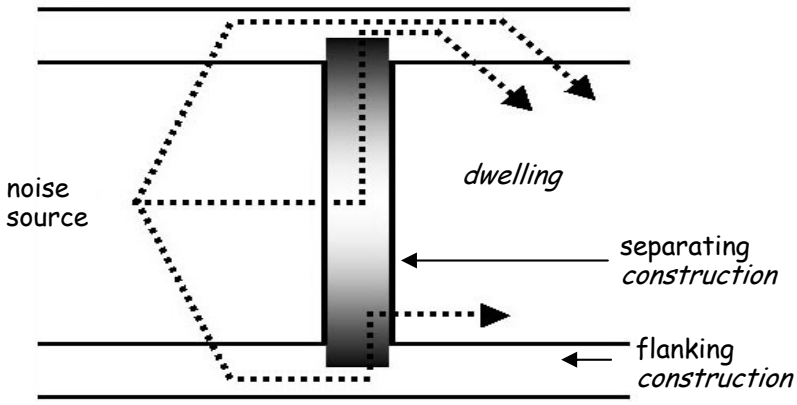
Flanking transmission occurs when there is a path for sound to travel along elements adjacent to *separating walls* or *separating floors*. If the flanking *construction* and its connections with the separating structure are not correctly detailed, flanking transmission can equal or even exceed sound levels perceived as a result of direct transmission.

Flanking transmission can occur, for instance, when a wall of low mass is continuous between a space and the *dwelling* below, such as the inner leaf of a cavity wall where the floor is not built into the inner leaf. Similarly, where a *separating wall* abuts the inner leaf of an external cavity wall, and the walls are insufficiently tied or bonded together, noise can travel along the path of the inner leaf.

Typical routes

(viewed in either plan or section)

Flanking transmission



5.1.3 Specified constructions

One of the possible approaches to standard 5.1 is to use specified *constructions.* The *specified constructions* presented in this guidance use common *building* techniques and materials. Quality of workmanship is critical in achieving protection from sound transmission when using these details.

Thickness, mass, and other dimensions are suggested minimum values. Timber sizes refer to actual sizes. Where the mass per unit area (kg/m^2) is given, it refers to the wall surface area, or to the floor surface on plan. Annex 5.A gives a method for calculating mass in relation to the specified *constructions*.

Workmanship

Research commissioned by the Scottish Executive suggests that particular care should be taken with certain wall and floor types in order to achieve satisfactory resistance to sound transmission (see www.scotland.gov.uk/development/bc/insulation.pdf).

Updated advice is offered for the wall types which use gypsum based board fixed to solid or cavity masonry. Updated advice is also offered for each of the floor types, including guidance on resilient materials which has been adjusted to reflect common practice.

When *dwellings* are created by *conversion*, the existing walls and floors should be checked to determine whether use of the specified *constructions* is appropriate.

The following constraints apply to the specified *constructions.*

Separating walls

No opening should be provided except a doorway with a *fire door* in accordance with section 2, Fire, where the doorway is either:

- between a *dwelling* and a common stairway or common passage in the same *building*; or
- between a *dwelling* and a stairway or passage in an area of another use which is in the same occupation as the *dwelling*.

No service pipes or *ducts* should pass between a *dwelling* and a common stairway, common passage or a services enclosure unless the pipes and *ducts* are protected as recommended by section 2 Fire.

Custom built and *system chimneys* should not be built into timber frame *separating walls*, including wall type 4. Only masonry *chimneys* (including *chimneys* built of precast concrete *flue blocks*) should be *built* into other types of *separating wall*.

Separating floors

In any *separating floor* being built to one of the specified *constructions*, no openings should be formed, apart from openings for service *ducts*, pipes, or *chimneys* which are protected as recommended by section 2, Fire and section 3, Environment, and are enclosed above and below the floor as described in the notes on floor penetrations for each of the recommended floor *constructions*. Guidance on the installation of down lighters has been added for floor type 4.

No specific guidance is given on how to achieve resistance to impact sound for walkways and roofs that act as floors, where they are directly above *dwellings*. In some instances, where only light traffic is involved, e.g. a rooftop patio, it may be possible to adapt one of the specified *constructions*. In other cases e.g. rooftop car parking, it is recommended that specialist advice is sought. In all cases guidance on weather protection, given in section 3, Environment, should be considered.

Loudspeakers

The development of flat panel loudspeakers and loudspeakers integrated within floor *constructions* has introduced an additional neighbour noise concern. No loudspeaker should be fitted within a *separating floor* or *separating wall*. Also, it should be noted that the specified *constructions* and performance test standards cannot provide sufficient sound reduction to prevent nuisance if 'surround sound' loudspeakers are mounted directly onto *separating walls* or *separating floors*.

Information relevant to other standards

The specified *constructions* do not show all the information that relates to the other building standards. For example, there is no consideration of the structural bracing of floors.

It is important that the specified *constructions* should be used with due regard for the *fire-stopping* guidance in section 2, Fire, and any other relevant standards.

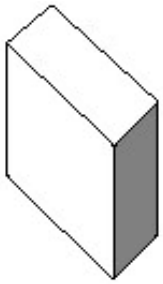
5.1.4 Specified wall constructions

Wall type 1: Solid masonry

The resistance to airborne sound transmission depends mainly on the mass of the wall.

Wall type 1 Points to watch

Fill masonry joints with mortar in order to achieve the mass and avoid air paths.
Limit the pathways around the wall (to reduce flanking transmission).



Chases for services may be provided if:

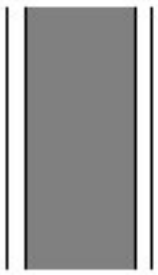
- the depth of any horizontal chase does not exceed one-sixth of the thickness of the leaf;
- the depth of any vertical chase does not exceed one-third of the thickness;
- chases are not back to back.

Constructions – wall type 1

Five recommended solid masonry wall *constructions* (A-E) are described below, including details of junctions to limit flanking transmission.

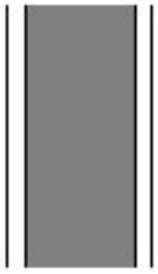
Wall type 1A

Brick, plastered both sides
Mass including plaster 375 kg/m^2.
13 mm plaster each side.
Lay bricks in a bond which includes headers and with frogs uppermost.
Example: 215 mm brick, 75 mm coursing, brick density 1610 kg/ m^3; lightweight plaster.



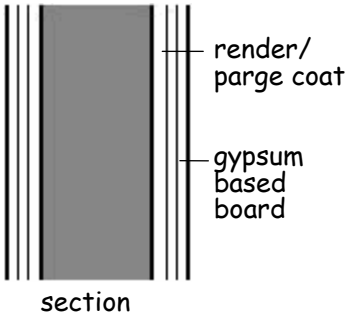
Wall type 1B

Concrete block, plastered both sides
Mass including plaster 415 kg/m^2.
13 mm plaster each side.
Use blocks which extend to the full thickness of the wall.
Two leaves of block side by side are not recommended
Example: 215 mm block, 110 mm coursing, block density of 1840 kg/m^3; lightweight plaster.



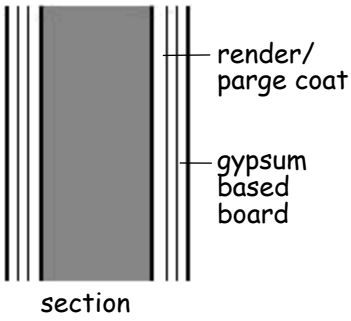
Wall type 1C

Brick, parged both sides, gypsum based board both sides.
Mass of brick and gypsum based board 375 kg/m^2.
13 mm internal render (parge coat) both sides, should not be smoothed or float finished. Minimum mass per unit area of internal render 18 kg/m^2, both sides.
Typical internal render mix: cement: lime : sand 1 : ½ : 4, by dry volume, in accordance with BS 5492: 1990.
12.5 mm gypsum based board each side, minimum mass per unit area 8.5 kg/m^2, both sides, fixed with plaster dabs, not battens.
Lay bricks in a bond which includes headers and frogs uppermost.
Example: 215 mm brick, 75 mm coursing, brick density 1610 kg/m^3.



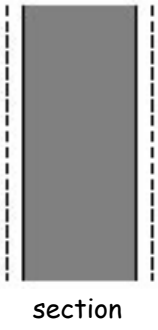
Wall type 1D

Concrete block, parged both sides, gypsum based board both sides.
Mass of masonry alone 415 kg/m^2.
13 mm internal render (parge coat) both sides, should not be smoothed or float finished.
Minimum mass per unit area of internal render 18 kg/m^2, both sides.
Typical internal render mix: cement : lime : sand 1 : ½ : 4, by dry volume, in accordance with BS 5492: 1990.
12.5 mm gypsum based board each side, minimum mass per unit area 8.5 kg/m^2, both sides, fixed with plaster dabs, not battens.
Use blocks which extend to the full thickness of the wall.
Two leaves of block side by side are not recommended.
Example: 215 mm block, 150 mm coursing, block density 1840 kg/m3.



Wall type 1E

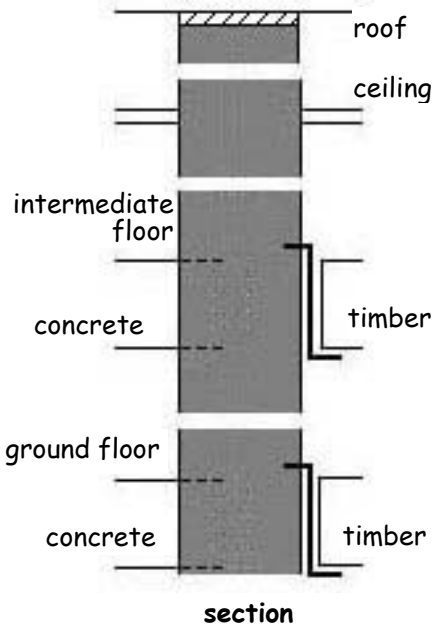
In-situ concrete or large concrete panel
Minimum density 1500 kg/m^3, plaster optional.
Mass (including plaster if used) 415 kg/m^2.
Fill joints between panels with mortar.
Example: 190 mm thick unplastered wall, density 2200 kg/m^3.



Junctions at roof, ceilings, floors
Guidance in sections 1, 2 and 6 should be considered.

Wall type 1

Fire-stop the joint between wall and roof (see section 2, Fire).
Where there is a heavy ceiling with sealed joints (12.5 mm gypsum based board or board material of equivalent mass), the mass of the wall above the ceiling may be reduced to 150 kg/m^2.
If lightweight aggregate blocks are used to reduce mass, seal one side with cement paint or plaster skim.
With a timber floor, use joist hangers instead of building joists into *separating walls*.
With a concrete floor the wall should be carried through, unless the concrete floor has a mass of 365 kg/m^2 or more.
See clause 5.1.3 for guidance on openings, pipes and *ducts*, and *chimneys*.



section

Junctions at external walls
The outer leaf of a cavity wall adjacent to a type 1 wall may be of any *construction*.

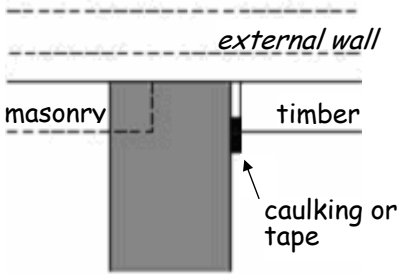
Wall type 1

Where a cavity wall has an inner leaf of masonry, or where the *external wall* is of solid masonry:

a. the masonry of the *separating wall* should:
   - be bonded together with the masonry of the inner leaf or the solid *external wall*; or
   - abut the masonry of the *external wall* and be tied to it with ties at no more than 300 mm centres vertically; and

b. the masonry should have a mass of 120 kg/m^2 unless the length of the *external wall* is limited by openings:
   - of 1 m high, and
   - on both sides of the *separating wall* at every *storey*, and
   - within 700 mm of the face of the *separating wall* on both sides (a short length of wall does not vibrate excessively at low frequencies to give flanking transmissions).

Where a cavity wall has an inner leaf of timber *construction* it should:
- abut the *separating wall*; and
- be tied to it with ties at no more than 300 mm centres vertically; and
- have the joints sealed with tape or caulking.



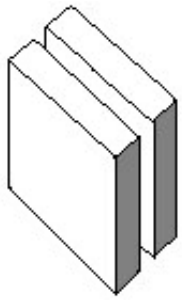
plan

Wall type 2

5.1.5 Specified wall constructions
Wall type 2: Cavity masonry

The resistance to airborne sound transmission depends on the mass of the leaves and on the degree of isolation achieved.

Points to watch



Fill masonry joints with mortar in order to achieve the mass and avoid air paths.
Maintain the cavity up to the underside of the roof.
Connect the leaves only where necessary for structural reasons.
Use only butterfly pattern ties, as described in BS 1243: 1978, spaced no further apart than 900 mm horizontally and 450 mm vertically (BS 5628: Part 3: 2001 limits this tie type and spacing to cavities of 50 mm to 75 mm with a minimum masonry leaf thickness of 90 mm).
Cavities should be kept clear of mortar droppings, which can reduce acoustic performance by creating a bridge between the 2 leaves.
50 mm cavities are acceptable for wall types 2A, 2B, and 2C, but 75 mm cavities make it is easier to avoid this problem.
If *external walls* are to be filled with an insulating material, other than loose fibre, the insulating material should be prevented from entering the cavity in the *separating wall*.

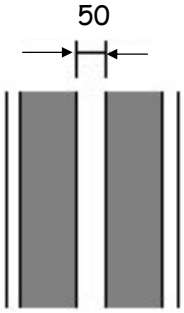
Chases for services can be provided if:

- the depth of any horizontal chase does not exceed one-sixth of the thickness of the leaf;
- the depth of any vertical chase does not exceed one-third of the thickness;
- chases are not back to back.

Constructions – wall type 2

Four recommended cavity wall *constructions* (A-D) are described below, including details of junctions to limit flanking transmission. Two of the specified *constructions* are only intended for use between *houses* with a step in elevation and / or a stagger in plan at the *separating wall* (C & D).

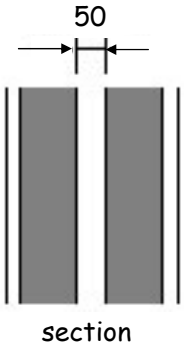
Wall type 2A



Two leaves of brick with 50 mm cavity, plastered on both *room* faces.
Mass including plaster 415 kg/m^2. 13 mm plaster each face.
Example: 102 mm leaves laid frogs uppermost, 75 mm coursing, brick density 1970 kg/m^3; lightweight plaster.

Wall type 2B

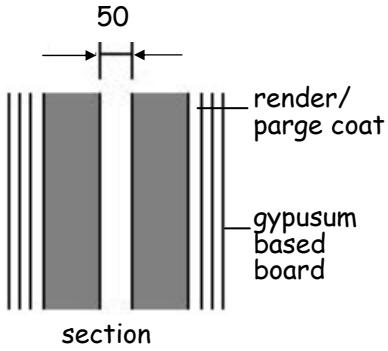
Two leaves of concrete block with 50 mm cavity, plastered on both *room* faces
Mass including plaster 415 kg/m^2. 13 mm plaster each face.
Example: 100 mm leaves, 225 mm coursing, block density 1990 kg/m^3; lightweight plaster.



Wall type 2C

Two leaves of concrete block with 50 mm cavity, both leaves parged, gypsum based board on both *room* faces.
Mass of masonry alone 415 kg/m^2.
12.5 mm gypsum based board each side, minimum mass per unit area 8.5 kg/m^2, both sides, fixed with plaster dabs.
13 mm internal render (parge coat) both leaves; should not be smoothed or float finished.
Minimum mass per unit area of internal render 18 kg/m^2, both leaves.
Typical internal render mix:
cement : lime : sand 1 : ½ : 4, by dry volume, in accordance with BS 5492: 1990.
Example: 100 mm leaves, 225 mm coursing; block density of 1990 kg/m^2 gives the required mass.

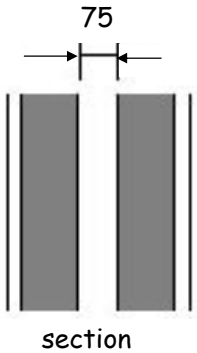
Adjacent *dwellings* using wall type 2C should be stepped and/or staggered by at least 300 mm.



Wall type 2D

Two leaves of lightweight aggregate concrete block with 75 mm cavity, plastered on both *room* faces.
Maximum block density 1500 kg/m^3.
Mass including plaster 250 kg/m^2.
13 mm plaster each face.
Seal the face of the blockwork, with cement paint or plaster, through the full width and depth of any intermediate floor.
Example: 100 mm leaves, 225 mm coursing, block density 1105 kg/m^3; lightweight plaster.

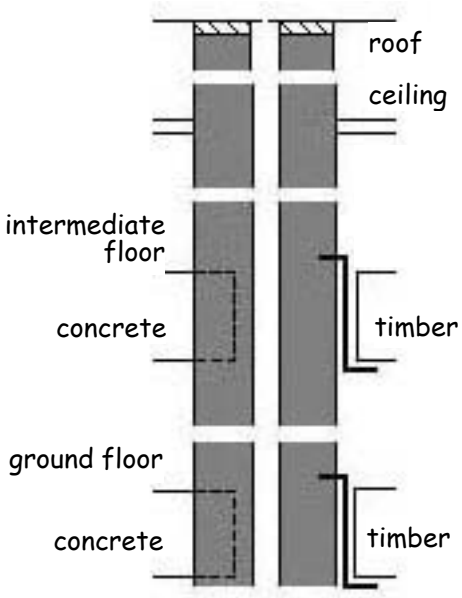
Adjacent *dwellings* using wall type 2D should be stepped and/or staggered by at least 300 mm.



Junctions at roof, ceilings, floors
Guidance in Sections 1, 2 and 6 should be considered.

Wall type 2

Fire-stop the joint between wall and roof (see section, 2 Fire).
Where there is a heavy ceiling with sealed joints (12.5 mm gypsum based board or board material of equivalent mass), the mass of the wall above the ceiling may be reduced to 150 kg/m^2.
The cavity should still be maintained.
If lightweight aggregate blocks are used to reduce mass, one face of the wall should be sealed with cement paint or plaster skim.
With a timber floor, use joist hangers for any joists supported on the wall.
With a concrete intermediate or suspended ground floor the floor may be carried through, only to the cavity face of each leaf.
A concrete slab on the ground may be continuous.
See clause 5.1.3 for guidance on openings, pipes and *ducts*, and *chimneys.*

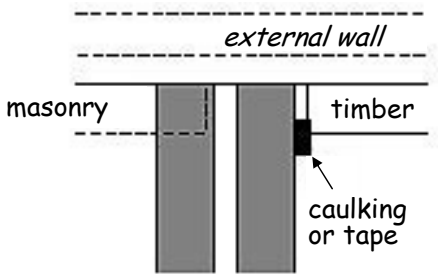


section

Junctions at external walls
The outer leaf of a cavity wall adjacent to a type 2 wall may be of any *construction*.

Wall type 2

Where a cavity wall has an inner leaf of masonry:
a. the masonry of the *separating wall* should:
   - be bonded together with the masonry of the inner leaf of the *external wall* to create a homogeneous unit; or
   - abut the masonry of the *external wall* and be tied to it with ties at no more than 300 mm centres vertically; and
b. the masonry should have a mass of 120 kg/m^2 except where *separating wall* type 2B is used, when there is no minimum appropriate mass.



plan

Where a cavity wall has an inner leaf of timber *construction* it should:
- abut the *separating wall*; and
- be tied to it with ties at no more than 300 mm centres vertically; and
- have the joints sealed with tape or caulking.

The cavity in the *separating wall* should only be sealed in accordance with the guidance in section 2, Fire.

Wall type 3

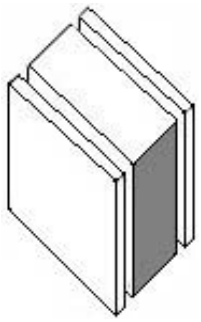
5.1.6 Specified wall constructions

Wall type 3: Solid masonry between isolated panels

The resistance to airborne sound transmission depends on the mass and type of core, and on the isolation and mass of the panels.

Points to watch

Fill masonry joints with mortar in order to achieve the mass and avoid air paths.
To achieve isolation, support the panels only from floor and ceiling, without fixing or tying to the core.
Cavity barriers between the masonry core and isolated panels should be the minimum necessary to follow the guidance in section, 2 Fire, and should be of a flexible type, to maintain the isolation.
Services may penetrate the free-standing panels but any gaps should be sealed with tape or caulking.



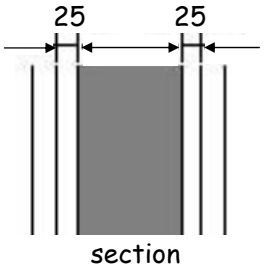
Wall type 3

Constructions – wall type 3

Four recommended masonry cores (A - D) and two panels (P1 & P2) are described below, including details of junctions to limit flanking transmission. Any of the masonry cores may be used in combination with either of the panels.

Basic construction

A masonry core, with an isolated panel on each side.
Minimum air space between panels and core 25 mm. Framing should be kept clear of the masonry core by at least 10 mm.



Masonry cores

Core A

Brick. Mass 300 kg/m^2.
Example: 215 mm core, laid with frogs uppermost, 75 mm coursing; brick density 1290 kg/m^3.

Core B

Concrete block. Mass 300 kg/m^2.
Example: 140 mm core, 110 mm coursing, block density 2200 kg/m^3.

Core C

Lightweight aggregate concrete block. Mass 200 kg/m^2. Maximum density 1500 kg/m^3.
Examples: 140 mm core, 225 mm coursing; block density 1405 kg/m^3. 215 mm core, 150 mm coursing; block density 855 kg/m^3.

Core D

Autoclaved aerated concrete block. Mass 160 kg/m^2

Examples: 200 mm core, 225 mm coursing; block density 730 kg/m^3. 215 mm core, 150 mm coursing; block density 855 kg/m^3.

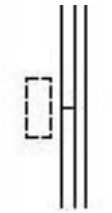
Isolated panels

Panel P1

Two sheets of gypsum based board joined by cellular core.
Mass (including plaster finish if used) 18 kg/m^2
Fit to ceiling and floor only.
Tape joints between panels.

Panel P2

Two sheets of gypsum based board with joints staggered.
Mass (including plaster finish if used) 18 kg/m^2
Thickness of each sheet 12.5 mm if a supporting framework is used, or total thickness of 30 mm if no framework is used.

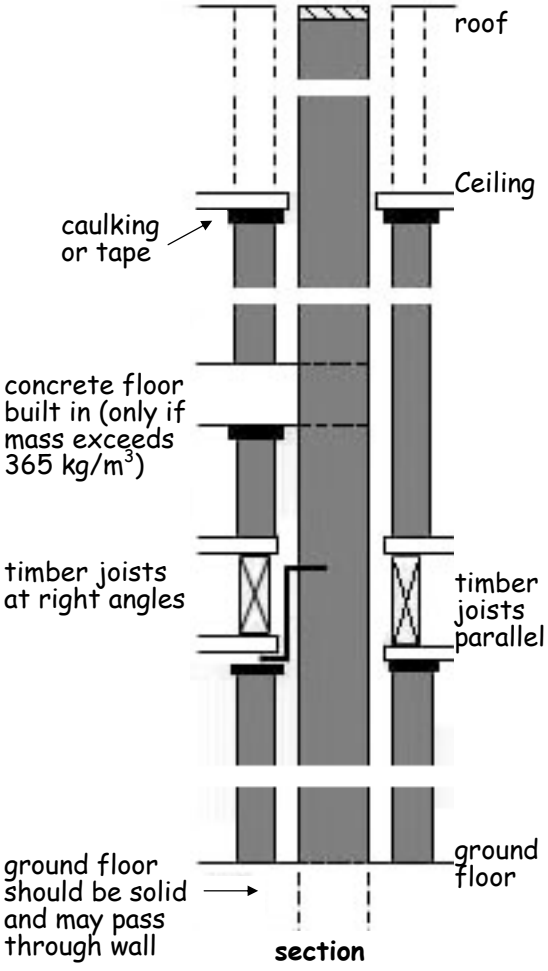


Junctions at roof, ceilings, floors

Guidance in sections 1, 2 and 6 should be considered.

Wall type 3

Fire-stop the joint between masonry core and roof (see section, 2 Fire).
Where there is a heavy ceiling with sealed joints (12.5 mm gypsum based board or board material of equivalent mass), the free-standing panels may be omitted in the *roof space* and mass of the core above the ceiling may be reduced to 150 kg/m^2.
If lightweight aggregate blocks are used to reduce mass, seal one side with cement paint or plaster skim.
Seal the junction between ceiling and free-standing panels with tape or caulking.
With a timber intermediate floor use joist hangers for any joists supported on the wall and seal the spaces between joists with full depth timber dwangs.
With a concrete intermediate floor the floor base may only be carried through where it has a mass of 365 kg/m^2.
Seal the junction between ceiling and panel with tape or caulking.
The ground floor should be a solid slab, laid on the ground to prevent air paths.



Junctions at external walls

The outer leaf of a cavity wall adjacent to a type 3 wall may be of any *construction*.

Wall type 3

The inner leaf of a cavity wall should have an internal finish of isolated panels as specified for the *separating wall*.

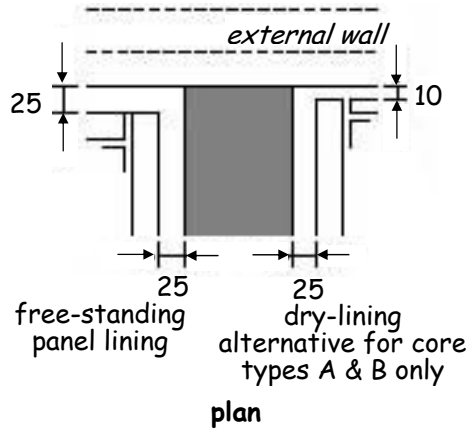
This is not necessary where the *separating wall* has core A or B, in which case plaster or dry-lining with joints sealed with tape or caulking may be used.

A layer of insulation may be added to such internal finish provided the 25 mm and 10 mm gaps shown in the diagram are maintained.

The inner leaf may be of any *construction* if it is lined with isolated panels.

If the inner leaf is dry-lined it should be masonry with a mass of 120 kg/m^2, butt jointed to the *separating wall* core with ties at no more than 300 mm centres, vertically.

See clause 5.1.3 for guidance on openings, pipes and *ducts*, and *chimneys*.



Junctions at partitions

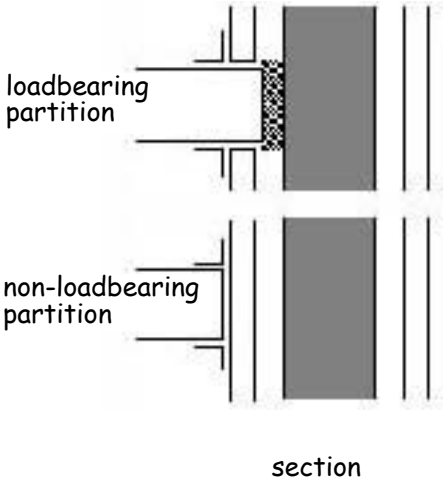
Wall type 3

Partitions abutting a type 3 *separating wall* should not be of masonry *construction*.

Other loadbearing partitions should be fixed to the masonry core through a continuous pad of mineral fibre quilt.

Non-loadbearing partitions should be tight butted to the isolated panels.

All joints between partitions and panels should be sealed with tape or caulking.



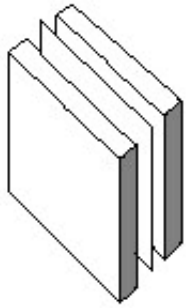
Wall type 4

5.1.7 Specified wall constructions

Wall type 4: Timber frames with absorbent curtain

The resistance to airborne sound transmission depends on the isolation of the frames plus absorption in the air space between them. Section 2 Fire limits the *storey* height at which this type may be used.

Points to watch



Only connect frames if necessary for structural reasons, and then use as few ties as possible. These should not be more than 14-16 gauge (40 mm x 3 mm) metal straps fixed at or just below ceiling level, 1.2 m apart.
Where *cavity barriers* are needed in the cavity between frames they should either be flexible or fixed to only one frame.
Services should not be contained in the wall. This is a structural fire precaution but also limits the creation of air paths through the lining.

Wall type 4

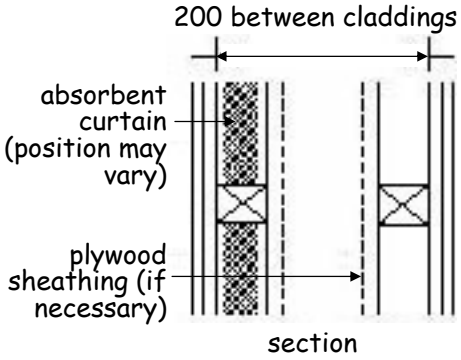
Constructions – wall type 4

Two recommended timber frame *constructions* (A & B) are given, together with details for cladding and absorbent curtains, and for junctions to limit flanking transmission.

Basic construction

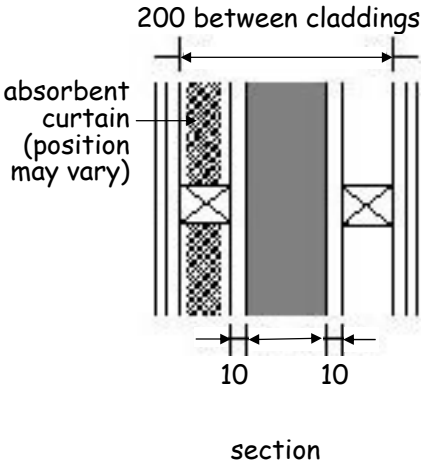
Wall type 4A

Timber frames plus absorbent curtain in cavity.
200 mm between claddings.
Plywood sheathing may be used in the cavity as necessary for structural reasons.



Wall type 4B

Timber frames, masonry core, plus absorbent curtain in a cavity.
200 mm between claddings (ignore core).
Framing should be clear of core by 10 mm.
The masonry core is not considered as part of the means of providing sound resistance, but it may be useful for structural support and/or easing the transition to external masonry cladding in stepped or staggered situations.
There are no restrictions on the type of masonry but the core may be connected to only one of the frames.



Cladding

On each side: 2 or more layers of gypsum based board, combined thickness 30 mm, joints staggered to avoid air paths.

Absorbent curtain
Unfaced mineral fibre quilt (which may be wire reinforced), density 12-36 kg/m^3, thickness 25 mm if suspended in the cavity between frames, 50 mm if fixed to one frame, or 25 mm per quilt if one fixed to each frame.

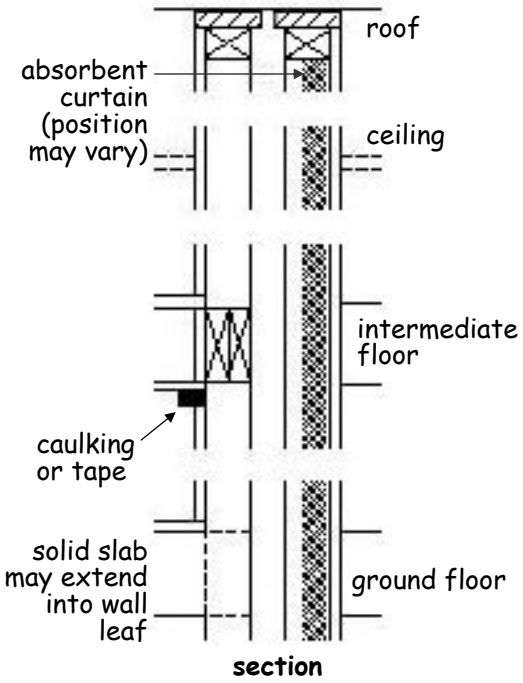
Wall type 4

Junctions at roof, ceilings, floors
Guidance in sections 1, 2 and 6 should be considered.

Roof
Fire-stop the joint between masonry core and roof (see section 2, Fire).

Ceiling and *roof space*
Carry the complete *construction* through to the underside of the roof.
Provision of a ceiling of any type is optional.

Intermediate floor and ground floor
Block the air path to the wall cavity either by carrying the cladding through the floor or by using a solid timber edge to the floor.
Where the joists are at right angles to the wall, seal spaces between joists with full depth timber dwangs.
See clause 5.1.3 for guidance on openings, pipes and *ducts*, and *chimneys*.



section

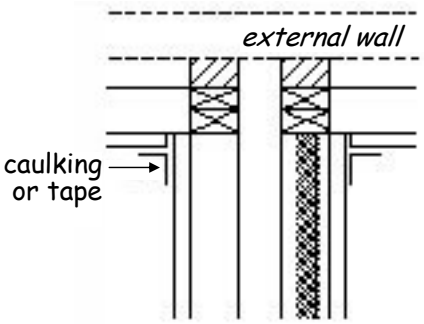
Junctions at external walls

Wall type 4

There are no restrictions on a traditional timber framed wall but if the wall is of cavity *construction*, the cavity should be sealed between the ends of the *separating wall* and the outer leaf to prevent air paths.

The internal finish of the external wall should be 12.5 mm gypsum based board or other equally heavy material having a mass of at least 10 kg/m^2 (thermal insulation may be incorporated within the framing).

Where there is an adjacent separating floor, an additional layer of 12.5 mm gypsum based board should be mounted on the inner leaf of the external wall. See also section 2, Fire.



plan

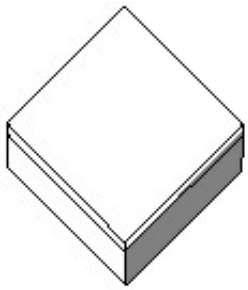
Floor type 1

5.1.8 Specified floor constructions
Floor type 1: Concrete base with soft covering

The resistance to airborne sound transmission depends on the mass of the concrete base and on eliminating air paths. The resistance to impact sound transmission depends on the soft covering.

Points to watch

Fill all joints between parts of the floor to avoid air paths.
Limit pathways around the floor to reduce flanking transmission.
Workmanship and detailing should be given special attention at the perimeter and wherever the floor is penetrated by a pipe or *duct*, to reduce flanking transmission and to avoid air paths.



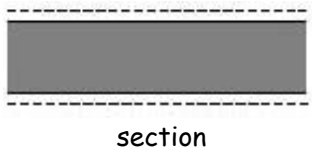
Floor type 1

Constructions – floor type 1
Four floor bases (A-D) are described below, together with details for soft coverings which increase resistance to impact sound transmission, and for junctions to limit flanking transmission.

Floor bases

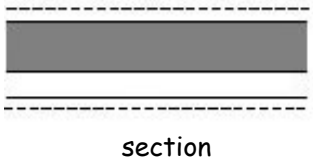
Base A

Solid concrete slab, cast in-situ.
Floor screed and/or ceiling finish optional.
Mass (including any screed and/or ceiling finish) 365 kg/m^2.



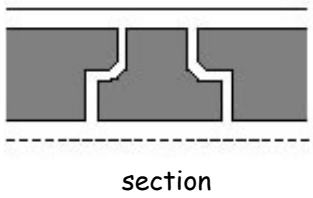
Base B

Solid concrete slab, cast in-situ, with permanent shuttering.
Floor screed and/or ceiling finish optional.
Mass 365 kg/m^2 including shuttering only if it is solid concrete or metal, and including any screed and/or ceiling finish.



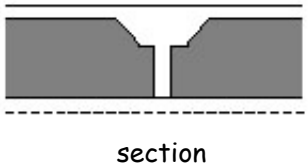
Base C

Concrete beams with infilling blocks
Floor screed and/or structural topping should be used.
Ceiling finish optional.
Mass 365 kg/m^2 including beams, blocks, any structural topping, screed, and any ceiling finish.



Base D

Concrete planks (solid or hollow)
Floor screed and/or structural topping should be used.
Ceiling finish optional.
Mass 365 kg/m^2, including planks, any structural topping and screed, including any ceiling finish.



Soft covering

Soft covering, fully bonded to the floor base:

- a resilient material, or material with a resilient base, with an overall uncompressed thickness of at least 4.5 mm; or
- a material with a weighted reduction in impact sound pressure level (ΔLw) of at least 17 dB when measured in accordance with annex 5.B.

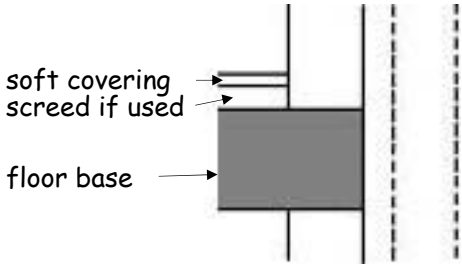
It is not suitable as a means to limit impact transmission to a *dwelling* below a walkway or a roof that acts as a floor.

Floor type 1

Junctions at walls at external or cavity separating walls

Guidance in sections 1, 2 and 6 should be considered.

The mass of the wall leaf adjoining the floor should be 120 kg/m^2, including any plaster. This is not necessary where the area of openings in the *external wall* exceeds 20% of its area: there is no recommendation for the minimum mass of such a wall.
The floor base, excluding any screed, should pass through the leaf whether spanning parallel to, or at right angles to, the wall.
The cavity should not be bridged.

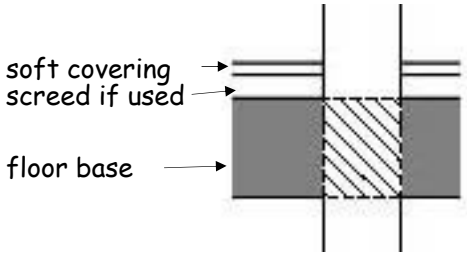


section

Floor type 1

Junctions at walls at internal or solid separating wall

If the wall mass is less than 355 kg/m^2 including any plaster then the floor base excluding any screed should pass through.
If the wall mass is more than 355 kg/m^2 including any plaster, either the wall or the floor base excluding any screed may pass through.
Where the wall does pass through, tying the floor base to the wall and grouting the joint, is recommended.



section

Floor type 1

Floor penetrations

No openings should be formed, apart from openings for service *ducts*, pipes, or *chimneys* which are protected as recommended by section 2, Fire and section 3, Environment.

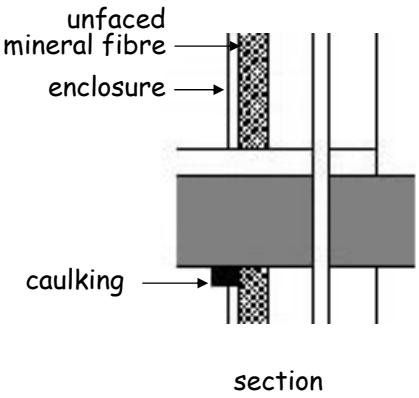
Ducts or pipes that penetrate the floor should be in an enclosure, both above and below the floor.

Either line the enclosure, or wrap the *duct* or pipe within the enclosure, with 25 mm unfaced mineral fibre.

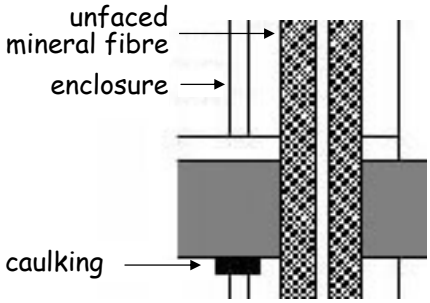
The material of the enclosure should have a mass of 15 kg/m^2.

Penetrations of a *separating floor* by *ducts* and pipes should have fire protection in accordance with section 2, Fire.

Where there is no conflict with advice in section 3, Environment, a *flue-pipe* may penetrate the floor, provided that it discharges either into a masonry *chimney* carried by the floor or any other type of *chimney* enclosed within a *non-combustible duct* that is lined with absorbent mineral fibre.



section



section

Floor type 2

5.1.9 Specified floor constructions

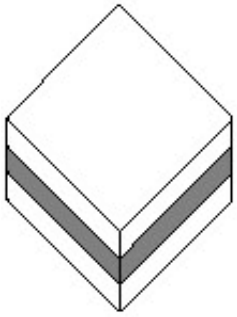
Floor type 2: Concrete base with floating layer

The resistance to airborne sound transmission depends mainly on the mass of the concrete base and partly on the mass of the floating layer. The resistance to impact sound depends on the resilient layer to isolate the floating layer from the base and from the surrounding *construction*.

In some cases resistance to impact sound is not necessary (see clause 5.1.1) however, the full *construction* should still be used, to avoid a detrimental effect on resistance to airborne sound transmission.

Points to watch

Fill all joints between parts of the floor base to avoid air paths.
Limit the pathways around the floor to reduce flanking transmission.
Workmanship and detailing should be given special attention at the perimeter and wherever the floor is penetrated, to reduce flanking transmission and to avoid air paths.
Take care not to create a bridge between the floating layer and the base, surrounding walls, or adjacent screeds.
With bases C and D a screed is used to accommodate surface irregularities and prevent reduced resistance to noise transmission at joints.



Floor type 2

Constructions – floor type *2*

Four floor bases (A-D) are described below, together with details for two floating layer constructions (F1 & F2). Any of these can be used in combination. Details for junctions to limit flanking transmission are also described below.

Floor bases

Base A

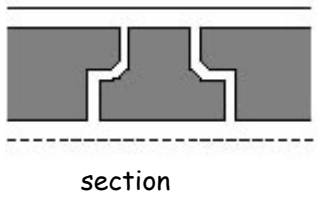
Solid concrete slab, cast in-situ, with shuttering removed.
Floor screed and/or ceiling finish optional.
Mass (including any screed and/or ceiling finish) 300 kg/m^2.

Base B

Solid concrete slab, cast in-situ, with permanent shuttering.
Floor screed and/or ceiling finish optional.
Mass 300 kg/m^2, including shuttering only if it is solid concrete or metal, and including any screed and/or ceiling finish.

Base C

Concrete beams with infilling blocks
Floor screed should be used; ceiling finish is optional but recommended to limit air paths at joints.
Mass 300 kg/m^2 including beams, blocks, any structural topping including screed, and any ceiling finish.



Base D

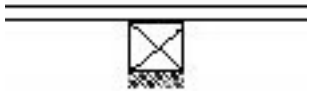
Concrete planks (solid or hollow)
Floor screed should be used; ceiling finish is optional but recommended to limit air paths at joints.
Mass 300 kg/m^2, including planks, any structural topping including screed and any ceiling finish.

section

Floating layer constructions

Floating layer F1

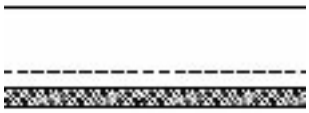
Timber raft
Timber boarding or wood based board, minimum 18 mm thick, with tongued and grooved edges, fixed to minimum 45 x 45 mm (nominal) timber battens with a bonded integral resilient polymer-based layer.
Polymer-based layers include foams, man-made fibres and elastomers.
Resilient flanking strips at least 5 mm thick should be fitted between floor edge and wall/skirting junction.
Floating floor treatment to demonstrate a weighted reduction in impact sound pressure level (ΔLw) of at least 25 dB when measured in accordance with annex 5.B.
Follow manufacturer's instructions for installation of proprietary systems.



section

Floating layer F2

Screed over resilient layer
Cement sand screed, 65 mm thick with mesh underlay to protect the resilient layer while the screed is being laid.
Resilient layer of extruded closed cell polyethylene foam, 12.5 mm thick, density 30-45 kg/m^3.
To protect the material from puncture it should be laid over a levelling screed.
Lay with taped joints.
The resilient layer should be faced with a membrane to prevent screed entering the layer**.**
Lay the material tightly butted and turned up at the edges of the floating layer.



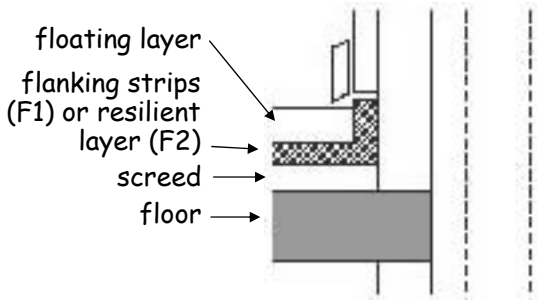
section

Floor type 2

Junctions at walls at external or cavity separating walls

Guidance in Sections 1, 2 and 6 should be considered.

The mass of the leaf adjoining the floor should be 120 kg/m^2, including any plaster. This is not necessary where the area of openings in the *external wall* exceeds 20% of its area: there is no recommendation for the minimum mass of such a wall.
The floor base, excluding any screed, should pass through the wall whether spanning parallel to, or at right angles to, the wall.
The cavity should not be bridged.
Carry the resilient layer up at all edges to isolate the floating layer.
Leave a 5 mm gap between skirting and floating layer or turn resilient layer under skirting.
Where a seal is necessary for the purposes of section 6, it should be flexible.

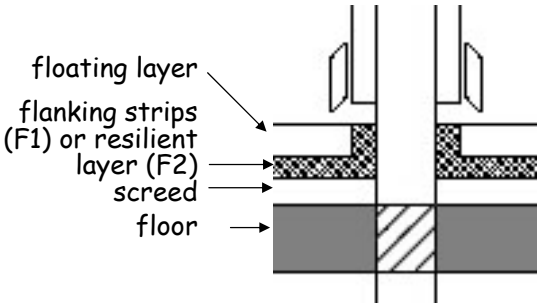


section

Floor type 2

Junctions at walls at internal or solid separating wall

If the wall mass is less than 355 kg/m^2 including any plaster then the floor base excluding any screed should pass through.
If the wall mass is more than 355 kg/m^2 including any plaster either the wall or the floor base excluding any screed may pass through.
Where the wall does pass through tying the floor base to the wall and grouting the joint, is recommended.



section

Floor type 2

Floor penetrations

No openings should be formed, apart from openings for service *ducts*, pipes, or *chimneys* which are protected as recommended by section 2, Fire and section 3, Environment.

Ducts or pipes that penetrate the floor should be in an enclosure, both above and below the floor.

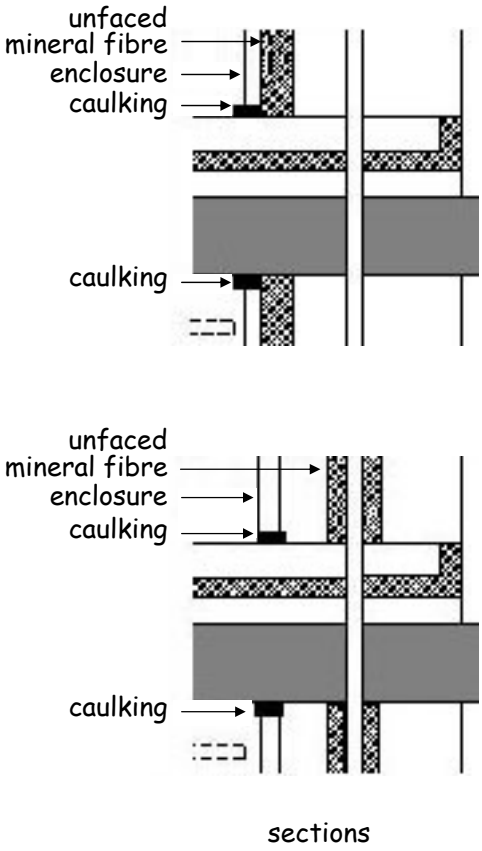
Either line the enclosure, or wrap the *duct* or pipe within the enclosure, with 25 mm unfaced mineral fibre.

The material of the enclosure should have a mass of 15 kg/m^2.

Penetrations of a *separating floor* by *ducts* and pipes should have fire protection in accordance with section 2, Fire.

Leave a 5 mm gap between enclosure and floating layer and seal with acrylic caulking or neoprene.

Where there is no conflict with advice in section 3, Environment, a *flue-pipe* may penetrate the floor, provided that it discharges either into a masonry *chimney* carried by the floor or any other type of *chimney* enclosed within a *non-combustible duct* that is lined with absorbent mineral fibre.



sections

Floor type 3

5.1.10 Specified floor constructions
Floor type 3: Timber base with floating layer

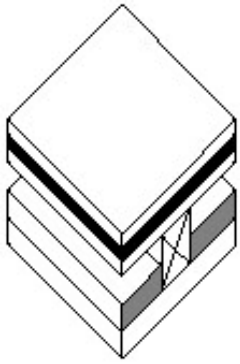
The resistance to airborne sound transmission depends partly on the structural floor plus absorbent blanket or deafening, and partly on the floating layer. Resistance to impact sound transmission depends on the resilient layer to isolate the floating layer from the base and the surrounding *construction*.

Section 2, Fire places limits on the *storey* height at which this type may be used.

This *construction* could be used where *dwellings* are created by *conversion*, provided the existing walls and floors are suitable and it is used with appropriate adjoining walls (see 'junctions' below). Floor types 3A and 3C-b should only be used for conversions.

Points to watch

Limit the pathways around the floor to reduce flanking transmission.



Workmanship and detailing should be given special attention at the perimeter and wherever the floor is penetrated, to reduce flanking transmission and to avoid air paths.

In order to maintain isolation:

- carefully select materials for the resilient layer, see annex 5.B;
- take care not to bridge between the floating layer and the base or surrounding walls (e.g. with services or fixings which penetrate the resilient layer);
- allow for movement of materials e.g. expansion of chipboard after laying (to maintain isolation).

Floor type 3

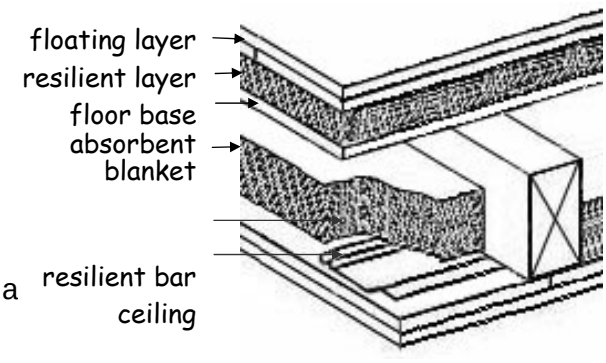
Constructions – floor type 3

Three complete *constructions* (A-C) are described below, together with details for junctions to limit flanking transmission. Note that there are alternatives within some *constructions*. There are also four *constructions* (A-DL, B-DL, C-a-DL, C-b-DL) for use with down lighters.

Floor type 3A

Floor base with floating layer

Platform floor with absorbent blanket (for use in *conversions* only)



Floating layer

Two types of floating layer may be used:

a. timber or wood based board, 18 mm thick with tongued and grooved edges and all joints glued, spot bonded to substrate of gypsum based board with a minimum mass of 13.5 kg/m^2; or

b. a floating layer of 2 thicknesses of cement bonded particleboard with joints staggered, glued and screwed together, total thickness 24 mm.

Resilient layer

Resilient layer of a material with a weighted reduction in impact sound pressure level (ΔLw) of at least 14 dB when measured in combination with the floating layer in accordance with annex 5.B.

Resilient flanking strips at least 5 mm thick should be fitted between floor edge and wall skirting junction.

Follow manufacturer's instructions for installation of proprietary systems.

Floor base

Floor base of 12 mm timber boarding or wood-based board nailed to timber joists.

Ceiling

Resilient ceiling bars fixed perpendicular to joist direction at 400 mm centres.

Absorbent blanket of 100 mm mineral fibre, density 10-33 kg/m^3, laid on ceiling between joists.

Ceiling of 2 or more layers of gypsum based board with joints staggered, overall minimum mass 24 kg/m^2, or total thickness 30 mm.

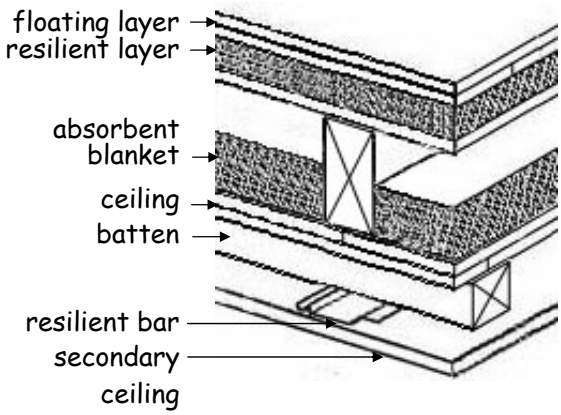
Floor type 3A-DL

Down lighters

A secondary ceiling should be fitted if down lighters are to be installed in a separating floor, to avoid penetration of the main ceiling layers.

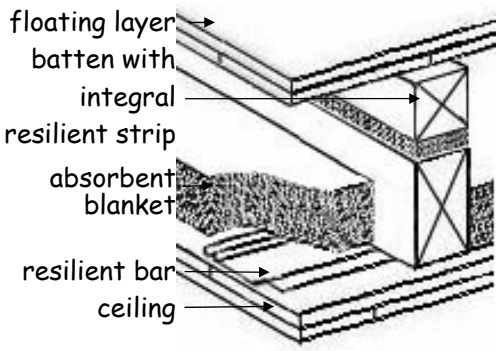
The ceiling layers should be fixed directly to the joists.

Secondary ceiling: 50 mm x 50 mm battens, resilient ceiling bars perpendicular to battens, and 12.5 mm gypsum based board.



Floor type 3B

Ribbed floor with absorbent blanket



Floating layer

Floating layer of timber or wood based board, minimum 18 mm thick with tongued and grooved edges and all joints glued, spot bonded to, and fixed through, a substrate of gypsum based board (minimum mass 13.5 kg/m^2) to minimum 45 x 45 mm nominal timber battens with a bonded integral resilient polymer-based layer.
Polymer-based layers include foams, man-made fibres and elastomers.
Resilient flanking strips at least 5 mm thick should be fitted between floor edge and wall/skirting junction.
Floating floor treatment to demonstrate a weighted reduction in impact sound pressure level (ΔLw) of at least 14 dB when measured in accordance with annex 5.B.
Follow manufacturer's instructions for installation of proprietary systems.

Floor base

Floor base of 45 mm wide timber joists.
Structural bracing is not shown.
Ribbed floors are routinely built with an additional sub-deck board (not shown) over the joists to provide safe access before fixing of the floating layer.
Such boarding should not introduce noise problems but does not add to the sound insulation.
The sub-deck board should be level and should not sag between joists.
When such boarding is used, the battens may either be laid in line with, or at 90° to the joists.

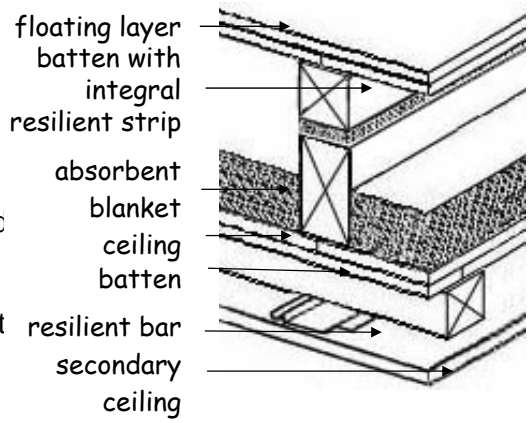
Ceiling

Resilient ceiling bars fixed perpendicular to joist direction at 400 mm centres.
Absorbent blanket of 100 mm mineral fibre, density 10-33 kg/m^3, laid on ceiling between joists.
Ceiling of 2 or more layers of gypsum based board with joints staggered, overall minimum mass 24 kg/m^2, or total thickness 30 mm.

Floor type 3B-DL

Down lighters

If down lighters are to be installed in a separating floor, the lights should be fitted within the depth of a secondary ceiling, to avoid the creation of air paths by penetration of the main ceiling layers.
In this case, the ceiling layers should be fixed directly to the joists.
Secondary ceiling:
50 mm x 50 mm battens fixed through to joist
Resilient ceiling bars perpendicular to battens; 12.5 mm gypsum based board.
See also note above on floor base.



Floor type 3C

Ribbed floor with heavy deafening (pugging)

Floating layer, deafening between joists.

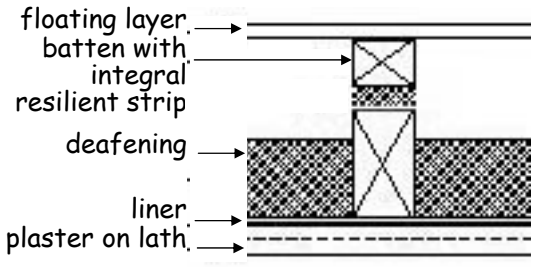
Floor type 3C-a

Floating layer

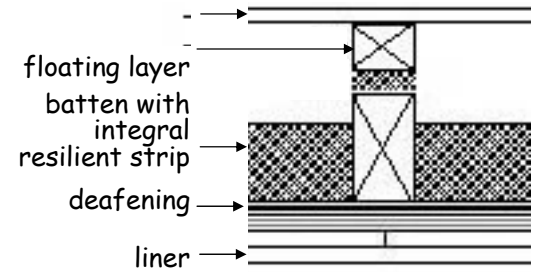
Two floating layer constructions are described. The second should only be used in conversions.

a. Battens along top of joists

Floating layer of timber or wood based board, minimum 18 mm thick with tongued and grooved edges and all joints glued, fixed to minimum 45 x 45 mm (nominal) timber battens with a bonded integral resilient polymer-based layer.
Polymer-based layers include foams, man-made fibres and elastomers.
Battens placed on top of the joists, in the same direction as the joists.
Resilient flanking strips at least 5 mm thick should be fitted between floor edge and wall/skirting junction.
Floating floor treatment to demonstrate a weighted reduction in impact sound pressure level (ΔL_w) of at least 14 dB when measured in accordance with annex 5.B.
Follow manufacturer's instructions for installation of proprietary systems.



section
lath and plaster ceiling option



section
board ceiling option

Floor base

Floor base of 45 mm wide timber joists.
Structural bracing is not shown.
Ribbed floors are routinely built with an additional sub-deck board over the joists to provide safe access before fixing of the floating layer.
Such boarding should not introduce noise problems but does not add to the sound insulation. The sub-deck board should be level and should not sag between joists. When such boarding is used, the battens may either be laid in line with, or at 90° to the joists.

Floor type 3C-b

b. Battens between joists (only for use in conversions)
Floating layer of timber or wood based board, 18 mm thick with tongued and grooved edges and all joints glued, nailed to 45 x 45 mm timber battens; floating layer placed onto resilient strip on top of joists, laid along their length.
Resilient strips of a material with a weighted reduction in impact sound pressure level (ΔLw) of at least 17 dB when measured in accordance with annex 5.B.

Structural bracing is not shown.

Ceiling

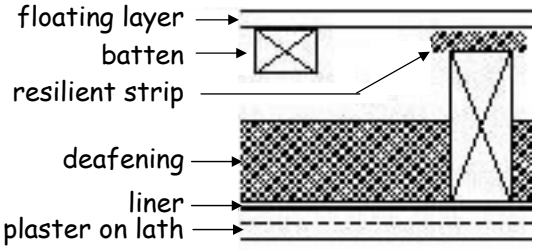
- 19 mm dense plaster on expanded metal lath; or
- 6 mm plywood fixed under the joists plus 2 layers of gypsum based board with joints staggered, total thickness 25 mm.

Deafening

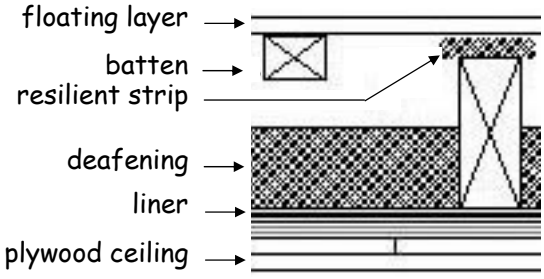
Both types of ceiling to have deafening (pugging) of mass 80 kg/m^2 laid on a polyethylene layer.
Deafening may be of the following types. Figures in brackets show approximate thickness to provide 80 kg/m^2:

- traditional ash (75 mm), or
- 2-10 mm limestone chips (60 mm), or
- 2-10 mm whin aggregate (60 mm), or
- dry sand (50 mm).

The water retentive properties of sand make it inappropriate for use in *kitchens*, bathrooms, shower-rooms or *toilets*.



section
lath and plaster ceiling option



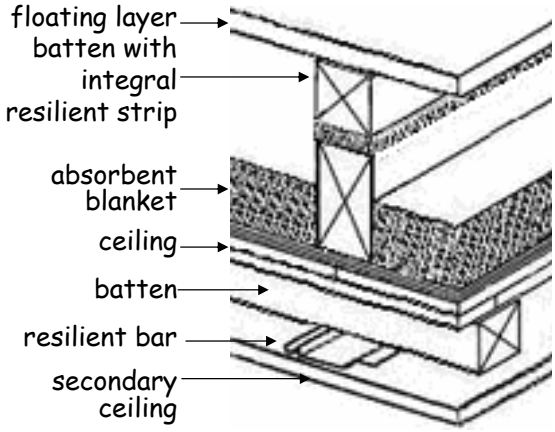
section
board ceiling option

Floor types 3C-a-DL

Downlighters

If down lighters are to be installed in a separating floor, the lights should be fitted within the depth of a secondary ceiling, to avoid the creation of air paths by penetration of the main ceiling layers.
In this case, the ceiling layers should be fixed directly to the joists.
Secondary ceiling:
50 mm x 50 mm battens fixed through to joists;
Resilient ceiling bars perpendicular to battens; and 12.5 mm gypsum based board.

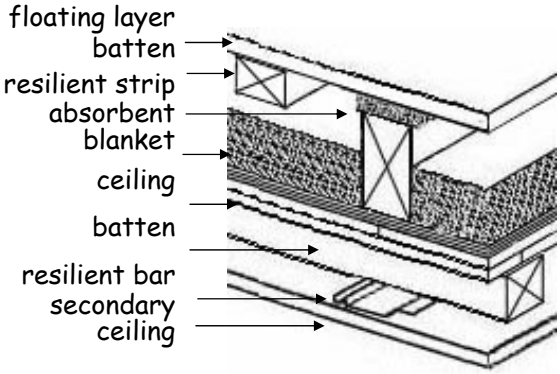
This *construction* could be used with an existing lath and plaster ceiling.



section, floor type 3C-a-DL board ceiling option

3C-b-DL

See also note on floor base for floor type 3Ca.



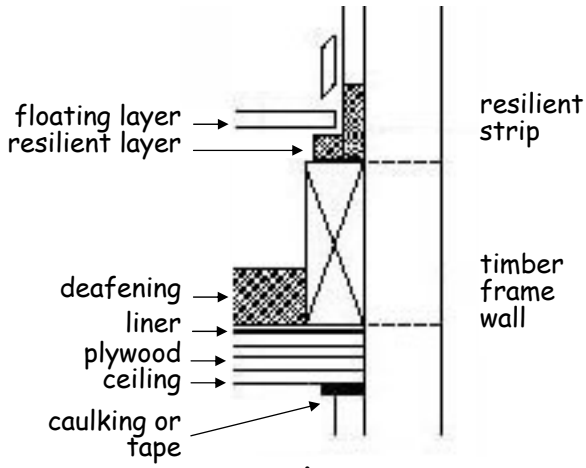
section, floor type 3C-b-DL board ceiling option

Floor type 3

Junctions at timber frame wall

Guidance in sections 1, 2 and 6 should be considered.

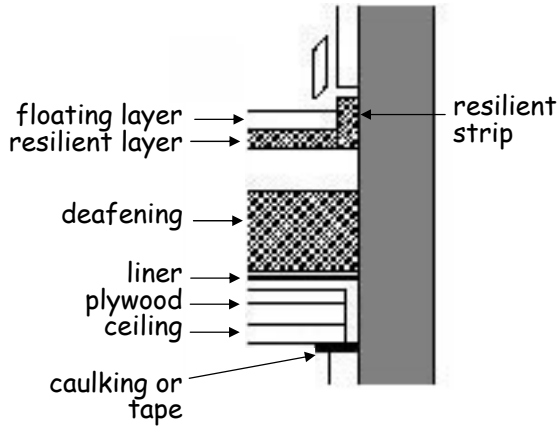
Seal the gap between wall and floating layer with a resilient strip glued to the wall.
Leave a 5 mm gap between skirting and floating layer.
Where a seal is necessary for the purposes of section 6, it should be flexible.
Block air paths between the floor base and the wall, including the space between joists when joists are at right angles to the wall.
Seal the junction of ceiling and wall with tape or caulking.



section

Floor type 3 **Junctions at heavy masonry leaf**

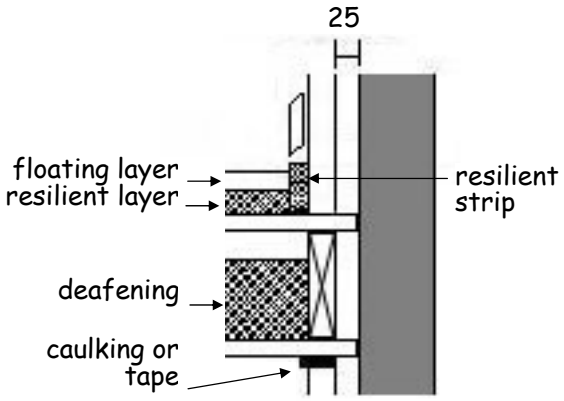
Mass of leaf 355 kg/m^2, including any plaster, both above and below floor.
Seal the gap between wall and floating layer with a resilient strip glued to the wall.
Leave a 5 mm gap between skirting and floating layer.
Where a seal is necessary for the purposes of section 6, it should be flexible.
Use any normal method of connecting floor base to wall.
Seal the junction of ceiling and wall lining with tape or caulking**.**



section

Floor type 3 **Junctions at light masonry leaf**

A free-standing panel as specified in wall type 3 should be used if the mass, including any plaster, is less than 355 kg/m^2.
Seal the gap between wall and floating layer with a resilient strip glued to the free-standing panel.
Leave a 5 mm gap between skirting and floating layer.
Where a seal is necessary for the purposes of section 6, it should be flexible.
Use any normal method of connecting floor base to wall but block air paths between floor and wall cavities.
Take ceiling through to masonry, seal junction with free-standing panel with tape or caulking.



section

Floor type 3

Floor penetrations

No openings should be formed, apart from openings for service *ducts*, pipes, or *chimneys* which are protected as recommended by section 2, Fire and section 3, Environment.

Ducts or pipes that penetrate the floor should be in an enclosure both above and below the floor.

Either line the enclosure, or wrap the *duct* or pipe within the enclosure, with 25 mm unfaced mineral fibre.

The material of the enclosure should have mass of 15 kg/m^2.

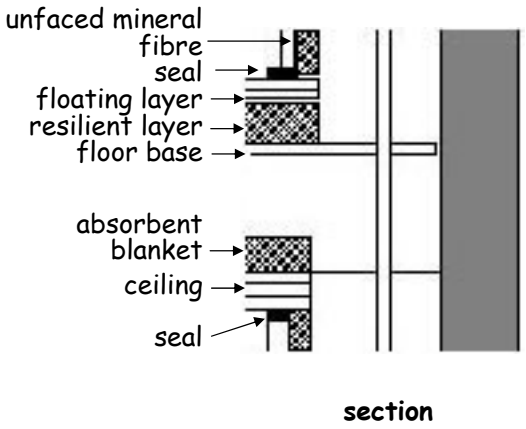
Leave a 5 mm gap between enclosure and floating layer, seal with acrylic caulking or neoprene.

Enclosure may go down to the floor base if *construction* A is used, but care must be taken to isolate the enclosure from the floating layer.

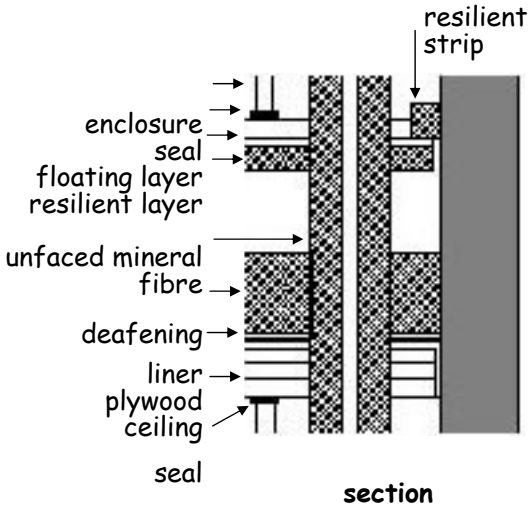
Where there is no conflict with advice in section 3, Environment, a *flue-pipe* may penetrate the floor, provided that it discharges either into a masonry *chimney* carried by the floor or any other type of *chimney* enclosed within a *duct* that is lined with absorbent mineral fibre.

Seal the junction of ceiling and enclosure with tape or caulking.

Penetrations of a *separating wall* by *ducts* and pipes should have fire protection in accordance with section, 2 Fire.



section



section

5.1.11 Specified floor constructions
Floor type 4: Timber base with independent ceiling

The resistance to airborne and impact sound depends mainly on the mass and isolation of the independent ceiling, and partly on the mass of the floor base.

Section 2, Fire places limits on the *storey* height at which this type may be used. It should only be used with heavy masonry walls.

Points to watch

Limit the pathways around the floor, especially at the edges of the independent ceiling, to reduce flanking transmission and to avoid air paths.

Workmanship and detailing should be given special attention wherever the floor is penetrated.

Take care not to create bridges between the floor base and the independent ceiling.

Floor type 4

Construction – floor type 4

One floor with independent ceiling is described below, together with details for junctions to limit flanking transmission.

Floor type 4

Timber floor, incorporating deafening:
Timber boarding or wood based board, 18 mm thick with tongued and grooved edges or 3.2 mm hardboard over the whole floor to seal gaps.

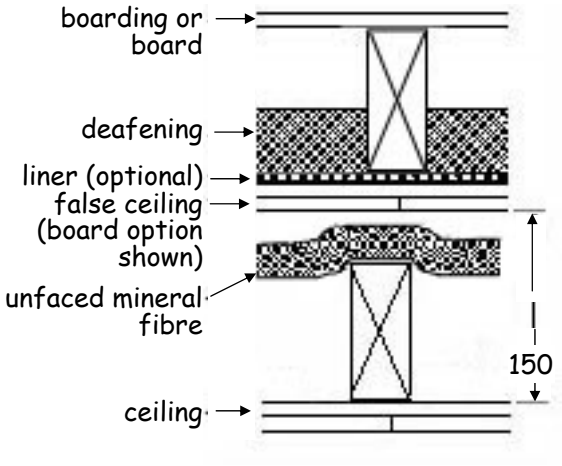
45 mm thick joists
Deafening of mass 80 kg/m^2
Intermediate ceiling of either:

- 19 mm dense plaster on lath; or
- 2 or more layers of gypsum based board with joints staggered, overall minimum mass 24 kg/m^2, or total thickness 30 mm.

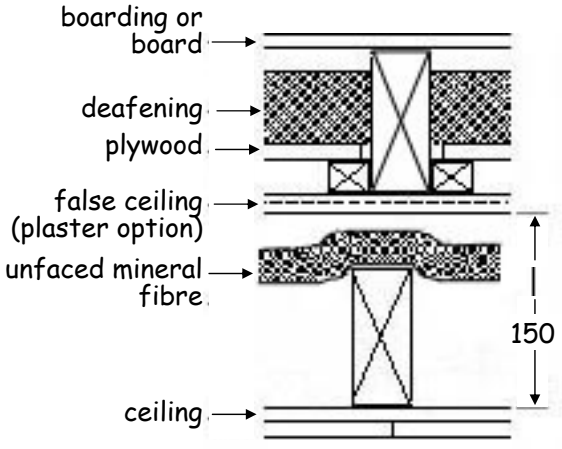
In existing floors deafening may be on boards between joists; in new *separating floors* use 6 mm plywood fixed to underside of joists. A polyethylene liner may be used if desired.

Independent ceiling:
Absorbent blanket of 25 mm unfaced mineral fibre, density 12-36 kg/m^3, draped over 45 mm thick joists supported independently of the floor.

Ceiling of two layers of gypsum based board with joints staggered, total thickness 30 mm. Keep ceiling 150 mm away from the underside of the intermediate ceiling.



section (new floor)



section (adapted existing floor)

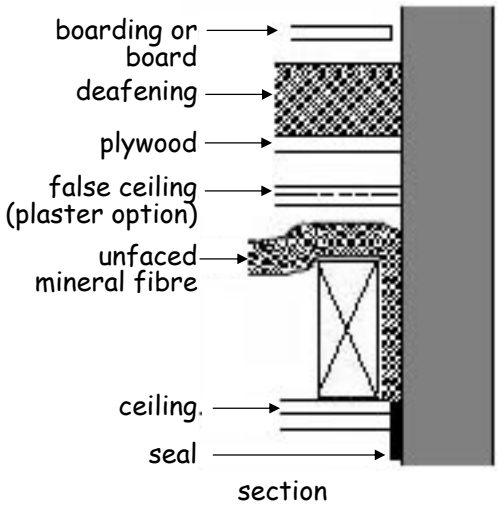
Floor type 4

Junctions at walls

Guidance in sections 1, 2 and 6 should be considered.

External or cavity separating walls

Mass of leaf should be 355 kg/m^2, including any plaster, both above and below the floor, on at least 3 sides.
Leaf on fourth side should be at least 180 kg/m^2.
Use bearers on walls to support the edges of the ceiling and to block air paths.
Seal the junction of ceiling and wall with tape or caulking.



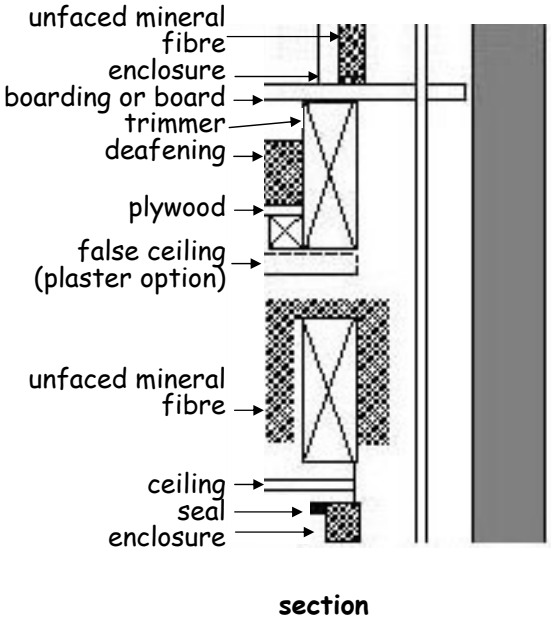
Internal wall

If masonry, mass should be 180 kg/m^2.
There is no recommendation for the mass of stud partitions.
Support and seal as for *external walls*.

Floor type 4

Floor penetrations

Ducts or pipes that penetrate the floor should be in an enclosure both above and below the floor.
Either line the enclosure, or wrap the *duct* or pipe within the enclosure, with 25 mm unfaced mineral fibre.
The material of the enclosure should have a mass of 15 kg/m^2.
Penetrations of a *separating floor* by *ducts* and pipes should have fire protection in accordance with section 2, Fire.
Where there is no conflict with advice in section 3, Environment, a *flue-pipe* may penetrate the floor, provided that it discharges either into a masonry *chimney* carried by the floor or any other type of *chimney* enclosed within a *duct* that is lined with absorbent mineral fibre.
Seal the junction of ceiling and enclosure with tape or caulking.



5.1.12 Performance testing

Use of performance testing is one of the possible approaches to standard 5.1. This clause sets minimum values for performance testing.

The performance testing approach is particularly useful where the separating or flanking *construction* is of innovative design and for *conversions* where flanking transmission may be significant.

It should be noted that testing to establish the performance values of *construction* is carried out on completed *buildings* and that rectification of poorly performing *construction* can be difficult at that stage. It may therefore be advisable to seek advice at the design stage from an acoustics consultant.

Annex 5.C describes methods of measurement and test procedures.

Acoustic parameters

Performance values are given in terms of 2 acoustic parameters, 1 related to airborne sound, the other related to impact sound.

Airborne sound insulation

The airborne sound insulation characteristics of a wall or floor are identified by measuring the sound pressure level difference between the source *room* (the *room* with the noise source) and the receiving *room* (to which the noise is transmitted).The larger the difference, the higher the level of airborne sound insulation. Recommended levels are given as minimum values of the acoustic parameter $D_{nT,w}$.

Impact sound insulation

Impact sound insulation is quantified by measuring the sound pressure level in the receiving *room*, rather than a difference in levels between *rooms*. Thus, a lower weighted sound pressure level represents a higher level of impact sound insulation. Recommended levels are given as maximum values of the acoustic parameter $L'_{nT,w}$.

Performance values

Recommended performance values for *separating walls* and *separating floors* are given below. Tests should be performed after *construction*, using the procedures given in annex 5.C.

Airborne Sound (minimum values)

Minimum values of weighted standardised level difference ($D_{nT,w}$), as defined in BS EN ISO 717-1: 1997:

	Mean Value (dB)	**Individual Value** (dB)
Walls	53	49
Floors	52	48

Impact Sound (maximum values)

Maximum values of weighted standardised impact sound pressure level ($L'_{nT,w}$) as defined in BS EN ISO 717-2: 1997

	Mean Value (dB)	**Individual Value** (dB)
Floors	61	65

5.1.13 Scheme operated by Robust Details Ltd

It is possible that use of the scheme operated by Robust Details Ltd. may offer a suitable approach to standard 5.1. However, full details of the scheme had not been fully reviewed in relation to construction practice in Scotland at the time of publication and notes on the use of the scheme, including consideration of the requirements of other sections, may be added or published separately.

Annex
5.A Method for calculating mass in relation to specified constructions

contents

annex

5.A

Method for calculating mass in relation to specified constructions

5.A.1 Expression of mass

Where a mass is specified for walls or floors, it is expressed in kg/m^2.

5.A.2 Mass of masonry wall leafs

To calculate the mass of a leaf of masonry the formulae in the table below should be used.

Densities of bricks or blocks (at 3% moisture content) may be taken from a current certificate issued by a *notified body* or from the manufacturer's literature, in which case the verifier may ask for confirmation e.g. that the measurement was done by an accredited test house. Note that the quoted density of bricks or blocks is normally the apparent density, i.e. the weight divided by the volume including perforations, voids or frogs. This is the density appropriate to the formulae.

For co-ordinating course heights other than those given in the table use the formula for the nearest height. Include any finish of plaster, render or dry lining in calculating the mass unless otherwise stated in the specified *construction*.

Formulae for wall leaf mass

Co-ordinating height of masonry course in mm	Appropriate formulae
75	$M = T(0.79D + 380) + NP$ or $D \dfrac{\left[\frac{M-NP}{T} - 380\right]}{0.79}$
100	$M = T(0.86D + 255) + NP$ or $D \dfrac{\left[\frac{M-NP}{T} - 255\right]}{0.86}$
150	$M = T(0.92D + 145) + NP$ or $D \dfrac{\left[\frac{M-NP}{T} - 145\right]}{0.92}$
200	$M = T(0.93D + 125) + NP$ or $D \dfrac{\left[\frac{M-NP}{T} - 125\right]}{0.93}$

M = Mass of 1 m^2 of leaf in kg/m^2
T = Thickness of masonry in metres (i.e. unplastered thickness)
D = Density of masonry units in kg/m^3 (at 3% moisture content)
N = Number of finished faces (i.e. N = 0 for no finish, 1 if finish on one side and 2 if finish on both sides)
P = Mass of 1 m^2 of wall finish in kg/m^2 (see next page)

Mass of finish in kg/m^2 at assumed thickness of 13 mm

Cement render	29
Gypsum plaster	17
Lightweight plaster	10
Gypsum based board	10

5.A.3 Mortar joints

5.A.1 assumes a mortar joint of 10 mm and a dry, set mortar density of 1800 kg/m^3. Values should vary by no more than 10%.

5.A.4 In-situ concrete, screeds, slabs and composite floor bases

For in-situ concrete or screeds calculate the mass by multiplying the density (kg/m^3) by the thickness (m).

For slabs or composite floor bases divide the total mass of the element (kg) by the plan area of the element (m^2).

Annex
5.B Methods for selection of resilient materials

contents

annex

5.B

Methods for selection of resilient materials used for soft coverings

5.B.0 Introduction

Resilient materials used for soft coverings must achieve a reduction in the weighted impact sound pressure level, appropriate to the specified construction. The reduction should be determined by use of 1 of the following methods.

5.B.1 BS EN ISO 140-8: 1998 and BS EN ISO 717-2: 1997

Measurement and calculation of the weighted reduction in impact sound pressure level (Lw) in accordance with BS EN ISO 140-8: 1998 and BS EN ISO 717-2: 1997.

5.B.2 Standardised core tests for impact sound reduction of soft coverings

The reduction is determined by comparing 2 tests (ΔLw = Test 1 – Test 2) using specified core floors:

Test 1: Weighted sound pressure level (Ln,w) for the core floor;

Test 2: Weighted sound pressure level (Ln,w) for the core floor with the floating floor treatment applied to the core floor surface.

Test facility

The test facility must have UKAS Accreditation (or EC equivalent) for the measurement of sound insulation in the laboratory for impact sound transmission. The test measurement should be undertaken in accordance with BS EN ISO 140-6: 1998 and the performance of each measurement rated in accordance with BS EN ISO 717-2: 1997. The measurements should be undertaken in a laboratory with suppressed flanking transmission and in accordance with BS EN ISO 140-1: 1998 and BS EN ISO 140-2: 1991.

Core floors

Testing should be undertaken on a core floor which consists of one of the following constructions, as appropriate to the specified construction used:

a. Concrete core floor (for testing soft covering for use with Floor type 1 and resilient strip for use in timber raft option for Floor type 2):
   150 mm hollow-core precast concrete plank of mass per unit area 295-305 kg/m^2, with hollow segments located at regular centres and distributed over a minimum of 80% of the plank width.

   The precast concrete hollow-core planks should be mounted in the test aperture to cover the entire test aperture area. The planks should be tightly abutted and all joints should be filled with grout including top and bottom joints. No voids should remain at the floor perimeter junction with the test aperture border. The 10 mm cement based screed with bonding agent should be applied such that it is directly bonded to the entire floor surface of the planks. No additional ceiling layers should be applied.

b. Timber core floor (for testing resilient layer for use with Floor types 3A, 3C-b)::
15 mm OSB timber decking board (or equivalent timber based board) with mass per unit area of 10-11 kg/m^2.
235 mm x 50 mm solid timber joists SC3 grade timber.
100 mm glass based mineral wool insulation with a density of 10-11 kg/m^3.
Two layers of 12.5 mm gypsum based board with a mass per unit area for each layer of 8-8.5 kg/m^2.

The timber joists should be mounted on joist hangers at 450 mm centres and the glass based mineral wool insulation should be placed in the cavities between the joists and also between the cavities formed between the joists and the test aperture border. The floor decking should be mounted on the timber joists with screws at 300 mm centres. All junctions between the floor surface perimeter and test aperture should be sealed with a flexible or acoustic mastic sealant.

The ceiling layers should be mounted with joints staggered and the first layer (inner layer) should be fixed to the underside of the joists with screws, at 300 mm centres within the field of the boards and at 150 mm centres at the board ends. The second layer (outer layer) should be fixed with screws, at 230 mm centres within the field of the boards and at 150 mm centres at the board ends. The perimeter of the ceiling should be sealed with flexible or acoustic mastic sealant and all joints and screw heads taped with self adhesive tape.

Floating floor treatment
The floating floor treatment should cover the entire test area of the core floor surface and should be constructed in accordance with the manufacturer's instructions. Flanking strips, which are required for the specified *constructions* to isolate the edge of the floor board from the perimeter walls, should be used in the laboratory measurements.

Expression of results
The impact sound transmission performance of the floating floor treatment should be expressed as a weighted reduction in impact sound pressure level (ΔLw) as a result of the application of the floating floor treatment to the core floor.

Annex
5.C Procedures for performance testing

contents

annex

5.C

Performance testing

5.C.0 Introduction

This annex covers field-testing of *separating walls* and *separating floors* for *dwellings*. Such tests should only be carried out on a *building* that is complete. It is most important that floor, wall and ceiling linings are complete and that doors, access hatches and windows are fitted.

5.C.1 Test procedures

Location of tests

For each wall or floor which is to be tested take 4 sets of measurements or as close to 4 as possible, given the following recommended constraints:

- for each set of measurements use a pair of *rooms* if possible; and
- use a pair consisting of a *room* and some other space only where necessary to make up the 4 sets; and
- use a pair consisting of spaces other than *rooms* only where no other measurement is possible; and
- take only one set of measurements between each pair.

Test conditions

The tests should be done in completed but unfurnished *dwellings*. Doors and windows should be closed.

When measuring between a pair of *rooms* which are of unequal area, the sound source should be in the larger *room*.

When measuring between a *room* and some other space, the sound source should be in the other space.

Walls and floors

In a *building* every wall or floor, or part of a wall or floor, which requires sound resistance and is of nominally identical *construction*, can be considered as forming part of a single wall or floor. For instance, wherever the *flat* plans are nominally identical in a block of *flats*, a wall rising through several *storeys* may be regarded as a single wall, and floors over a whole *storey* may be regarded as a single floor.

A wall which changes *construction* only in a *roof space* can be considered as a single wall.

In any group of *dwellings* covered by one building warrant, the walls and floors of nominally identical *dwelling* types which are similarly situated in regard to adjoining *buildings* may all be regarded as meeting the performance standard if the ones selected for test meet the standard.

Test methods

Carry out the tests for airborne sound in accordance with BS EN ISO 140-4: 1998 and for impact sound in accordance with BS EN ISO 140-7: 1998.

The tests will determine the standardised level differences (D_{nT}) for airborne sound transmission and the standardised impact sound pressure levels (L'_{nT}) for impact sound transmission.

For each set of measurements calculate the weighted standardised level difference ($D_{nT,w}$) in accordance with BS EN ISO 717-1: 1997 or the weighted standardised impact sound pressure level ($L'_{nT,w}$) in accordance with BS EN ISO 717-2: 1997.

Evaluation of test results

The calculated value from each set of measurements should be no worse than the recommended 'Individual Value' in the table to clause 5.1.12.

The mean of the 4 calculated values should be no worse than the recommended 'Mean Value' in the table to clause 5.1.12. If only 2 or 3 sets of measurements are possible the mean should still be reached, and if only one set is possible the value achieved should not be worse than the mean value.

Concession for *fire doors*

Separating walls in some situations may incorporate a doorway, protected by a *fire door* (see section 2, Fire), but there is no requirement for resistance to sound transmission by doors and door sets. The acoustic performance of a *separating wall* could be prejudiced by such a doorway. If a *separating wall* is to be tested, but incorporates such a doorway, it would be acceptable to temporarily infill the doorway, in order to obtain an indicative measurement of the performance of the wall *construction*.

Application of test procedures

Note that the test procedure described above is intended only to provide evidence that a particular wall or floor achieves the recommended performance values in the following situations:

- if it is not *built* to a specified *construction*; or
- if it is not *buil*t under the scheme operated by Robust Details Ltd, but see clause 5.1.13; or
- if a verifier is not satisfied that a specified *construction* has been *built* in accordance with the warrant and standard 5.1.