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Acoustic Detailing For Steel Construction

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FOREWORD

The Building Regulations Approved Document E sets minimum standards of acoustic performance for walls and floors between dwellings (separating walls and floors). The Regulations allow two methods of demonstrating compliance: pre-completion on-site acoustic testing; by using Robust Details (RDs). The RDs have undergone a testing regime to prove that they more than satisfy the requirements of Part E. RDs are limited in their coverage of steel framed construction details. However, for steel framed residential buildings, some pre-completion site testing will generally be required.

For low to medium rise buildings, a hot-rolled steel frame may be used or light steel framing can be used to form the load-bearing walls and floors. For higher rise buildings, hot-rolled steel frames are used with light steel stud walls to create separating walls between dwellings, internal partitions within a dwelling and for external infill walls. In modular construction, hot-rolled structural steel components can be combined with load-bearing light steel framing.

This publication gives acoustic details for steel framed buildings with a range of floor and wall constructions. The guidance is based on acoustic test results and information published by manufacturers and suppliers of plasterboard, light steel framing, acoustic systems and associated products. It has been produced to provide designers, developers and architects with confidence that their projects will satisfy the sound insulation requirements, provided the guidance given is followed.

This publication supersedes the previous SCI publication, P336, and updates and extends the guidance given in SCI publications P128, P320, P321, P322.

The publication was prepared by Andrew Way of The Steel Construction Institute. Some of the details are taken from or based on information given in SCI publication P336, which was written by Andrew Way and Graham Couchman. Valuable contributions, information and comments were gratefully received from the following individuals and organisations:

John Grubb	SCI Consultant
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Note: All acoustic performance values quoted in this publication are indicative. Manufacturers' literature, system suppliers and/or acoustic consultants should be consulted for detailed specifications and precise predictions of expected acoustic performances.

Contents

SUMMARY

Steel construction is widely used in residential developments. Both light steel framing and hot-rolled steel frames are used for the primary structural material. Acoustic performance is important in such applications and this publication demonstrates the wide range of acoustic solutions available using various forms of steel construction. It provides advice to architects, designers and other construction professionals on detailing to achieve the required acoustic performance.

The general principles of sound insulation, the regulatory requirements for modern residential buildings and generic acoustic solutions using steel construction technologies are presented. The acoustic solutions include constructions suitable for separating walls and floors between dwellings (and between rooms for residential purposes), for internal walls and floors within dwellings and for suitable junction details between such walls and floors. It explains how to integrate building elements into separating walls and floors. For each separating wall or floor included in this publication, an expected acoustic performance is quoted. For walls and floors, expected airborne sound insulation values are provided; for floors, impact sound properties are also provided. Recommended junction details are provided in Appendix B for separating floors supported on hot-rolled steel frames.

1 INTRODUCTION

1.1 Purpose of this publication

The construction details of the floors and walls of a building are the key to its acoustic performance i.e. the transmission of sound from one part of the building to another. The purpose of this publication is to describe the different forms of floor and wall construction that can be used in steel-framed buildings to achieve levels of acoustic performance demanded by current regulations.

The details provided in this publication are intended to indicate the general make-up of the walls and floors rather than being exact specifications. Manufacturers' literature, system suppliers and/or an acoustic consultant should be consulted for detailed specifications and more accurate expected acoustic performance. Whilst some guidance is given concerning the position of fire stops, cavity barriers, etc, specific guidance should be sought concerning their provision.

In Sections 2 and 3, wall and floor constructions are presented along with an expected acoustic performance range. The expected acoustic performance range for all the walls and floors shown has been derived by using a combination of published literature and the results from on-site acoustic testing.

This publication updates and extends the guidance given in previous SCI publications P128[1], P320[2], P321[3], P322[4] and P336[5]. The scope of the present publication covers all forms of steel construction appropriate for residential construction.

1.2 Sound

Sound is produced when objects vibrate in air. The movement causes air particles to vibrate giving rise to rapid pressure fluctuations that are detected by the ear. The manner in which humans perceive sound governs the way it is measured and described. Two important characteristics of sound which humans can detect are:

- The level or loudness
- The pitch or frequency.

Sound levels and sound insulation (i.e. attenuation) values are expressed in decibels (dB), whilst pitch or frequency is expressed in Hertz (Hz). In the case of sound levels, the decibel rating is a representation of the volume of the sound whilst in the case of sound insulation values, it is a measure of the amount by which sound transmitted from one room to another is reduced by the separating construction. Some typical sound levels and sound insulation values are shown in Figure 1.1.

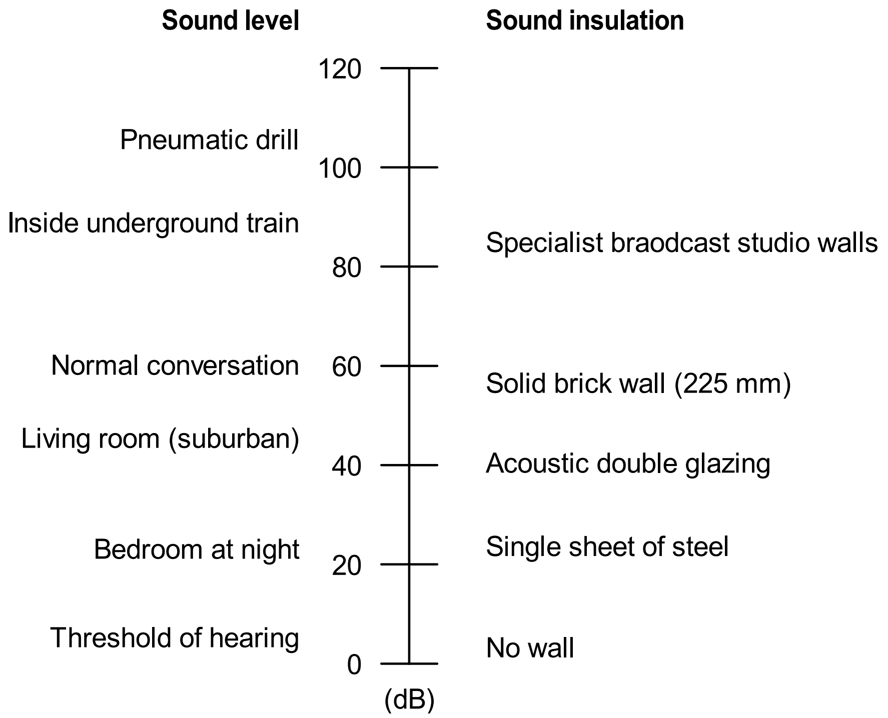


Figure 1.1 *Typical sound levels and sound insulation values (dB)*

The sound insulation properties of walls or floors vary with frequency and, as most sounds are a mixture of several different frequencies, certain frequencies within a sound are likely to be attenuated more effectively than others by a given construction. Low pitched sounds (i.e. low frequencies) are normally attenuated less than high pitched sounds (i.e. high frequencies). Therefore, the sound reduction characteristics of walls and floors are measured at a number of different frequencies across the hearing range. The normal frequency range of measurements is shown in Figure 1.2.

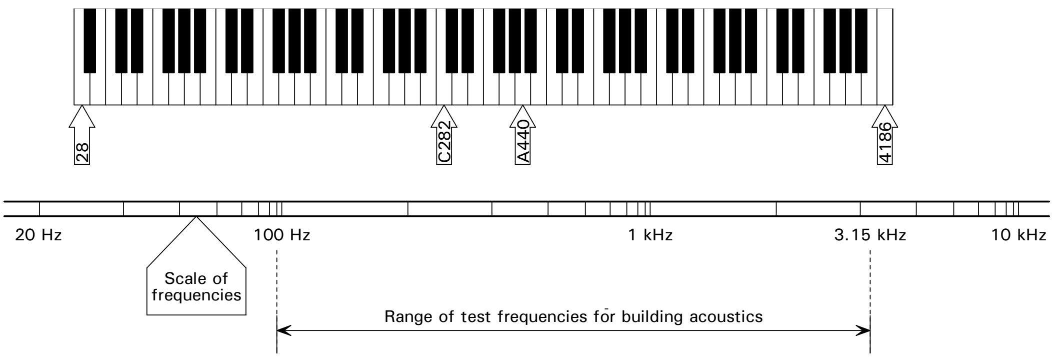


Figure 1.2 *The frequency range of building acoustics (Hz)*

There are two types of sound that should be considered in the acoustic design of buildings:

- Airborne sound
- Impact sound.

Sound insulation can be described in a variety of ways depending on the type of sound and the method of measurement. This can initially be confusing when trying to evaluate performance quoted in manufacturers' literature against client specifications and Building Regulation requirements. The following sections explain some of the main terms. More comprehensive descriptions are given in BS EN ISO 140-1:1998 [6].

Airborne sound insulation

Airborne sound insulation is important for both walls and floors. Airborne sound insulation between rooms can be measured by generating a steady sound of a particular frequency in one room (the source room) and comparing it with sound in a second adjacent room (the receiving room). These measurements are made at a number of different frequencies. The difference between the two levels is referred to as the level difference D. This level difference is influenced by the amount of acoustic absorption in the receiving room. When a sound wave reaches a surface it will be partly reflected off the surface back into the room and continue travelling in a new direction, and it will be partly absorbed by the surface. The sound absorption of a room can be estimated by measuring the reverberation time T. The reverberation time is the time taken for the reverberant noise to decay by 60 dB. A sound created in a room with a long reverberation time will sound louder than the same sound created in a room with a short reverberation time. In order that airborne sound insulation measurements in different buildings may be compared, the level differences can be adjusted to a standard reverberation time of 0.5 seconds. This gives the standardised level difference D_{nT}.

Individual building elements such as partitions, doors or windows can be tested in acoustic laboratories. These laboratories comprise two massively constructed adjacent rooms that are isolated against flanking transmission (See Section 1.3) and connected by an aperture containing a test panel of the building element. The level difference is measured between the two rooms and the result adjusted to be independent of both the area of the panel and the acoustic absorption of the room. The resulting value is the sound reduction index R.

Impact sound insulation

Impact insulation is generally only relevant to floors. A standard impact sound source (a tapping machine consisting of automated hammers) is used to strike the floor repeatedly at a standard rate. The resulting sound in the receiving (downstairs) room is measured and this value is termed the impact sound pressure level L. Measurements in buildings can be standardised to a reverberation time of 0.5 seconds. This gives the standardised impact sound pressure level L'_{nT} which is a field measurement. Tests in laboratories, normalised for area and absorption give the normalised impact sound pressure level L_{n}.

This test method means that the better the impact sound insulation, the lower the value of L'_{nT} or L_{n}.

Single figure rating values

Sound insulation is measured at a number of different frequencies, usually at 16 one-third octave bands from 100 Hz to 3150 Hz. However, for many purposes, including the requirements for dwellings given in building regulations (see Section 1.4), a single figure rating is required. There are several methods that could be used to reduce the sound insulation values at the sixteen individual frequencies to a single figure value. An obvious method is to take the arithmetic mean, but very high levels of sound insulation at some frequencies can offset poor performance at others. The most common method of overcoming this is to compare the measured results with a set of sixteen reference results i.e. a reference curve. The reference curve is defined in BS EN ISO 717-1[7] and is based on the relative human perception of different frequencies of sound. The rating is made by considering only those sound insulation values which fall short of the reference curve. In this way, one or two very good results have much less effect on the single figure value. The method used for calculating a single figure airborne sound insulation value is shown graphically in Figure 1.3. The position of the reference curve is moved up or down until the sum of the adverse deviations is less than or equal to 32 dB but as close as possible to 32 dB. The $D_{nT,w}$ value is then read from the position at 500 Hz point of the reference curve. A similar method is used for impact sound.

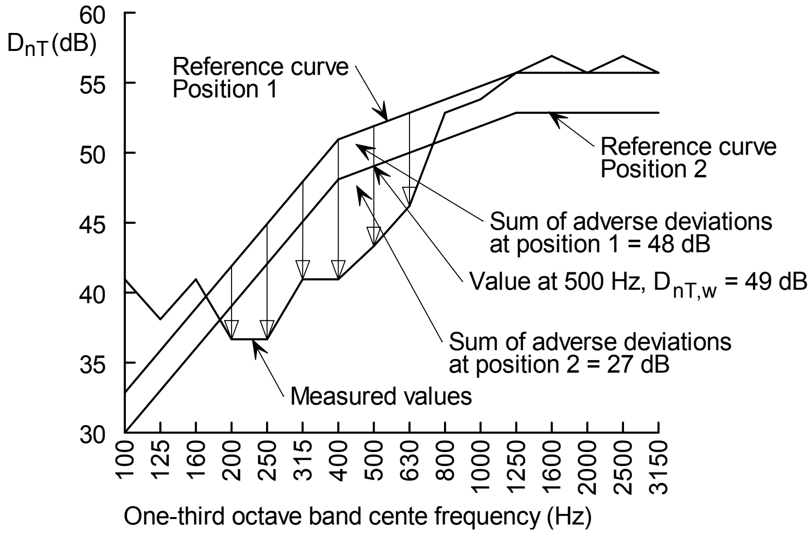


Figure 1.3 *Calculation of single figure value* $D_{nT,w}$

The single figure values are called:

- Standardised weighted level difference $D_{nT,w}$ when generated from D_{nT}
- Weighted sound reduction R_w when generated from R
- Standardised weighted impact sound pressure level $L'_{nT,w}$ when generated from L'_{nT}
- Normalised weighted impact sound pressure level $L_{n,w}$ when generated from L_n.

1.3 Principles of acoustic detailing

Direct and flanking transmission

Where a room is separated from another room, sound can travel by two routes: directly through the separating structure called direct transmission, and around the separating structure through adjacent building elements called flanking transmission. These routes are indicated in Figure 1.4. Sound insulation for both routes is controlled by the following three characteristics:

- Mass
- Isolation
- Sealing.

Direct transmission depends upon the properties of the separating wall or floor and can be estimated from laboratory measurements. Flanking transmission is more difficult to predict because it is influenced by the details of the junctions between the building elements and the quality of construction on site. It is notable that, in certain circumstances, such as where separating walls have a high standard of acoustic insulation but side walls are constructed to lower standards and are continuous between rooms, flanking transmission can account for the passage of more sound than direct transmission. It is therefore important that the junctions between separating elements are detailed and built correctly to minimise flanking sound transmission (see Sections 1.5 and 4).

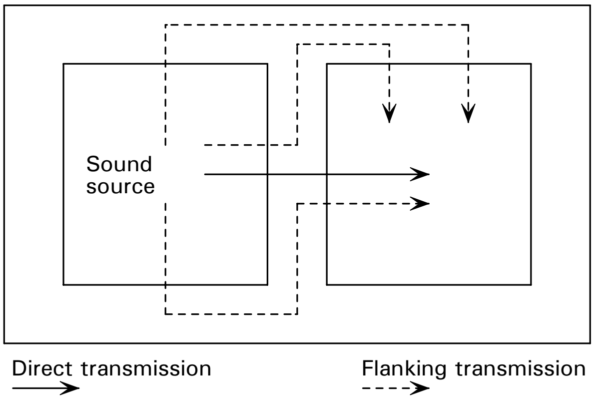


Figure 1.4 *Transmission of sound*

Mass

Transmission of airborne sound across a solid wall or a single skin partition will obey what is known as the mass law. This law may be expressed in a variety of ways. In principle, the law suggests that the sound insulation of a solid element will increase by approximately 5 dB per doubling of mass. The mass law is applicable between 10 kg/m^2 and 1000 kg/m^2.

Isolation

Lightweight framed construction achieves far better standards of airborne sound insulation than the mass law would suggest because of the presence of a cavity and therefore a degree of isolation between the various layers of the construction. It has been demonstrated that the sound insulations of individual elements within a double skin partition tend to combine together in a simple cumulative linear relationship. The overall performance of a double skin partition can therefore generally be determined by simply adding together the sound insulation ratings of its constituent elements. In this way, two comparatively lightweight partitions of 25 to 30 dB sound reduction can be combined to give an acoustically enhanced partition with a 50 to 60 dB sound reduction, whereas the mass law alone would have suggested only a 5 dB improvement. This is the basis of many lightweight partition systems, and is further illustrated in Figure 1.5.

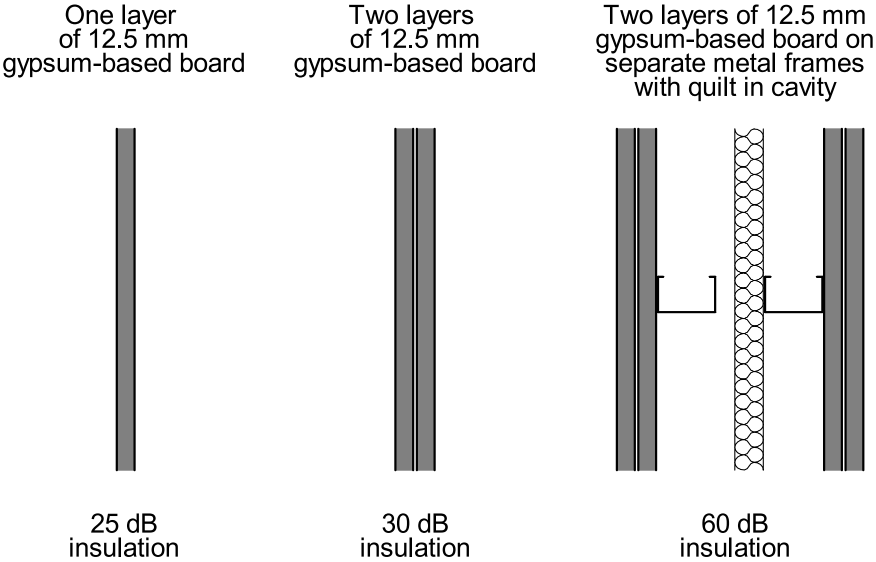


Figure 1.5 *Sound insulation by layers*

The width of the cavity between separate layers is important to the acoustic performance of a wall. The cavity width should be at least 40 mm.

Sealing

It is important to provide adequate sealing around floors and partitions because even a small gap can lead to a marked deterioration in acoustic performance. Joints between walls and between walls and ceilings should be sealed with tape or caulked with sealant. Where walls abut profiled metal decks, or similar elements, mineral wool packing and acoustic sealants may be required. Where there are movement joints at the edges of walls, special details are likely to be necessary; advice should be sought from manufacturers.

Ideally, wall linings (e.g. gypsum-based board, see Section 2.2) should not be penetrated by services. This is particularly important for separating walls between dwellings. Where service penetrations do occur in sensitive locations, particular attention should be given to the way in which these are detailed (see Section 5.2).

1.4 Acoustic regulations

The acoustic requirements of residential buildings are normally given in national building regulations and associated guidance documents. For England and Wales, acoustic performance requirements are given in Part E of the Building Regulations 2000[8] and in Approved Document E[9]. Similar equivalent documents exist for use in Scotland and Northern Ireland.

Part E of the Building Regulations

The full scope of Part E covers:

- Acoustic insulation of separating walls and floors between newly built dwellings, and dwellings formed by a material change of use.
- Acoustic insulation between hotel rooms, boarding house rooms, and other rooms used for residential purposes such as student halls of residence and

key worker accommodation, formed by new-build or by a material change of use.

- Acoustic insulation between rooms within a dwelling formed by new-build or by a material change of use.
- Acoustic characteristics of common parts of apartment buildings.
- Acoustic characteristics of schools. Comprehensive guidance on requirements and ways of meeting them is covered by Building Bulletin 93[10].

Requirement E1 relates to separating walls and floors, and their junction details. The other regulations in Part E refer to surface finishes, internal (i.e. non-separating) walls and other building types. Requirement E1 states:

> *E1: Protection against sound from other parts of the building and adjoining buildings*
>
> *Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.*

Rooms for residential purposes, as referred to in requirement E1, include rooms in hotels, hostels, boarding houses, halls of residence and residential homes etc. but do not including rooms in hospitals, or other similar establishments, used for patient accommodation.

Approved Document E provides guidance on how the Regulations may be satisfied and sets acoustic performance standards. The required levels of insulation to airborne and impact sound are summarised in Table 1.1 and Table 1.2 respectively.

Table 1.1 *Airborne sound insulation requirements*

Building type	Element	Airborne sound insulation performance (dB)
Purpose built: Dwelling houses and flats	Separating walls	$D_{nT,w} + C_{tr} \geq 45$
	Separating floors and stairs	$D_{nT,w} + C_{tr} \geq 45$
	Internal wall	$R_w \geq 40$
	Internal floor	$R_w \geq 40$
Purpose built: Rooms for residential purposes	Separating walls	$D_{nT,w} + C_{tr} \geq 43$
	Separating floors and stairs	$D_{nT,w} + C_{tr} \geq 45$
	Internal wall	$R_w \geq 40$
	Internal floor	$R_w \geq 40$

Note:

$D_{nT,w}$ is the standardised weighted sound level difference

C_{tr} is a spectrum adaptation term

R_w is the weighted sound reduction index

Table 1.2 *Impact sound insulation requirements*

Building type	Element	Impact sound insulation performance (dB)
Purpose built: Dwelling houses and flats	Separating floors and stairs	$L'_{nT,w} < 62$ (dB)
Purpose built: Rooms for residential purposes	Separating floors and stairs	$L'_{nT,w} < 62$ (dB)

Note:

$L'_{nT,w}$ is the standardised weighted impact sound pressure level

The C_{tr} spectrum adaptation term is used to take account of low frequency sounds (e.g. traffic and bass music). The value of C_{tr} is negative and is typically in the range of -4 to -16 dB.

Demonstrating compliance with Part E

Approved Document E describes two methods of demonstrating compliance with Part E of the Building Regulations; pre-completion testing (PCT) and by use of Robust Details (RDs).

PCT is carried out on-site and the onus is on the builder to demonstrate compliance. It is recommended that 1 in 10 of each type of construction detail is tested. PCT only applies to separating walls and floors and is not necessary for internal walls and floors. PCT should be carried out when the rooms either side of the separating element are essentially complete, except for decoration. Tests are generally required to be carried out without non-permanent decorative floor coverings (e.g. carpet, laminate flooring, vinyl). In some cases integral soft floor coverings are permitted, provided the floor covering is glued to the concrete slab below.

Robust Details were developed as an alternative to PCT. A range of details has been developed which have been proved through testing to consistently satisfy (and exceed) the acoustic performance requirements specified in Approved Document E. The available RDs and their specification requirements are given in *Robust Details Handbook*[11] published by Robust Details Limited. To use a Part E Robust Detail in the construction process, builders must first obtain permission from Robust Details Limited and pay the requisite fee for each dwelling. Provided that the Robust Details are built correctly, this will be accepted by building control bodies in England and Wales as evidence that the homes are exempt from PCT.

Some of the wall and floor details presented in Sections 2 and 3 are RDs when specified to comply with the requirements given in the *Robust Details Handbook*. Where this is the case, the Robust Details reference is given. Some of the recommended junction details in Appendix B.2 are also RDs, provided that the wall, floor and junction are specified to comply with the requirements given in the *Robust Details Handbook*.

Guidance constructions, that when built correctly should provide the required acoustic performances, are provided in Approved Document E. However, these are generally conservative solutions and still require PCT to be carried out.

Both methods of compliance (PCT and RDs) can be used for steel construction, although pre-completion testing is probably the most appropriate because it allows more flexibility in the design and detailing. The scope of the current range of RDs for steel construction is not sufficient to include all the junction details that are typically present on a residential development. Therefore, even if RDs have been used there will usually be some junctions where building control could request site testing. The range of RDs is continually growing so over time there will be fewer instances where RDs cannot be used. The approval process for new RDs requires significant amounts of site test data for similar details, for the tests to show that the details exceed the Building Regulation requirements by 5 dB on average and for the details to become public. Hence, there is often little incentive for system suppliers to share their information if they are satisfied with the results obtained from PCT.

1.5 Construction quality

The acoustic performance of a building can be sensitive to the quality of the workmanship. Gaps, absent absorption quilt or loss of isolation between elements can all seriously impair the sound insulation performance or increase the amount of flanking sound transmission of a separating wall or floor.

Material substitution or changes to construction details can reduce the sound insulation performance of separating elements. Apparently similar products can have significantly different acoustic properties. Therefore, any changes to construction details or material substitutions should be approved by a suitably qualified person such as an acoustic consultant.

One of the recognised benefits of steel construction and off-site construction in particular is that the quality and consistency of construction is improved. Therefore, the acoustic performance is more reliable. Off-site prefabrication improves quality by factory-controlled production, and is less dependent on site trades and the weather. Steel does not shrink, warp, or creep under load, and therefore does not contribute to cracking or deterioration of the non-structural elements and finishes; gaps and sound paths are not created; the acoustic performance is maintained.

To ensure that the quality of construction is of the required standard, trained installers should be used and there should be sufficient site supervision.

2 WALLS

2.1 Light steel wall studs

'C' and 'I' Section studs

'C' and 'I' section cold formed steel studs are used as vertical elements in walls. They are available in a range of widths, lengths and thicknesses depending on requirements for strength, height, impact resistance and sound insulation. Typical cross sections are shown in Figure 2.1. Sections are typically 70 to 100 mm deep and 0.9 to 1.6 mm thick. Light steel stud walls can be load-bearing or non load-bearing.

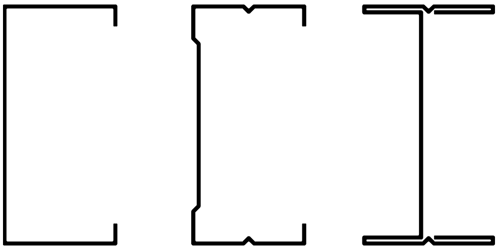


Figure 2.1 *Typical cross-sections of 'C' and 'I' section studs*

Acoustic studs

Manufacturers produce acoustic studs which have unique characteristics for increased acoustic performance. The studs have specially developed profiles, particularly the web, which absorb sound energy and reduce sound transfer through walls. Acoustic studs can be used to upgrade the acoustic performance of wall systems. Typical cross sections of acoustic studs available are shown in Figure 2.2. Acoustic studs are generally non load-bearing. Sizes are similar to those for 'C' and 'I' section studs but the thickness is usually less.

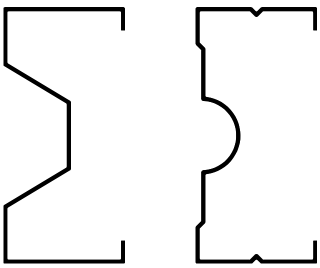


Figure 2.2 *Typical cross-sections of acoustic studs*

2.2 Wall linings

There are many different types of gypsum-based boards which have been developed to have different properties suitable for different purposes. Gypsum-based boards fall into two main categories; plasterboards and fibre reinforced boards.

Generic descriptions of the different types of boards are provided below. However, boards from different manufacturers will have different physical properties and different performance characteristics, even though they may have been developed for similar uses. Therefore, substitution of boards should only be carried out with the agreement of the system supplier or an acoustic consultant.

Gypsum-based boards are suitable for lining light steel frame walls, partitions and also ceilings.

2.2.1 Plasterboards

Conventional plasterboards consist of a pure gypsum core bonded between two paper liners. The composition of the gypsum core and the paper liners are varied and other materials are laminated to the boards to create a range of plasterboards with different performance characteristics. The different types of plasterboards are often colour coded for identification on site and are described below. In many cases manufacturers can combine different properties into one plasterboard product. Plasterboards properties are defined in BS EN 520: 2004[12].

Standard board

Standard board is used for internal walls, ceilings and partitions, in both domestic and commercial premises.

Sound resistant board

Sound control board is a heavy duty board used where superior acoustic performance is required. It has a dense high purity gypsum core between two high quality paper liners.

Fire control board

Fire control board is used for the encasement of structural steelwork, lining walls, ceilings, shafts and partitions where high levels of fire resistance are required.

Fire control boards provide a higher degree of fire resistance than standard board by incorporating additives, such as glass fibre, in the gypsum core.

Moisture control board

Moisture control board is used in bathrooms, kitchens, domestic garages and other applications that require increased resistance to the effects of moisture and humidity. The gypsum plaster core and paper liners are treated with water repellent additives but it remains permeable to water vapour allowing the underlying structure to breathe. It is not suitable for areas of continuous wetting or high humidity conditions such as in swimming pools.

Thermal control board

Thermal control boards are a range of plasterboard thermal laminates. Plasterboard is bonded to different types of insulation to suit a variety of thermal requirements. Possible thermal laminates include expanded polystyrene, extruded polystyrene and phenolic foams.

Vapour control board

Vapour control board has a film bonded to one face, which acts as a vapour control layer and can also give improved thermal performance.

Impact resistant board

Impact resistant board is heavy duty plasterboard for use in active environments such as schools, hospitals and residential corridors. The increased impact resistance is provided by heavy duty paper facings and a higher density core.

2.2.2 Gypsum fibre boards

Cellulose fibre reinforced gypsum boards

High performance boards are produced by combining gypsum with cellulose fibres from recycled paper. Cellulose fibre reinforced gypsum boards are suitable for lining all forms of walls, partitions and ceilings. Cellulose fibre reinforced gypsum board is heavier and stronger than plasterboard and has enhanced performance in terms of resistance to moisture, sound, fire and impact. The higher strength of the board is advantageous for supporting fixings, restraining light steel joists and studs and providing racking resistance.

Flooring products are manufactured using cellulose fibre reinforced gypsum boards bonded to insulation and isolation layers as appropriate.

Glass fibre reinforced gypsum boards

Glass fibre reinforced gypsum boards are also suitable for lining all forms of walls, partitions and ceilings. The board gives enhanced levels of fire and impact protection and offers increased levels of moisture performance compared to plasterboard. Boards can be supplied bonded to a foil-backed phenolic foam and integral vapour control layer.

2.2.3 Board weights and densities

The weights and densities of the various types of boards suitable for wall linings are summaries in Table 2.1.

Table 2.1 *Weight of gypsum-based boards*

Board type	Thickness (mm)	Mass per unit area (kg/m^2)	Density (kg/m^3)
Standard plasterboard	9.5, 12.5, 15, 19	6.3 - 15.0	660 - 790
Sound resistant plasterboard	12.5, 15	10.2 - 13.1	820 - 870
Fire control plasterboard	12.5, 15	9.8 - 12.8	780 - 850
Moisture control plasterboard	12.5, 15	8.6 - 10.3	680 - 700
Thermal control plasterboard*	18 - 65	6.0 - 9.0	140 - 330
Vapour control plasterboard	9.5, 15	6.3 - 9.8	650 - 660
Impact resistant plasterboard	12.5, 15	11.7 - 13.9	930 - 940
Cellulose fibre reinforced	10, 12.5, 15, 18	11.5 - 21.0	1200
Glass fibre reinforced	6 - 30	6 - 25.5	850 - 1000

* Properties are for the composite product (plasterboard and bonded insulation)

2.2.4 Resilient bars

Resilient bars can be used to increase the sound insulation by absorbing vibrations. These bars may be fixed between the light steel wall studs and the wall linings (see Section 2.3.5). Resilient bars are manufactured from light gauge steel (typically 0.5 mm thick); the sections are typically 16 mm deep.

2.3 Separating walls

This Section shows the range of types of light steel wall constructions suitable for separating walls between dwellings and for internal walls between rooms for residential purposes. There is a wide range of possible separating wall constructions, due to the permutations of type and thickness of stud, board and insulation that may be used. Therefore, the constructions shown are only a sample of the possible constructions.

For guidance on detailing junctions between these walls and other components of the building, refer to Sections 4 and 5.

All expected acoustic performance values are indicative and provided that the walls are built correctly and their junctions are properly detailed (see Section 4) these examples should provide the quoted expected acoustic performance. Manufacturers' literature, system suppliers and/or an acoustic consultant should be consulted for detailed specifications and more precise expected acoustic performance figures.

The following wall constructions are presented:

2.3.1 - Twin light steel frames (insulation between frames)

2.3.2 - Twin light steel frames (insulation between studs)

2.3.3 - Twin light steel frames for modular construction

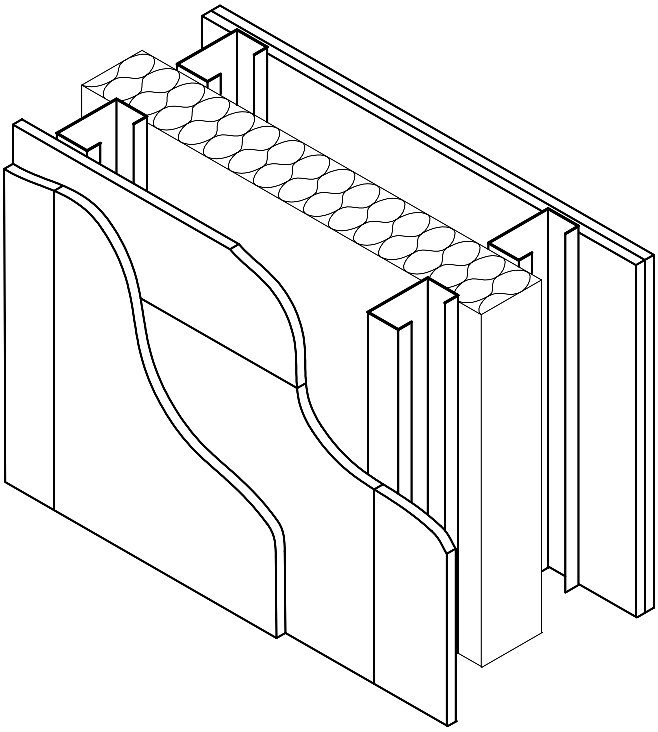
2.3.4 - Single acoustic stud light steel frame

2.3.5 - Single light steel frame with resilient bars

2.3.6 - Staggered stud light steel frame.

When detailed in accordance with the *Robust Details Handbook*[11], the twin light steel frame walls (2.3.1, 2.3.2 and 2.3.3) are Robust Detail separating walls.

2.3.1 Twin light steel frames (quilt between frames)



Studs

Studs are typically 50 to 100 mm deep and are usually ‘C’ or ‘I’ sections. The shape, size and spacing of the studs will depend on whether the wall is load-bearing or non load-bearing. 100 mm studs are typically used for load-bearing walls. This wall is a Robust Detail (E-WS-1) when specified to comply with the requirements given in the *Robust Details Handbook*[11].

Quilt

Mineral wool quilt placed in the cavity between the two frames is typically 50 to 100 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant or fire resistant plasterboard or two layers of 10 mm gypsum fibre board.

Construction thickness

The overall wall thickness is typically 250 to 300 mm.

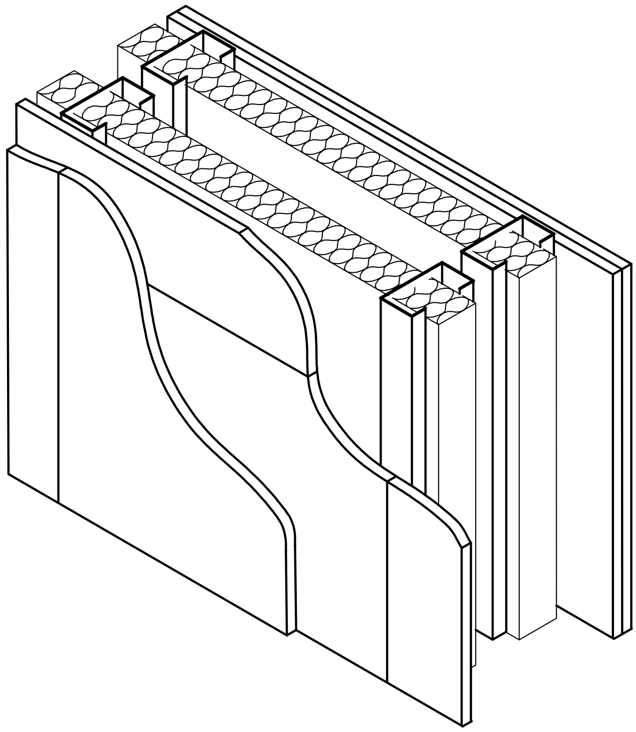
Expected performance

R_w = 56 to 66 dB

$D_{nT,w} + C_{tr}$ = 45 to 56 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.3.2 Twin light steel frames (quilt between studs)



Studs

Studs are typically 50 to 100 mm deep and are usually 'C' or 'I' sections. The shape, size and spacing of the studs will depend on whether the wall is load-bearing or non load-bearing. 100 mm studs are typically used for load-bearing walls. This wall is a Robust Detail (E-WS-1) when specified to comply with the requirements given in the *Robust Details Handbook*[11].

Quilt

Mineral wool quilt is placed between the studs of each frame. Each layer is typically 50 to 75 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant or fire resistant plasterboard or two layers of 10 mm gypsum fibre board. The cavity between inner faces of the wall linings should be at least 200 mm.

Construction thickness

The overall wall thickness is typically 250 to 300 mm.

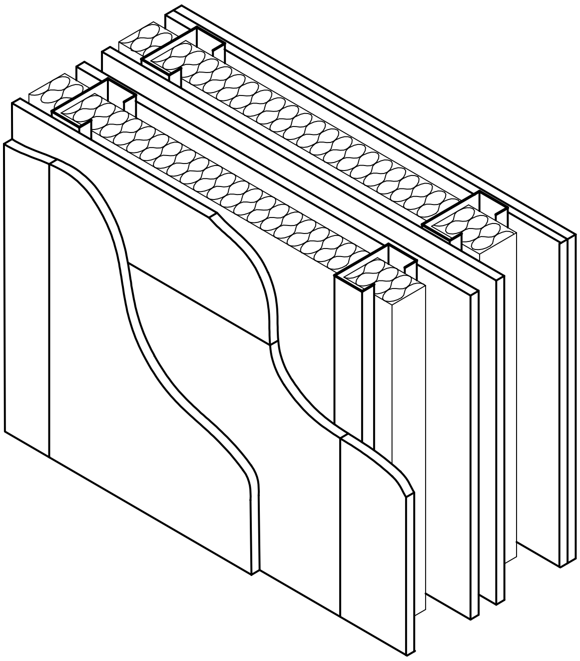
Expected performance

R_w = 56 to 66 dB

$D_{nT,w} + C_{tr}$ = 45 to 56 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.3.3 Twin light steel frames for modular construction



Studs

Studs are typically 70 to 100 mm deep and are usually ‘C’ sections of 1.6 mm thickness. This wall is a Robust Detail (E-WS-3) when specified to comply with the requirements given in the *Robust Details Handbook*[11].

Quilt

Mineral wool quilt is placed between the studs of each frame. The quilt in each frame is typically 50 to 80 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each room face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant or fire resistant plasterboard or two layers of 10 mm gypsum fibre board.

A sheathing board is fixed to the other face of each stud frame. The sheathing board is generally OSB, plywood, cement particle board or alternatively a weather resistant gypsum-based board. The cavity between the two sheathing boards should be at least 40 mm.

Construction thickness

The overall wall thickness is typically 260 to 350 mm.

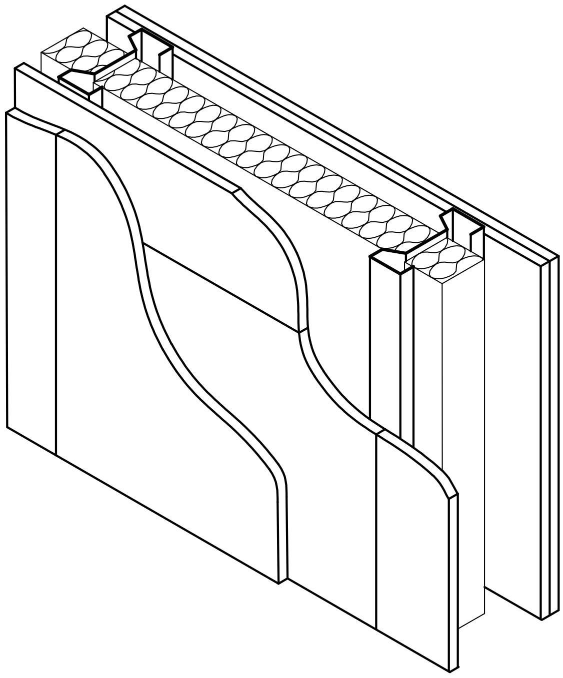
Expected performance

R_w = 57 to 69 dB

$D_{nT,w} + C_{tr}$ = 47 to 56 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.3.4 Single acoustic stud light steel frame



Studs

Specially designed acoustic studs used in separating walls are typically 90 to 150 mm deep. Acoustic studs are generally non load-bearing.

Quilt

Mineral wool quilt placed between the studs is typically 50 to 75 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant plasterboard or two layers of gypsum fibre board one 12.5 mm and one 10 mm.

Construction thickness

The overall construction thickness is typically 150 to 210 mm.

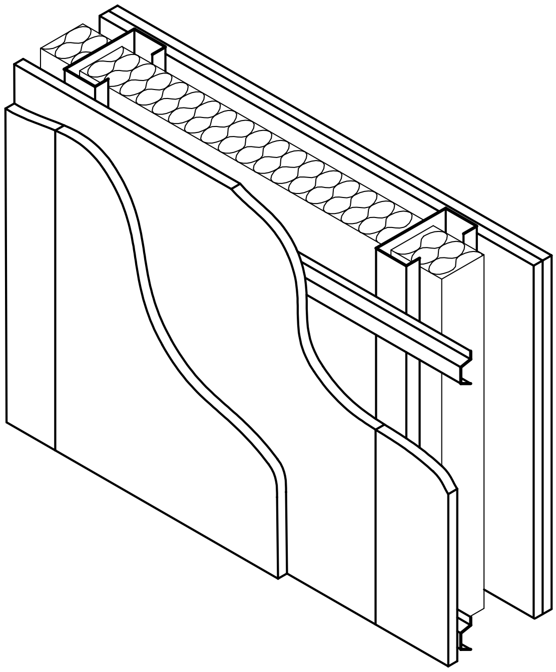
Expected performance

R_w = 56 to 61 dB

$D_{nT,w} + C_{tr}$ = 45 to 50 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.3.5 Single light steel frame with resilient bars



Studs

Studs are typically 70 to 150 mm deep and are usually ‘C’ or ‘I’ sections. The shape, size and spacing of the studs will depend on whether the wall is load-bearing or non load-bearing. Resilient bars may be fixed to only one side of the studs (as shown) or to both sides for enhanced performance. Resilient bars are typically 17 mm deep.

Quilt

Mineral wool quilt placed between the studs is typically 50 to 75 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant or fire resistant plasterboard or two layers of 10 mm gypsum fibre board.

Construction thickness

The overall construction thickness is typically 140 to 220 mm.

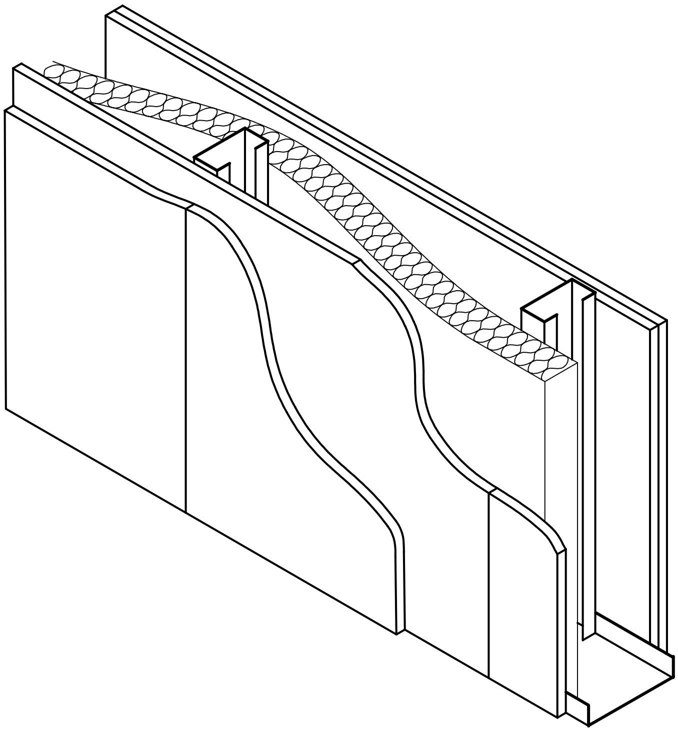
Expected performance

R_w = 59 to 62 dB

$D_{nT,w} + C_{tr}$ = 47 to 51 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.3.6 Staggered stud light steel frame



Studs

Studs are typically 60 to 90 mm deep and are usually ‘C’ or ‘I’ sections. These are fixed inside top and bottom tracks which are wider than the stud and are fastened to alternate sides of tracks so that studs are staggered. Tracks are usually 90 to 150 mm wide.

Quilt

Mineral wool quilt placed between the studs is typically 25 to 50 mm thick and has a density between 10 and 60 kg/m^3.

Boards

Two layers of gypsum-based board on each face with a minimum total mass per unit area of 22 kg/m^2 per face. Typically this comprises two layers of 15 mm sound resistant plasterboard or two layers of gypsum fibre board, one 12.5 mm and one 10 mm.

Construction thickness

The overall construction thickness is typically 120 to 210 mm.

Expected performance

R_{w} = 57 to 63 dB

$D_{nT,w} + C_{tr}$ = 45 to 52 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.4 Internal walls

All the details shown below are suitable for internal walls within dwellings. Manufacturers' literature or system suppliers should be consulted for detailed specifications and expected acoustic performance.

For guidance on detailing junctions between these walls and other components of the building, refer to Sections 4 and 5.

The following wall constructions are presented:

2.4.1 - Single light steel frame (with quilt)

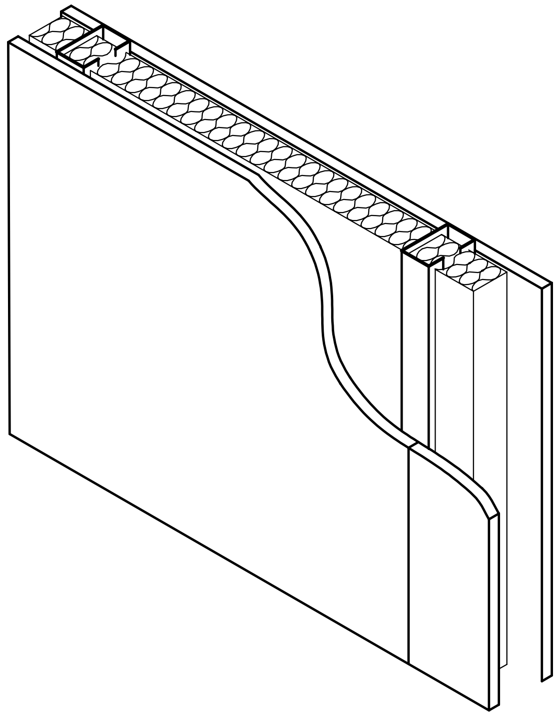
2.4.2 - Single light steel frame (without quilt)

2.4.3 - Single acoustic stud light steel frame (with quilt)

2.4.4 - Single acoustic stud light steel frame (without quilt).

Internal walls are not required to undergo on-site testing to demonstrate compliance with the noise insulation requirements of Approved Document E.

2.4.1 Single light steel frame (with quilt)



Studs

Studs are typically 50 to 150 mm deep and are usually ‘C’ or ‘I’ sections.

Quilt

Mineral wool quilt placed between the studs is typically 25 to 50 mm thick and has a density between 10 and 45 kg/m^3.

Boards

One layer of gypsum-based board on each face. This may be 12.5 or 15 mm thick standard wall board, sound resistant plasterboard or gypsum fibre board, depending on the required acoustic performance.

Construction thickness

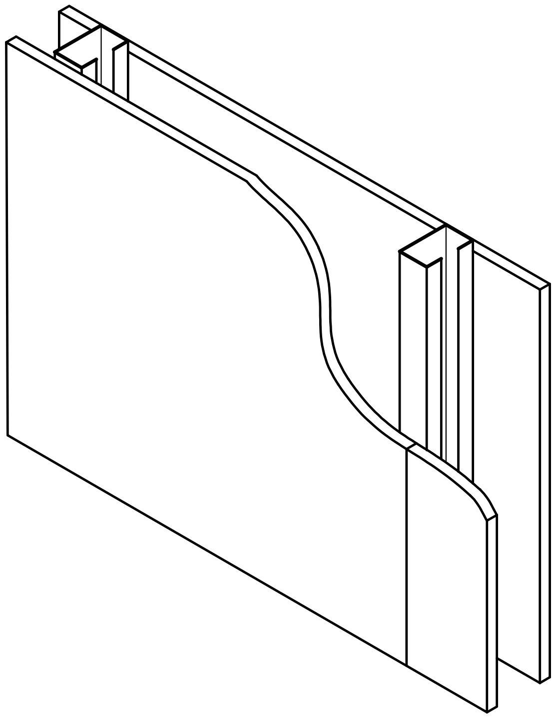
The overall construction thickness is typically 75 to 175 mm.

Expected performance

R_w = 40 to 50 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.4.2 Single light steel frame (without quilt)



Studs

Studs are typically 50 to 150 mm deep and are usually 'C' or 'I' sections.

Quilt

There is no quilt in this wall construction.

Boards

One layer of gypsum-based board on each face. This may be 12.5 or 15 mm thick standard wall board, sound resistant plasterboard or gypsum fibre board, depending on the required acoustic performance.

Construction thickness

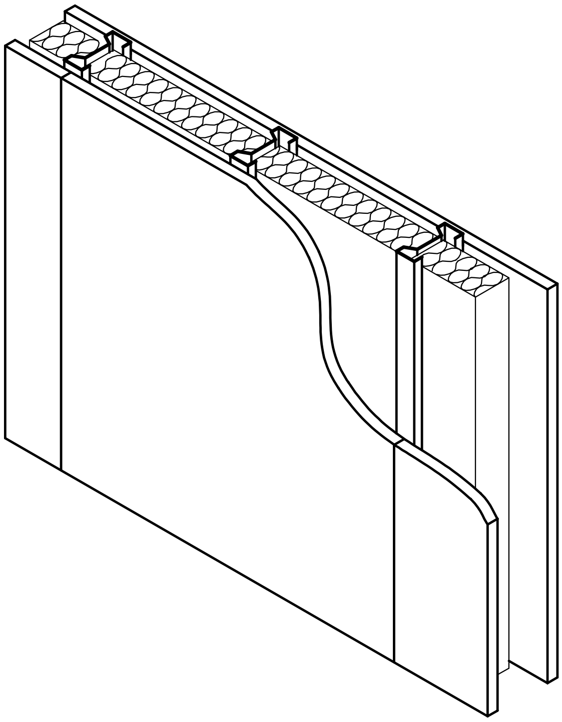
The overall construction thickness is typically 75 to 175 mm.

Expected performance

R_w = 34 to 43 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.4.3 Single acoustic stud light steel frame (with quilt)



Studs

Studs are typically 45 to 125 mm deep and are usually variations on ‘C’ sections.

Quilt

Mineral wool quilt placed between the studs is typically 25 to 50 mm thick and has a density between 10 and 25 kg/m^3.

Boards

One layer of gypsum-based board on each face. This may be 12.5 or 15 mm thick standard wall board, sound resistant plasterboard or gypsum fibre board, depending on the required acoustic performance.

Construction thickness

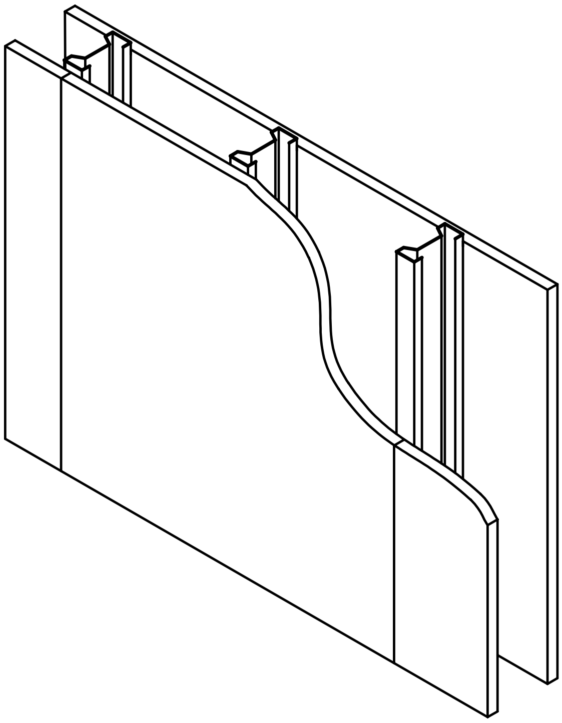
The overall construction thickness is typically 75 to 150 mm.

Expected performance

R_w = 43 to 52 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

2.4.4 Single acoustic stud light steel frame (without quilt)



Studs

Studs are typically 45 to 125 mm deep and are usually variations on ‘C’ sections with specially designed profiles, as described in Section 2.1.

Quilt

There is no quilt in this wall construction.

Boards

One layer of gypsum-based board on each face. This may be 12.5 or 15 mm thick standard wall board, sound resistant plasterboard or gypsum fibre board, depending on the required acoustic performance.

Construction thickness

The overall construction thickness is typically 75 to 150 mm.

Expected performance

R_w = 39 to 43 dB

Note: Consult manufacturers’ literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3 FLOORS

3.1 Separating floors

This Section shows floor constructions suitable for separating floors between dwellings. There is a wide range of possible separating floor constructions, due to the permutations of type of floor treatment, ceiling, quilt and structural solution that may be used. The floors shown are therefore only a sample of the possible separating floors that can be used with steel construction. Provided the floors are built correctly and the junctions are properly detailed, these constructions should provide compliance with Approved Document E.

For guidance on detailing junctions between these walls and other components of the building, refer to Sections 4 and 5.

All acoustic performance values quoted in this publication are indicative. Manufacturers' literature, system suppliers and/or an acoustic consultant should be consulted for detailed specifications and for more accurate information on expected acoustic performance.

The following separating floor constructions are presented:

3.1.1 - Composite floor on steel beams

3.1.2 - Precast units supported on steel beams

3.1.3 - Light steel joists with boards

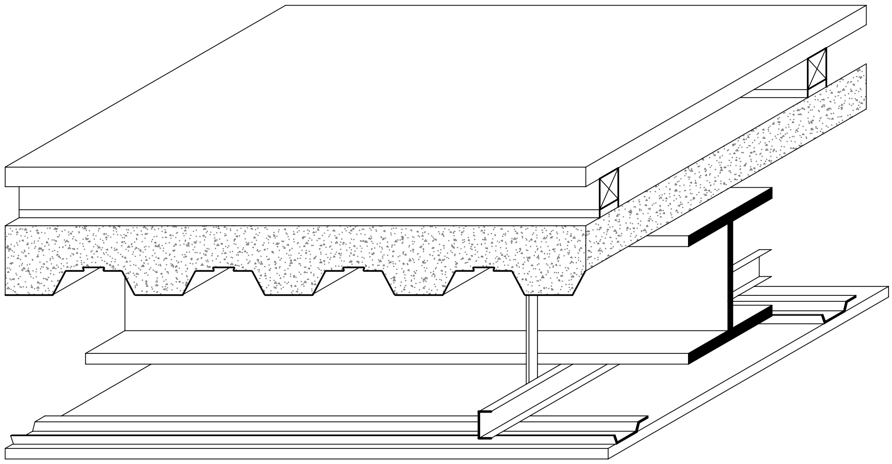
3.1.4 - Light steel lattice truss with screed

3.1.5 - Light steel joist for modular construction

3.1.6 - Light steel lattice truss with boards.

More detailed guidance on the acoustic detailing of precast units supported on steel beams is provided in SCI publication P351[13].

3.1.1 Composite floor on steel beams



Structural floor

A composite floor slab consisting of *in situ* normal weight concrete and steel decking supported on steel beams. The steel beams may be below the composite slab (as shown) or integrated into the depth of the slab. The decking may be 'shallow' or 'deep', re-entrant or trapezoidal. Typically, the concrete thickness is at least 80 mm at the shallowest point and at least 130 mm at the deepest point. This floor is a Robust Detail (E-FS-1) when specified to comply with the requirements given in the *Robust Details Handbook*[11].

Ceiling

One layer of gypsum-based board with a minimum mass per unit area of 8 kg/m^2. This should be at least 12.5 mm standard wall board or a 10 mm gypsum fibre board. The ceiling board may be supported on a proprietary metal frame, timber battens and/or resilient bars. The ceiling board or the support system should not be in direct contact with the steel beam. The distance between the top of the ceiling board and the top of the floor slab should generally be at least 300 mm.
See Section 3.4 for further guidance.

Floor treatment

Typical floor treatments applied to the composite floor slab included battened floors, platform floors and isolated screed floors. See Section 3.3 for details of these options.

Construction depth

The overall construction depth is typically 400 to 800 mm.

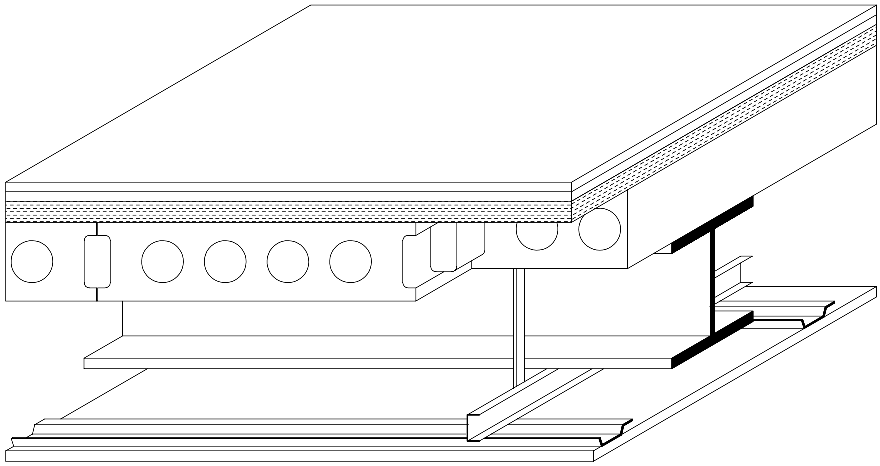
Expected performance

Airborne: $D_{nT,w} + C_{tr} = 48$ to 60 dB

Impact: $L'_{ntw} = 25$ to 50 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.1.2 Precast units on steel beams



Structural floor

Precast hollow core concrete units supported on steel beams. The precast units should be at least 150 mm thick and at least 300 kg/m^2. The joints between adjacent precast units and voids around columns should be filled with grout.

Ceiling

One layer of gypsum-based board with a minimum density of 8 kg/m^2. This should be at least 12.5 mm thick standard wall board or a 10 mm gypsum fibre board. The ceiling board may be supported on a proprietary metal frame, timber battens and/or resilient bars. The ceiling board or the support system should not be in direct contact with the steel beam. The distance between the top of the ceiling board and the top of the precast unit should generally be at least 300 mm. See Section 3.4 for further guidance.

Floor treatment

Typical floor treatments applied to the precast units include isolated screeds and battened floors or platform floors applied over non-isolated screeds. See Section 3.3 for details of these options. Appropriate isolating layers for screeds are described in Sections 3.3.8 and 3.3.9 .

Construction depth

The overall construction depth is typically 400 to 950 mm.

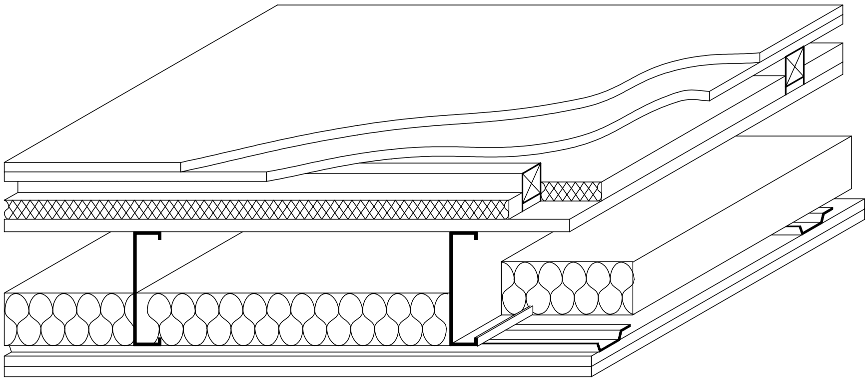
Expected performance

Airborne: $D_{nT,w} + C_{tr}$ = 47 to 58 dB

Impact: L'_{ntw} = 39 to 60 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.1.3 Light steel joists with boards



Structural floor

Light steel joists at 400 to 600 mm centres. The light steel joists are generally 150 to 250 mm deep 'C' sections. A decking board is fixed to the top of the joists; the decking board may be chipboard, OSB or plywood. The thickness of a chipboard or OSB decking board is typically 18 to 22 mm; a plywood decking board is typically 9 to 15 mm. A resilient isolation tape can be applied to the top of the steel joists to improve impact sound insulation. This floor is expected to achieve Robust Detail status in early 2008.

Ceiling

Two layers of gypsum-based board with a minimum density of 22 kg/m^2. This is typically two layers of 15 mm sound resistant plasterboard or two layers of 10 mm gypsum fibre board. The ceiling board is supported on resilient bars fixed to the underside of the light steel joists.

Quilt

Mineral wool quilt placed between the joists should be at least 100 mm thick and 10 to 45 kg/m^3.

Floor treatment

Battened floor treatments (as shown), platform floor treatments or proprietary screeds are used. See Section 3.3 for details of these options. Battened floor treatments used with this type of floor should include a layer of 19 mm gypsum-based board under the floor boarding and mineral wool quilt between battens. A platform floor treatment should also include a layer of 19 mm gypsum-based board under the floor boarding.

Construction depth

The overall construction depth is typically 250 to 380 mm.

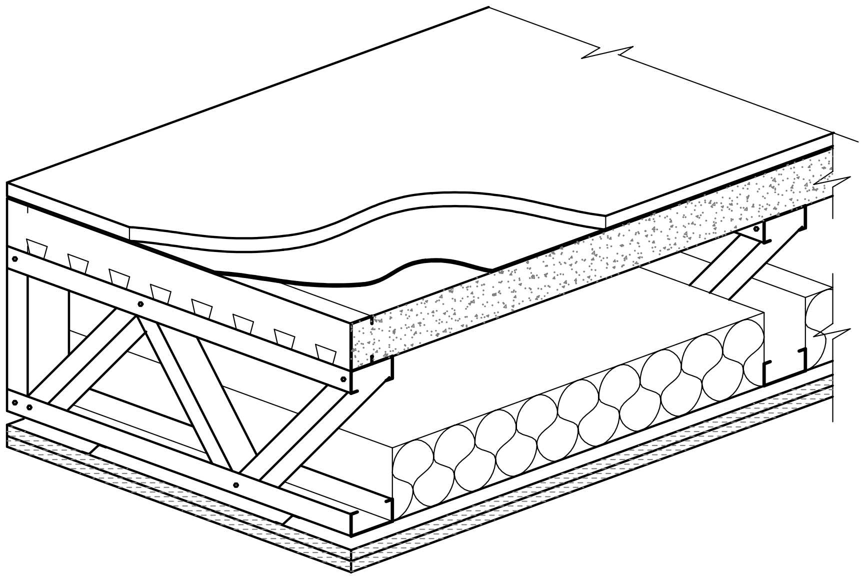
Expected performance

Airborne: $D_{nT,w} + C_{tr}$ = 47 to 57 dB

Impact: L'_{ntw} = 44 to 58 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.1.4 Light steel lattice truss with screed



Structural floor

Light steel lattice trusses spaced at 400 to 600 mm centres. The trusses are constructed with light steel 'C' sections and are typically 200 to 400 mm deep. Over the trusses is shallow metal decking (16 to 25 mm deep) and a gypsum-based or concrete screed (50 to 70 mm thick). A 6 mm thick resilient isolation tape is applied to the top of the steel joists to improve impact sound insulation.

Ceiling

Two layers of gypsum-based board with a minimum density of 22 kg/m^2. Typically two layers of 15 mm sound resistant plasterboard or two layers of 10 mm gypsum fibre board. The ceiling board is supported on resilient bars fixed to the underside of the light steel lattice trusses.

Quilt

Mineral wool quilt placed between the trusses should be at least 100 mm thick and 10 to 45 kg/m^3.

Floor treatment

A resilient floor covering consisting of flooring grade chipboard, or a gypsum fibre board, pre-bonded to an acoustic layer. The floor treatment thickness is typically 25 to 48 mm.

Construction depth

The overall construction depth is typically 320 to 500 mm.

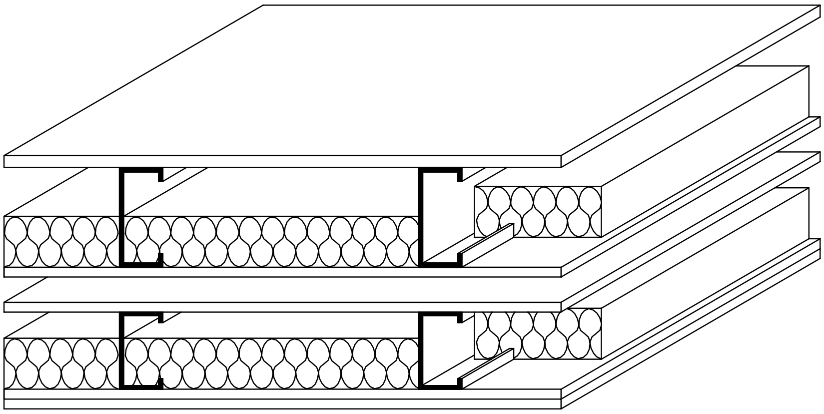
Expected performance

Airborne: $D_{nT,w} + C_{tr} = 46$ to 56 dB

Impact: $L'_{ntw} = 50$ to 62 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.1.5 Light steel joist and ceiling for modular construction



Structural floor

Two sets of light steel joists spaced at 400 to 600 mm centres. The upper set of joists support the floor of the upper module and the lower set of joists supports the ceiling of the lower module. The light steel joists are generally 70 to 180 mm deep 'C' sections. A chipboard, OSB or plywood layer is fixed to the top of the joists. The thickness of a chipboard or OSB layer is typically 18 to 22 mm, a plywood layer is typically 9 to 18 mm. An isolating strip, typically 3 mm thick, can be applied along the upper set of joists between the joists and the board to improve impact sound insulation.

Ceiling

Two layers of gypsum-based board with a minimum density of 18 kg/m^2. Typically, two layers of 12.5 mm sound resistant plasterboard or two layers of 10 mm gypsum fibre board. The ceiling board is fixed to the underside of the lower set of joists.

Quilt

There may be one or two layers (as shown) of quilt placed between the joists. The total depth of mineral wool quilt should be at least 100 mm and 10 to 45 kg/m^3.

Floor treatment

Generally, no additional floor treatment is required.

Construction depth

The overall construction depth is typically 300 to 460 mm.

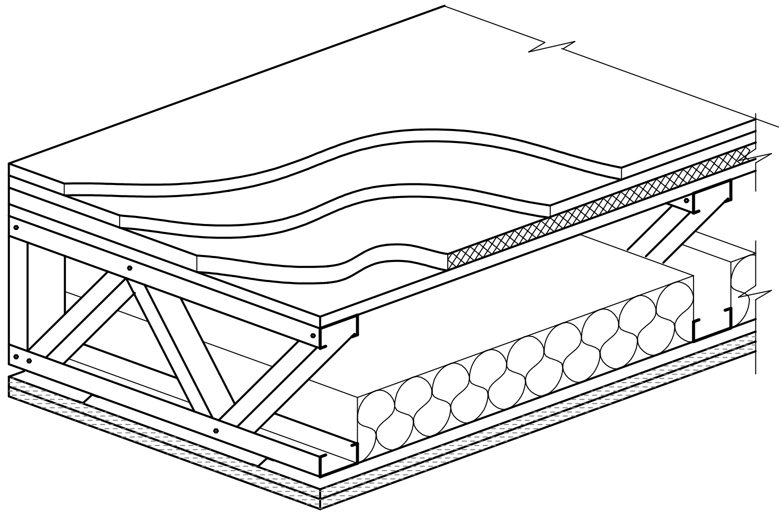
Expected performance

Airborne: $D_{nT,w} + C_{tr} = 46$ to 55 dB

Impact: $L'_{ntw} = 50$ to 60 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.1.6 Light steel lattice truss with acoustic boards



Structural floor

Light steel lattice trusses spaced at 400 to 600 mm centres. The trusses are constructed with light steel 'C' sections and are typically 250 to 400 mm deep. A decking board is fixed to the top of the trusses; the decking board may be chipboard, OSB or plywood. The thickness of a chipboard or OSB decking board is typically 18 to 22 mm; a plywood decking board is typically 9 to 18 mm. An isolating strip, typically 3 mm thick, can be applied between the trusses and the board to improve impact sound insulation.

Ceiling

Two layers of gypsum-based board with a minimum density of 22 kg/m^2. Typically two layers of 15 mm sound resistant plasterboard or two layers of gypsum fibre board. The ceiling board is supported on resilient bars fixed to the underside of the light steel lattice trusses.

Quilt

Mineral wool quilt placed between the trusses should be 100 to 200 mm thick and 10 to 45 kg/m^3.

Floor treatment

A platform floor treatment consisting of 18 mm floor grade chipboard over 19 mm gypsum-based board on 25 to 30 mm layer of dense mineral wool quilt (approximately 100 kg/m^3).

Construction depth

The overall construction depth is typically 320 to 520 mm.

Expected performance

Airborne: $D_{nT,w} + C_{tr} = 46$ to 54 dB

Impact: $L'_{ntw} = 35$ to 55 dB

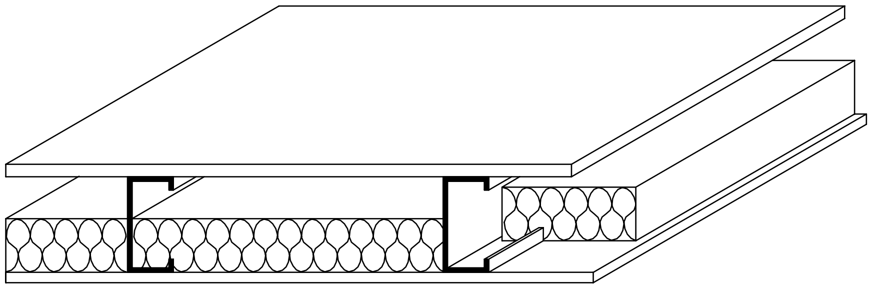
Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise specification and expected acoustic performance figures.

3.2 Internal floors

This Section shows floor constructions suitable for internal floors within a dwelling. Internal floors are rare within multi-storey residential buildings (i.e. apartments) because individual dwellings are generally designed to be on only one level. Internal floors are common within low rise residential buildings (i.e. houses).

All acoustic performance values quoted are indicative. Manufacturers' literature, system suppliers and/or an acoustic consultant should be consulted for detailed specifications and expected acoustic performance.

3.2.1 Light steel joist (with quilt)



Structural floor

Light steel joist 'C' sections spaced at 400 to 600 mm centres. The light steel joists are generally 80 to 250 mm deep. A chipboard, OSB or plywood layer is fixed to the top of the joists.

Ceiling

One layer of gypsum-based board with a minimum density of 10 kg/m^2. Typically one layer of 12.5 mm sound resistant plasterboard or one layer of 10 mm gypsum fibre board.

Quilt

Mineral wool quilt placed between the joists should be 80 to 100 mm thick and 10 to 45 kg/m^3.

Floor treatment

No additional floor treatment is required.

Construction depth

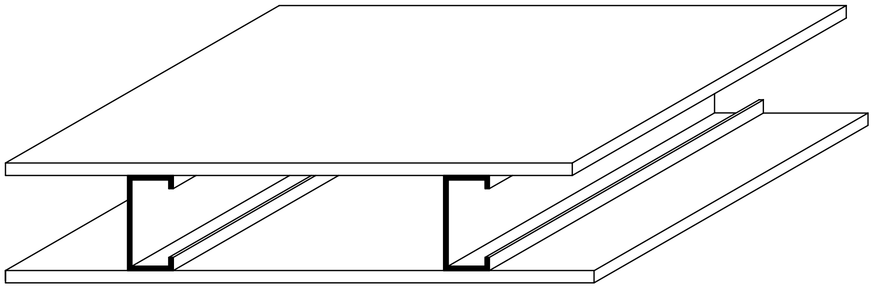
The overall construction depth is typically 100 to 270 mm.

Expected performance

R_w = 40 to 43 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise expected acoustic performance figures.

3.2.2 Light steel joist (without quilt)



Structural floor

Light steel joist 'C' sections at least 200 mm deep. A layer of 18 mm tongue and groove flooring grade chipboard at least 18 mm thick.

Ceiling

One layer of gypsum-based board with a minimum density of 15 kg/m^2. Typically one layer of 12.5 mm fibre reinforced gypsum-based board or one layer of 10 mm gypsum fibre board.

Quilt

None.

Floor treatment

No additional floor treatment is required.

Construction depth

The overall construction depth is typically 220 to 270 mm.

Expected performance

R_w = 40 dB

Note: Consult manufacturers' literature, system suppliers and/or acoustic consultants for precise expected acoustic performance figures.

3.3 Floor treatments

Floor treatments are applied on top of the structural floor to enhance the acoustic performance of the overall floor system (i.e. structural floor, floor treatment and ceiling). This Section describes the floor treatments mentioned in Section 3.1 in more detail. Table 3.1 shows which floor treatments are suitable for use with which separating floor types.

Table 3.1 *Suitable structural floor and floor treatment combinations*

	Floor treatment						
Structural floor	**Deep batten floor**	**Cradle and batten floor**	**Standard batten floor**	**Platform floor [3]**	**Shallow platform floor**	**Sand and cement screed floor**	**Light weight screed floor**
Composite floor on steel beams	✔	✔	✔	✔	✔	✔	✔
Precast units on steel beams	✔	✔	✔	✔	✔	✔	✔
Light steel joists with boards	✔[1]	✔[1]	✔[1]	✔[2]	✘	✘	✔
Light steel lattice truss with screed	✘	✘	✘	✔	✔	✘	✘
Light steel joist and ceiling for modular construction	Generally, no additional floor treatment is required.						
Light steel lattice truss with acoustic boards	✘	✘	✘	✔[2]	✘	✘	✘

Key:

✔ Floor treatment is suitable for use with this floor.

✘ Floor treatment is not suitable or not necessary for use with this floor.

[1] Mineral wool quilt should be placed between battens and a 19 mm gypsum-based board should be included under the flooring board.

[2] A 19 mm gypsum-based board should be included under the flooring board.

[3] Applies to platform floor with timber board or gypsum fibre board.

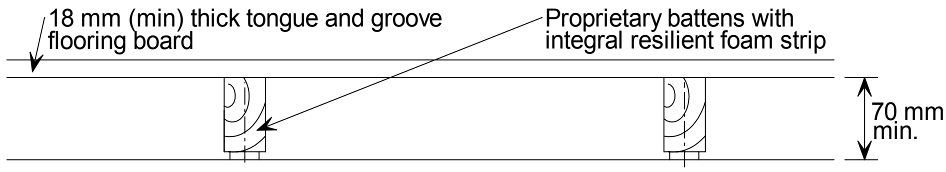
For all floor treatments, separate flanking strips should be used to isolate separating walls from the floor treatment system.

There are many manufacturers of acoustic floor treatments. All acoustic floor treatments must be carefully installed in accordance with the manufacturer's instructions.

Floors should not be tiled without installing an appropriate resilient material under them otherwise the impact sound transmission will be unacceptable.

The relative performance of floor treatments depends on the type of structural floor to which they are applied and the exact specification of the floor treatment. Factors affecting the performance of the floor treatment are the degree of isolation from the structural floor, the mass of the floor treatment and its depth.

3.3.2 Deep batten floor



The floor treatment consists of:

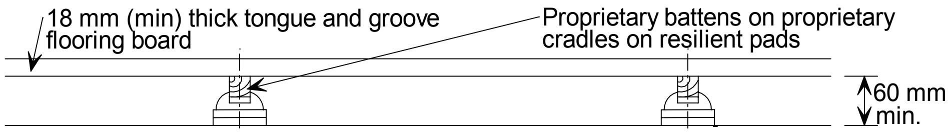
- Tongue and groove flooring board at least 18 mm thick
- Resilient composite battens at least 70 mm deep (total clearance ≥ 70 mm when loaded to 25 kg/m^2). The timber batten is bonded to resilient foam strips that may be at the top or at the bottom.

For additional performance:

- A 19 mm gypsum-based board may be included under the flooring board (optional).
- Mineral wool quilt may be included between the battens (optional).

Services installed in the floor should not bridge the resilient foam strip.

3.3.3 Cradle and batten floor



The floor treatment consists of:

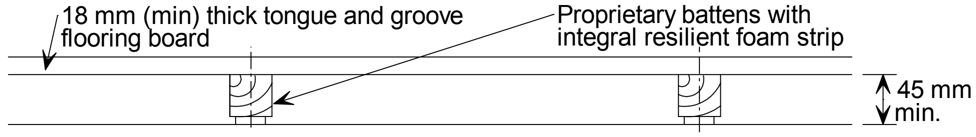
- Tongue and groove flooring board at least 18 mm thick
- Resilient cradle and batten system at least 60 mm deep (Total clearance ≥ 60 mm when loaded to 25 kg/m^2). Timber battens are supported on cradles and resilient pads.

For additional performance:

- A 19 mm gypsum-based board may be included under the flooring board (optional).
- Mineral wool quilt may be included between the battens (optional).

Services installed in the floor should not bridge the resilient pads.

3.3.4 Standard batten floor



The floor treatment consists of:

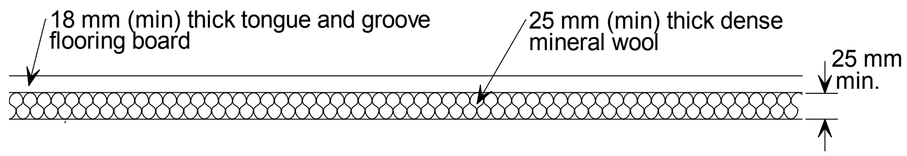
- Tongue and groove flooring board at least 18 mm thick
- Resilient composite standard battens at least 45 mm deep (Total clearance ≥ 45 mm when loaded to 25 kg/m^2). The timber batten is bonded to resilient foam strips which may be at the top or at the bottom.

For additional performance:

- A 19 mm gypsum-based board may be included under the flooring board (optional).
- Mineral wool quilt may be included between the battens (optional).

Services installed in the floor should not bridge the resilient foam strip.

3.3.5 Platform floor (Timber board)

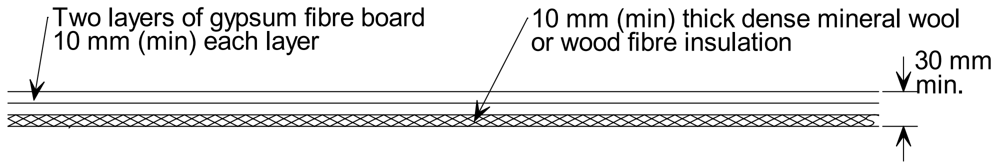


The floor treatment consists of:

- Tongue and groove timber flooring board at least 18 mm thick
- Mineral wool resilient layer at least 25 mm thick and approximately 150 kg/m^3
- Overall mass per unit area of floor system should be at least 16 kg/m^2
- For additional performance, a 19 mm gypsum-based board may be included under the flooring board (optional).

No services should be installed in the floor system.

3.3.6 Platform floor (Gypsum fibre board)

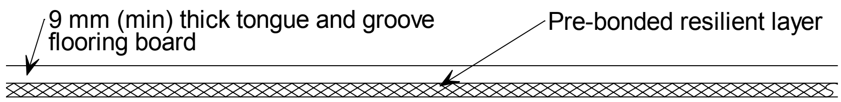


The floor treatment consists of:

- Two layers of gypsum fibre board, each layer at least 10 mm thick.
- Mineral wool resilient layer at least 10 mm and approximately 100 kg/m^3 or compressed wood fibre at least 10 mm and approximately 150 kg/m^3
- Overall mass per unit area of floor system should be at least 16 kg/m^2.

No services should be installed in the floor system.

3.3.7 Shallow platform floor

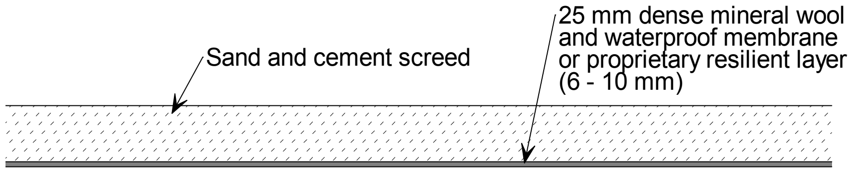


The floor treatment consists of:

- Tongue and groove flooring board at least 9 mm thick
- A resilient layer (e.g. foam or rubber) pre-bonded to the flooring board.

No services should be installed in the floor system.

3.3.8 Sand and cement screed floor



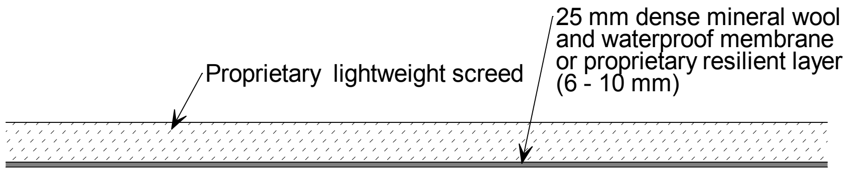
The floor treatment consists of:

- Sand cement screed, typically 60 to 80 mm thick
- An isolating layer comprised of dense mineral wool and waterproof membrane carefully installed to ensure continuity. Alternatively, a proprietary resilient layer may be used (it must be installed in accordance with the manufacturer's instructions).

No services should be installed in the floor system.

Care must be taken to avoid air gaps at the edges of the screed.

3.3.9 Light weight screed floor



The floor treatment consist of:

- Gypsum based light weight screed, typically 40 to 70 mm thick
- An isolating layer comprised of dense mineral wool and waterproof membrane carefully installed to ensure continuity. Alternatively, a proprietary resilient layer may be used (it must be installed in accordance with the manufacturer's instructions).

No services should be installed in the floor system.

Care must be taken to avoid air gaps at the edges of the screed.

3.4 Ceiling treatments

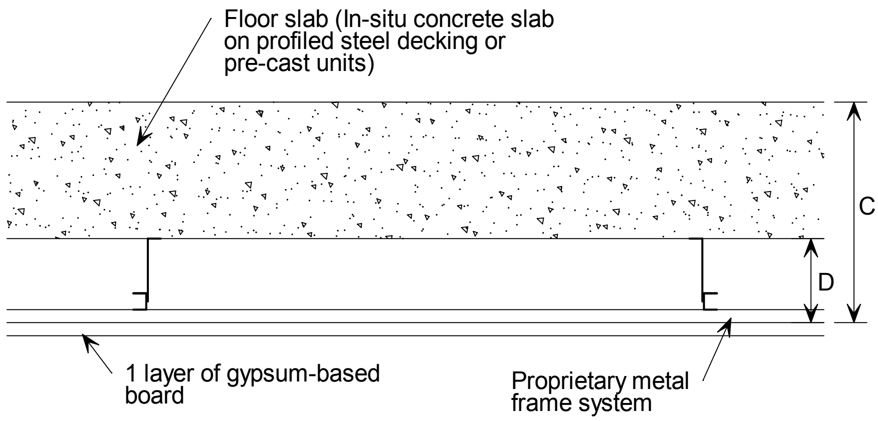
Typically, separating floors should have a ceiling treatment of at least one layer of gypsum-based board. The minimum ceiling requirements for each separating floor type are given in Section 3.1.

Composite separating floors and precast unit separating floors use a suspended ceiling that is not supported directly from the structural floor. The ceiling treatment options for composite and precast separating floors are shown in Sections 3.4.1, 3.4.2 and 3.4.3. For light steel separating floors the ceiling board is generally supported directly by the structural floor as shown in Section 3.1.

For composite separating floors and precast unit separating floors where only one layer of ceiling board and no insulation in the ceiling void is specified, the sound insulation performance of a ceiling treatment can be increased by placing a mineral wool quilt in the ceiling void or by using two layers of gypsum-based board. Including mineral wool quilt in the ceiling void can improve performance by 3 - 4 dB for airborne and 4 - 5 dB for impact sound. Using two layers of gypsum-based board can improve performance by 2 - 4 dB for airborne and 3 - 5 dB for impact sound.

Ceiling treatments must be installed in accordance with the manufacturers' instructions and all ceiling board joints must be sealed with tape or caulked with sealant.

3.4.1 Metal frame system



Proprietary metal frame systems can be used to hang the ceiling below downstand beams to form a flat soffit.

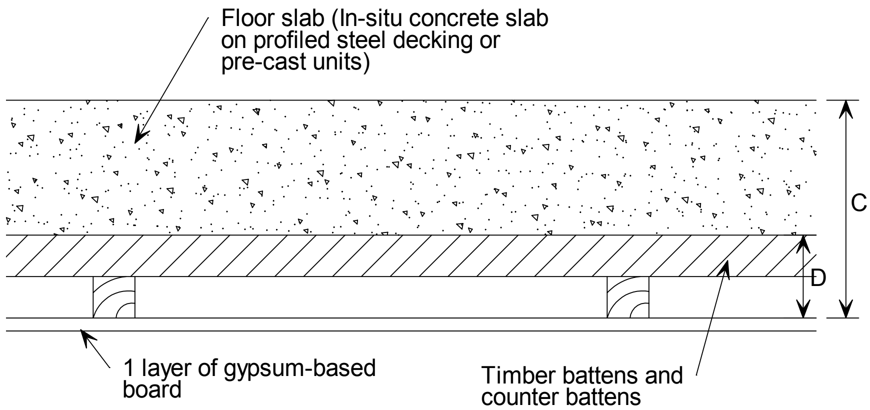
For in-situ concrete slabs supported by profiled steel decking:

- Ceiling board must be at least 8 kg/m^2 of gypsum-based board
- *C* must be $\geq$ 300 mm for use with RD (E-FS-1).

For precast unit floors:

- Ceiling board must be at least 8 kg/m^2 of gypsum-based board
- *D* must be $\geq$ 100 mm with 200 mm deep precast units
- *D* must be $\geq$ 150 mm with 150 mm deep precast units.

3.4.2 Timber battens



Timber battens fixed to the underside of the slab support the ceiling board close to the slab.

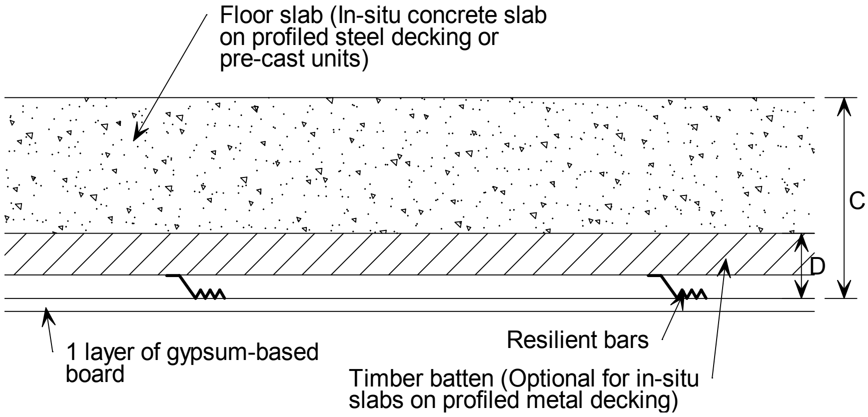
For in-situ concrete slabs supported by profiled steel decking:

- Ceiling board must be at least 8 kg/m^2 of gypsum-based board
- *C* must be $\geq$ 300 mm for use with RD (E-FS-1).

For precast unit floors:

- Ceiling board must be at least 8 kg/m^2 of gypsum-based board
- Only suitable for use with 200 mm deep precast units or 150 mm deep precast units with a structural topping
- *D* must be $\geq$ 100 mm.

3.4.3 Resilient bars



Proprietary resilient bars decouple the ceiling from the floor slab and enhance acoustic insulation of the floor.

For in-situ concrete slabs supported by profiled steel decking:

- Ceiling board must be at least 8 kg/m^2 of gypsum-based board
- *C* must be $\geq$ 300 mm for use with RD (E-FS-1)
- Resilient bars may be fixed directly to the underside of the deck.

For precast unit floors:

- Ceiling board must be at least 10 kg/m^2 of gypsum-based board
- Only suitable for use with 200 mm deep precast units
- *D* must be $\geq$ 65 mm.

4 JUNCTION DETAILS

4.1 Introduction

This Section presents junction details appropriate for both light steel and hot-rolled construction between wall and floor elements suitable for use within a residential building. For each junction detail type (e.g. separating wall with separating floor), generally only one wall and one floor construction from Sections 2 and 3 are considered. Due to the range of wall and floor constructions, it is impracticable to include junction details for all the possible combinations. The details that are included show the level of detailing that is required at the junctions and give principles that can be applied to junctions which are not shown. The details are provided for guidance and should not be used for construction unless checked and approved by a competent person such as an acoustic consultant. Light steel frame system suppliers will generally have their own specific junction details that they have developed and that have shown to be satisfactory through on-site testing.

Additional junction details for separating floors supported on hot-rolled steel frames (i.e. for composite floors and floors with precast units) are provided in Appendix B.

As explained in Section 1.3, it is important that the junctions are detailed correctly to minimise the transmission of flanking sound.

To reduce flanking sound transmission the following measures are suggested:

(a) Direct contact between the wall lining and floor finish board should be avoided, to reduce vibration transfer. Wall plasterboard linings should be stopped about 5 mm above the floor decking. The gap should be filled with acoustic sealant (see Figure 4.1 and Figure 4.3).

(b) Where a separating floor meets an external or party wall, the void within the wall between the studs should be filled with mineral wool to at least 300 mm above and below the separating floor (see Figure 4.1 and Figure 4.7).

(c) A light steel frame inner leaf structure of an external wall should not be continuous across a junction with a separating wall. A physical break should be maintained, and any sheathing board should also be discontinuous at this point (see Figure 4.5).

(d) Where a separating wall meets an internal or external wall, additional mineral wool should be placed between the wall studs adjacent to the junction of the inner leaf of the external wall (see Figure 4.3 and Figure 4.5). However, in many cases, the inner leaf of the external wall will be filled with mineral wool for thermal insulation.

(e) Internal non-load bearing walls within an apartment should, if possible, not break through the ceiling of a separating floor, and should not touch the steel floor joists.

(f) Air paths through separating elements should be avoided.

(g) Joints in successive layers of lining board should be staggered.

(h) Any gaps should be sealed with acoustic sealant.

The details generally assume that light steel frame separating walls in light steel framed buildings are load bearing. Internal walls can be load bearing or non-load bearing.

4.2 Separating wall with separating floor

Light steel separating floor

The junction of a twin light steel frame separating wall with a light steel joist with board separating floor is shown in Figure 4.1. The wall boards are not in direct contact with the floor decking board or the flooring board. The gap between the wall boards and the decking board is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. Additional mineral wool is placed between the wall studs in the floor zone. A platform floor is shown in Figure 4.1 but the same detail can be used for any suitable floor treatment from Table 3.1.

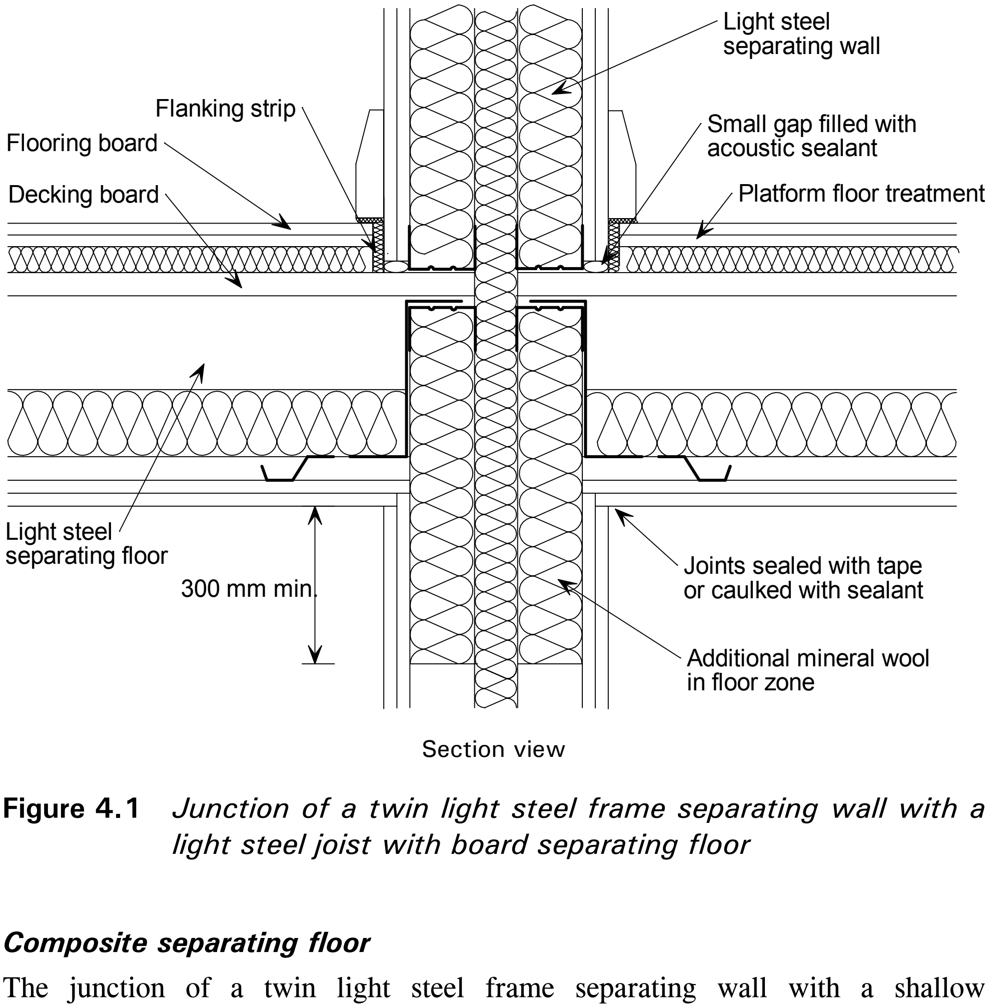


Figure 4.1 *Junction of a twin light steel frame separating wall with a light steel joist with board separating floor*

Composite separating floor

The junction of a twin light steel frame separating wall with a shallow composite separating floor is shown in Figure 4.2. The wall boards are not in direct contact with the floor treatment or the composite slab. The decking may span in either direction but where decking profiles are at right angles to the walls the voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant. The gap between the wall boards and the slab is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. A platform floor is shown in Figure 4.8 but the same detail can be used for any suitable floor treatment from Table 3.1. Ceiling and wall boards should not be in direct contact with any steel beams or columns. Floor treatment should not be continuous under separating wall.

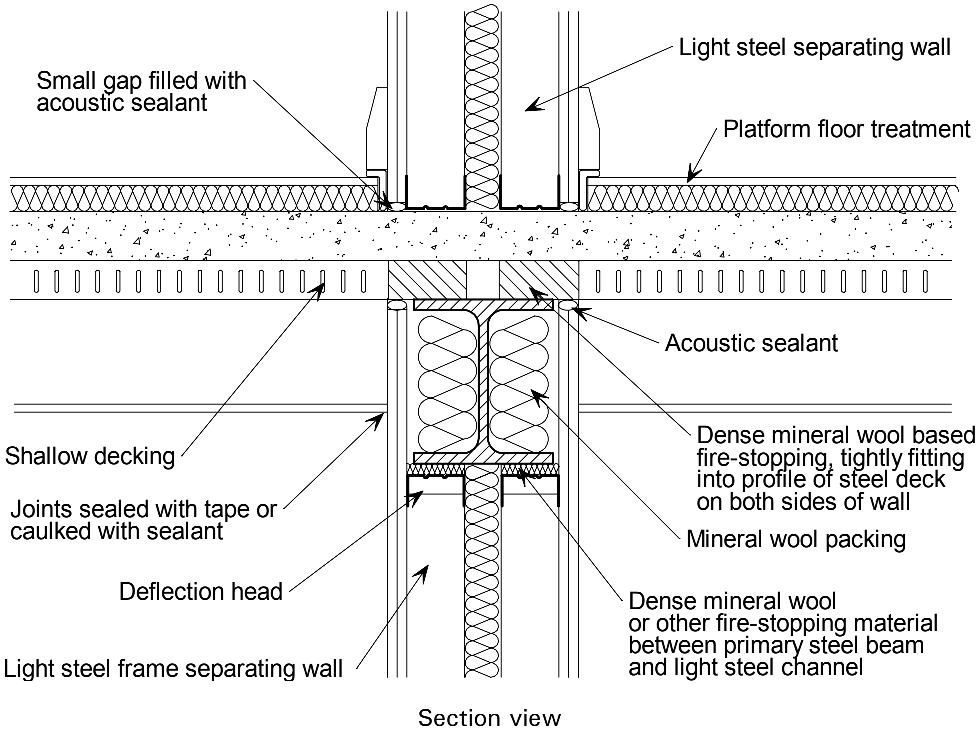


Figure 4.2 *Junction of a twin light steel frame separating wall with a shallow composite separating floor*

4.3 Separating wall with internal floor

The junction of a twin light steel frame separating wall with a light steel joist internal floor is shown in Figure 4.3. The wall boards are not in direct contact with the flooring board and the gap is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. Additional mineral wool is placed between the wall studs in the floor zone. The floor joists may span in either direction but should not be continuous between dwellings.

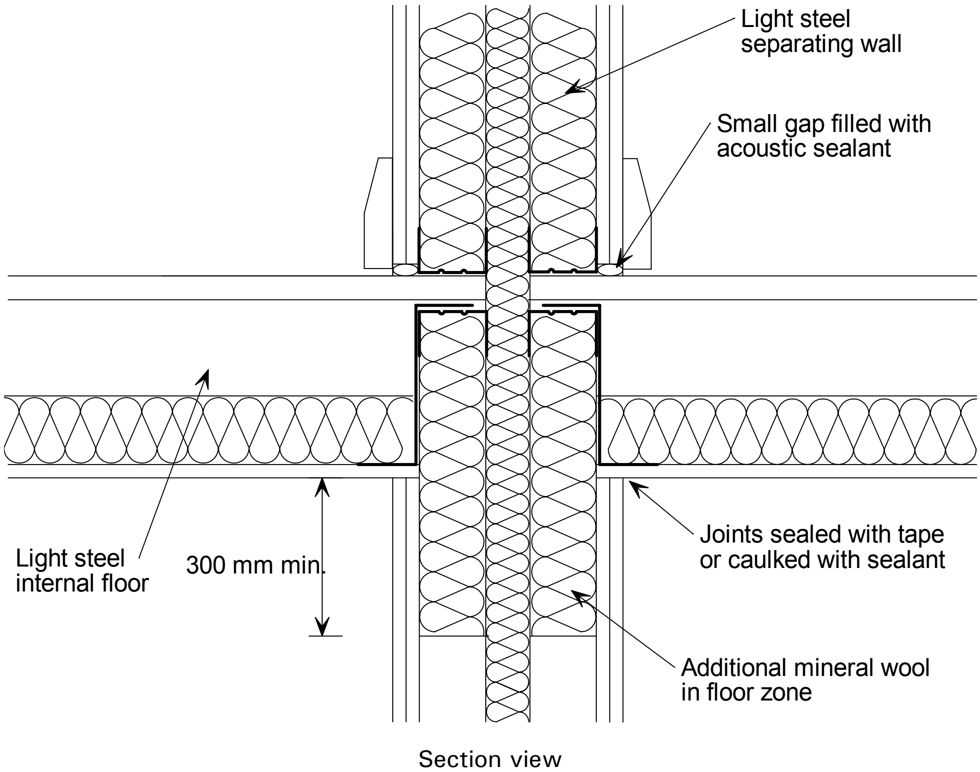


Figure 4.3 *Junction of a twin light steel frame separating wall with a light steel joist internal floor*

4.4 Junctions between two separating walls

A 'T' junction between two twin light steel frame separating walls (as shown in 2.3.1) is shown in Figure 4.4. Joints between wall boards are sealed with tape or caulked with sealant. A detail showing how to incorporate a steel column into this junction is provided in Figure 5.2.

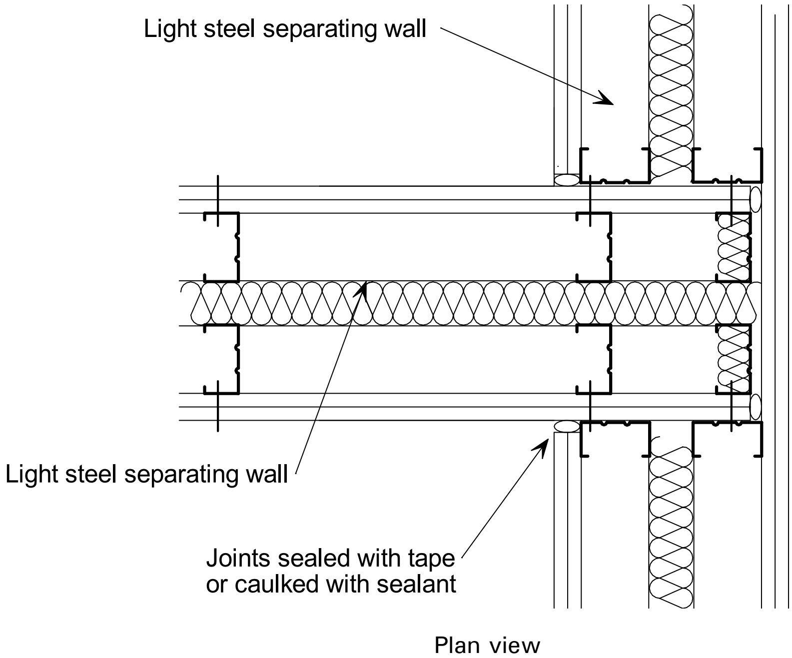


Figure 4.4 *'T' junction of two twin light steel frame separating walls*

4.5 Separating wall with external wall

A junction between a twin light steel frame separating wall and an external wall with a light steel inner leaf is shown in Figure 4.5. The light steel frame inner leaf and rigid insulation sheathing board are discontinuous at the junction with the separating wall. Joints between wall boards are sealed with tape or caulked with sealant. Additional mineral wool (if not already part of the wall construction) is placed between the wall studs in the junction zone. A detail incorporating structural column section is shown in Figure 5.4.

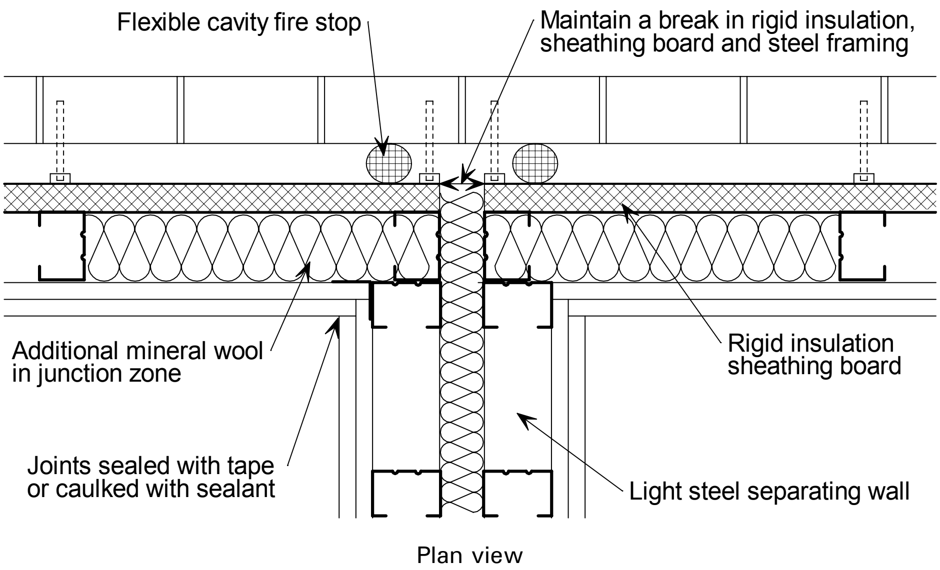


Figure 4.5 *Junction of a twin light steel frame separating wall with an external wall*

4.6 Separating wall with internal wall

A junction between a twin light steel frame separating wall and a light steel internal wall is shown in Figure 4.6. The structure of the separating wall, including the wall linings, is maintained through the junction. The joints between wall boards are sealed with tape or caulked with sealant. The internal wall shown in Figure 4.6 is a light steel frame without quilt but the same junction detail would be applicable for any of the internal walls presented in Section 2.4.

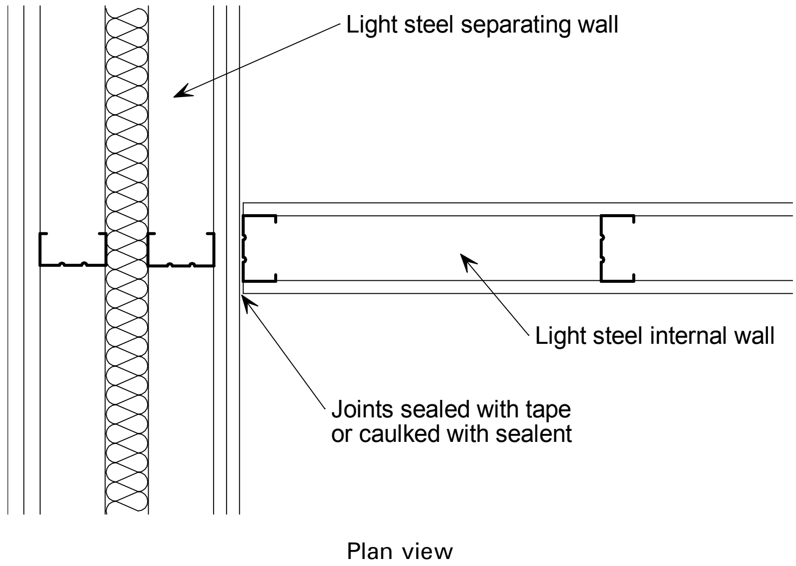


Figure 4.6 *Junction of a twin light steel frame separating wall with a light steel internal wall*

4.7 Separating floor with external wall

Light steel separating floor

The junction of a light steel joist separating floor with an external cavity wall with a light steel inner leaf is shown in Figure 4.7. The wall boards are not in direct contact with the floor decking board or the flooring board. The gap between the wall boards and the decking board is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. Additional mineral wool (if not already part of the wall construction) is placed between the wall studs in the floor zone. A platform floor is shown in Figure 4.7 but the same detail can be used for any suitable floor treatment.

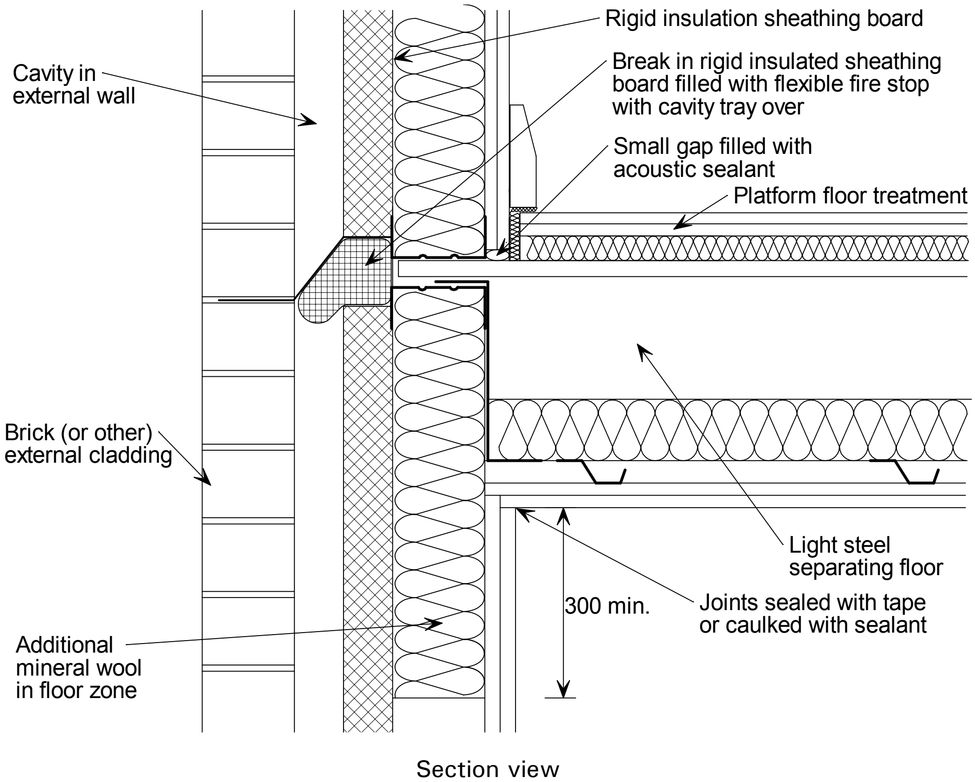
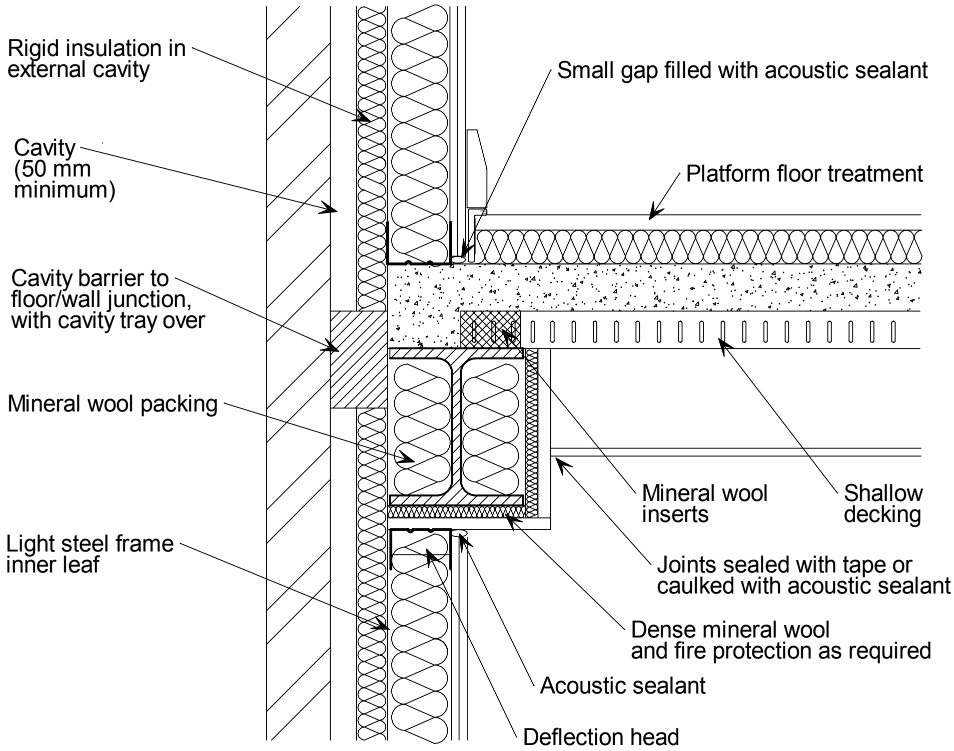


Figure 4.7 *Junction of a light steel joist separating floor with an external cavity wall*

Composite separating floor

The junction of a shallow composite separating floor with an external cavity wall with a light steel inner leaf is shown in Figure 4.8. The wall boards are not in direct contact with the floor treatment or the composite slab. The decking may span in either direction but where decking profiles not parallel with the walls the voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant. The gap between the wall boards and the slab is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. A platform floor is shown in Figure 4.8 but the same detail can be used for any suitable floor treatment from Table 3.1. Ceiling and wall boards should not be in direct contact with any steel beams or columns. Inner leaf must not be continuous between storeys.



Section view

Figure 4.8 *Junction of a shallow composite separating floor with an external cavity wall*

4.8 Separating floor with internal wall

Load bearing internal wall

The junction of a load bearing light steel frame internal wall with a light steel joist with board separating floor is shown in Figure 4.9. The wall boards are not in direct contact with the floor decking board or the flooring board. The gap between the wall boards and the decking board is filled with acoustic sealant. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. Additional mineral wool (if not already part of the wall construction) is placed between the wall studs in the floor zone. The floor treatment shown in Figure 4.9 is discontinuous under the internal floor. However, the floor treatment can be continuous under the internal wall, provided that adequate support is provided (see Figure 4.10). Product manufacturers should be consulted to determine adequate support.

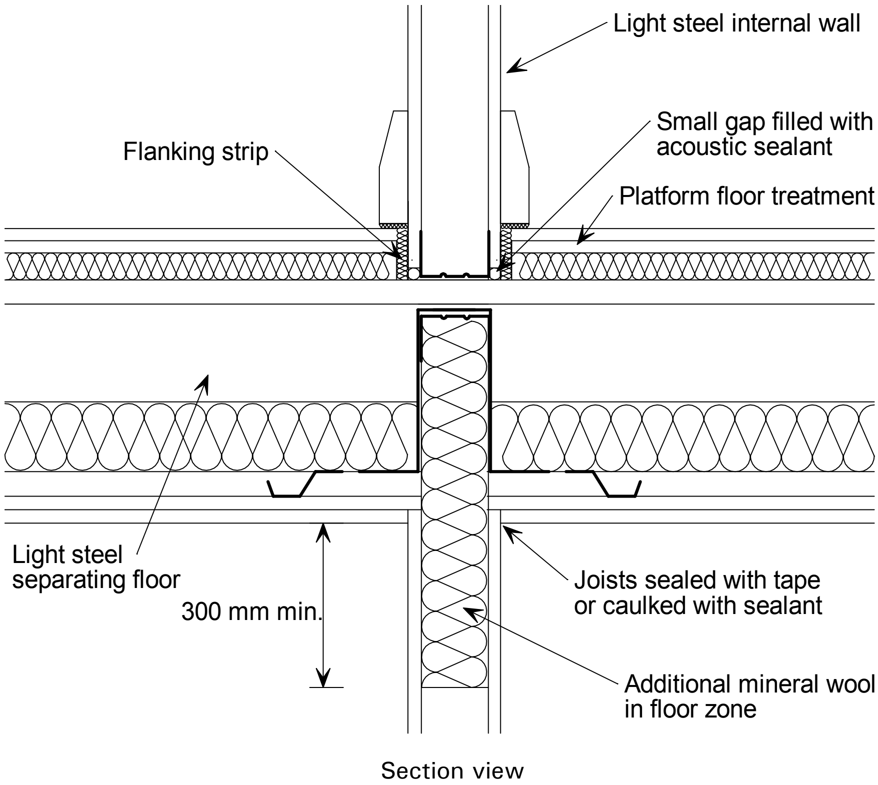


Figure 4.9 *Junction of a load bearing light steel frame internal wall with a light steel joist with board separating floor*

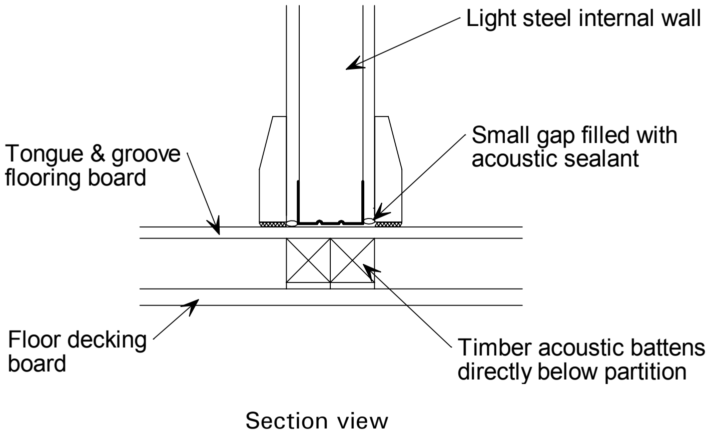


Figure 4.10 *Floor treatment continuous under a light steel internal wall*

Non-load bearing wall

The junction of a non-load bearing light steel frame internal wall with a light steel joist with board separating floor is shown in Figure 4.11. The joints between wall boards and the ceiling boards are sealed with tape or caulked with sealant. The ceiling board of the separating floor is continuous through the junction with the internal wall and the internal wall is isolated from the steel floor joists.

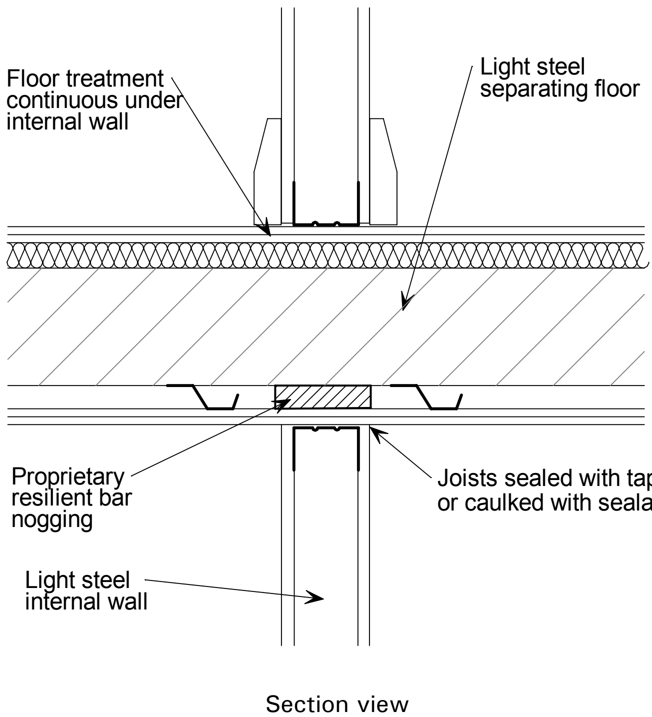


Figure 4.11 *Junction of a non-load bearing light steel frame internal wall with a light steel joist with board separating floor*

4.9 Internal wall with internal wall

A junction between two light steel frame internal walls is shown in Figure 4.6. This is a simple detail. The joints between wall boards are sealed with tape or caulked with sealant.

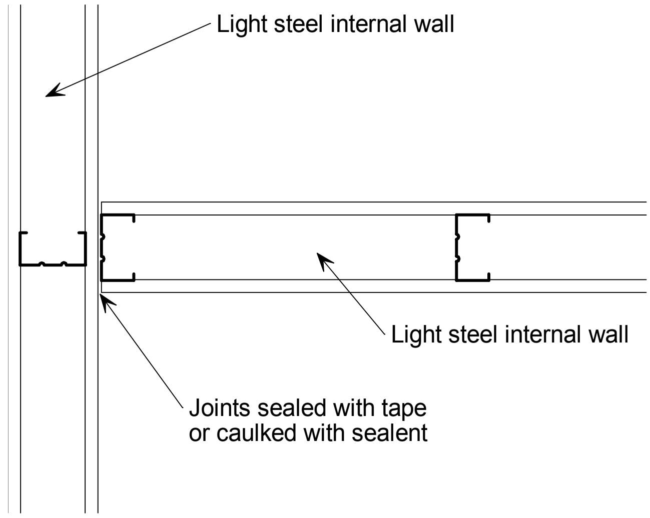


Figure 4.12 *'T' junction of two light steel frame internal walls*

5 INTEGRATION OF ELEMENTS

This Section addresses the integration of building elements into separating walls and floors without impairing their acoustic performance. The building elements considered are structural (e.g. hot-rolled columns) and non-structural (e.g. building services). When integrating elements, it is important to follow the principles of isolation and sealing for acoustic detailing, as described in Section 1.3.

5.1 Integration of structural elements

Columns

The integration of columns into infill separating walls is the most common situation where structural elements need to be considered.

Any columns that are on the line of the separating wall must be integrated so they do not act as a bridge through the wall for sound transmission. It is important to ensure that the gypsum lining is not fixed directly to the columns, and to provide some resilience between the column and the separating wall structure. This is usually achieved by providing 30 mm of dense mineral wool board around the column. Figure 5.1 to Figure 5.4 show examples of suitable details.

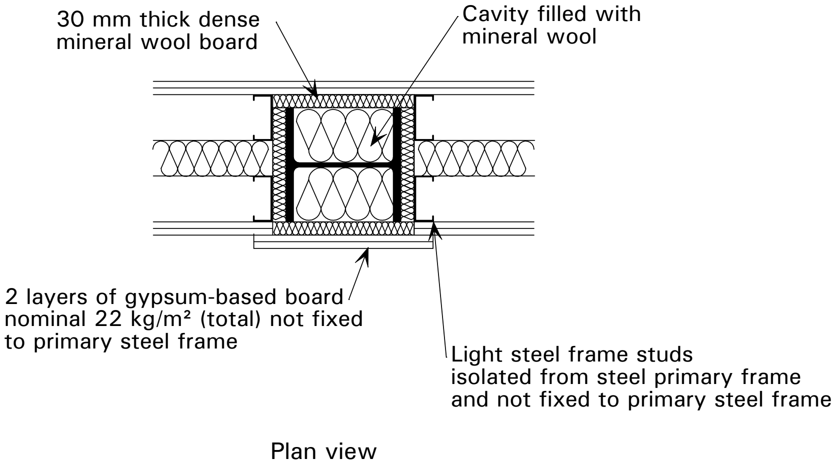


Figure 5.1 *Open section column integrated into light steel separating wall*

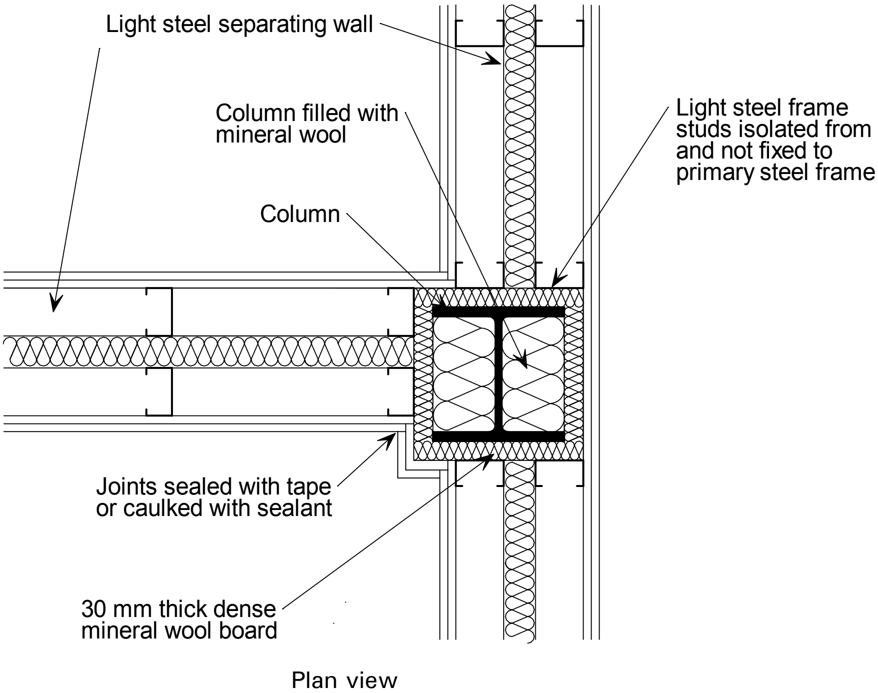


Figure 5.2 *Open section column integrated into a light steel separating wall 'T' junction*

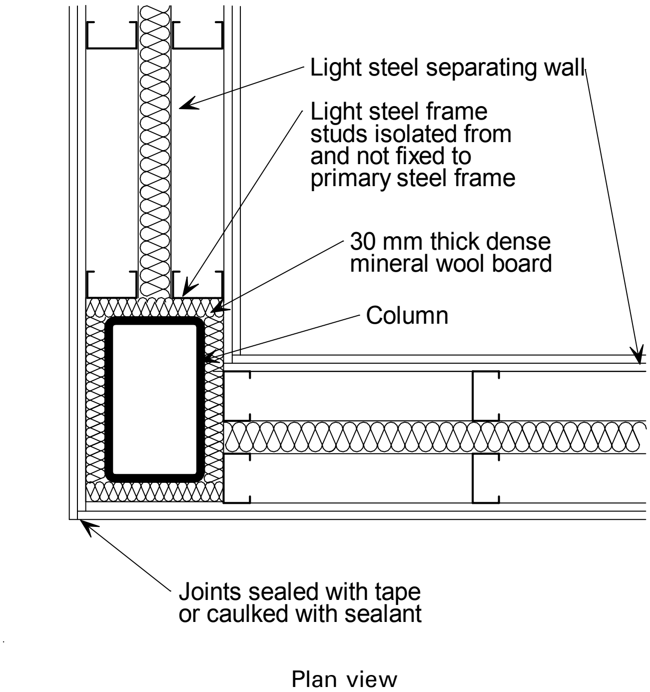


Figure 5.3 *Hollow section column integrated into a light steel separating wall corner junction*

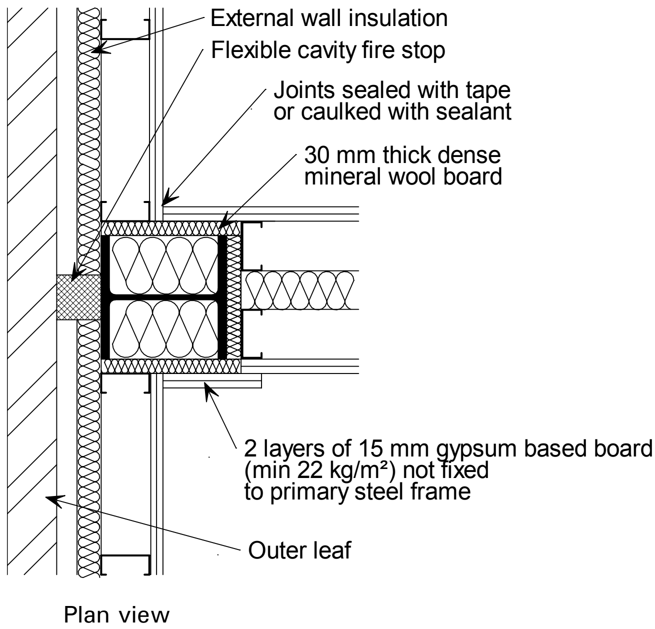


Figure 5.4 *Open section column integrated into an external wall with a light steel inner leaf*

Typical details integrating columns into solid masonry and cavity masonry walls are provided in Advisory Desk note AD287[14].

Beams

Details for incorporating beams into separating floors or at the head of separating walls are provided in Appendix B.

Beams that pass through separating walls should be isolated from the rooms with 25 mm of mineral wool (at least 10 kg/m^3) and two layers of gypsum-based boards (at least 8 kg/m^2 each layer). Any voids between the beam and the separating walls should be filled with flexible acoustic sealant (Figure 5.5).

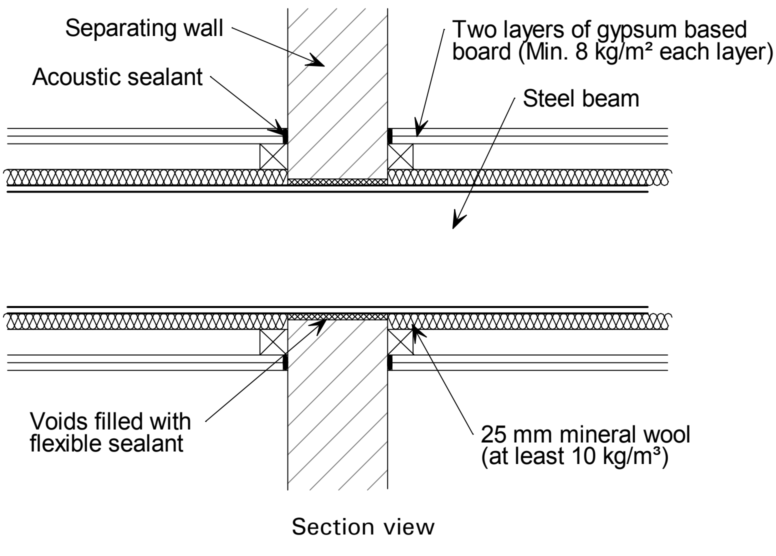


Figure 5.5 *Open section beam through a separating wall*

5.2 Integration of services

Services that penetrate separating walls or floors or are located within separating walls or floors must be detailed appropriately to ensure that the acoustic performance of the separating construction is not impaired.

The following aspects should be considered:

- The location of electrical and piped services in separating walls should be carefully considered, if possible, they should be avoided.
- Where services in separating walls cannot be avoided they should be staggered on either side of a separating wall and should be backed by two layers of gypsum-based board and mineral wool. (Figure 5.6 and Figure 5.7).
- Where there are several services to be located in close proximity (e.g. in a kitchen) creating a service void is the preferred method for ensuring that the acoustic performance is not impaired (Figure 5.8).
- Services in a separating floor can be accommodated within battened floor treatments but the services should not bridge the resilient foam strip (Figure 5.9).
- Services that penetrate a separating floor should be boxed in using two layers of gypsum-based board (at least 8 kg/m^2 each layer) and 25 mm of mineral wool (at least 10 kg/m^3). Any voids between the beam and the separating walls should be filled with flexible acoustic sealant (Figure 5.10).

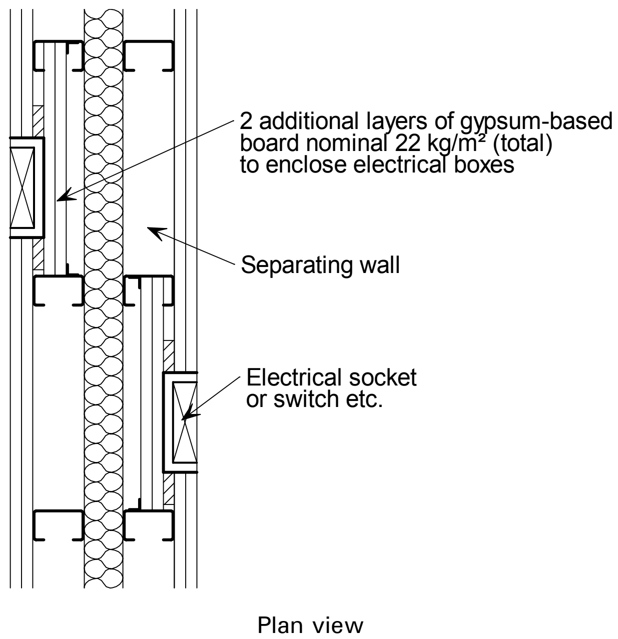


Figure 5.6 *Electrical sockets in a separating wall*

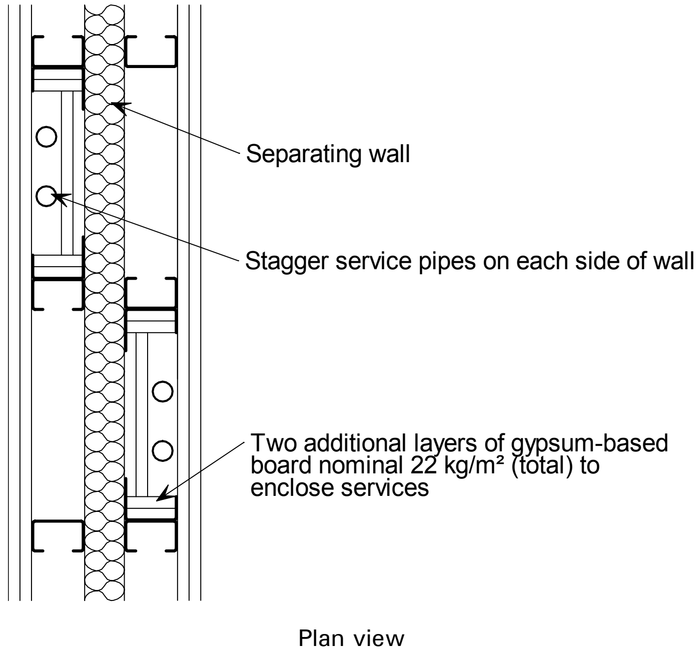


Figure 5.7 *Piped services in a separating wall*

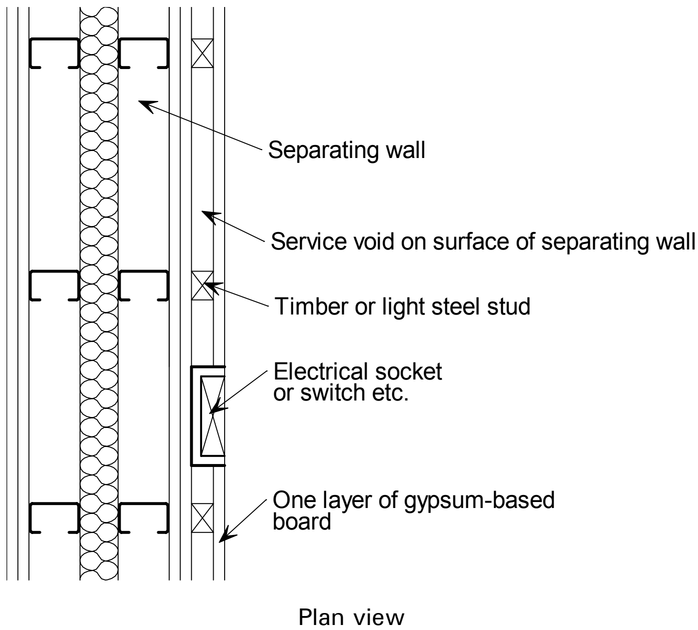


Figure 5.8 *Services located within a service void*

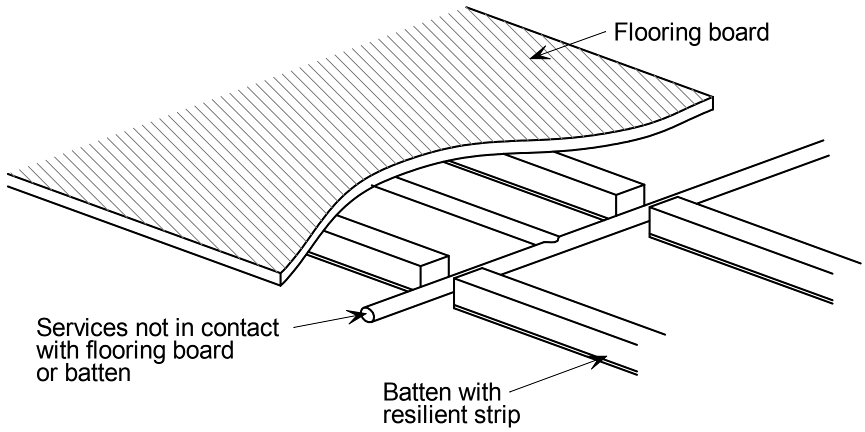


Figure 5.9 *Services within a batten floor treatment*

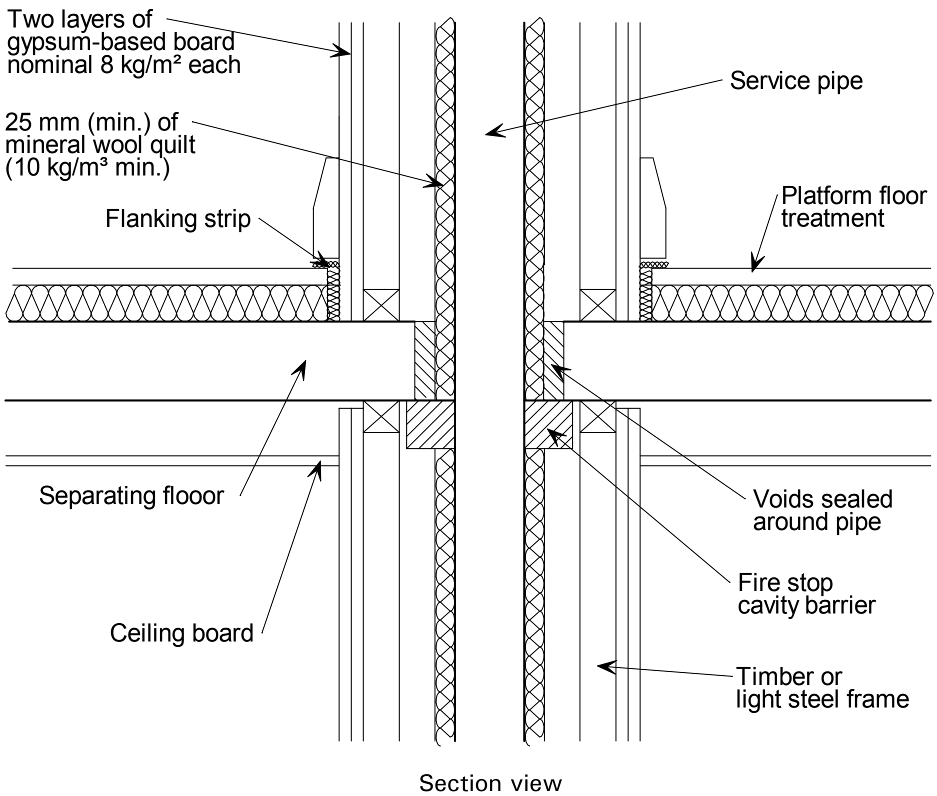


Figure 5.10 *Service penetrating a separating floor*

Down lighters and recessed lighting

Down lighters or recessed lighting may be installed in the ceilings of separating floors with composite decks or precast unit floors with no significant loss of acoustic performance, provided that:

- There is a minimum ceiling void of 75 mm
- Lighting is installed in accordance with the manufacturer's instructions

- There is no more than one light per 2 m^2 of ceiling area in each room
- The centres between lights are not less than 0.75 m
- The openings do not exceeding 100 mm diameter or 100 $\times$ 100 mm.

Down lighters or recessed lighting may be installed in the ceilings of light steel separating floors with no significant loss of acoustic performance, provided that:

- The down lighters are backed by two layers of gypsum-based board at least 23 kg/m^2, or proprietary acoustic hoods can be applied to down lighters.
- Alternatively, laboratory acoustic testing can be conducted to determine the impact of down lighters on the acoustic performance of the separating floor system. The impact of the down lighter on the acoustic performance of the floor will be product-specific.

When down lighters or recessed lighting are installed, particular attention should be paid to Building Regulations Part B – Fire Safety[15]. Some down lighters are available with integral acoustic (and fire) resistance; or proprietary acoustic covers are available.

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APPENDIX A Notation

D	Level difference (airborne sound)
D_{nT}	Standardised level difference (airborne sound)
$D_{nT,w}$	Standardised weighted level difference (airborne sound)
L	Impact sound pressure level
L_n	Normalised impact sound pressure level (laboratory measurement)
$L_{n,w}$	Normalised weighted impact sound pressure level (laboratory measurement)
L'_{nT}	Standardised impact sound pressure level (field measurement)
$L'_{nT,w}$	Standardised weighted impact sound pressure level (field measurement)
R	Sound reduction index (laboratory measurement)
R_w	Weighted sound reduction (laboratory measurement)
dB	Decibel
Hz	Hertz
PCT	Pre-Completion Testing
RDs	Robust Details
RDL	Robust Details Limited

APPENDIX B Recommended junction details

B.1 Introduction

This Appendix presents recommended construction details for use in hot-rolled steel-framed residential buildings. The details presented are based on a range of similar details which through on-site testing have been shown to satisfy the requirements of Approved Document E.

The details shown are appropriate for the acoustic performance values given in Sections 2 and 3 for a range of wall and floor types.

Some of the recommended acoustic details in B.2 are Robust Details, provided that the wall, floor and junction are specified to comply with the requirements given in the *Robust Details Handbook*[11]. Where this is the case, the Robust Details reference is given.

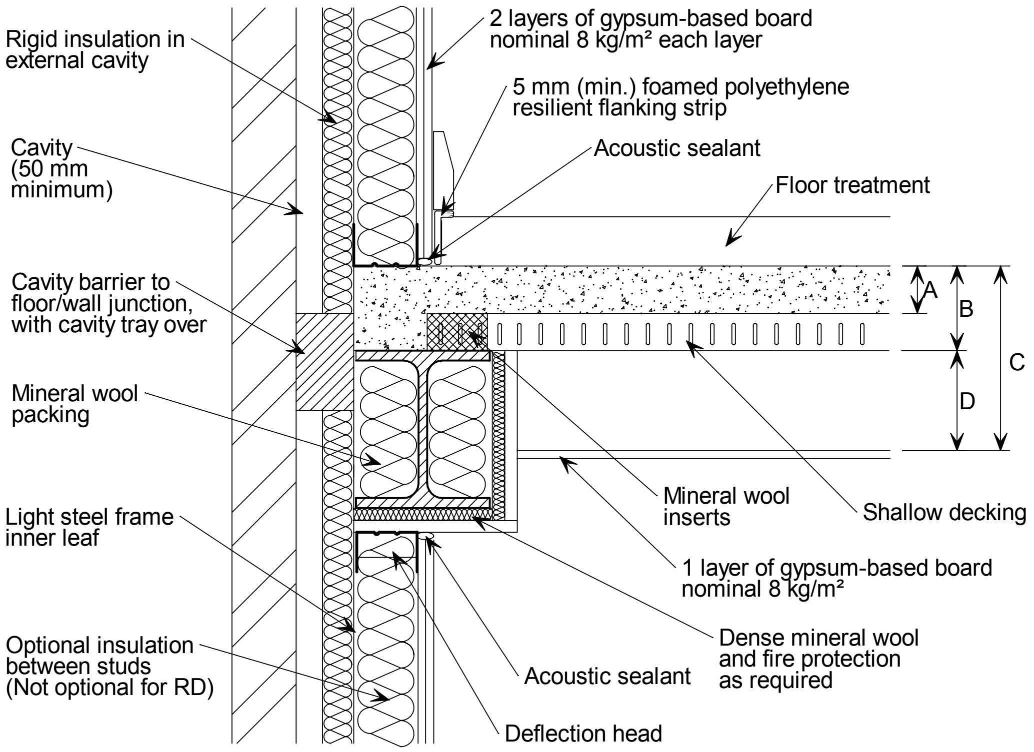
Details in B.3 show separating walls combined with separating floors. Whilst similar walls used with other types of floors are covered by Robust Details, none of the combinations shown in B.3 are currently (see note below) in the *Robust Details Handbook*. Post-completion testing of the wall would therefore be required in all cases.

Details in B.4 and B.5 show generic solutions for precast units on hot-rolled steel frames. In some cases, as noted on specific details, similar details exist which are Robust Details; reference to the appropriate Robust Detail is given.

Note: The portfolio of available Robust Details is updated regularly. Robust Details Ltd should be contacted for the latest information.

B.2 External wall and composite floor junction details

B.2.1 External cavity wall with light steel internal leaf and shallow deck composite floor (with downstand beam)



General notes

This detail is a Robust Detail (E-FS-1) when it is used in conjunction with an RD floor treatment, $A \geq 80$ mm, $B \geq 130$ mm, $C \geq 300$ mm, the concrete density is at least 2200 kg/m^3 and the light steel frame inner leaf has insulation between the studs.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Decking may be trapezoidal or re-entrant in profile.

Decking may span in either direction.

Where decking profiles are at right angles to the walls, voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

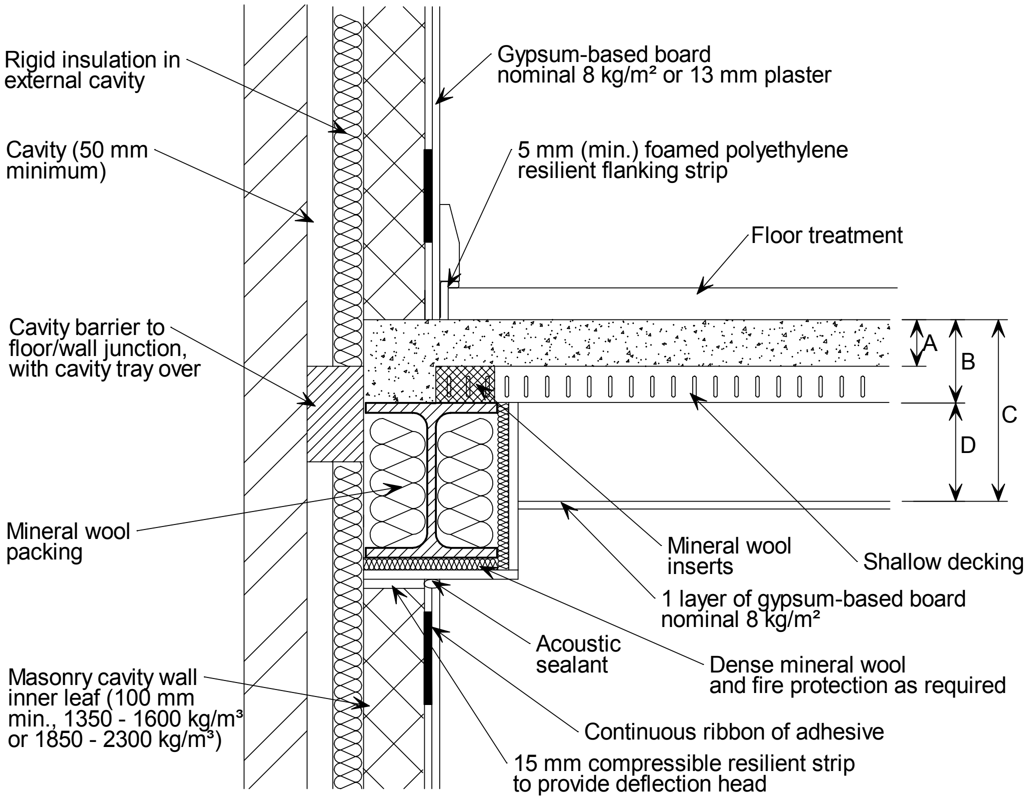
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Outer leaf may be masonry or precast panels.

Inner leaf must not be continuous between storeys.

B.2.2 External cavity wall with masonry internal leaf and shallow deck composite floor (with downstand beam)



General notes

This detail is a Robust Detail (E-FS-1) when it is used in conjunction with an RD floor treatment, $A \geq 80$ mm, $B \geq 130$ mm, $C \geq 300$ mm, the concrete density is at least 2200 kg/m^3, the inner leaf concrete block is of density 1350 - 1600 kg/m^3 or 1850 - 2300 kg/m^3 and the inner leaf $\geq$ 100 mm.

Dimension D should be $\geq$ 100 mm with ceiling board of 8 kg/m^2 or $\geq$ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Decking may be trapezoidal or re-entrant in profile.

Decking may span in either direction.

Where deck profiles are at right angles to the walls, voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

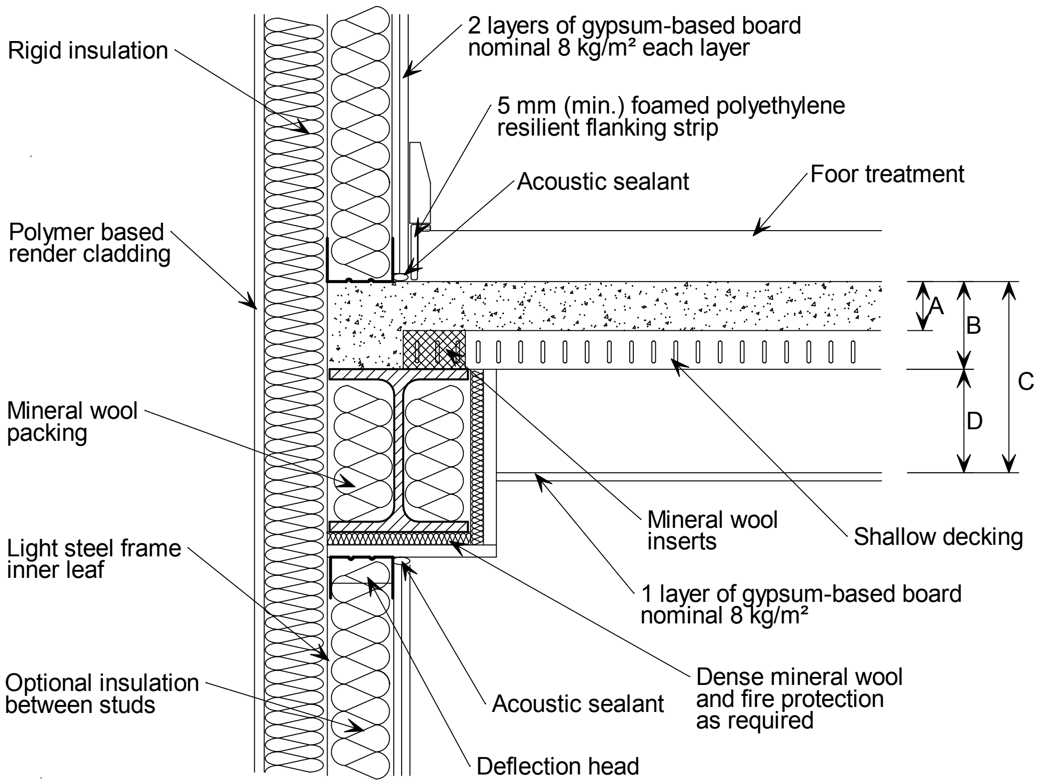
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Outer leaf may be masonry or precast panels.

Inner leaf must not be continuous between storeys.

B.2.3 External render wall (no cavity) with light steel and shallow deck composite floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm and $B \geq 130$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may be trapezoidal or re-entrant in profile.

Decking may span in either direction.

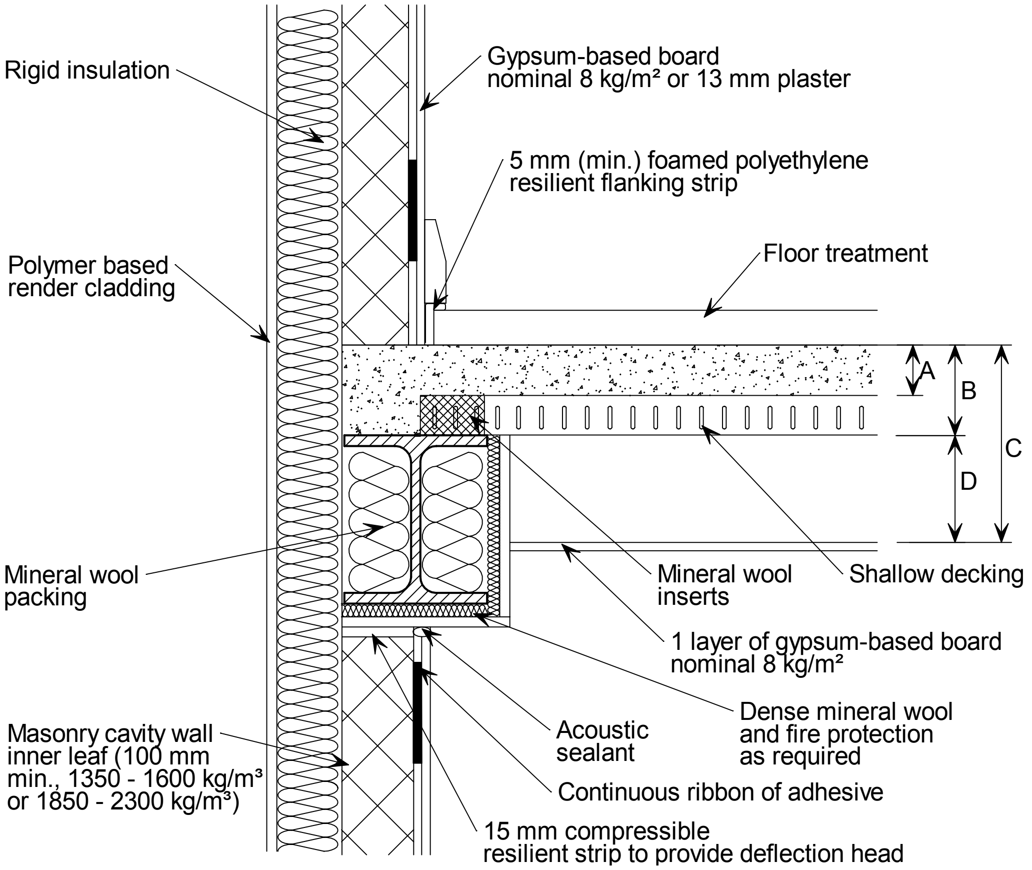
Where decking profiles are at right angles to the walls, voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Inner leaf must not be continuous between storeys.

B.2.4 External render wall (no cavity) with masonry and shallow deck composite floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm and $B \geq 130$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may be trapezoidal or re-entrant in profile.

Decking may span in either direction.

Where deck profiles are at right angles to the walls, voids (above the beam) must be filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

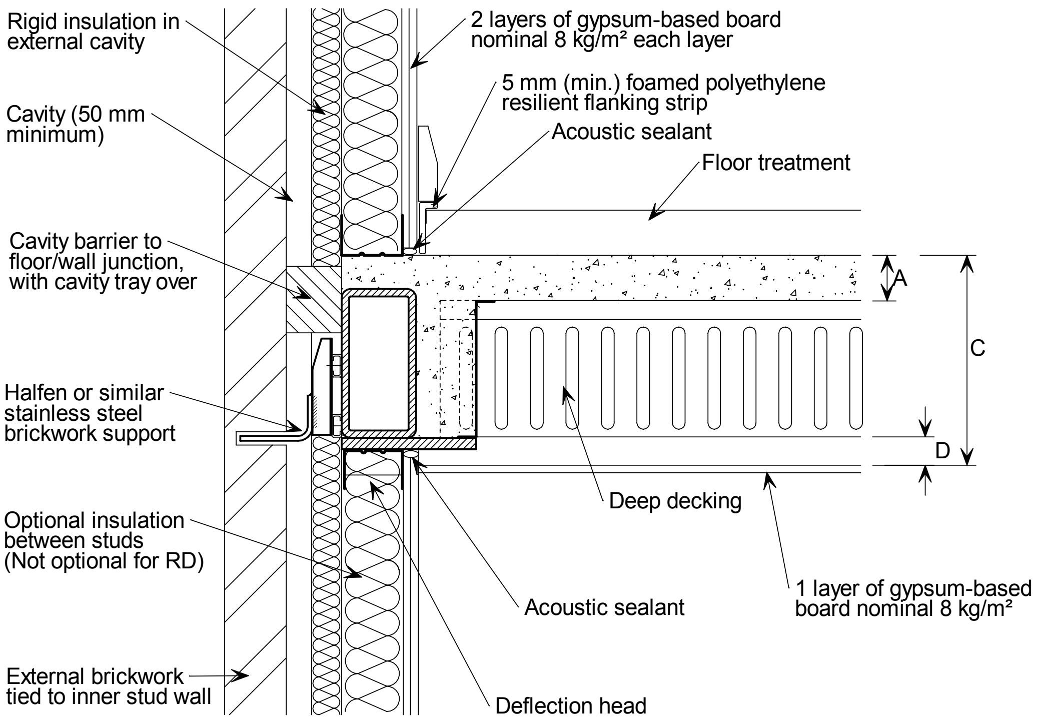
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Inner leaf must not be continuous between storeys.

B.2.5 External cavity wall with light steel internal leaf and deep deck composite floor (with RHS or ASB edge beam)



General notes

This detail is a Robust Detail (E-FS-1) when it is used with an ASB edge beam, in conjunction with an RD floor treatment, $A \geq 80$ mm, $C \geq 300$ mm, the concrete density is at least 2200 kg/m^3 and the light steel frame inner leaf has insulation between the studs.

The edge beam may be an RHS with welded plate or an ASB. However, acoustic performance may be impaired if an RHS is used.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Decking may span in either direction.

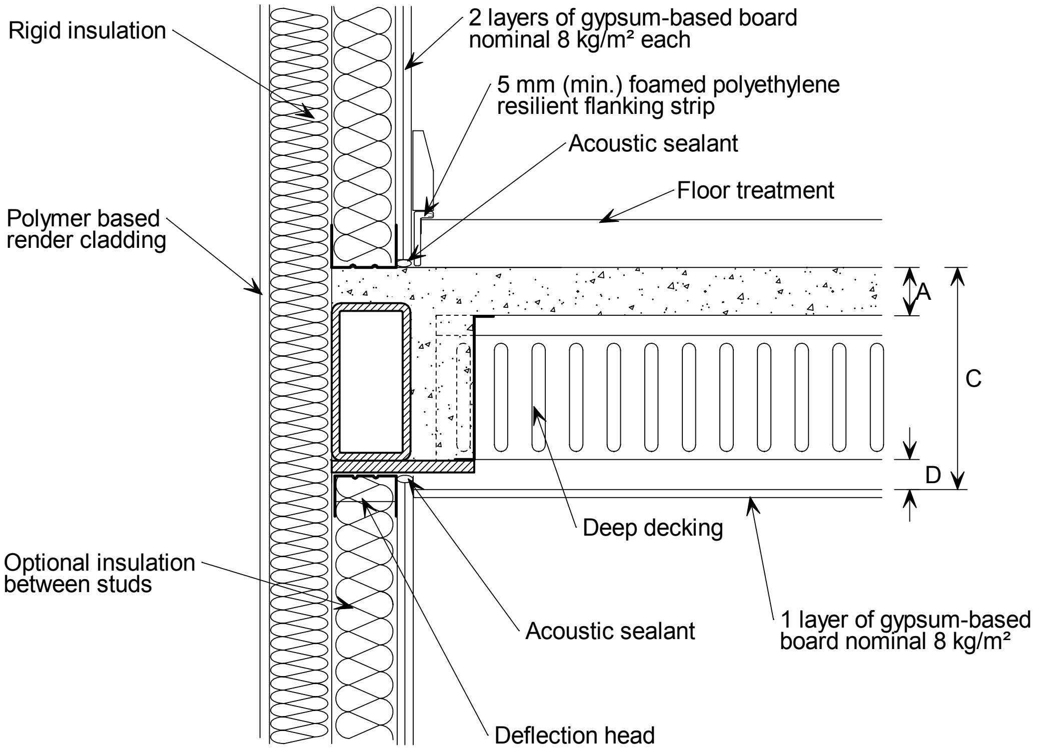
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Outer leaf may be masonry or precast panels.

Inner leaf must not be continuous between storeys.

B.2.6 External render wall (no cavity) with light steel and deep deck composite floor (with RHS or ASB edge beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm.

Edge beam may be an RHS with welded plate or an ASB. However, acoustic performance may be impaired if an RHS is used.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

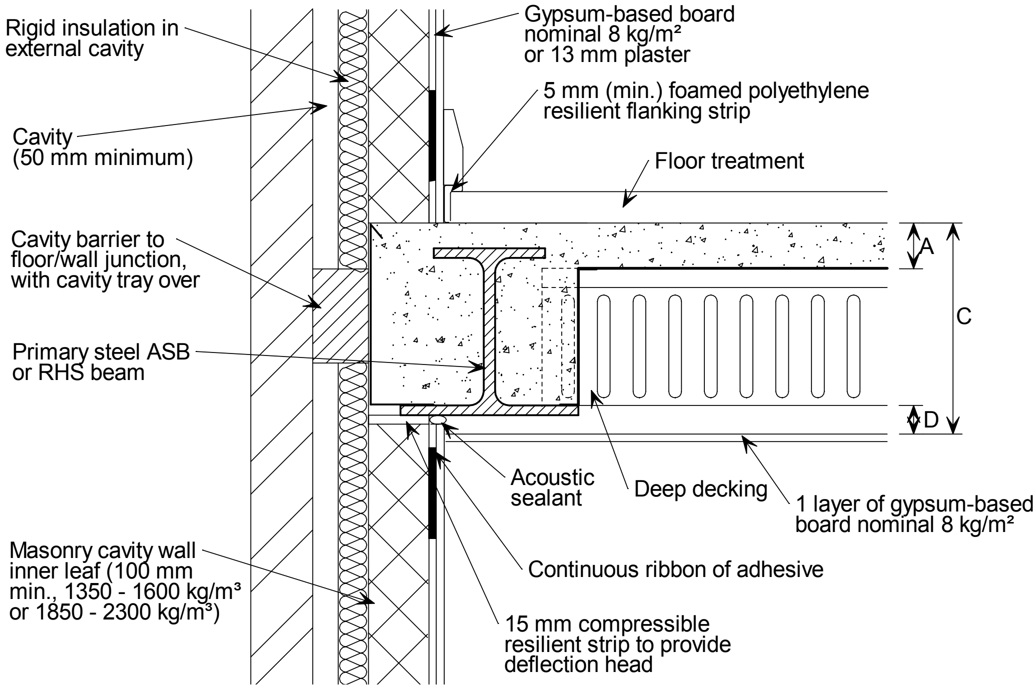
Decking may span in either direction.

Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Inner leaf must not be continuous between storeys.

B.2.7 External cavity wall with masonry inner leaf and deep deck composite floor (with ASB or RHS edge beam)



General notes

This detail is a Robust Detail (E-FS-1) when it is used with an ASB edge beam, in conjunction with an RD floor treatment, $A \geq 80$ mm, $C \geq 300$ mm, the concrete density is at least 2200 kg/m^3, the inner leaf concrete block is of density 1350 - 1600 kg/m^3 or 1850 - 2300 kg/m^3 and the inner leaf $\geq$ 100 mm.

The edge beam may be an RHS with welded plate or an ASB. However, acoustic performance may be impaired if an RHS is used.

Dimension D should be $\geq$ 100 mm with ceiling board of 8 kg/m^2 or $\geq$ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Decking may span in either direction.

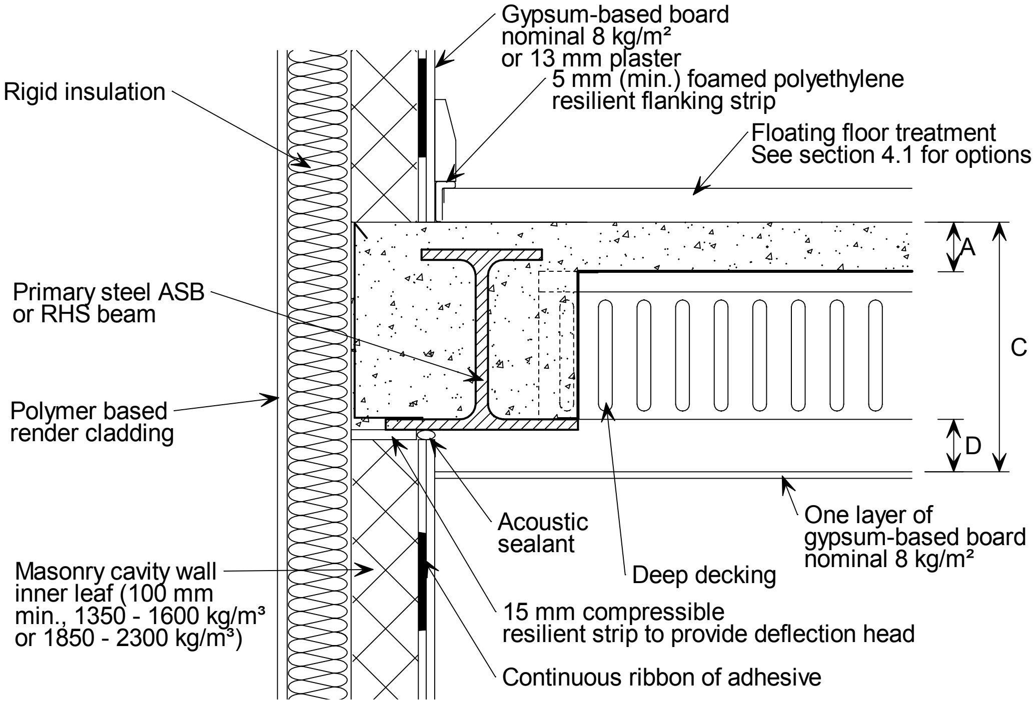
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Outer leaf may be masonry or precast panels.

Inner leaf must not be continuous between storeys.

B.2.8 External render wall (no cavity) with masonry and deep deck composite floor (with ASB or RHS edge beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm.

Edge beam may be an RHS with welded plate or an ASB. However, acoustic performance may be impaired if an RHS is used.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

Ceiling board should not be in direct contact with any steel beams or columns.

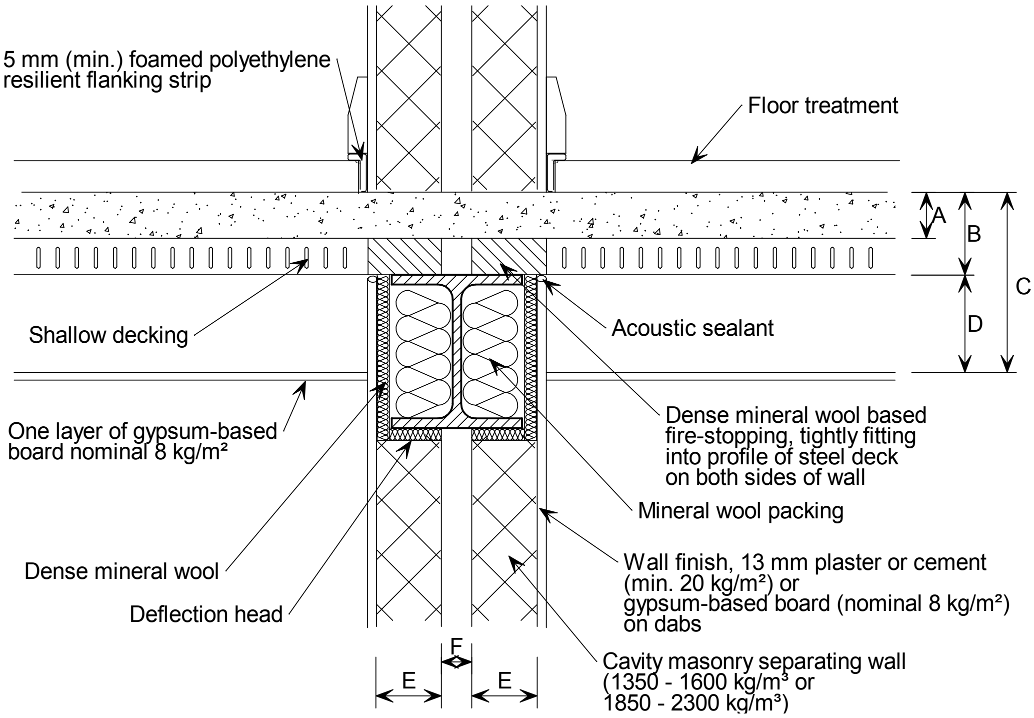
Wall materials

Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Inner leaf must not be continuous between storeys.

B.3 Separating wall and composite floor junction details

B.3.1 Internal light steel separating wall and shallow composite deck floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm, $B \geq 130$ mm, $E \geq 200$ mm and $F \geq 50$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

Decking may be trapezoidal or re-entrant in profile.

Where decking profiles are at right angles to the walls, voids (above the beam) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

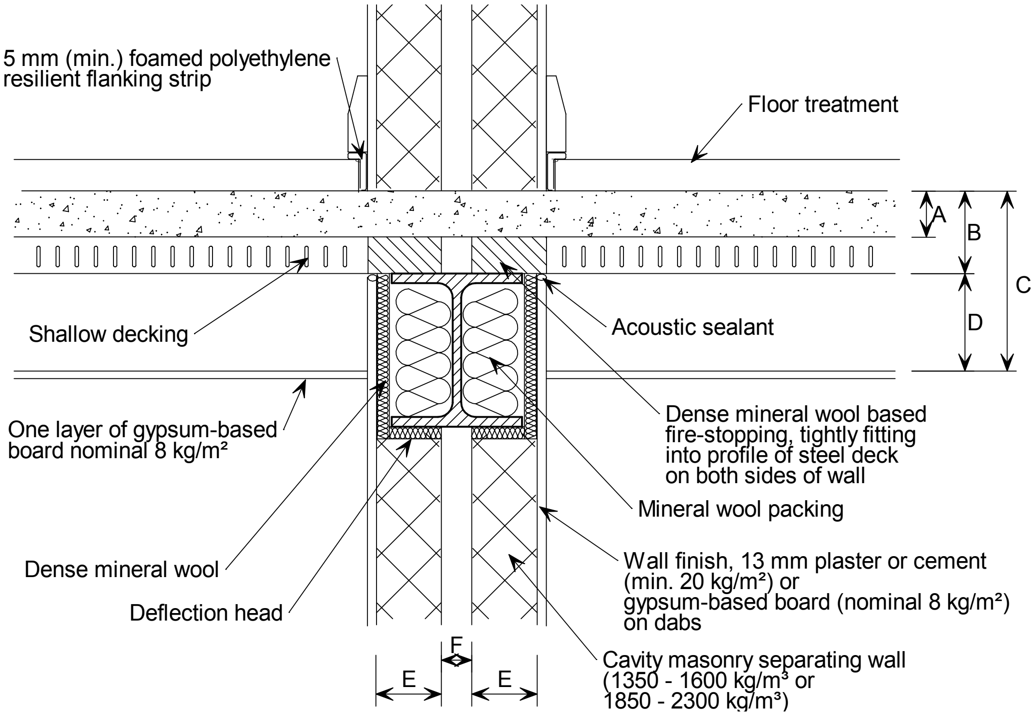
Ceiling board should not be in direct contact with any steel beams or columns.

Floor treatment should not be continuous under separating wall.

Wall materials

Wall board should not be in direct contact with any steel beams or columns.

B.3.2 Internal cavity masonry separating wall and shallow composite deck floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm, $B \geq 130$ mm, $E \geq 100$ mm and $F \geq 75$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

Decking may be trapezoidal or re-entrant in profile.

Where decking profiles are at a right angle to the walls, voids must be filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

Ceiling board should not be in direct contact with any steel beams or columns.

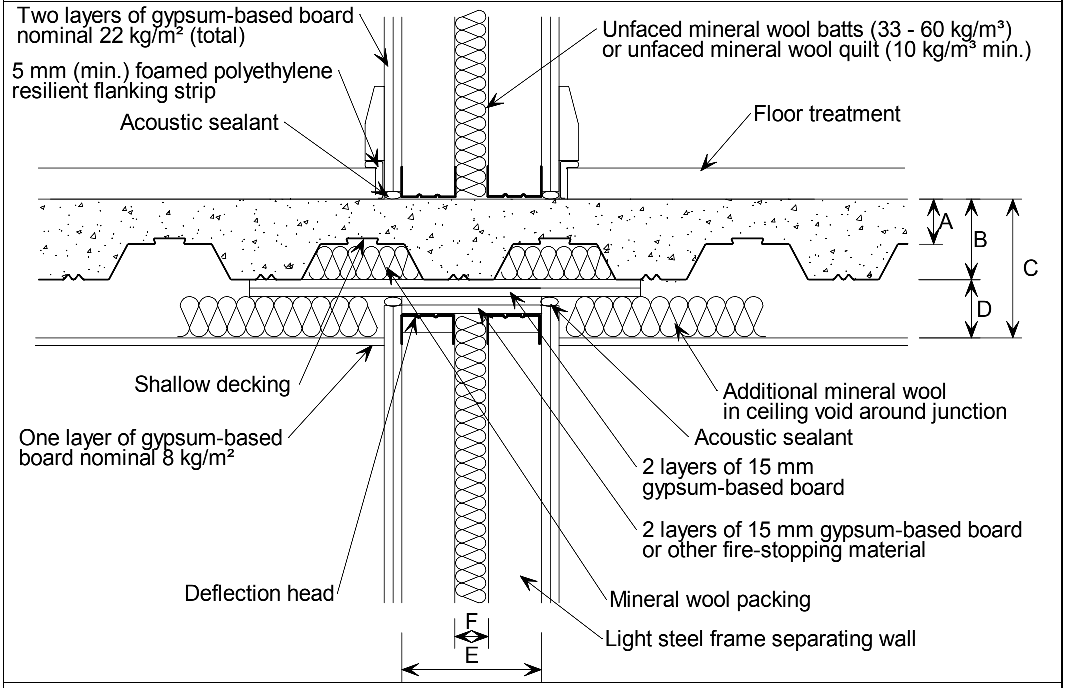
Floor treatment should not be continuous under separating wall.

Wall materials

Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Wall board should not be in direct contact with any steel beams or columns.

B.3.3 Internal light steel separating wall and shallow composite deck floor (no downstand beam)



General notes

Performance levels similar to those for an RD could be expected with $A \geq 80$ mm, $B \geq 130$ mm, $E \geq 200$ mm and $F \geq 50$ mm.

Proprietary alternative solutions that exist may be adopted.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m² or ≥ 75 mm with ceiling board of 10 kg/m².

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m³.

Decking may span in either direction.

Decking may be trapezoidal or re-entrant in profile.

Where decking profiles are at right angles to the walls, voids (above the wall) are filled with profiled mineral wool inserts and caulked with acoustic or flexible sealant.

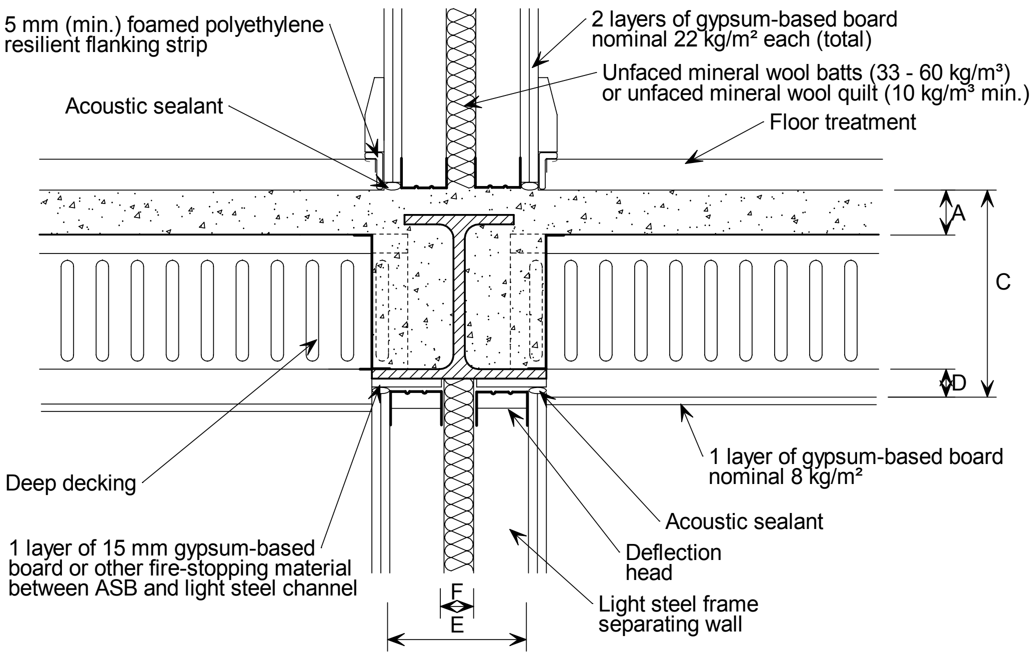
Ceiling board should not be in direct contact with any steel beams or columns.

Floor treatment should not be continuous under separating wall.

Wall materials

Wall board should not be in direct contact with any steel beams or columns.

B.3.4 Internal light steel separating wall and deep deck composite floor (with ASB beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm, $E \geq 200$ mm and $F \geq 50$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

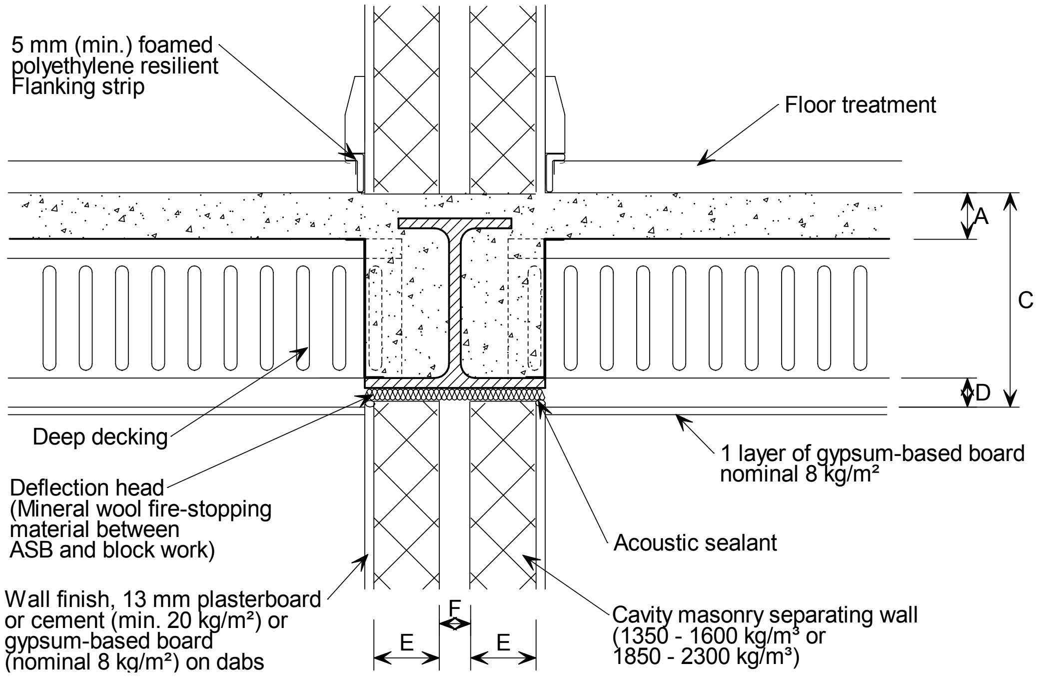
Floor treatment should not be continuous under separating wall.

Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Wall board should not be in direct contact with any steel beams or columns.

B.3.5 Internal cavity masonry separating wall and deep deck composite floor (with ASB beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm, $E \geq 100$ mm and $F \geq 75$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

Ceiling board should not be in direct contact with any steel beams or columns.

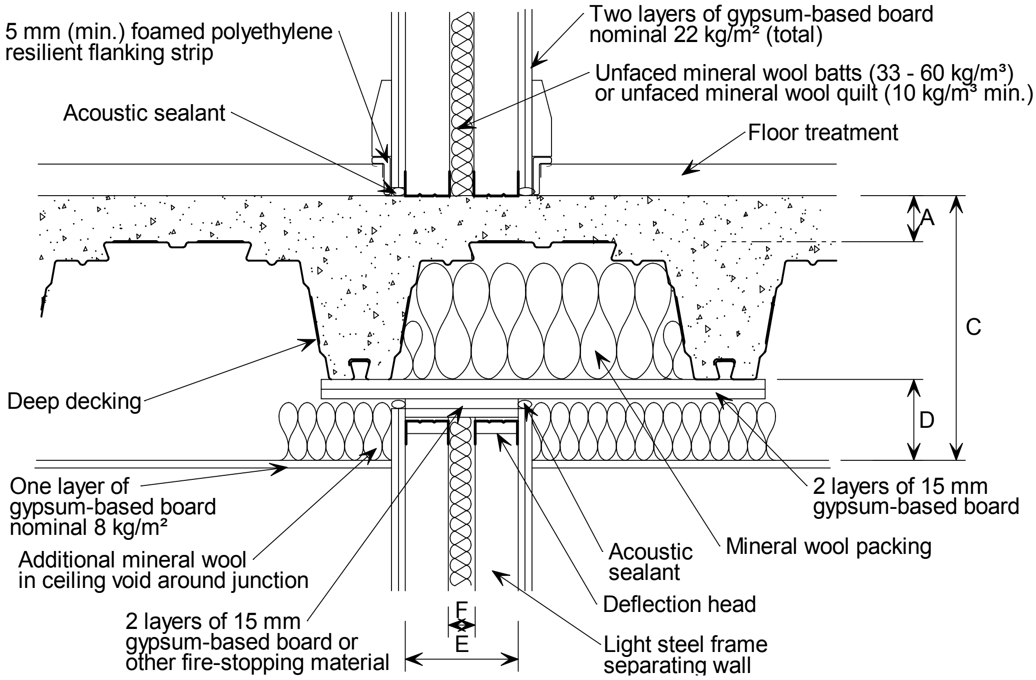
Floor treatment should not be continuous under separating wall.

Wall materials

Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Wall board should not be in direct contact with any steel beams or columns.

B.3.6 Internal light steel separating wall and deep deck composite floor (with no beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 80$ mm, $E \geq 200$ mm and $F \geq 50$ mm.

Dimension D should be ≥ 100 mm with ceiling board of 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Concrete density should be at least 2200 kg/m^3.

Decking may span in either direction.

Ceiling board should not be in direct contact with any steel beams or columns.

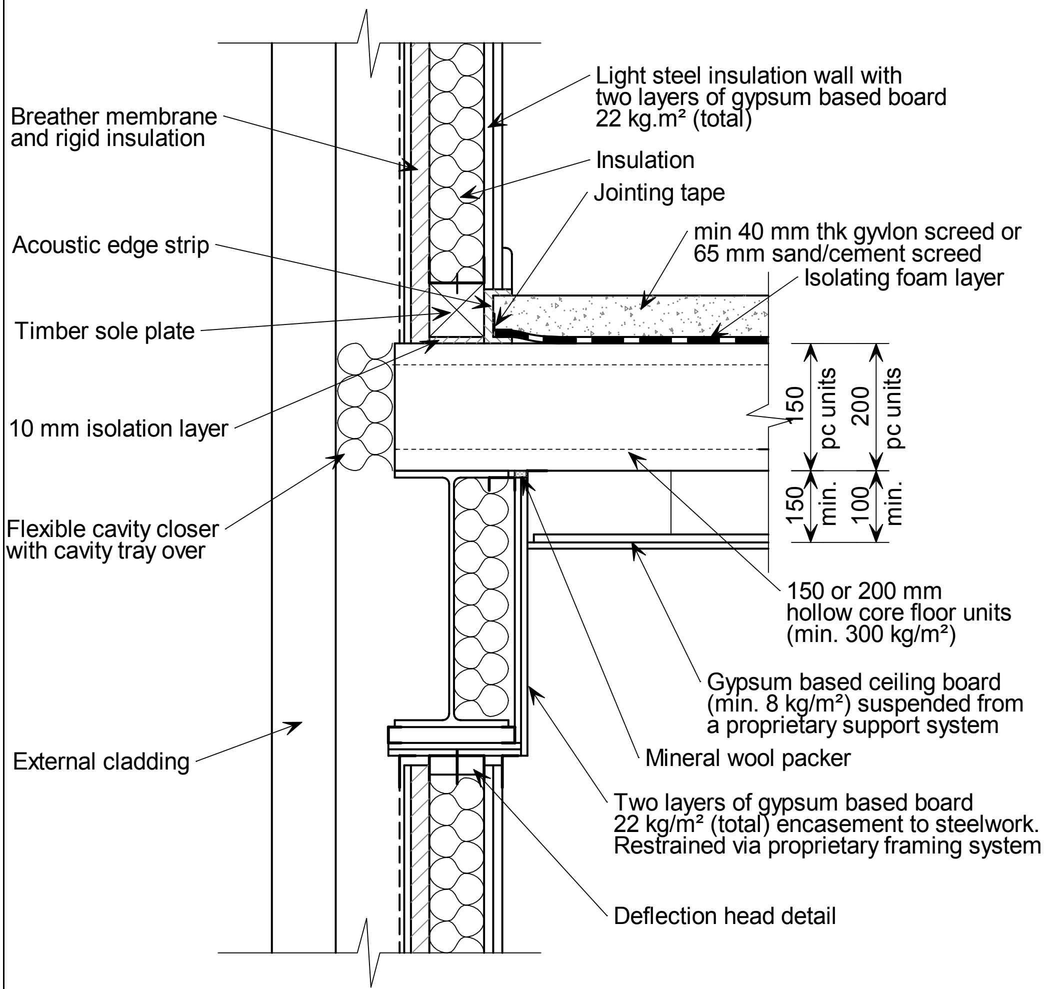
Floor treatment should not be continuous under separating wall.

Wall materials

Wall board should not be in direct contact with any steel beams or columns.

B.4 External wall and precast floor junction details

B.4.1 External cavity wall with light steel internal leaf and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with the construction shown above.

Combined depth of precast unit and ceiling void should be at least 300 mm.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Outer leaf may be masonry or precast panels.

Precast units must butt tightly together and all voids between units must be grouted.

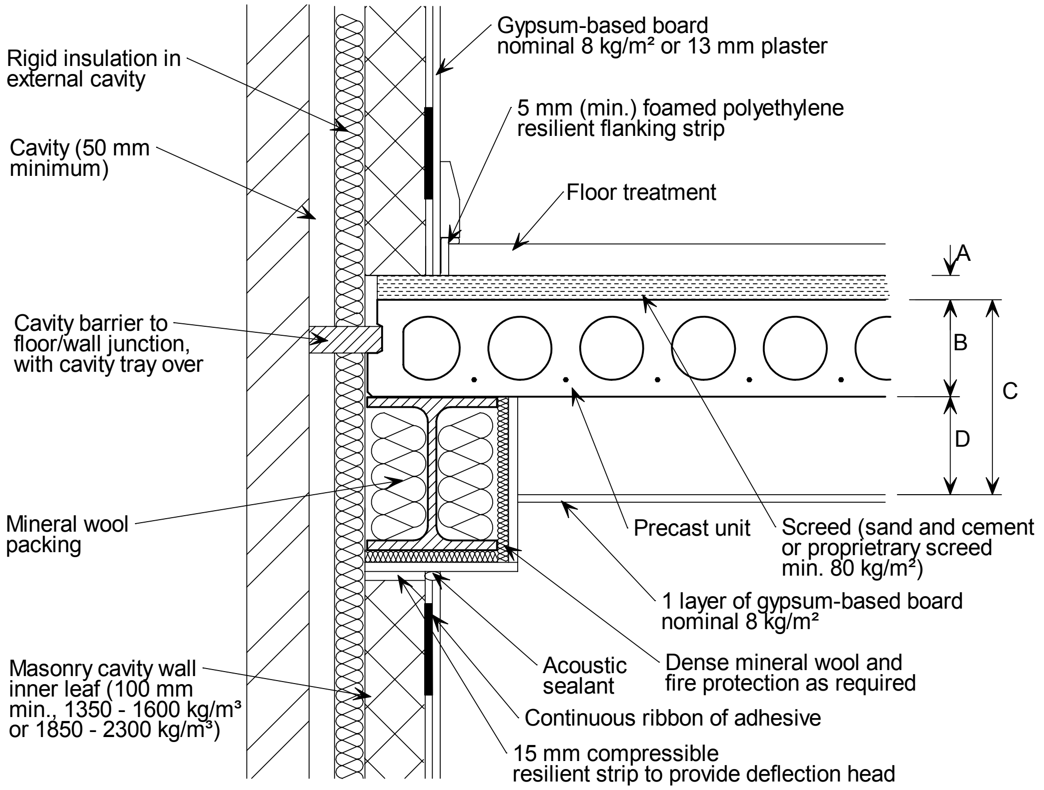
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Inner leaf must not be continuous between storeys.

B.4.2 External cavity wall with masonry internal leaf and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 40$ mm and $B \geq 150$ mm. This detail is similar to Robust Detail E-FC-1.

For a ceiling supported on a proprietary metal frame system, dimension D should be ≥ 100 mm with ceiling board of at least 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Screed mass should be at least 80 kg/m^2.

Precast units must butt tightly together and all voids between units must be grouted.

Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

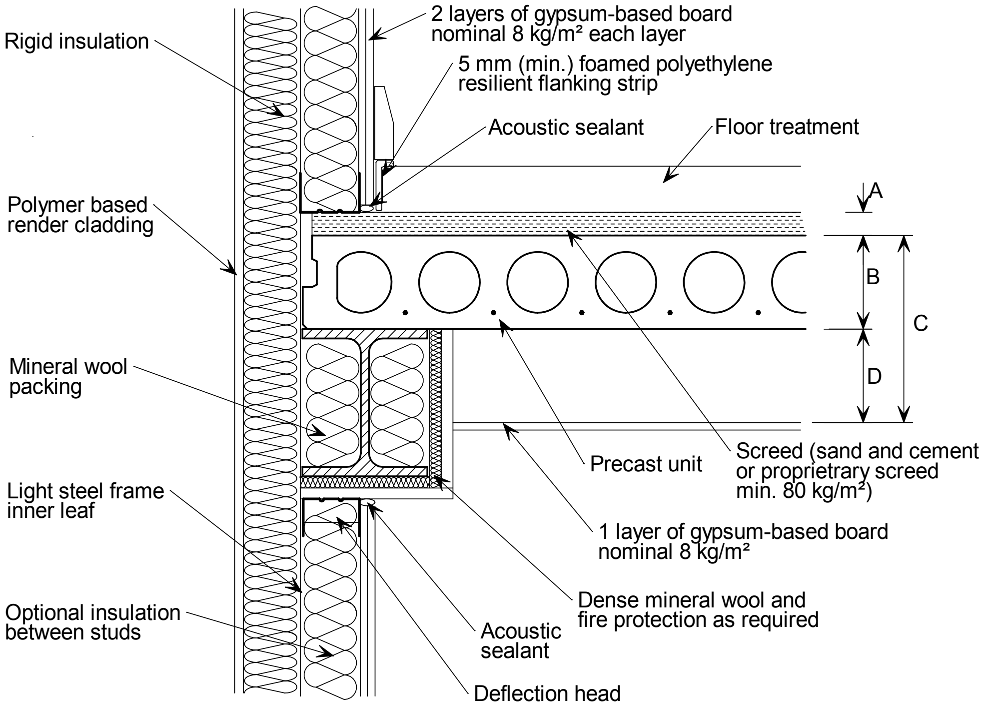
Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Inner leaf must not be continuous between storeys.

Outer leaf may be masonry or precast panels.

B.4.3 External render wall (no cavity) with light steel and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 40$ mm and $B \geq 150$ mm.

For a ceiling supported on a proprietary metal frame system, dimension D should be ≥ 100 mm with ceiling board of at least 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Screed mass should be at least 80 kg/m^2.

Precast units must butt tightly together and all voids between units must be grouted.

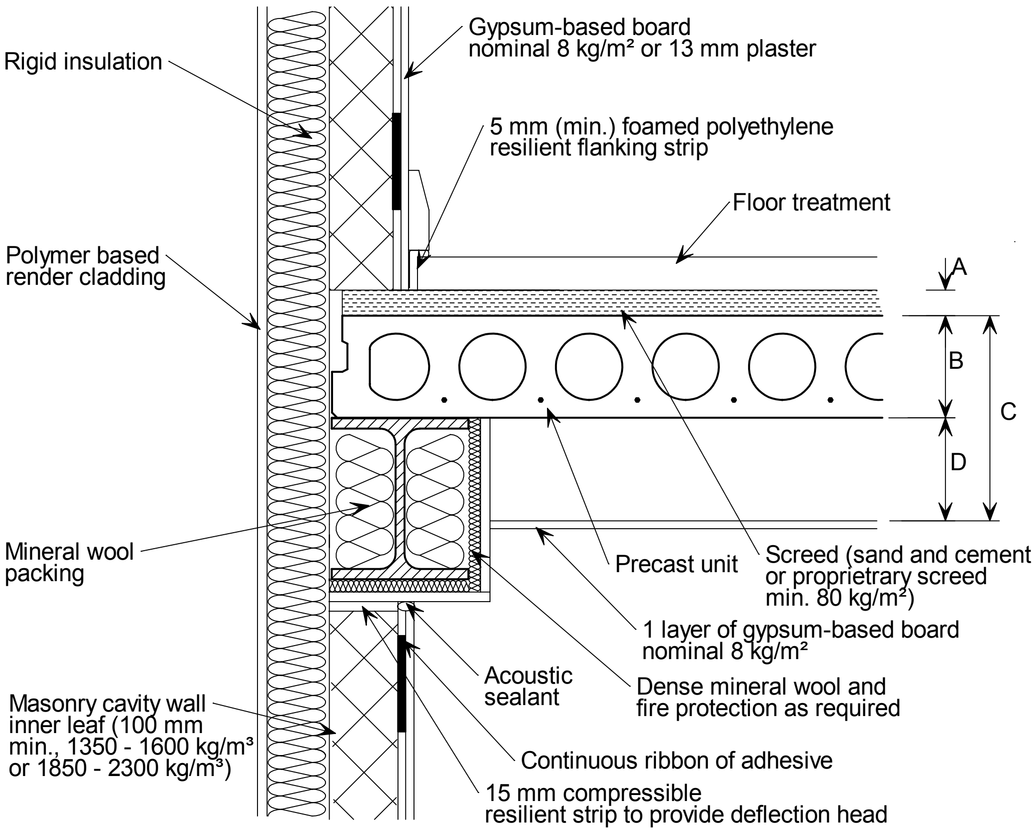
Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Inner leaf must not be continuous between storeys.

B.4.4 External render wall (no cavity) with masonry and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 40$ mm and $B \geq 150$ mm. This detail is similar to Robust Detail E-FC-1.

For a ceiling supported on a proprietary metal frame system, dimension D should be ≥ 100 mm with ceiling board of at least 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Screed mass should be at least 80 kg/m^2.

Precast units must butt tightly together and all voids between units must be grouted.

Ceiling board should not be in direct contact with any steel beams or columns.

Wall materials

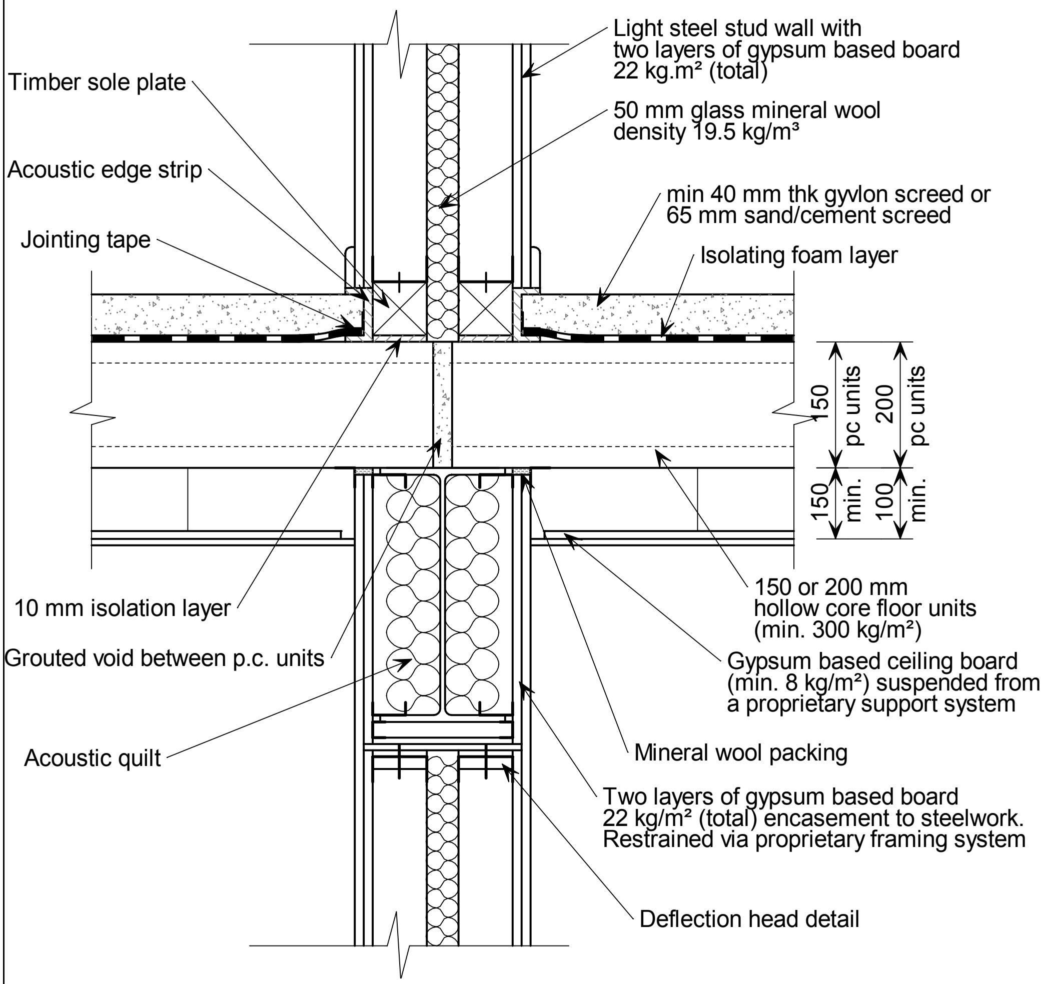
Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Inner leaf must not be continuous between storeys.

B.5 Separating wall and precast floor junction details

B.5.1 Internal light steel separating wall and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with the construction shown above.

Combined depth of precast unit and ceiling void should be at least 300 mm.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Precast units must butt tightly together and all voids between units must be grouted.

Ceiling board should not be in direct contact with any steel beams or columns.

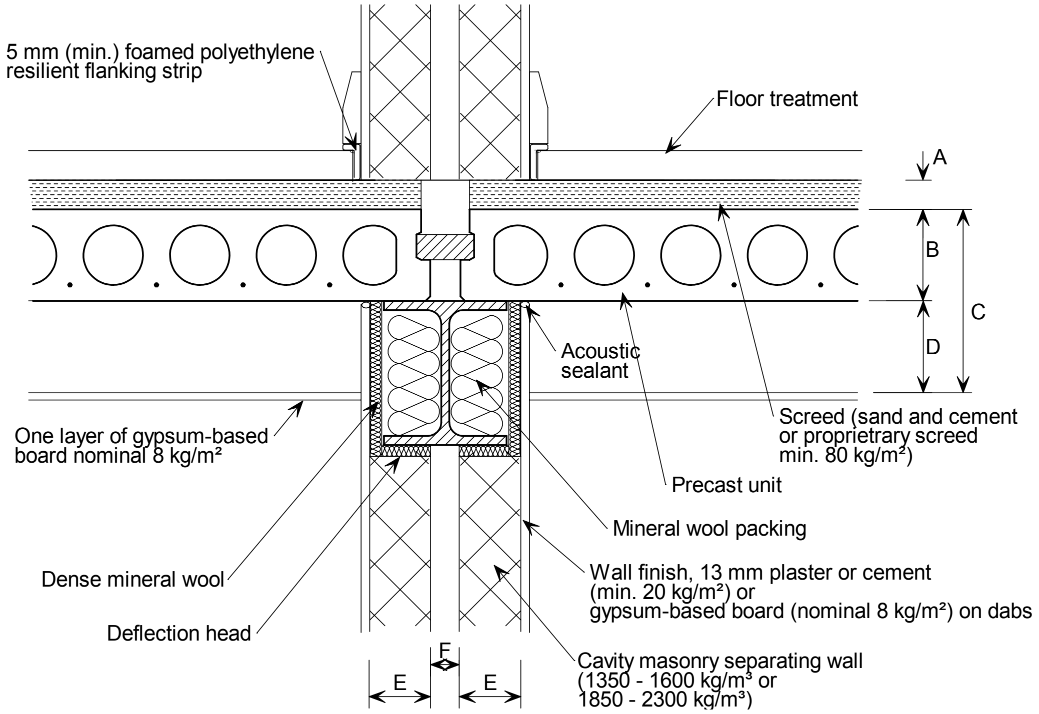
Floor treatment should not be continuous under separating wall.

Wall materials

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Wall board should not be in direct contact with any steel beams or columns.

B.5.2 Internal cavity masonry separating wall and precast floor (with downstand beam)



General notes

Performance levels similar to those of an RD could be expected with $A \geq 40$ mm, $B \geq 150$, $E \geq 100$ mm and $F \geq 75$ mm. This detail is similar to Robust Detail E-FC-1.

For a ceiling supported on a proprietary metal frame system, dimension D should be ≥ 100 mm with ceiling board of at least 8 kg/m^2 or ≥ 75 mm with ceiling board of 10 kg/m^2.

See Section 3.3 for floor and Section 3.4 for ceiling treatment options.

Floor materials

Precast unit mass should be at least 300 kg/m^2.

Screed mass should be at least 80 kg/m^2.

Precast units must butt tightly together and all voids between units must be grouted.

Ceiling board should not be in direct contact with any steel beams or columns.

Floor treatment should not be continuous under separating wall.

Wall materials

Concrete block density should be 1350 – 1600 kg/m^3 or 1850 – 2300 kg/m^3.

Voids between the wall and floor must be filled with acoustic or flexible sealant.

Wall board should not be in direct contact with any steel beams or columns.

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