Noise control

Noise can interfere with sleep, rest and conversation and cause fatigue, irritability, headaches and stress. We all need to contain and reduce noise in order to enjoy a healthy life. Thoughtful design and practice can reduce the impact of noise on our lives and improve the quality of our living environment.

NEIGHBOURHOOD NOISE

Common sources of neighbourhood noise include:

> Road, rail and aircraft traffic.

> Air conditioners, refrigeration units.

> TVs and stereos.

> Burglar and car alarms.

> Household appliances.

> Dogs and other animals.

> Industrial premises and backyard workshops.

> Music from houses, commercial premises and concerts.

> Road and building maintenance and construction.

Sound pressure level is measured in decibels (dB) and some typical values are given below.

SOUND LEVEL (dB)	PERCEPTION EXAMPLE
120	Extreme jet take off at 100 m
110	Pop group
100	Loud car horn
90	Very loud heavy traffic
80	Noisy office
70	Loud busy street
60	Average office
50	Noisy normal conversation
40	Moderate quiet office
30	Quiet conversation
20	Quiet room
10	Very faint normal breathing
0	Threshold of hearing

Communities usually agree about what noise volumes are acceptable and what are not but there are several subjective elements that determine our response to noise. Our perception of noise is affected by subjective factors. These include the type of noise, our mood, the time of day, background noise levels and our expectations.

OPTIONS TO REDUCE NOISE

Recognising these subjective factors helps us determine when others are creating noise unfairly and how to respond. If neighbourhood noise is a genuine problem for you there are some actions you can take:

> Choose a quiet neighbourhood.

> Reduce the noise by talking it over with whoever is causing the problem, or by lodging a complaint.

> Block the noise with barriers, sound absorbent materials and appropriate home design.

> Minimise your own contribution to neighbourhood noise.

> Carry out noisy activities during the day.

> Inform your neighbours whenever you need to generate noise, such as a party at home.

> Design your home to minimise noise transfer to your neighbours.

TRAFFIC NOISE

For most Australians road noise is the most important neighbourhood noise issue as it affects a high proportion of the population, and the problem is growing as traffic levels increase. [See: 2.6 Transport]

Minimise the impact of traffic noise on your home – and your contribution to the problem:

> Cycle or walk, rather than drive.

> Buy a quiet car, and drive it less.

> Drive slowly and calmly and maintain your car.

> Shop locally and buy locally made products to reduce freight travel.

> Report noisy vehicles.

Work with your neighbourhood, local council, community organisations and government to create more livable communities with reduced traffic noise. Central to this is the creation of urban villages based on public transport, walking, cycling, traffic calming and other traffic reduction initiatives. [See: 2.6 Transport]

Surveys show that noise is an important environmental concern for most Australians. Many people complain that traffic noise has the greatest direct impact.

NOISE IN BUILDINGS

Non-traffic related noise complaints are rising, particularly in medium and high density housing areas. Many new medium and high density developments are unnecessarily noisy.

It can be very difficult or expensive to do anything about a noise nuisance after a house is built or purchased. Consider potential noise problems before you buy, build or renovate.

Ask for design specifications for noise levels before buying a multi residential unit and ask your solicitor to link them to your contract as a performance measure. This will give you more options if you discover a problem after moving in.

Part 3.8.6 of BCA Volume Two contains sound insulation requirements and technical solutions for separating walls and floors for single dwellings.

The following design sound levels are recommended for an inner suburban house.

Recommended design levels

(dB) ACTIVITY	SATISFACTORY	MAXIMUM
Recreation areas	35	40
Bedrooms	30	35
Work areas	35	40

From Table 1 AS 2107

TYPES OF NOISE

There are two types of building noise to consider:

1. Airborne noise

Airborne noise comes from common sound sources such as voices, TVs and radios. The noise performance of a building system is called the Sound Transmission Class (STC). The higher the STC the better the system is at isolating airborne noise. An STC rating of 45 means that the element reduces the sound passing through it by 45dB.

Rooms with a lot of hard surfaces can be very noisy as they readily reflect sound. Soft furnishings, drapes and rugs can make a significant improvement.

A change of 3 STC (or dB) in the sound level means a doubling or halving of the sound energy. As the human ear does not perceive sound in a linear way, a 3dB change is barely perceptible. The table below shows the subjective perception of sound energy.

REDUCTION IN dB	%	REDUCTION IN SOUND ENERGY SUBJECTIVE PERCEPTION
3	50	Barely perceptible
4-5	70	Significant
6	75	Sound appears to be reduced by about 1/4
7-9	87	Major reduction
10	90	Sound appears to be less than half original

The table below outlines what this means in practice for building elements.

STC	EFFECT ON SPEECH PERCEPTION
25	Normal speech can be heard easily
30	Loud speech can be heard easily
35	Loud speech can be heard but not understood
42	Loud speech heard as murmur
45	Must strain to hear loud speech
48	Loud speech can be barely heard
53	Loud speech cannot be heard

2. Structure-borne noise

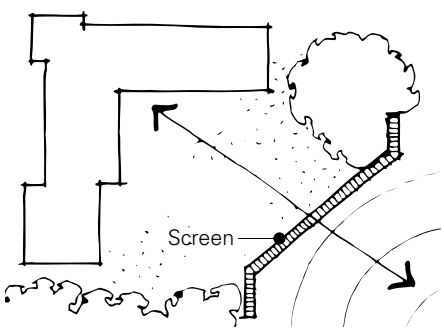
Structure-borne noise, also called impact noise, is produced when part of the building fabric is directly or indirectly impacted. Energy passes through the building structure and creates noise in nearby rooms. Examples are heavy footsteps (particularly on bare timber or tile floors), banging doors, scraping furniture, vibrations from loud music, and plumbing noise. The Impact Insulation Class (IIC) is used to rate the impact noise insulation of floors.

IIC	
45	People walking around are clearly audible
50	People walking around are audible and noticeable
55	People walking around audible but acceptable
62	Walking heard as low frequency thump
70	Heavy walking heard as low frequency thump

NOISE AND GOOD DESIGN

Site planning

Consider noise sources such as shops, hotels, garbage and recycling collection when siting buying or renovating your home.



Place screens such as fences, trees and hedges between the noise source and your home. Place driveways/garages away from bedrooms and living rooms.

Building layout and design

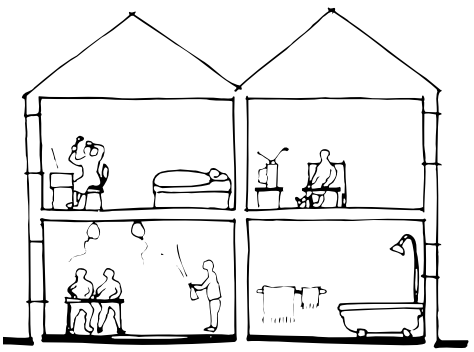
> Locate quiet rooms as far away from noise sources as possible, without compromising passive solar design principles.

> Install windows away from noise sources if possible.

> Locate noisy areas together and away from quiet areas.

> Avoid putting laundries, bathrooms or living rooms next to, above or below bedrooms without adequate sound insulation.

> Accommodate teenagers by providing extra soundproofing for their rooms and locate them away from adult living and sleeping areas, and neighbours.



Noise is a particular problem within medium and high density housing, and special care in design is needed to avoid problems. If people are unable to open windows to keep cool in summer they may need to install mechanical cooling.

> Minimise the need for noisy mechanical cooling.

> Use solid dividing fins between balconies.

> Build units around quiet courtyards and face them away from roads.

> Keep pedestrian and vehicle thoroughfares away from bedrooms and living rooms.

> Avoid placing windows and doors of neighbouring units opposite or adjacent to one another.

Construction

The BCA Building Code of Australia (BCA) specifies the minimum STC wall and floor requirements between adjoining dwellings. The BCA uses a sound reduction index (Rw) which is directly equivalent to STC.

The BCA specifies the minimum required Rw (airborne) + Ctr (impact) sound values for separating wall construction in new single dwellings (Class 1 building). For further information please refer to Part 3.8.6 of the Volume Two of the BCA.

Exceeding the minimum specifications is highly recommended, particularly given the trend towards higher density living.

The BCA does not specify IIC, but certain construction types are 'deemed to comply'.

Rw levels in the BCA only consider individual building elements as measured in a laboratory. Sound transmission properties of the structure as a whole or on-site construction practices are not taken into account. These can reduce the effective value by up to 5 Rw due to flanking sound transmission paths.

Good design detail and construction practice is critical to the performance of both heavy and light construction.

Pay attention to elements like floor and ceiling plates and installation of services such as plumbing and power outlets to ensure the desired performance is achieved.

BCA Rw requirements for walls between adjoining dwellings are:

	MINIMUM R_w
Floors above dwellings	50
Walls between a bathroom, laundry or kitchen and a habitable room in adjoining dwelling*	50
Other walls	45

*These walls must also have a satisfactory level of impact insulation as outlined in the code

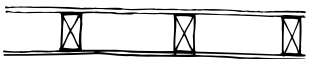
For the BCA minimum requirements for Rw (airborne) + Ctr (impact) sound values for separating wall construction in new single dwellings (Class 1 building) please refer to Table 3.8.6.1 Required Rw airborne and impact sound levels for separating walls.

Although the BCA specifies no sound insulation requirements within dwellings it is important to consider sound transmission in homes now that multiple TVs, stereos and bathrooms are common.

The Rw ratings of some typical wall and floor construction methods are outlined here.

Heavy dense materials, such as concrete, are generally better for sound insulation but a range of lightweight solutions are also available.

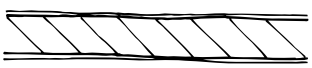
Walls



Rw32. Using 10mm plasterboard on 100 x 50mm timber studs at 450mm centres provides very little sound insulation and is not recommended for occupied rooms.

Rw42. 100mm low density AAC block with 10mm adhered plasterboard both sides.

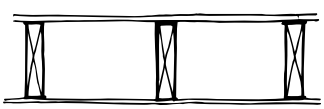
Rw45. 90mm calcium silicate brick with adhered 10mm plasterboard both sides. This complies with the BCA minimum for adjoining dwellings.



Rw50. 90mm solid concrete block with adhered 10mm plasterboard both sides.

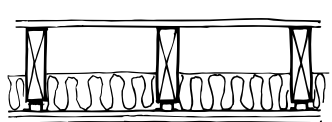
Rw50. 16mm fire protective plasterboard on staggered timber 70 x 45mm studs at 600mm centres both sides with 120 x 35mm timber plates and 50mm glass fibre batts.

Floors

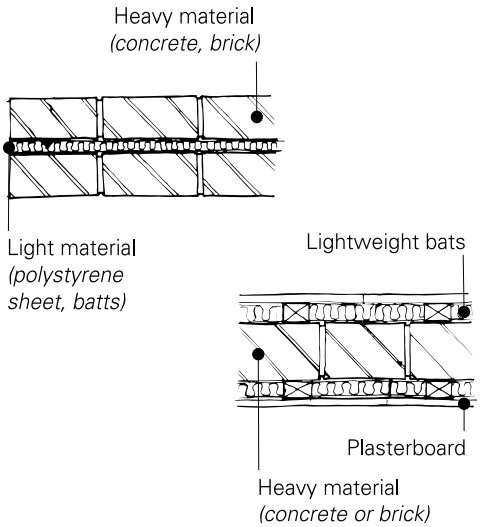


Rw35. Bare 20mm floorboards on 200 x 50mm joists at 450mm centres, with one layer of 13mm plasterboard. This provides very little sound or impact insulation and is not recommended.

Rw48. 150mm concrete slab (365kg/m^2) with 10mm of plaster.



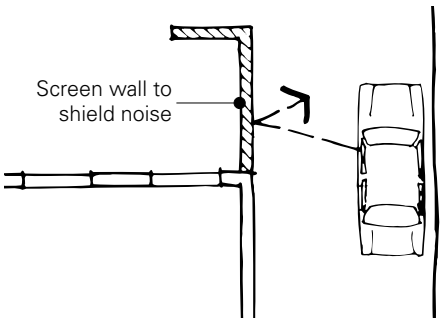
Rw50. IIC 50. Bare 20mm floorboards on 200 x 50mm joists at 450mm centres, with two layers of 16mm fire protective plasterboard on furring channels and resilient mounts, and 100mm batts. Using carpet and underlay will increase the IIC to 70.

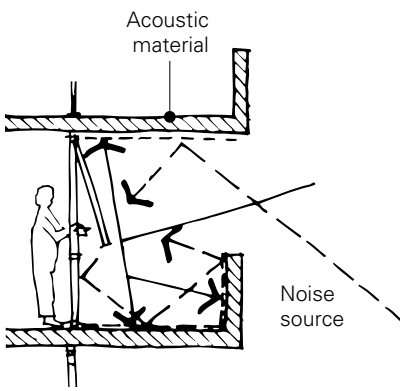


Dense materials will, however, readily transmit impact noise.

Composite construction using combinations of light and heavy mass materials are best to reduce noise transmission.

Airborne noise is easily reflected. Provide screen walls to shield noise and use acoustic materials to reduce noise reflection.





Glass and noise

A 3mm single glazed window has a very low STC, and windows can let in a lot of noise, open or closed. The potential sound reduction from a highly insulating wall can be substantially reduced by poor window design.

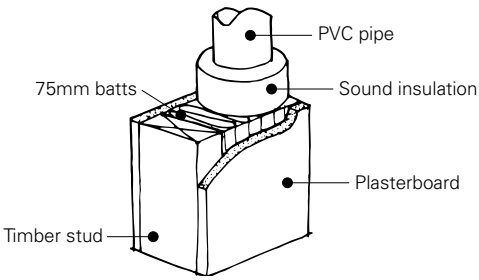
Double glazing and laminated glass are both effective at reducing noise.

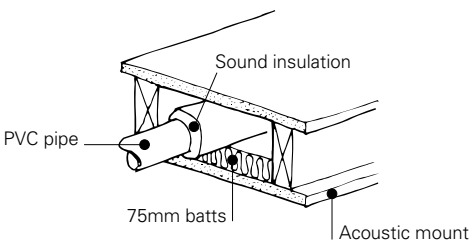
The table below shows the percentage noise reduction compared to 3mm glass. Note that these percentage reductions are not the same as STC values.

VOICE NOISE REDUCTION	%	TRAFFIC NOISE REDUCTION	%
Glazing type (Single)		Glazing type (Single)	
6.38mm laminated	13	6.38mm laminated	24
10mm glass	24	10mm glass	38
10.38mm laminated	29	10.38mm laminated	43
Glazing type (Double)		Glazing type (Double)	
4mm /12mm space /4mm	19	10mm /12mm space/6.38mm laminated	46
10mm /12mm space/6mm	34	6mm /100mm space/4mm	57
6.38mm laminated/8mm space/4mm	46		

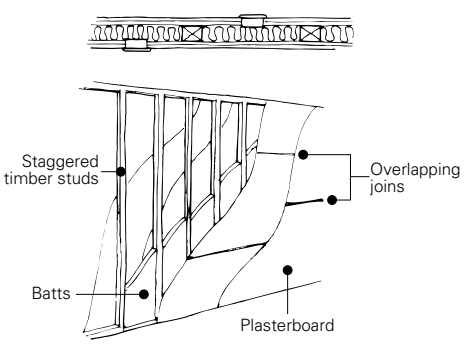
Source Pilkingtons Note: Thicker glass generally does not improve thermal insulation.
For a combination of sound and thermal insulation use double glazing. [See: 4.10 Glazing]

Other noise abatement tips





> Plumbing and waste pipes should not pass close to quiet rooms or should be adequately soundproofed. A range of sound insulation products exist for plumbing and waste pipes in walls and floors.



> Pay special attention to details that might affect the integrity of sound insulation such as power points and plasterboard joints. Power outlets should be offset and placed in different sections of the wall cavity. When using double layers of plasterboard ensure the joints overlap and offset joints on opposite sides of the wall.

> Provide extra sound insulation for noisy rooms such as laundries. Use acoustic mounts or pads for clothes washers and dryers.

> Avoid hard floor surfaces that are above ceilings without good sound insulation. Use cork, carpet or impact absorbing finishes instead of bare timber or tiles.

> Low density coverings such as carpet will have little effect on STC but will greatly reduce both impact noise (increasing the IIC by about 20 points) and internal sound reflection.

> Proprietary noise reduction underlays can be used to increase both STC and IIC ratings of floors. They are ideal for reducing sound transmission on existing floors within a home.

> Use built-in robes as sound buffers between bedrooms.

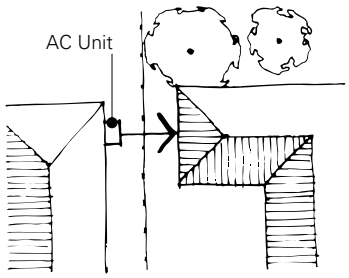
> Solid core doors are more effective sound insulators than hollow core. Use door closers or foam/plastic strips on door frames to stop doors banging.

> Reduce sound reflection transmission through gaps with draught sealing strips.

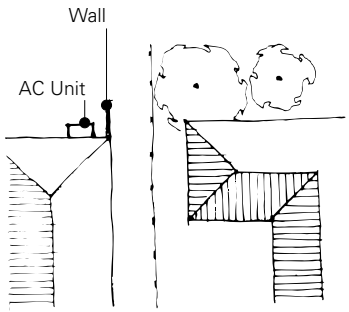
OUTDOOR NOISE SOURCES

> Site noisy areas like swimming pools and outdoor living areas away from neighbour's windows.

> Hard exterior surfaces such as concrete paving reflect sound rather than absorb it. Softer surfaces are more desirable, particularly in higher density housing, as they absorb sound. Permeable surfaces also reduce stormwater run-off. [See: 7.5 Stormwater]



Unsuitable location for air conditioning unit.



Suitable location for air conditioning unit.

> Make sure outdoor noise sources (AC units, pool pumps) are not going to be a nuisance for neighbours. If pumps can't be placed far enough away, build a noise reduction enclosure.

> There are laws governing noisy air conditioners that may annoy neighbours. The best solution is to buy the quietest air conditioner suited to your needs. Install it as far as possible from your neighbour or in a well shielded location. Most air conditioners in Australia have a label that specifies the amount of noise they make. The smaller the number of dBA on the label the quieter the air conditioner. Get specialist advice from the supplier or installer.

ADDITIONAL READING

Contact your State / Territory government or local council for further information on noise control in residential areas.
www.gov.au

Australian Building Codes Board (2007), *Building Codes of Australia Volume 1 and 2*, AGPS Canberra.
www.abcb.gov.au

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