Technical Handbook - Non-Domestic

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Noise

5.0 Introduction

5.0.1 Background

Noise is unwanted sound. In order to limit the effects of unwanted sound the standards intend to improve the resistance of building elements to sound transmission. Research has presented clear evidence that noise can indirectly contribute to a range of health issues such as stress and anxiety.

Inadequate sound insulation can impair health by allowing noise from other people to disrupt normal life. A number of people in residential buildings complain of noise made by others. The World Health Organisation has established a relationship between noise exposure and sleep disturbance however the next-day or long-term effects are still not clear.

5.0.2 Aims

The purpose of the standards in Section 5 is to limit the transmission of sound to a level that will not threaten the health of occupants from sound transmission emanating from attached buildings and a differently occupied part of the same building. They also cover sound from within the same dwelling if occupants are in rooms where they would expect to have some degree of peace and quiet.

It is important to recognise that the standards will not guarantee freedom from unwanted sound transmission. The standards aim to limit the effects from sound created from normal domestic activities, but not from excessive noise from things such as power tools, audio systems inconsiderately played at high volume or even raised voices.

The standards do not address environmental noise through the building facade from sources such as aircraft, trains, road traffic or industry. Other legislation covers these areas and further information may be obtained from Planning Advice Note PAN 1/2011 ‘Planning and Noise’.

5.0.3 Latest changes

The following is a summary of the main change that has been introduced since 1 October 2010.

- Standard 5.1 - removal of guidance regarding the phased introduction of sound tests.

5.0.4 Explanation of terms

There are a number of terms used in this section some are included below, these and other useful terms are included in Annex A of the Example Constructions.

Airborne sound is sound which is propagated from a noise source through the medium of air. Examples of these are speech and sound from a television.

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

Direct transmission refers to the path of either airborne or impact sound through elements of construction.

$D_{nT,w}$ is the weighted standardised level difference. A single-number quantity (weighted) which characterises the airborne sound insulation between two rooms, in accordance with BS EN ISO 717-1: 1997.

Flanking transmission is airborne or impact transmission between rooms that is transmitted via flanking elements and/or flanking elements in conjunction with the main separating elements. An example of a flanking element is the inner leaf of an external wall that connects to the separating ‘core’ of a wall or floor.

Impact sound is sound which is propagated from a noise source through a direct medium. An example of this is footfall on a floor.

Impact sound transmission is sound which is spread from an impact noise source in direct contact with a building element.

$L'_{nT,w}$ is the weighted standardised impact sound pressure level. A single-number quantity (weighted) to characterise the impact sound insulation of floors, in accordance with BS EN ISO 717-2: 1997.

R_w is a single number quantity (weighted) which characterises the airborne sound insulation of a building element from measurements undertaken in a laboratory, in accordance with BS EN ISO 717-1: 1997.

5.0.5 Reduction of sound transmission

The reduction of sound transmission from attached buildings and within buildings can be provided through different mechanisms which involve mass, isolation, absorption, resilience and stiffness (see annex A of the Example Constructions). Wall and floor constructions that provide a combination of such mechanisms generally provide better sound insulation.

Good design incorporates at least 2 or more of the above mechanisms and can reduce a range of sound frequencies typically found in attached residential buildings.

The effects these variables can have in predicting both sound transmission and insulation are as follows:

- through a heavyweight wall or floor it is its mass per unit area. A reduction in sound transmission and increase in sound insulation are expected with increasing mass, as the heavier the wall or floor, the less it vibrates in response to sound waves and hence the less sound energy is radiated. For example, heavyweight constructions such as masonry cavity walls provide mass and isolation

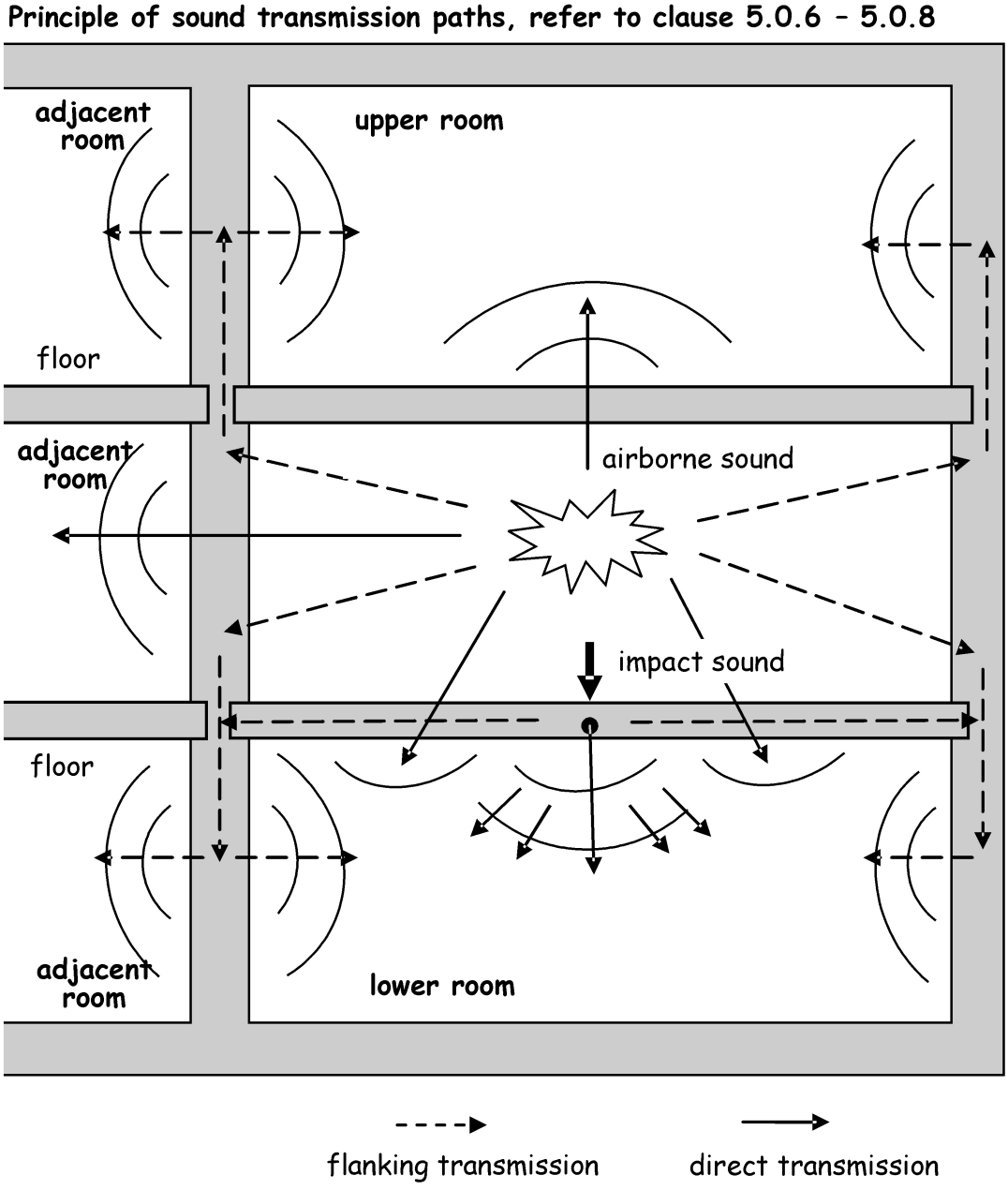
- through a lightweight wall or floor it is the use of cavities, structural coupling and absorption. A reduction in sound transmission and an increase in sound insulation are expected by the use of cavities with fewer and less stiff connections, while absorptive material hung in the wall cavity will absorb mid to high frequency sound energy. The formation of narrow cavities, such as dry linings on dabs, can also create an unwelcome ‘drum’ effect at low frequencies and filling or lining them with absorbing material can help to reduce this. For example in lightweight constructions such as timber frame walls, the twin stud of the timber frame provides isolation, stiffness and absorption

- resilience is often required for separating floors in residential buildings where there is direct vibration impact such as footfall noise. Resilience reduces the impact vibration by dynamic movement and also converts the energy into heat. Examples of resilient

elements for floors include floating floor treatments such as battens and cradles, resilient bars and resilient floor coverings, other than carpet

- mass and stiffness help to reduce significantly low frequency sound transmission whereas absorption and resilience predominantly reduce mid and high frequency sound transmission
- isolation has the most influence over all frequencies of sound but can be limited by structural connections such as wall ties, straps and fixings that may bridge isolated leafs or elements.

Figure 5.1 principle of sound transmission paths



5.0.6 Principles of airborne sound transmission

When sound waves strike a wall or floor, the pressure variations cause the construction to vibrate. A portion of the vibrational energy on the sound source side will be transferred

through the wall or floor where it is radiated as airborne sound on the other side. There is a loss in sound transmission as the frequency of the incident sound (sound waves produced from striking against a wall or floor for example) increases. This also varies with the direction of the sound waves, and is usually assumed to be the average for all possible angles of incidence.

5.0.7 Principles of impact sound transmission

Impact sound is sound that is spread from an impact or vibrational source in direct contact with a building element such as a floor. A structural vibration is transmitted from the point of impact through the structure causing vibration leading to the radiation of sound into an adjacent room below. In a building this is commonly caused by an object hitting the floor, from where the vibration is transferred into the structure. Usually the vibration path will lead to the ceiling and perimeter walls below. The amount of impact sound heard below will depend upon many factors including the force of the impact, the vibration transmission characteristics of the floor construction and the floor covering.

5.0.8 Principles of flanking sound transmission

Flanking sound transmission occurs when there is an indirect path for sound to travel along elements adjacent to walls and floors. If the flanking construction and its connections with the separating structure are not correctly detailed, flanking transmission can equal, or even exceed, sound levels perceived as a result of direct transmission. Flanking transmission can occur, for instance, when a wall abuts the face of the inner leaf of an external cavity wall, and the walls are insufficiently tied or bonded together, thus allowing the noise to travel along the inner leaf.

5.0.9 Relevant legislation

Listed below are some pieces of legislation and guidance that may be relevant and/or helpful to those using the guidance in this particular section.

The Common Law of Nuisance recognises that an occupant has the right to the free and absolute use of the property, but only to the extent that such use does not discomfort or annoy a neighbour.

Part IV of the Civic Government (Scotland) Act 1982 sets out a range of public nuisance offences.

The Environmental Protection Act 1990 as it relates to noise, states that ‘any premises in such a state as to be prejudicial to health or a nuisance ranks as a statutory nuisance’.

The Human Rights Act 1998 (as it relates to noise) Article 8 guarantees the right to respect for private and family life.

Antisocial Behaviour etc. (Scotland) Act 2004 empowers the local authority to serve a warning notice in relation to noise which exceeds the permitted level.

The Planning Advice Note PAN 1/2011 ‘Planning and Noise' provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.

The SHTM 2045 provide guidance on designing for noise in hospitals and healthcare facilities.

5.0.10 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or construction for compliance with the mandatory

functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the work of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the work covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

5.1 Noise separation

Mandatory Standard

Standard 5.1

Every building, which is divided into more than one area of different occupation, must be designed and constructed in such a way to limit the transmission of source noise from normal domestic type activities, between such areas, to a level that will not threaten the health of, or cause inconvenience to the building occupants.

Limitation:

This standard only applies to a building in different occupation incorporating:

a. attached dwellings

b. attached residential buildings, or

c. a roof, walkway or access deck located directly above an area that is either a dwelling or a residential building.

5.1.0 Introduction

Noise nuisance affecting people who stay in residential buildings such as hotels or care homes has risen over the years as rooms are used for more than just sleeping accommodation. These rooms are now multi-functional, and greater numbers of noise-producing pieces of equipment and appliances such as audio and TV are now used. Noise generated by people in hotel corridors as they move about and bang doors or talk loudly can cause disturbance to those trying to sleep in nearby rooms.

Complaints regarding noisy services are made regularly. Dealing with the varying levels of sound produced by service equipment, such as lifts, heat pumps or air conditioning units in buildings is a complex task, and not an issue specifically dealt with here. However guidance is given on special care that should be taken at the decision stage in the choice of service equipment, their installation and location within the building.

Designers should be aware that some Local Authorities' may also set noise reduction targets. This is usually enforced through environmental health and planning legislation for noise emanating from non-domestic premises. More information on this is contained in PAN1/2011.

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

5.1.1 Scope of standard

Airborne sound insulation should be provided where any separating wall or separating floor is formed between areas in different occupation. For example:

- between rooms that are intended to be used for sleeping and other buildings
- between rooms that are intended to be used for sleeping and other parts of the same building, such as bedrooms and a communal hall.

Impact sound insulation should be provided where any separating floor is formed between areas in different occupation. For example:

- between rooms intended to be used for sleeping. The lower room should be protected from sound emanating from the upper room
- between rooms intended to be used for sleeping and other parts of the same building. The room below should be protected from sound emanating from other parts of the building above
- between rooms intended to be used for sleeping and other parts of the same building directly above e.g. common stair or corridor, communal lounge, or car parking garage
- a roof, walkway or access deck located directly above rooms intended to be used for sleeping and to which there is access, other than where it meets the conditions of (c) or (d) below.

Impact sound insulation need not be provided for:

a. a roof above a non-habitable space, such as a roof space

b. a separating floor between a residential building and any other non-domestic building directly below

c. a roof, walkway or access deck located directly above rooms intended to be used for sleeping to which there is access for maintenance purposes only

d. a roof, walkway or access deck located directly above rooms and to which there is access, where it is for the sole use of the residents of the residential building.

5.1.2 Design performance levels

The following design performance levels are given for the control of sound through separating walls and separating floors. Although not specifically covering non-domestic buildings, the levels have been developed from research covering sound and perceived sound in dwellings. They have been identified as levels based on normal domestic activities that have been shown to produce few noise complaints.

However experience shows that the performance of a construction is dependent upon:

- achieving a high quality of workmanship on site
- supervision throughout the construction process
- the relationship between separating and adjoining elements (e.g. external walls, roofs and windows) to combat flanking transmission

and these factors should be carefully considered at the design stage.

All work should be designed to the levels in the following table:

Table 5.1 Design performance levels in dB [1]

Design Performance	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Additional information:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see clause 5.0.4.

2. Notice should be taken of the guidance on conversions in clause 5.1.5.

3. See clause 5.1.1 for application of these performance levels to separating walls and separating floors.

Two methods are provided on ways to achieve these levels which can lead to meeting the standard. They are by the use of:

a. Example Constructions (see clause 5.1.3), or

b. other constructions (see clause 5.1.4).

These methods are to be used in conjunction with the testing arrangements (see clause 5.1.7 to 5.1.9).

5.1.3 Example Constructions

Example Constructions have been developed that will repeatedly achieve the design performance levels in the table to clause 5.1.2. They have also been developed from constructions that are in general use in the UK, and that are known to reduce the range of sound frequencies that can generate complaints. As these are designed for domestic types of construction they may not be suitable for use in non-domestic buildings.

The Example Constructions are available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

5.1.4 Other constructions

Clause 5.1.3 provides guidance on constructions that have been designed and tested to repeatedly achieve the performance levels in the table to clause 5.1.2. However it may be necessary, preferable or desirable, to include new or innovative constructions into a proposed design.

Where constructions that have not been tested previously are used, the services of an acoustic specialist may be obtained, who should be able to offer design guidance on constructions that are capable of achieving the performance levels in the table to clause 5.1.2.

5.1.5 Conversions

Achieving the design performance levels for conversions can present challenges to a designer. The presence of hidden voids within constructions, back to back fireplaces, cupboards and gaps between construction elements in walls and floors, mean that it may

not be possible to use ‘pattern book’ type constructions to achieve the design performance levels. When conversions are undertaken, the adaption of the existing building should be considered at the design stage. Conversions and conversions of traditional buildings should achieve the performance levels in the table to clause 5.1.2.

With older buildings achieving the performance levels in clause 5.1.2 becomes more difficult, therefore the levels for traditional buildings are less demanding than for new build and conversions.

The design proposals for the conversion of a traditional building should be considered carefully so that any measures taken will improve the sound insulation. The performance levels in the table to clause 5.1.2 should be considered as a benchmark, but it may not be possible to achieve these levels in all circumstances. Consultation on such matters at an early stage with both the verifier and the planning officer of the relevant authority is advisable.

Historic and Listed buildings will prior to conversion display unique characteristics as far as sound insulation is concerned. The original building design and construction will influence the level of sound insulation achievable for the separating walls and separating floors. For this reason, specific prescriptive guidance on such buildings is not appropriate. The relevant authority may, at their discretion, agree measures that respect the character of the building.

Although not specifically covering non-domestic buildings further advice on providing sound insulation in listed buildings can be obtained from the Building Performance Centre, Napier University booklet ‘Housing and Sound Insulation – Improving existing attached dwellings and designing for conversions' http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

The building owner may wish to carry out a pre-conversion sound test prior to the start of any conversion, ideally during the building survey process. The acoustic performance of the existing construction can then be established and problems identified that will allow the design of a tailored acoustic solution to be determined at an early stage.

For larger or more complex work, advice on conversions may be sought from an acoustic specialist who should be able to offer appropriate design guidance.

5.1.6 Noise from services

Building service installations serving common areas in residential buildings have the potential to cause noise nuisance. For example, common plant such as lifts, air conditioning units, ventilation systems, and drainage pipes running the height of a building have all been known to be a source of complaint.

Therefore, it is important that the design of building services, their position in the building and the building structure should be considered at an early stage in the design process.

Services passing through separating walls or separating floors must comply with the relevant standards in Section 2: Fire.

Service pipes or ducts should not pass through a separating wall, unless they are of small diameter, such as lateral pipework from network risers such as gas, electricity, water and telecom. These pipes or ducts may pass through a separating wall from a common area only.

Custom-built or system chimneys should not be built into timber-framed separating walls. Only masonry chimneys (including precast concrete flue-blocks) may be included as an integral part of a separating wall. However, some thickening of the construction may be necessary to achieve the performance levels in clause 5.1.2.

Only service openings for ducts, service pipework or chimneys may be formed in separating floors. These services should be enclosed above and below the floor with a construction that will maintain the levels of noise reduction recommended for a separating floor in the table to clause 5.1.2.

Service equipment rooms should not be located next to quiet areas such as rooms intended for sleeping. Locating plant in a larger space can help dissipate sound. Also, plant machinery and equipment such as lift rails should be isolated from the walls and floor to reduce vibrations and the resulting sound transmission to rooms intended for sleeping. Vibration from mechanical equipment can be reduced with the use of inertia blocks and resilient mounts.

Structure borne noise is the most common cause of complaints and the most effective approach is to structurally de-couple service installations and mechanical equipment from separating walls and separating floors. Lightweight structures need special consideration and it may be necessary to support noisy plant on a separate, rigid structure. The installation of an independent wall or ceiling lining may help achieve the performance levels in clause 5.1.2.

Although not specifically covering non-domestic buildings, a report ‘Limit noise transmission to dwellings from services' includes several useful design guide annexes http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Annex H of BS EN 12354-5: 2009 provides more detailed guidance on the reduction of service noise transmittance through separating walls and separating floors.

Design guides covering low carbon equipment, such as air source heat pumps, contain advice on sound reduction measures and are available at http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

5.1.7 Post-completion performance test levels

The effectiveness of a construction to reduce sound transmission depends on several factors; the design, the buildings within which it is formed and the quality of the workmanship.

The use of any of the methods listed in clause 5.1.2 alone will not guarantee that the performance levels will be achieved. Good workmanship is essential to their performance, and post-completion testing will confirm these levels have been achieved.

Table 5.2 Test levels for Example and other constructions in dB [1]

Design Performance	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Additional information:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see clause 5.0.4.

2. Notice should be taken of the guidance on conversions in clause 5.1.5.

3. See clause 5.1.1 for application of these performance levels to separating walls and separating floors.

5.1.8 Post-completion testing

On completion, new buildings and conversions should be tested. At least 1 test should be carried out on each separating wall and separating floor of different construction within the completed buildings, where there is a room intended for sleeping.

Inaccessible areas - there may be some locations where it is not possible to carry out a sound test, as access to an adjoining building may be restricted or prevented. When a conversion of an attached building occurs, for example to a mid terrace building, it may not be possible to gain access to the adjacent building to carry out tests to the separating wall. In such cases, it may not be appropriate to test.

Methods of testing - sound tests should only be carried out on a building that is complete and when doors, access hatches and windows are fitted. Carpet, should not be used as bonded resilient floor covering or laid before an impact test for separating floors. Sound testing should be carried out in accordance with:

a. BS EN ISO 140-4: 1998 and BS EN ISO 717-1: 1997, for airborne sound transmission, and

b. BS EN ISO 140-7: 1998 and BS EN ISO 717-2: 1997, for impact sound transmission.

At least two different loudspeaker positions should be used for the source noise, in accordance with BS EN ISO 140-4: 1998.

Methods using a single source - for each source position, the average sound pressure level in the source and receiving rooms is measured in one-third-octave bands using either fixed microphone positions (and averaging these values on an energy basis), or using a moving microphone.

For the source room measurements, the difference between the average sound pressure levels in adjacent one-third-octave bands should be not more than 6dB. If this condition is not met, the source spectrum should be adjusted and the source room measurement repeated. If the condition is met, the average sound pressure level in the receiving room, and hence a level difference, should be determined.

It is essential that all measurements made in the source and receiving rooms to determine a level difference should be made without moving the sound source or changing the output level of the sound source, once its spectrum has been correctly adjusted (where necessary).

The sound source should now be moved to the next position in the source room and the above procedure repeated to determine another level difference. At least two positions should be used for the source. The level differences obtained from each source position should be arithmetically averaged, D as defined in BS EN ISO 140-4: 1998.

Airborne and sound impact insulation testing - for both types of testing it is possible to use fixed microphone positions, rotating booms or manual moving microphones (mmm), in accordance with BS EN ISO 140-4: 1998 and BS EN ISO 140-7: 1998.

Professional expertise - testing should be carried out by persons who can demonstrate relevant, recognised expertise in acoustics for sound insulation testing. This should include membership of a professional organisation which accredits its members as competent to both test and confirm the results.

5.1.9 Remedial action following a test failure

Noise transmission in buildings is a complex subject and it is difficult to provide definitive guidance on resolving specific problems that have occurred in individual buildings. It may

be prudent to seek advice from a specialist who, through experience of sound testing, may be able to identify and resolve any problems.

If the failure is attributed to the construction of the separating and/or associated flanking elements, other rooms that have not been tested may also fail to meet the test performance levels. Additional tests may be needed, over and above the number recommended in clause 5.1.8 to check that the work achieves the test performance levels.

5.2 Noise reduction between rooms

Mandatory Standard

Standard 5.2

Every building, must be designed and constructed in such a way to limit the transmission of source noise from normal domestic type activities, through a wall or floor, between a room and internal space where noise is likely to occur, to a level that will not cause inconvenience to the building occupants.

Limitation:

This standard only applies to a wall or floor forming an apartment in a dwelling and a room in a residential building which is capable of being used for sleeping; other than:

a. a wall between an en-suite bathroom and the apartment or room it serves

b. a hospital

c. a place of lawful detention.

5.2.0 Introduction

In the past many noise complaints have came, from occupants of residential buildings, such as hotels, residential care buildings and student residences. In most cases, these tend to occur where there is noise transfer from communal areas, particularly when people return late, bang doors or talk too loudly, and to a lesser extent noise between rooms.

Although noise within a unit of residential accommodation can be controlled by the management to a certain extent, it is not possible to control all of the noise made from everyone and every source within the building. This increase in noise levels from speech and music within individual units can lead to anxiety and stress.

NHS regulations, SHTM 2045, provide guidance on designing for noise in hospitals and healthcare facilities.

The Scottish Prison Service produces guidance on the design requirements for places of lawful detention.

Conversions - in the case of conversions as specified in regulation 4, the building as converted shall meet the requirements of this standard (regulation 12, schedule 6).

5.2.1 Design performance level

Internal walls are normally built off the structural floor. A door located in such a wall provides a path for sound to bypass a wall under test. On-site sound testing of internal

walls and intermediate floors cannot be relied upon due to excessive flanking sound transmission through doors. For this reason a laboratory test is used. A laboratory test result is termed dB R_w.

As disturbance to occupants can occur from other areas within a residential building, the level of sound heard should be reduced in the rooms in which people may sleep. Therefore it is the internal walls between rooms, rooms intended for sleeping and an internal space where noise is likely to occur that should achieve the sound performance level. An internal wall between an en-suite bathroom and the room it serves need not have sound insulation.

The design performance levels for internal walls and intermediate floors covered by this standard should achieve a minimum airborne sound insulation level of 43 dB R_w.

5.2.2 Internal walls

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

5.2.3 Intermediate floors

Improving the sound insulation over parts of an intermediate floor only above or below rooms that are intended for sleeping, could lead to expensive remedial measures if an area is missed or if future alteration work is carried out. It is therefore recommended that sound insulation should be provided across the entire area of each intermediate floor if there is a room that is intended for sleeping, located directly above or below the floor.

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

Although setting impact sound insulation design levels for intermediate floors is not reasonably practicable, insulation against impact noise can be improved by adding a soft covering such as a carpet or foam-backed vinyl. However a carpet or foam-backed vinyl is a floor covering and should not be included as part of the construction used to achieve the design levels in clause 5.2.1.

5.2.4 Conversions

Many of the existing wall and floor constructions within a traditional building, will be constructed from materials generally not still in use, for example lath and plaster. In such cases the sound insulation level will not be known therefore, it is not reasonably practicable for the existing walls or floors to meet the performance levels in clause 5.2.1.

5.2.5 Doors in internal walls

Doors in residential buildings that provide direct access from common areas to rooms intended for sleeping, such as hotel bedrooms create a weak point in the wall, acoustically. This allows unwelcome noise into the room. Noise can more readily pass through a lightweight door than a heavy door and, the weakest point for noise to enter will be through the gap between the door and the frame.

Rooms intended for sleeping should be separated by a door that will act as a sound barrier and reduce noise transference. Therefore, a door that provides direct access to a room intended to be used for sleeping should have an overall mass per unit area of at least 25 kg/m^2.

The door should also be fitted with a perimeter seal, excluding the threshold, to minimise noise transmittance through the doorset. A compressible type of seal may be used, such as a rubber strip. Where the seal is of a type that combines a smoke and noise seal, the product literature should be consulted to confirm the seal will achieve the desired effect. The seal should not interfere with the closing mechanisms of a fire door and provide a positive seal between the door frame and the door.