

VENTILATION

Application

This Noise Technical Fact Sheet is for use by applicants who are undertaking a residential development (single or multiple housing and apartments) and require guidance on compliance with the noise provisions within the Adelaide (City) Development Plan and the natural ventilation and energy efficiency air movement requirements of the Building Code of Australia whilst attaining the desired level of acoustic comfort. The Fact Sheet does not address the issues associated with residential areas of Motels and Hotels.

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

Introduction

Ventilation is movement of air, typically between an indoor space and the outside. In an enclosed space ventilation is required to exchange indoor air with outdoor air to replenish oxygen and to remove moisture, odours, smoke, heat, and airborne bacteria.

Ventilation is one of the most important factors for maintaining healthy indoor air quality in a building and the Building Code of Australia (BCA) requires that any occupied room within a residence be ventilated with outdoor air. Methods for ventilating a building may be divided into natural and mechanical types.

Natural ventilation is the ventilation of a building with natural unconditioned outside air without the use of a fan or other mechanical system and is usually achieved with openable windows and doors.

Where natural ventilation is not provided, a room within a building is required by the BCA to be ventilated with outside air by use of a fan or other mechanical system that complies with Australian Standard AS1668.2 - *Mechanical ventilation for acceptable indoor-air quality*. Required mechanical ventilation to apartments must also comply with AS/NZS 3666.1 - *Air-handling and water systems of buildings - Microbial control*. Factors in the design of such systems include the flow rate (which is a function of the fan speed and exhaust vent size) and noise level.

It is important to understand that the provision of mechanical ventilation and air conditioning are not necessarily the same. Air conditioning by use of a split system AC unit does not provide outside air, but conditions the inside air to achieve the required comfort levels (either heating or cooling). A mechanical ventilation system that complies with AS 1668.2 conditions the external air and delivers it to the inside of the building. These systems are more expensive to purchase and will consume more energy.

Where it is necessary to reduce the level of external noise within a building it is necessary to consider all of the Building Code of Australia provisions in conjunction with any proposed method of increasing acoustic performance.

Building Code of Australia Requirements

Adelaide's climate can be described as temperate or Mediterranean and is ideal for the use of naturally cooling breezes in the appropriate seasons, however the internal air is often conditioned (by heating and/or cooling) in the Winter and Summer months to ensure the appropriate levels of comfort for the building's occupants.

Where it is necessary to minimise the ingress of external noise into a habitable room, the use of windows that are fixed closed with sealed airtight edges may be considered, however the requirements of the Building Code of Australia must be met. It may be more appropriate to use opening windows that are sealed when closed thereby giving the occupants choice of ventilation if they require it.

The BCA requirements in more detail state that in a separate dwelling or an apartment, any room occupied by persons require either natural or mechanical ventilation with outdoor air which maintains the air quality. There are different requirements that must be complied with depending on whether natural or mechanical ventilation is used.

Additionally, the BCA has energy requirements which aim to reduce greenhouse gases by the efficient use of energy, and these requirements must be satisfied in conjunction with the ventilation requirements.

In summary:

- ventilation is required to all habitable rooms in apartments or houses, and can be either natural or mechanical;
- cross ventilation in the form of breeze paths is required for all habitable rooms in houses and apartments where there are no ceiling fans or evaporative coolers; and
- where mechanical ventilation is used it must introduce outside air into the apartment or house and if there is no cross ventilation then ceiling fans or evaporative cooling must be provided.

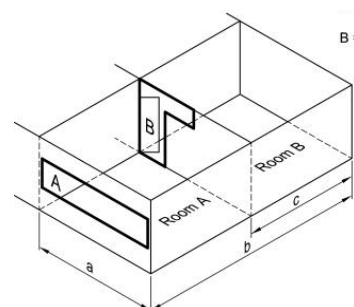
Natural Ventilation

All habitable rooms in houses and apartments must be provided with natural ventilation.

In Adelaide, natural ventilation must consist of permanent openings or openable devices (such as windows and doors) which have an area which is:

- 7.5% of the total floor area when there is no ceiling fan in the room; and
- 5% of the total floor area when there is a ceiling fan in the room.

Generally, the permanent openings must be open to the outside but in some circumstances it may be appropriate to obtain ventilation from another room. If the windows of a habitable room are sealed airtight for sound insulation purposes, natural ventilation must be via an adjacent room.



Source: 2006 Building Code of Australia

Natural Ventilation from another Room

In apartments or townhouses, if ventilation is coming from another room, that room must be within the same sole unit or a common property enclosed verandah.

Where there are no ceiling fans installed and where air is taken from an adjoining room (instead of from outside) the following is required:

- the room requiring ventilation or the adjoining room cannot be a bathroom or toilet;
- the ventilating area of the room being ventilated directly from outside (Room A) must be at least 7.5% of the total floor area of both the ventilated room and the room borrowing ventilation (Room A and Room B); and
- the opening between a room requiring ventilation (Room A) to the other room requiring ventilation (Room B) must be 7.5% of the floor area of the room requiring ventilation (Room A).

Mechanical Ventilation

The BCA states that a mechanical ventilation system that provides ventilation to a building must comply with Australian Standard AS1668.2 - *Mechanical ventilation for acceptable indoor-air quality*.

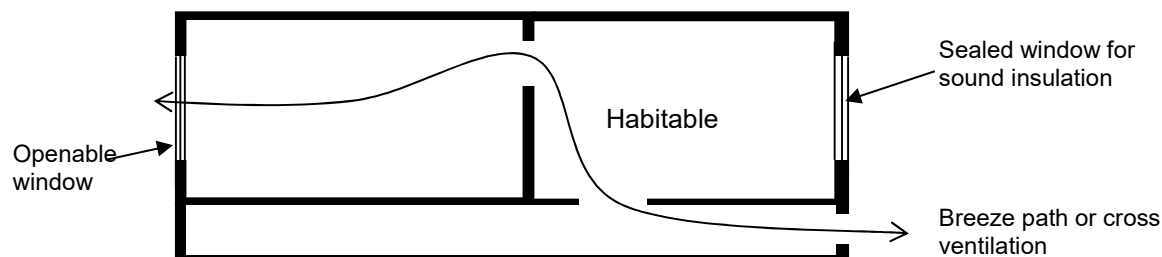
Cross Ventilation

Cross ventilation by way of breeze paths is required in all habitable rooms in:

- houses; and
- apartments where there is no ceiling fan or evaporative cooler.

Cross ventilation requires a ventilation opening in a habitable room to be connected by a breeze path to a ventilation opening in another room. It is possible for a breeze path to traverse through three rooms. To achieve this air must be able to travel from outside through an opening in the first habitable room, then through the second habitable room and finally through a third habitable room to exit to the outside of the building.

The diagram below shows a possible cross ventilation path when the windows of a habitable room are sealed shut. *Note: the length of the path must be no greater than 20m and can only pass through two internal walls.



Design Options

Natural Ventilation Direct from an Outside Opening

Generally, the ventilation requirements are achieved through windows and doors, compliant with the area requirements, openable to outside.

Natural Ventilation from another Enclosed Space

If the windows of one room are fixed and sealed airtight, natural ventilation can be achieved through an opening into another enclosed space with openable windows or doors which are compliant with the BCA area requirements.

Natural Ventilation Direct from Outside and Mechanical Ventilation

This option is a combination of natural ventilation through air vents to outside (or similar) and mechanical ventilation. Mechanical ventilation is required to make up the required outdoor air quantity, as generally, air vents will not provide the required BCA natural ventilation requirement.

A standard air vent will not be appropriate in most situations as it will provide an untreated path for outdoor noise. If air vents are appropriate for an application, acoustically treated air vents should be used to minimise noise ingress into the residence. At this stage, the 'Silenceair' brick vent is the only known available product in Australia which is a passive acoustic ventilator that lets outdoor air inside whilst providing some noise control. The vent can be installed in new buildings or retrofitted into existing buildings. One unit allows for 25m³ of air per hour. For further information see www.silenceair.com

The air flow required for mechanical ventilation to make up the required air quantity is dependant on the quantity of air which is coming through the air vents. See below for mechanical ventilation options.

*Note: As further products are introduced into the market, the Fact Sheet will be updated.

Natural Ventilation Direct from Outside and another Enclosed Space

This option is a combination of different natural ventilation paths; through air vents to outside and from air from another space. Two paths are required to make up the required outdoor air quantity, as generally, air vents will not provide the required BCA natural ventilation requirement.

Again, an acoustic ventilator should be used.

The ventilation areas required to make up the required air quantity is dependant on the quantity of air which is coming through the air vents.

Unconditioned Outdoor Air

Fan

A fan with the flow of mechanically provided outside air that complies with AS 1668.2 and with an acoustically treated path for mechanical noise control to within the ventilated space.

Proprietary Ventilator

At this stage the only mechanical ventilator that attenuates incoming noise available on the market is the 'Aeropac' ventilator by Acoustica. The ventilator can be used to provide filtered fresh air to buildings in locations where windows need to be closed. The ventilator pulls in external air via a fan mounted in acoustic housing and allows for 30 - 130m³ of air per hour. This ventilator has a maximum air quantity of 37.5 L/s, and will be suitable where it complies with the required flow as calculated from AS 1668.2. For further information see www.acoustica.com.au/ventilation.html

Like with natural ventilation, there may be comfort issues using mechanical ventilation which brings in unconditioned outside air as there is no method for temperature and humidity control.

*Note: As further products are introduced into the market, the Fact Sheet will be updated.

Air Conditioning

A reverse cycle air conditioning system can be designed to introduce the required volume of outside air to meet the agreed occupancy.

An evaporative cooling system would supply 100% outside air and therefore would exceed the code requirement.

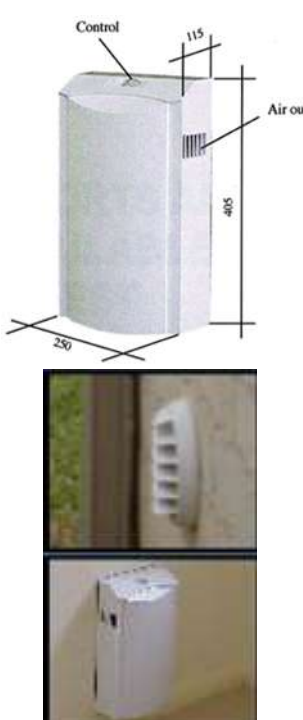
Air conditioning a space would be the preferred option as it will provide controllable comfort for occupants.

Refer to *Fact Sheet 7* for more information on selecting air conditioning for a residence.

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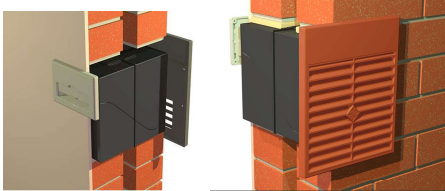

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Acoustic Ventilation Systems for Residential Use

| Products Available in Australia | Features of the Product | Absorption Rate and Air Flow | Advantages/ Disadvantages | Cost (not incl installation) |
|---|---|--|---|--------------------------------|
| <p>Acoustica Aeropac Ventilator</p>  | <p>The AEROPAC Ventilator:-</p> <ul style="list-style-type: none"> is a <u>mechanical</u> ventilator that provides fresh outside air inside; is used to provide filtered fresh air to building occupants in locations where windows need to be closed to avoid noise and unpleasant fumes; pulls external air via a quiet fan mounted in acoustic housing. vents are placed at an angle to the wall provide a constant, draught-free flow of fresh air; uses acoustic insulation to reduce the operational noise of the motor (maximum flow the operating noise rating is 30 dB (A)) | <p>Sound Reduction Standard noise reduction in standard room of 52 -54dB, as reported by Acoustica.</p> <p>Air Flow Allows for 30 - 135 cubic metre of air per hour.</p> | <p>Advantages:</p> <ul style="list-style-type: none"> Vents can be opened or closed; Incorporates an active carbon filter to minimize odours and removes most gaseous pollutants from the air (has absorption properties for aromatic hydrocarbons (derivatives of benzene), potential carcinogens found in car exhaust fumes). Only 8cm hole required in wall for installation <p>Disadvantages</p> <ul style="list-style-type: none"> carbon filter has an anticipated life of about 14-16 months; bulkier than silenceair; and uses energy to operate, although unit is energy efficient | <p>\$698 per unit plus GST</p> |

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| Products Available in Australia | Features of the Product | Absorption Rate and Air Flow | Advantages/ Disadvantages | Cost (not incl installation) |
|---|---|---|---|--------------------------------|
| Silenceair Brick Vent   | <p>The Silenceair brick vent:-</p> <ul style="list-style-type: none"> allows for natural ventilation without compromising noise attenuation; is a brick that can be inserted into buildings to allow the natural passage of air while reducing noise from the outside; is designed for use in buildings located in noise-affected locations; utilises a suite of technologies that use the energy of the soundwaves to reflect and dissipate sound. | <p>Sound Reduction: Removes over 85% of the noise that enters a room through a ventilation opening.</p> <p>Blocks noise in the 500Hz to 2kHz range and can be adjusted according to the frequency of the noise.</p> <p>Air Flow: 1 unit allows for 25 cubic metres of air per hour. 2 units allows for 50 cubic metres of air per hour.</p> | <p>Advantages:</p> <ul style="list-style-type: none"> no energy required; can replace existing vents; size of standard brick home handyman with mid-level skills may install it; minimal visual impact on the room and is discretely hidden in the wall, with only a faceplate showing; faceplates and external louvres exposed to the sun are designed to last a minimum of 20 years; can be incorporated into new work or retrofitted in to existing buildings; and internal louvers can be opened or closed. <p>Disadvantages:</p> <ul style="list-style-type: none"> For natural ventilation to be created, require 'whirly gig' or ceiling fan to create negative pressure and air flow | <p>\$150 per unit plus GST</p> |

*Acoustic Ventilation Systems should be considered as supplementary to BCA requirements for natural ventilation (that requires openings to be between 5% and 7.5% of the floor area of the subject room).

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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