

SOUND INSULATION FOR GLAZED DOORS AND STANDARD DOORS

The sound insulation of glazed doors refers to the ability of a closed door to reduce noise entering your residence.

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

Key Issues and Considerations

When designing or modifying an external door, consideration should be given to the reduction of outside noise. Construction that reduces the ingress of external noise must be designed to ensure that it is integral with all other Building Rule requirements such as Energy Efficiency. If you are concerned about noise where you live, or are planning to renovate or purchase a house or apartment, you should consider the sound insulation of doors in your residence.

Doors will provide an acoustic weakness to the external facade of a building as noise is transferred more easily through them than through the external walls. Improving the sound insulation of doors will help to reduce external noise ingress.

Noise and Insulation

The Building Code of Australia (BCA) does not have sound insulation requirements for doors that open to the outside. Accordingly, it is important to consider your expectations regarding noise when choosing doors for your residence.

The wide range of activity in the inner city generates higher levels of external noise than in suburban areas. Noise from activity such as traffic, people on the street, operational commercial sites and waste collection can adversely affect the amenity of those living in the City. As low frequency noise is particularly invasive, reducing the impact of noise from truck engines, buses, music etc may need to be considered. To effectively lower the amount of external noise that enters a building and subsequently maintain the amenity of an inner city residence, particular attention to the construction detail of the doors is required. Generally, the sound insulation properties of a door depend on the door's composition and its seals.

If you are considering any sound insulation, it is recommended 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.

Other Performance Considerations

The design of doors to reduce noise should be considered alongside thermal insulation requirements and the local environment. Consideration should also be given to other requirements such as vermin-proofing, and resistance to fire, smoke, chemicals, weather and dust.

Glazed Doors

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

- frame design;
- glazing;
- composition of glass pane type; and
- seals.

Effect of Distance: The more distant the noise source, the lower the noise level. If you situate balconies away from a noise source, you can expect lower levels of noise.

Effect of Height: On higher floors in a building, the street noise level is expected to decrease.

General Acoustic Design of Glazed Doors

When choosing a glazed door to reduce noise, you should consider:

- materials,
- general construction, and
- best practice design.

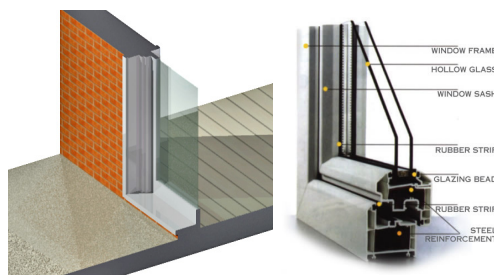
Materials

Frame

There are several different materials commonly used for glazed door frames, however, the type of material does not usually have a significant influence on noise reduction properties. The installation of perimeter door seals is critical to the reduction of noise transfer via door frames.

The door frame should be well sealed between the frame and the supporting wall as sound can flank around the frame when not properly fitted. This also improves thermal efficiency and prevents moisture ingress.

Hinged doors are preferred to sliding doors as they are able to achieve a positive compression seal between the door and the frame. There are proprietary framing systems that provide improved acoustic performance.



Door glazing - an example of single and double glazed frames
Source: Titane Pty Ltd

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Source: City of Melbourne's City Sounds2 Noise Fact Sheets
Glazed doors - an example of sliding and hinged type glazed frames

Glazing

There are a number of glazing options available:

- *Single glazing* is the use of a single pane of glass in a window.
- *Double glazing* is the use of two panes of glass in a window separated with a spacer.
- *Secondary glazing or retrofit double glazing* is the use of two separate single glazed doors, where a second single pane is retrofitted to the inside of the existing exterior door to effectively double glaze the system.

There is no single best method as each residence and situation is different. For example, the heritage status of a property or body corporate requirements may limit changes you can make to external doors, restricting options. Checking these factors and employing an acoustic consultant will guide you in selecting the best option for your residence.

Glass Pane Type

For single glazed doors, after appropriate sealing, the thickness of glass used is the major factor influencing the passage of sound after the seals. Typically, thicker glass offers better sound insulation than thinner glass, particularly when the major problem is low frequency noise such as truck engine or music noise. Toughened, coated, wired and patterned glass types behave acoustically the same as standard float glass.

Laminated glass performs slightly better than other types of glass when the major problem is high frequency noise such as freeway traffic noise. The improvement is due to a PVB (polyvinyl butyral) interlayer that helps to reduce the passage of sound at high frequencies. This layer is sandwiched between two panes of glass. However, laminated glass offers little improvement over other glass of the same thickness when the main problem is low frequency noise.

Laminated glass can also offer a thermal protection layer that can significantly improve energy efficiency. Thick PVB laminated glass in conjunction with tight seals and a well manufactured and installed frame system ensures a good level of sound insulation.

General Construction

Distance between Glass Panes in Double or Secondary Glazing Systems

In most cases, the larger the air cavity between glass panes in double glazed systems, the more noise the window system can reduce. All air gaps must be sealed to ensure the glazed door achieves maximum noise reduction.

Small air gaps between panes of glass can provide good thermal insulation properties but only offer minimal acoustic insulation. To achieve good thermal insulation double glazed systems should have an air gap of about 12mm between each pane of glass, whereas to achieve good acoustic insulation the air gap should be between 50mm and 150mm. It is important to distinguish between thermal and acoustic insulation as some glazing suppliers may not specialise in both areas.

Seals

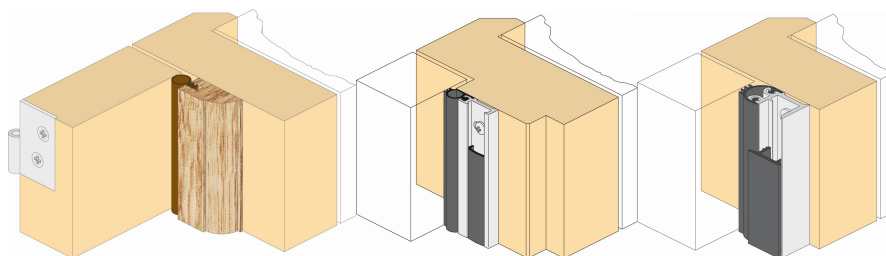
As with all building structures, cracks enable sound to enter a building. These noise *flanking paths* can defeat noise reduction techniques. This is of particular concern for doors. Even doors with good weather stripping can have compromised noise reduction due to air leakage.

Glazed doors should have acoustic seals around the head, jamb and foot to reduce flanking. Hinged doors are preferred to sliding doors as they are able to achieve a positive compression seal.

*Note: acoustic seals only provide suitable performance if they are properly fitted. Seals should be selected on their performance and simplicity of use, and they should be low maintenance and have a long life. Solid seals are more acoustically effective than brush type seals in sealing any gaps around the perimeter of the door.

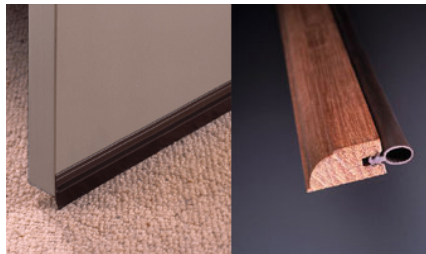
Test Your Existing Door Seals

- Before you purchase new doors, consider fixing or installing seals on your existing doors. This could achieve the noise reduction you want.
- Seal any gaps around doors with plasticine, or an equivalent malleable, but weighty substance.
- Consider the improvements for several days and nights.
- If improvements are sufficient, sealing devices can be fitted which will allow doors to open, whilst maximising noise reduction when closed.
- The tighter a door closes the better the noise reduction.



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Sealing door frames for noise reduction - Examples of rubber seals
Source: Images Courtesy of Raven Pty Ltd

Installation

Correct installation is an important aspect of door treatment. Consult a reputable tradesperson when arranging installation.

Best Practice

- Frames should be well sealed internally and externally to provide acoustic, thermal and moisture protection. Hinged doors are preferred to sliding doors as they are able to achieve a positive compression seal. Consider the kind of noise you are trying to reduce when choosing a glazing system. There are several proprietary framing systems that provide improved acoustic performance.
- 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.
- If you are comparing quotations for sound insulation, look at the noise reduction performance of different options. Remember that most products perform better in laboratory conditions than in final installation. Ensure the specified noise reduction of the treatment is presented in decibels or a suitable acoustic measurement.

Examples of Design

This section provides examples of different acoustic treatments for glazed door types. They are provided as examples only and are by no means exhaustive. Consultation with an acoustic consultant is recommended to ensure correct design for your project.

Single Glazing

Single glazing in non-sealed frame:

- 6mm float glass set in a non-sealed timber frame.

This is the construction of standard glazed doors. It is usually sufficient for residences where there is minimal external noise. This type of glazing generally does not have good airborne sound insulation (R_w 15 – 20) as the glazing perimeter is not sealed and due to the use of thin standard glass. The acoustic performance of single glazing can be improved by replacing the pane with thicker and/or PVB laminated glass with and installing high quality perimeter seals (see improved treatment).



Source: City of Melbourne's City Sounds2 Noise Fact Sheets.

Single glazing with acoustic seals:

- 6mm or 10mm glass set in sealed metal or timber frame.

The use of high quality seals around the door frame reduces flanking around the edges of the glazing. This increases the sound insulation of the glazed door system (R_w 30 – 33).

Single laminated glazing with acoustic seals:

- 12.38mm PVB laminated glass set in sealed metal or timber frame.

Laminated glass performs slightly better than ordinary glass due to a PVB interlayer that helps reduce the passage of sound, but only at high frequencies. In most cases, thick laminated glass in conjunction with tight seals and a well manufactured and installed frame system ensures a good level of sound insulation (R_w 33 – 36).

Hinged doors are preferred as they are able to achieve a positive compression seal on closure. The quality of the seals is the most important component of a glazed door.



Source: City of Melbourne's City Sounds2 Noise Fact Sheets.

Secondary Glazing (retrofit double glazing)

Secondary glazing with acoustic seals:

A second pane can be retrofitted to the interior of a sliding door; the fitted secondary sliding door will slide across to allow the door to open.

- 6.38mm - 12.38mm PVB laminated glass set in a sealed metal frame with a minimum 100 mm air gap to original glazing; or
- 4.50mm - 10mm optical grade acrylic set in a sealed metal frame with a minimum 100mm air gap to original glazing.

The installation of an additional glazed pane retrofitted to the existing glazing can significantly improve sound insulation.

The improvement on noise reduction depends on the:

- thickness of the original glazing;
- thickness and type of the additional pane;
- distance between the panes; and
- effectiveness of the perimeter window seals.

With high quality acoustic seals, the airborne sound insulation of this type of window is good (R_w up to 40).



Example for secondary glazing for sliding glazed doors.
Source: Magnetite

Challenges

Low Frequency Noise

Low frequency noise is usually generated by music or heavy vehicles and it is more difficult to control and reduce than high frequency noise. Where low frequency noise is of concern, the overall design of a glazed door may need to be evaluated by an acoustic consultant as standard glazing may not achieve the quality of noise insulation expected.

Standard double glazing (e.g. 6mm glazing – 50mm air gap – 6mm glazing) is often ineffective at significantly reducing low frequency noise. The reduction of low frequency noise depends on the glazing thickness and the air gap between panes. A single, thick (10 – 12mm) pane of glass may be more effective in reducing low frequency noise than standard double glazing systems. For low frequency noise, laminated glass is no better than float or toughened glass.

Standard Doors

General Acoustic Design of Doors

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

- door composition;
- the type of seals used; and
- best practice design.

Door Composition

There are two main door types:

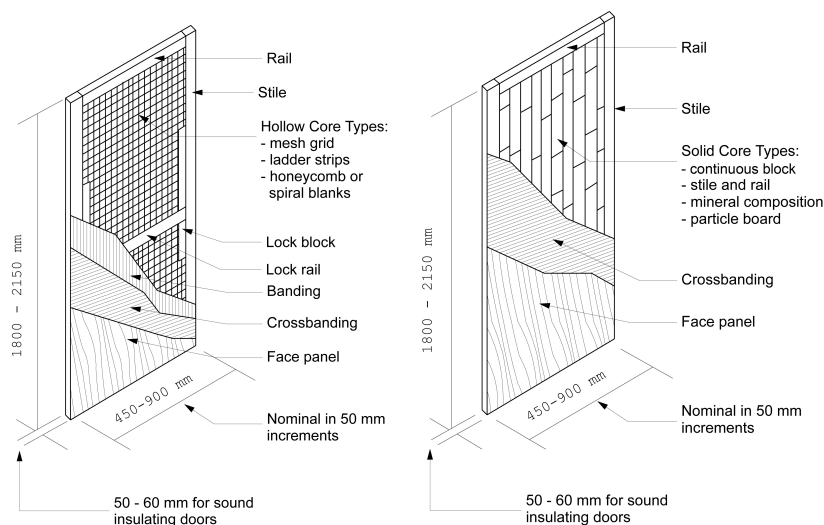
Hollow Core

Hollow core doors are lightweight, and are primarily for interior use. They have little inherent acoustic or thermal insulation properties. Generally, hollow cores are limited to a mesh grid, ladder strips or honeycomb/spiral blanks.

Solid Core

Solid core doors are primarily for exterior use, and wherever increased sound, fire or thermal insulation is required. Generally, solid cores comprise of continuous block, stile and rail, mineral composition or particleboard. Using a damping compound in the core, along with special stops, gaskets and thresholds at the perimeter can increase the sound insulation properties of a door. There are a number of core types and surface treatments, such as steel lining or copper shielding that can also increase acoustic performance.

When installing sound-rated doors in stud wall construction, a structural steel subframe is bolted to the floor and the underside of the floor above. This holds firm the door-set, as standard metal studs allow too much flexing.



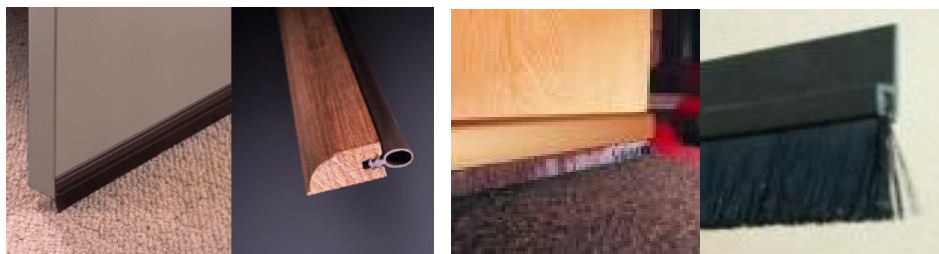
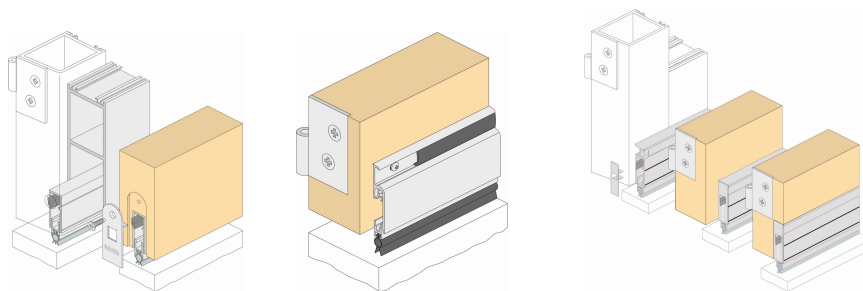
Door Construction – Hollow versus Solid Core
Source: City of Melbourne's City Sounds2 Noise Fact Sheets.

Door Seals

Installing sound-rated doors with acoustic seals should provide the necessary acoustic insulation to reduce external noise. The use of perimeter seals for doors reduces the potential for flanking noise through gaps around the door frame.

*Note: acoustic seals only provide suitable performance if they are properly fitted. Seals should be selected on their performance and simplicity of use, and they should be low maintenance and have a long life. Solid seals are more acoustically effective than brush type seals in sealing any gaps around the perimeter of the door. Air grilles should not be used in sound-rated doors.

Consideration should be given to other seal performance requirements such as vermin-proofing, and resistance to fire, smoke, chemicals, weather and dust when selecting appropriate perimeter seals.



Sealing frames for noise reduction - brush versus rubber seals
Source: Images courtesy of Raven Pty Ltd

Best Practice

- Door frames should be well sealed. A solid core door with correctly installed seals will provide a good level of sound insulation. However, this will still be typically less than the building façade.
- 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.
- If you are comparing quotations for sound insulation, look at the noise reduction performance of different options. Remember most products perform better in laboratory conditions than in final installation. Ensure the specified noise reduction of the treatment is presented in decibels or a suitable acoustic measurement.

Examples of Design

This section provides examples of different acoustic treatments for doors. They are provided as examples only and are by no means exhaustive. Consultation with an acoustic consultant is recommended to ensure correct design for your project.

Hollow Core Doors

- 45mm hollow core plywood door set in a non-sealed frame.

Generally this is the construction of standard interior doors and is not used for exterior doors. This type of door generally does not have good airborne sound insulation (R_w 15 – 20) as the door perimeter is not sealed and due to the use of a non-insulated hollow core door. The acoustic performance of the door can be improved by sealing the frame perimeter, and/or installing damping compound in the core, or a metal lining to the exterior faces.



Source: City of Melbourne's City Sounds2 Noise Fact Sheets.

Solid Core Doors with Acoustic Seals

- 40mm to 45mm solid core timber door set in sealed frame.

In most cases, a thick solid core, in conjunction with well manufactured and installed perimeter seals, will ensure a good level of sound insulation (R_w 30 – 33).



Source: City of Melbourne's City Sounds2 Noise Fact Sheets.

Acoustic Proprietary Doors

To achieve an acoustic rating higher than R_w 33, an acoustic proprietary door is normally required. These doors are very costly and the subjective level of noise reduction may not be worth the expense.

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

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

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

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

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Acknowledgements

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Contact Us

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