

### SOUND INSULATION FOR INTERNAL/COMMON WALLS

Internal walls are walls separating different rooms of a single residence and common walls are inter-tenancy walls which separate individual apartments. The sound insulation of an internal/common wall refers to the ability of a wall system to reduce noise transference between different rooms within a single residence, and the ability of a wall system to reduce noise entering your residence from adjacent residences.

The sound insulation of common walls is a particularly important consideration in the design of apartments as residents have less ability to control noise generating activities of neighbours.

The acoustic terminology used in this fact sheet is explained in *Fact Sheet 11: Acoustic Terminology*.

### Key Considerations

When designing or modifying an interior or common wall, consideration should be given to the required reduction of noise from adjoining rooms or areas, and its integration with other building elements.

### Noise and Insulation

There is a higher density of living in the inner city which means that there are many people living in apartments or townhouses with common walls. Noise from activity in adjacent apartments can adversely affect the amenity of residents. To effectively reduce internal noise transfer to adjacent apartments and maintain the amenity of the resident, it is important for the walls to be designed properly.

Wall design is principally concerned with ensuring high acoustic and thermal performance for minimal thickness, minimal weight and minimal cost. To meet these requirements simultaneously, close attention to design is required.

When designing a wall to reduce noise, consider the sounds likely to travel between your apartment and adjoining dwellings, or between rooms in your residence. This is particularly important when choosing walls of noise sensitive areas such as bedrooms or studies, or noise generating areas such as living rooms or laundries. Issues to consider include:

- Will the sounds be loud?
- Will they occur while a noise sensitive room is being used?
- Will noise from a home theatre or appliances affect the use of sensitive areas such as bedrooms or studies?

The Building Code of Australia (BCA) has set particular requirements for the sound insulation of common walls. Common walls must be of discontinuous construction if they bound a wet area such as kitchen, bathroom or laundry, and a habitable room in an adjoining dwelling. The BCA does not set requirements for walls within a residence. It is important to consider your expectations regarding noise when choosing materials for walls for your residence.

The ability of a wall to reduce noise is dependent on the following elements:

- Type of construction;
- Materials; and
- Insulation.

If you are considering any sound insulation, City of Adelaide recommends you verify any sound insulation specifications with your developer and/or employ the services of an acoustic consultant to ensure the proposed changes provide significant noise reduction.

## Integration with Other Building Elements and Thermal Considerations

Construction for noise reduction should be considered alongside thermal insulation requirements and the nature of the local environment. Keep the age of the building in mind when refurbishing, as older buildings were subject to lower acoustic standards.

It is important to consider the acoustic construction of other building elements connecting with a wall system. To achieve maximum performance with minimal thickness, weight and cost, close attention to design is required.

## General Acoustic Design

When choosing a system to reduce noise, you should consider:

- Materials;
- General construction; and
- Best practice design.

## Materials

### Stud and Masonry Walls

The type of material used plays a major role in the sound insulation properties of a wall.

Generally, masonry construction has better insulation capabilities for airborne noise. However, for structure-borne sounds such as plumbing, or noise from washing machines and dryers, it is sometimes best to use a combination of masonry and stud to achieve the desired result.

Stud walls can equal or outperform the level of noise insulation provided by masonry walls at a fraction of the weight if they are constructed correctly.

Some particular systems can achieve very high levels of sound insulation with small footprints.

### Blockwork Walls

Blockwork walls perform reliably if they are well constructed and of adequate mass. Plastering can improve the noise insulation of blockwork which can otherwise be compromised by fissures and movement cracks.

Lightweight thermal block,  $350 - 700 \text{ kg/m}^3$ , has poor noise insulation properties compared with masonry. The best blockwork is  $2000 \text{ kg/m}^3$  solid, no-voids, dense, concrete masonry, with a thickness greater than or equal to 120 mm.

### Brickwork Walls

Brickwork is usually better than blockwork. The smaller units can be built more precisely, resulting in less cracking due to movement. The heaviest construction ( $2300 \text{ kg/m}^3$ ) can be achieved using solid engineering bricks.

### Stud Partitions

With care, lightweight construction can outperform masonry mass-for-mass. It is possible to achieve better performance with less wall thickness. It is desirable to have minimal wall thickness as it increases the useable and lettable floor area. In plasterboard partitions, metal studding has largely replaced timber studding. Metal studs provide better noise insulation as the leaves are more resiliently coupled. Care must be taken to ensure the cavity in a stud wall is not too narrow. If it is, low frequency resonance in the partition can have a negative effect on noise reduction.

### Plasterboard Lining

Increasing the thickness of the plasterboard lining for walls may also increase the noise insulation of the system. The thickness of the plasterboard lining may be increased by increasing the number of layers of plasterboard used or by simply using thicker plasterboard.

Additionally, fire-rated or sound-rated plasterboard may increase the noise insulation of a system.

### Insulation

The insulation inside a wall cavity also plays a role in reducing noise transmission through the wall. Generally, thicker insulation will contribute to improved noise reduction. Density is also important and fibrous materials such as glassfibre, polyester batts and rockwool should have a minimum density of  $14 \text{ kg/m}^3$ .

Increasing the size of a cavity allows thicker acoustic insulation to be installed, achieving an increased level of noise insulation. There are proprietary insulation systems and materials available for walls. When choosing insulation, you should also consider any thermal requirements.



Installing wall insulation  
Source: CertainTeed Pty Ltd



### Folding Doors and Partitions

Folding doors and partitions should be avoided when a high level of noise insulation is required. Typically, they will provide the same level of insulation as that of a standard hollow-core door. Improved insulation can be gained by using thicker acoustic-rated panels in conjunction with acoustic seals.

Folding panels are better than concertina types. The best assemblies will have high quality acoustic seals and a locking mechanism to ensure correct sealing.

As with other door assemblies, the composition of the panels and seals around the head, foot and jamb are critical, to ensure an acceptable level of noise insulation.

When considering the use of an acoustic door or partition for a European style laundry or a kitchen area, be sure to consult the manufacturer regarding the required ventilation for your appliances.

### General Construction

#### Wall Construction

There are two main construction techniques for walls:

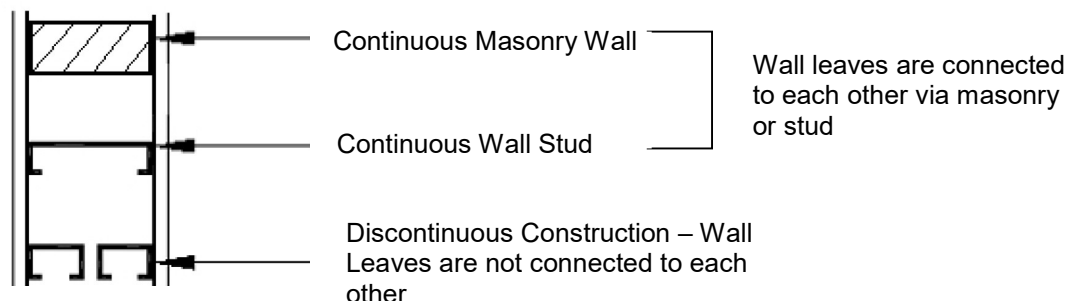
##### Continuous construction

Continuous construction is where the wall components are mechanically connected such as single brick or single stud.

##### Discontinuous construction

Discontinuous construction is where the two leaves of the wall are not connected by any means except at the periphery.

Discontinuous construction is defined such that walls are to have a minimum 20 mm gap between separate leaves. Cavity masonry walls are to have resilient wall ties or no wall ties. For other walls there are to be no linkages between wall leaves except at the wall periphery. A staggered stud wall is not deemed to be discontinuous.



Wall Construction – Continuous vs. Discontinuous  
Source: ABCB Document: Guideline on Sound Insulation

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Discontinuous wall construction is good in controlling structure borne noise which can be associated with such things as plumbing and externally mounted air conditioning units. Generally, external walls or common walls requiring acoustic insulation against structure-borne noise are constructed as discontinuous.

## Air Gaps

The larger the air cavity between the wall leaves, the more noise the wall system can reduce. This concept is similar as with other building elements such as double glazed windows.

The minimum cavity in dual layer walls which is acoustically beneficial is 50 mm. Wider cavities will improve low frequency performance, which provides better insulation against noise from sound systems and home theatres. Increasing the size of a cavity also allows thicker acoustic insulation to be installed, achieving an increased level of noise insulation.

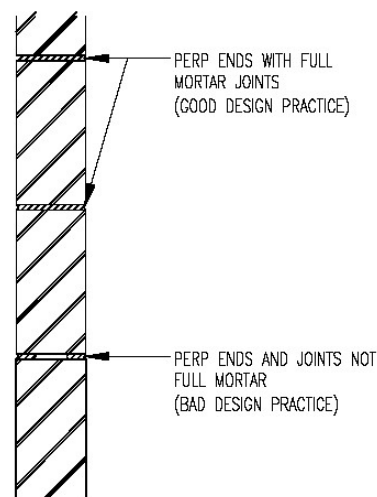
It is important to remember that impact-rated or discontinuous walls require more attention to detail to ensure the desired result is achieved. It is possible to compromise the acoustic performance of a wall system through carelessness, such as leaving debris inside a wall cavity, or connecting the leaves of a discontinuous wall by ties or services. This can reduce the noise reduction characteristics of a wall.

## Material Thickness and Insulation

The acoustic performance of these systems can be improved by employing either thicker/heavier wall systems, or systems with larger cavities and moderate cladding thickness. To save weight, some heavy single-leaf wall systems can be replaced by lightweight constructions using thinner leaves of material combined with insulation-filled cavities.

## Seals and Junctions

An important feature of well constructed walls is properly sealed junctions which aid in the reduction of noise transferred via flanking paths (gaps at the edge of building elements that allow sound to travel through). Even a sound-rated system may not perform adequately if joints and junctions are not properly sealed.



Treatment of joints - Masonry Walls

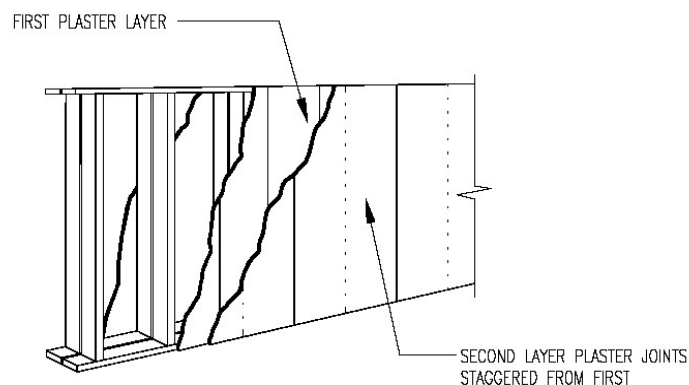
Source: ABCB Document: Guideline on Sound Insulation

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Full-mortar joints should be used when a sound-rated masonry wall system is used.

- The depth of mastic in joints should be sufficient to maintain the acoustic rating of the construction. Typically, the depth of mastic should be equal to or greater than the width of the joint. Suitable backing rods are generally required.
- Joints in dissimilar materials may open up if there is building movement. It is important that the acoustic seal in joints accommodates building movement.
- Insulation considerations should form part of the initial design. Insulation needs to be installed prior to the finishing stages.
- Sheeting joints in dry wall/masonry combination systems should be staggered. Where multiple layers of material are used on walls, the joints should not overlap.



**Optimum Joint Configuration - Dry Wall Sheeting**  
Source: ABCB Document: Guideline on Sound Insulation

## Best Practice

- A well designed wall will use suitably dense and thick materials. Discontinuous construction, an appropriate air gap, cavity insulation and internal sound absorption will also assist in the reduction of noise. To minimise noise transfer through gaps and cracks, the design of a wall should consider all connected building elements.
- If you have a noise problem, achieving a useful improvement in sound insulation requires a decrease of at least five decibels (dB), preferably 10 to 15 dB. An improvement of less than 5 dB is normally not worth the additional expense as the change will only be just perceptible.
- When comparing quotations for sound insulation, look at the noise reduction performance of different options. Remember most products perform better in laboratory conditions than after installation. Ensure the specified noise reduction of the treatment is presented in decibels or a suitable acoustic measurement. Noise reduction figures presented as percentages can be misleading.



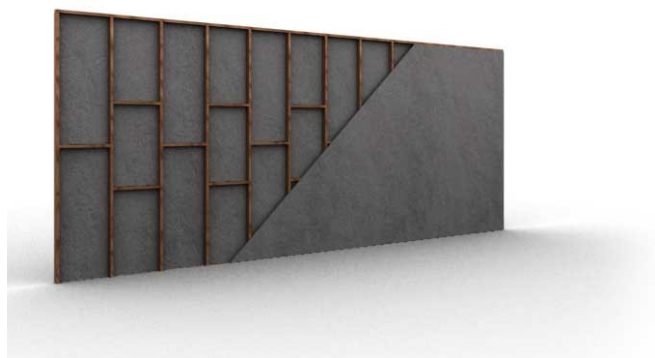
### Examples of Design

This section provides examples of different acoustic treatments for exterior walls. They are provided as examples only and are not exhaustive. City of Adelaide recommends consultation with an acoustic consultant to ensure correct design for your project.

#### Typical timber stud wall (non fire-rated)

- 70 mm x 35 mm timber studs at 600 mm centres;
- 50 mm mineral insulation between studs with a density of 11 kg/m<sup>3</sup>; and
- One layer of 13 mm plasterboard on both sides of the studs.

This construction is suited for internal walls within a house or apartment, but not as a common wall between residences. A typical stud wall, designed with little concern for acoustic design, will have poor airborne and impact sound insulation. The addition of thicker plasterboard or gypsum lining is not very effective in this case, as the noise transfers through the timber stud. Changing to a steel stud, or adding a resilient furring channel to the timber stud will ensure that upgrades such as adding insulation or adding extra layers of plasterboard will be effective.



Source: City of Melbourne/RMIT Fact Sheets

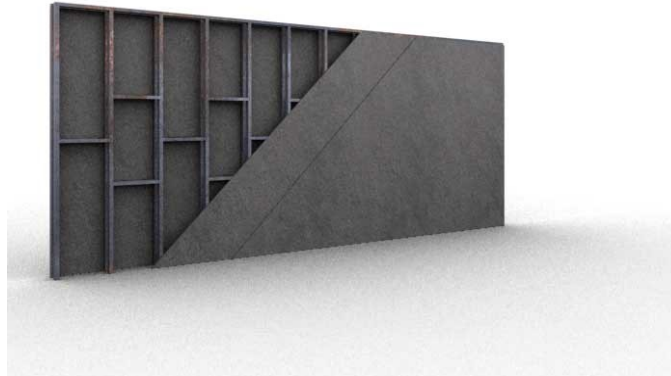
#### Steel framed discontinuous stud wall

This method of wall construction is an example of minimum compliance with the regulations stated in the Building Code of Australia regarding sound insulation for walls between dwellings (common walls). The construction provides insulation against impact noise, airborne noise and bass frequencies generated by stereos and home theatre systems.

- two rows of 64 mm steel studs at 600 centres;
- air gap > 80 mm between the internal faces of the studs, and no mechanical linkage between the two rows of studs;
- 200 mm polyester insulation with a density of 14 kg/m<sup>3</sup> between studs;
- One layer of 13 mm fire-grade plasterboard plus one layer of 13 mm standard plasterboard to one side; and
- One layer of 13 mm fire-grade plasterboard to other side.

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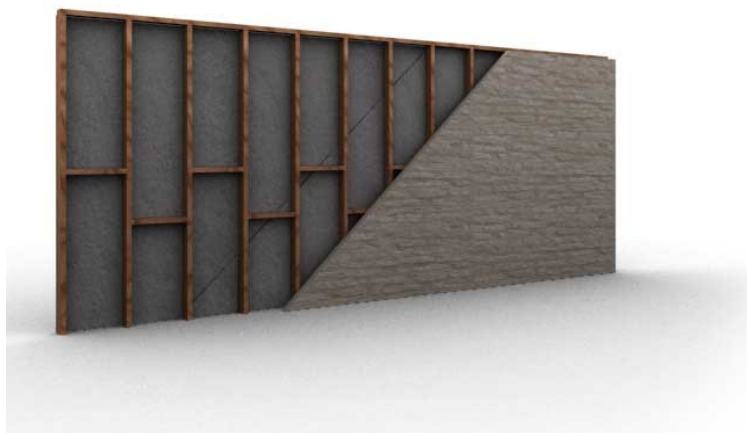


Source: City of Melbourne/RMIT Fact Sheets

## Combination masonry stud wall

This wall construction provides very good sound insulation above the level required to comply with the Building Code of Australia. The width, materials and discontinuous construction in this example provide a good level of impact noise insulation, in particular when the wall is impacted on the stud wall side. Additionally, it will provide good insulation against airborne noise and bass frequencies generated by stereos and home theatre systems. Proprietary wall systems are available to achieve increased levels of sound insulation with a smaller wall width or footprint.

- 90 mm concrete block;
- 120 mm timber or steel studs at 600 mm centres with an air gap > 20 mm between the internal stud face and the concrete block;
- 100 mm polyester insulation with a density of 14 kg/m<sup>3</sup> between studs; and
- Two layers of 16 mm fire-grade plasterboard attached to studs.



Source: City of Melbourne/RMIT Fact Sheets



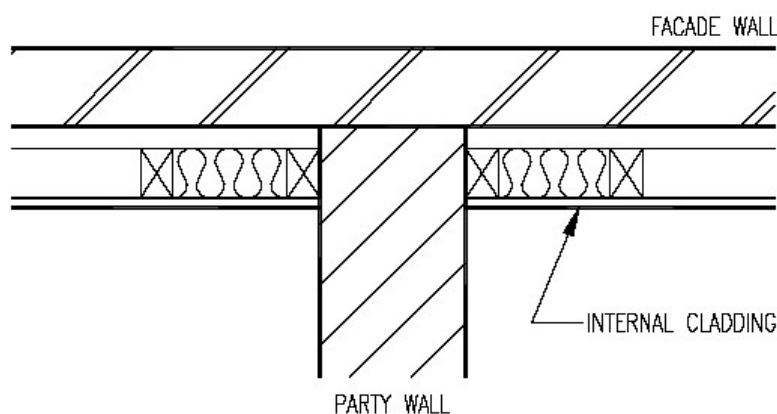
Challenges to good acoustic design of internal or common walls can arise from noise transferred via flanking paths. It is important to minimise flanking through services and penetrations. The impact insulation of a wall may also be compromised by insufficient attention to detail.

Flanking is the transfer of noise through paths around a building element, rather than through the element directly. Flanking can describe the transfer of noise through gaps and cracks in a building element, or via incorrectly sealed junctions between two materials.

These noise flanking paths can defeat noise reduction techniques. For walls, it is essential to consider the design of junctions, including internal detail. Common flanking paths arise because of poor design inside the wall, when the junction of building elements is inadequately detailed.

- Full height walls should not stop short of the slab soffit or roof above; they should extend to the element above and be sealed airtight with a flexible caulking compound or mastic compound.
- There should be no residual gaps around full-height sound-rated walls, especially around roof structure such as rafters and purlins.

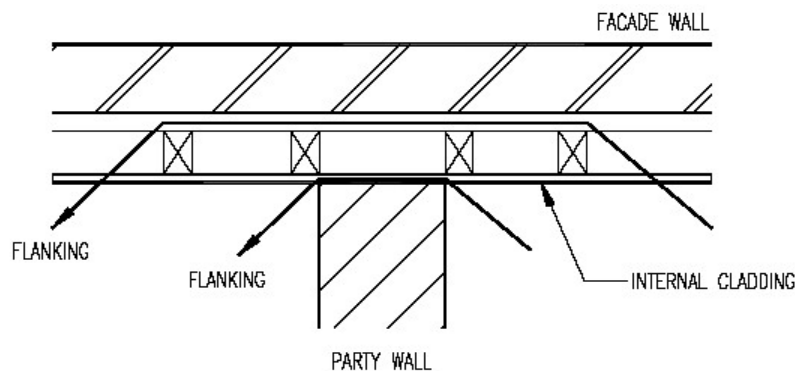
Facade walls can reduce the acoustic performance of common walls by producing a flanking path for noise. Detailed design measures and the use of sound absorption materials may be required to overcome this flanking.



**External Wall Flanking Control – Good Design Practice**  
**Source: ABCB Document: Guideline on Sound Insulation**

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**External Wall Flanking Control – Bad Design Practice**  
Source: ABCB Document: Guideline on Sound Insulation

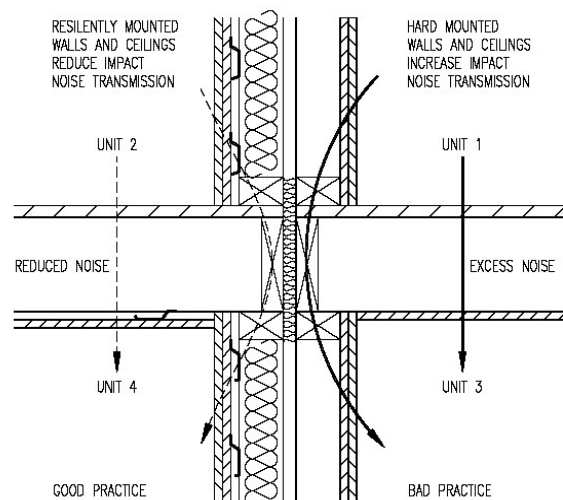
Design measures may need to be applied to the entire facade wall at the time of construction, allowing suitable flexibility for the location of common walls. For instance, common walls should align at structural columns in the facade where possible, and should not be bridged by common air supply grilles or by windows in the facade.

For more information see *Fact Sheet 2: Gaps and Flanking Paths*

## Integration with Floor and Ceiling Systems

The design of a wall system needs to include detail for all connected floor and ceiling systems.

Any full-height wall should be designed and constructed so it does not leave gaps at the ceiling perimeter. In timber constructions, it is good practice to install walls and ceilings on insulation mounts to improve impact insulation between floors.



**Wall and Ceiling Insulation – Timber Construction**  
Source: ABCB Document: Guideline on Sound Insulation

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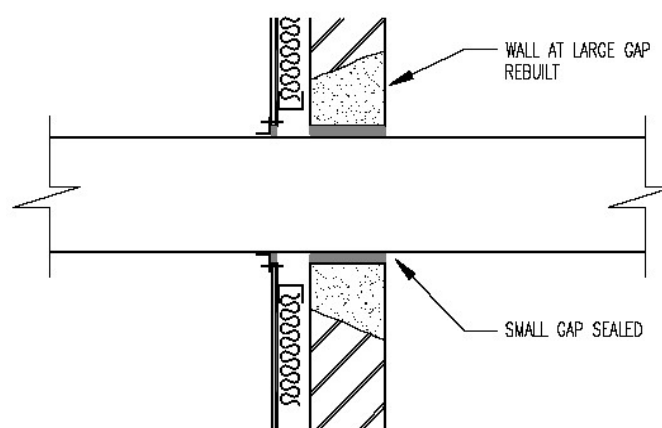
Sealing gaps at the perimeter of floor/ceiling systems is essential, as gaps at the junction of these building elements are a common flanking path, especially in renovated buildings. Gaps at the perimeter of wall and floor/ceiling systems should be sealed and made airtight, using an appropriate mastic compound.

## Services and Penetrations

Design of a wall should consider services and penetrations from other building elements. Penetrations in a system can compromise its acoustic performance and will require extra consideration. Also, it is important not to chase services into masonry or concrete walls.

For wall designs that rely on sound-rated ceilings, detail should be developed to control noise intrusion through ceiling penetrations such as downlights, mechanical ventilation grilles, fire services and ceiling speakers.

- All penetrations in sound-rated building elements should be neatly cut or drilled. Avoid excessively sized penetrations.
- The wall around any large penetration should be rebuilt with the same material. Small residual gaps at penetrations can be sealed with suitable mastic.
- The normal tolerance in building construction should be considered when installing penetrations, and at wall/floor junctions. Revised detailing is needed where residual gaps are too large to allow effective sealing with mastic.
- Gaps around all penetrations in sound-rated walls or ceilings should be treated and sealed to maintain acoustic ratings.
- Sealing should be effective, resilient, resistant to the surrounding environment, and designed to last for the life of the building.



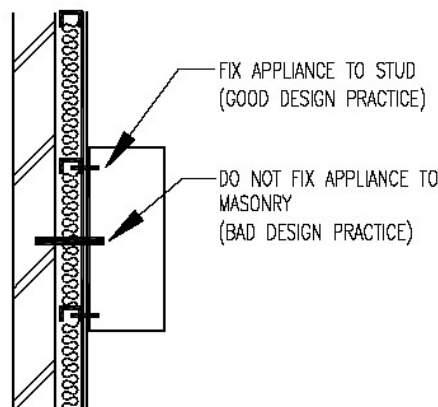
**Treatment of Gaps and Penetrations**  
Source: ABCB Document: Guideline on Sound Insulation



### Compromising Impact Insulation for External Walls

During the construction of a wall, it is important to ensure the desired level of sound insulation is obtained. The performance of a sound-rated wall can be compromised if elements are wrongly connected, or bridged by other wall materials.

- Discontinuity in isolated walls should not be 'bridged' or short-circuited by noggins, battens or packers on dry wall linings.
- There should be no building debris or rubbish left in wall cavities. This material can span the discontinuity, causing bridging or short-circuiting.
- Cupboards, wall furniture, appliances and toilet cisterns should be mounted onto the cladding/supports of the front wall only. Wall elements should not be supported behind a wall discontinuity.
- Insulation should be evenly spaced throughout the entire cavity where needed.



**Mounting of Wall Furniture**

Source: ABCB Document: Guideline on Sound Insulation

Sufficient space should be allowed for the construction of sound-rated walls. Wall furniture should be fixed so it does not bridge vibration insulation elements in walls. This is particularly the case for cupboards, toilet bowls, clothes dryers and other appliances. These should be fixed to drywall cladding or its associated studwork, rather than freestanding masonry or the separate studs forming the discontinuous wall behind the cladding.

### Future Proofing Design

If the acoustic performance of a wall is below expectation or fails, there should be enough space to allow rectification and a further upgrade to the wall.

There are proprietary insulation systems and materials available for walls. It is important to remember that the treatment of walls to reduce noise should be considered alongside thermal insulation, fire proofing and other structural requirements.

### Acoustic Consultant

If you are considering any sound insulation, it is recommended that you verify any sound insulation specifications with your architect/builder and/or employ the services of an acoustic consultant to ensure the proposed changes provide significant noise reduction.

To contact an acoustic consultant visit the Yellow Pages Directory (under Acoustical Consultants) or for an acoustic consultant who is part of the Association of Australian Acoustical Consultants (AAAC) visit [www.aaac.org.au](http://www.aaac.org.au)

### Other Fact Sheets

A number of other Noise Technical Fact Sheets complement the information in this document. These can be downloaded from the City of Adelaide website: [www.cityofadelaide.com.au/noise](http://www.cityofadelaide.com.au/noise)

*Fact Sheet 1: Sound Insulation Guidelines*

*Fact Sheet 2: Gaps and Flanking Paths*

*Fact Sheet 3: Sound Insulation for Windows*

*Fact Sheet 4: Sound Insulation for Glazed Doors and Standard Doors*

*Fact Sheet 5: Sound Insulation for Exterior Walls and Facade Systems*

*Fact Sheet 6: Ventilation*

*Fact Sheet 7: Sound Insulation for Air Conditioners and Other External Mechanical Plant*

*Fact Sheet 8: Sounds in the City*

*Fact Sheet 9: Adelaide City Road Traffic Noise Map*

*Fact Sheet 10: Noise Ready Reckoner*

*Fact Sheet 11: Acoustic Terminology*

*Fact Sheet 12: Frequently Asked Questions*

*Fact Sheet 13: Sound Insulation for Internal/Common Walls*

*Fact Sheet 14: Sound Insulation of Floors*

*Fact Sheet 15: Mechanical Plant for Commercial Buildings*

*Fact Sheet 16: AAAC Star Rating*

### The Building Code of Australia Compliance

The Building Code of Australia (BCA) should be consulted to ensure that any sound insulation upgrades comply with the requirements of the BCA. It should be noted that although the upgrade of a building element may be acoustically beneficial, it may not comply with the requirements of the BCA.

### Australian Building Codes Board

The Noise Technical Fact Sheets contain content sourced from the Building Code of Australia and Guidelines on Sound Insulation, published by the Australian Building Codes Board (ABCB). These documents can be purchased from the ABCB website: [www.abcb.gov.au](http://www.abcb.gov.au)

### Standards

The standards which apply in the Development Plan are:

- Australian/New Zealand Standard 2107:2000 “Acoustics - Recommended design sound levels and reverberation times for building interiors”
- World Health Organisation, Guidelines For Community Noise, Edited by B Berglund et al, 1999) (<http://www.who.int/docstore/peh/noise/guidelines2.html>)
- Recognised liquor licensing noise limits ([www.olgc.sa.gov.au](http://www.olgc.sa.gov.au)). These are modified to apply within bedroom and living areas.

### Contacts / Additional Information

Additional information can be obtained from:

- Australian Association of Acoustic Consultants ([www.aaac.org.au](http://www.aaac.org.au))
- Australian Acoustical Society ([www.acoustics.asn.au](http://www.acoustics.asn.au))
- Office of the Liquor and Gambling Commissioner ([www.olgc.sa.gov.au](http://www.olgc.sa.gov.au))
- South Australian EPA ([www.epa.sa.gov.au/noise.html](http://www.epa.sa.gov.au/noise.html))
- South Australian Police ([www.sapolice.sa.gov.au](http://www.sapolice.sa.gov.au))
- Yellow Pages ([www.yellowpages.com.au](http://www.yellowpages.com.au) search “acoustic”)
- Australian Window Association ([www.awa.org.au](http://www.awa.org.au))



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## Acknowledgements

This project has been developed by City of Adelaide in partnership with Bassett Acoustics.

## Contact Us

For further information call City of Adelaide on (08) 8203 7203 or email [city@cityofadelaide.com.au](mailto:city@cityofadelaide.com.au)

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