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ACOUSTIC TERMINOLOGY

The following is a glossary of terms used within the Noise Fact Sheets. It includes acoustic terminology, acoustic symbols as well as building and construction terminology.

Acoustic Terminology

Air Borne Noise

Air borne noise is noise that is transferred from one space to another via the air or atmosphere.

Attenuation

Attenuation of noise is the reduction in the intensity or the sound pressure level of sound, which is transmitted from one point to another.

Building Code of Australia - BCA

The Building Code of Australia (BCA) sets minimum standards for design and construction of new homes. The BCA currently set standards for the minimum allowable noise transmission within new homes but does not address external sound insulation.

Flanking

Flanking is the transfer of noise through paths around a building element, rather than through the building element itself. Flanking can describe the transfer of noise through:

- gaps and cracks in a building element;
- incorrectly sealed junctions between two materials; or
- other indirect paths such as air conditioning ducts or ceiling cavities.

These noise flanking paths can defeat noise reduction techniques.

Frequency

All sounds can be described by their frequency or their mix of frequencies. Sounds have a mix of frequencies that are particular to the nature of the sound. Frequency is measured on a scale of Hertz (Hz) (cycles per second).

Higher frequency sound is generated by sources such as tire squeals or speech. Low frequency sound is generated by sources such as music subwoofers or truck engines. Low frequency sound is more difficult to control or reduce than high frequency sound and requires specialised design and construction.

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Impact Noise

Impact noise is typically caused by impact on the walls or floor of an adjoining room.

Typical sources of impact noise are footsteps on the floor above a residence, washing machines and dryers that are incorrectly mounted to a wall and slamming doors on cupboards mounted on a common wall. Impact noise can also be generated in kitchens when washing dishes or banging objects on counters mounted on a common wall.

Impact Isolation

Impact isolation is the ability of a material or construction to stop noise generated by impacts.

The reduction of impact noise normally requires a decoupled or isolated construction such as a floating floor or discontinuous wall.

Sound Absorption

Smooth or hard surfaces in a room tend to reflect high frequency sound. Hard surfaces like concrete and timber can allow sound reflection or reverberation.

Sound absorption is the ability of a material to absorb sound within a room. Sound absorbent materials such as curtains or carpet are commonly used to reduce sound reflections or echoes. Sound absorption can improve the sound quality within a room (see sound reverberation).

Sound absorptive materials are also useful within walls, facades or above suspended ceilings as they help absorb sound within the cavity, reducing noise through the building element. Efficient sound absorbers in cavities are typically made from glass wool, rock wool, polyester fibre, natural wool or cellulose fibre. These materials are often used for sound and thermal insulation.

The ability of a *surface* material to reduce sound reflection (sound absorption) is not the same as its ability to control noise passing through from the adjoining residence above (sound insulation). It is important to make this distinction when choosing materials. High mass, dense and well sealed materials generally offer improved sound insulation but no sound absorption.

Sound Insulation

Sound insulation refers to the ability of a material to stop or reduce the transmission of airborne sound. High mass, dense and well sealed materials generally offer improved sound insulation.

External Sound Insulation refers to the ability of materials to reduce sound transmitting into or from a building. Good external sound insulation is important when designing and constructing the external elements of a building. This includes walls, windows, doors, ventilation and roofing.

Good acoustic design uses a combination of sound insulation (to stop sound transmitting into or from a room) and sound absorption (to reduce sound reflections within a room).

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Sound Power - L_w

Sound power is the measure of sound energy generated or radiated by a noise source per unit of time; it is measured in Watts (W).

Sound Pressure - L_p

Sound pressure is the measure of the level or intensity (loudness) of sound. The practical unit of measurement is decibels (dB). 0 dB is taken as the threshold of human hearing.

Some typical noise sources and their respective sound pressure (noise) levels		
Noise Level (dB)	**Source**	**Subjective Description**
120	Rock Concert	Intolerable
110	Accelerating Motorcycle (at five metres)	
100	Pneumatic Hammer (at two metres)	Very Noisy
90	Loud Factory	
80	Kerbside of Busy Street, Shouting	Noisy
70	Busy Traffic	
60	Department Store, Speech Level	
50	Quiet Restaurant	
40	Residential Area at Night	Quiet
30	Theatre	
20	Rustling of Leaves	Very Quiet
10	Human Breathing (at three metres)	
0	Threshold of Hearing for normal young people	

Source: Bies D.A and Hansen C.H, Engineering Noise Control: Theory and Practice.

Sound Reverberation

A rooms 'liveliness' can be quantified through the measurement of its 'reverberation time'. In layman terms, reverberation is the build up of sound within a room due to multiple reflections from the room's surfaces. The Reverberation Time (RT) is a measure of how long it takes for a burst of sound to decay 60 dB and is given the abbreviation of RT_{60}. A 'lively' room (e.g. a tiled bathroom with lots of hard surfaces) has a long reverberation time, and an acoustically 'dead' room (e.g. a carpeted room with mineral fibre ceiling tiles) has a short reverberation time.

Reverberation control is important as a noise source (also from external sources) will generate greater sound pressure levels in a reverberant space because the sound energy takes longer to decay. Noise in a 'lively' room can in practice be up to approximately 5 - 7 dB(A) louder than in an acoustically dead room. Therefore, it is important when designing 'quiet' spaces that the surface area of sound absorptive finishes be considered.

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Sound Transmission Loss

When sound is incident on a building element, such as a wall or window, some of the sound will be reflected off the element and some will pass through. The sound transmission loss is a measure of the ability of an element to reduce the flow of sound energy through it.

Structure Borne Noise

Structure borne noise is noise that is transferred from one space to another via the vibration of building structures such as the walls and ceilings.

Acoustic Symbols

dB - Decibel

The decibel (dB) is the unit used for sound level measurement. Variations of the dB are used for different types of noise measurement. The most commonly used variation is the dB(A).

dB(A) - Decibel A-Weighted

Unit of sound level, in A-weighted decibels. The human ear is not equally sensitive to all frequencies of sound, we interpret a low frequency sound as quieter than a high frequency sound of the same level. The A weighting approximates the sensitivity of the human ear by filtering these frequencies. A dB(A) measurement is considered representative of average human hearing.

$D_{nT,w}$

$D_{nT,w}$ is the Weighted Standardised Field Level Difference which is single number rating describing the noise isolation performance achieved between two spaces across a building element. It is characterised by the difference in noise level on each side of a wall or floor.

Measured in the field, $D_{nT,w}$ is subject to the inherent inaccuracies involved in such a measurement. It is a field measurement that relates to the R_w laboratory measurement. The higher the $D_{nT,w}$ rating, the better the insulation performance.

L_{90}

Noise level exceeded 90% of the measurement period. This represents the background noise level. Where background noise levels are referenced in the noise fact sheets the L_{90} level is inferred.

L_{10}

Noise level exceeded for 10% of the measurement period. This represents the average upper intrusive noise level.

L_{eq}

Energy averaged noise level over the measurement period. This measure is used for comparison with relevant standards for ambient noise.

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L_{max}

The maximum noise level of the measurement period.

NIC - Noise Isolation Class

The Noise Isolation Class (NIC) terminology has been superseded and the current terminology in the BCA and Australian Standards is now $D_{nT,w}$. *Note: the $D_{nT,w}$ rating is approximately equivalent to the NIC rating.

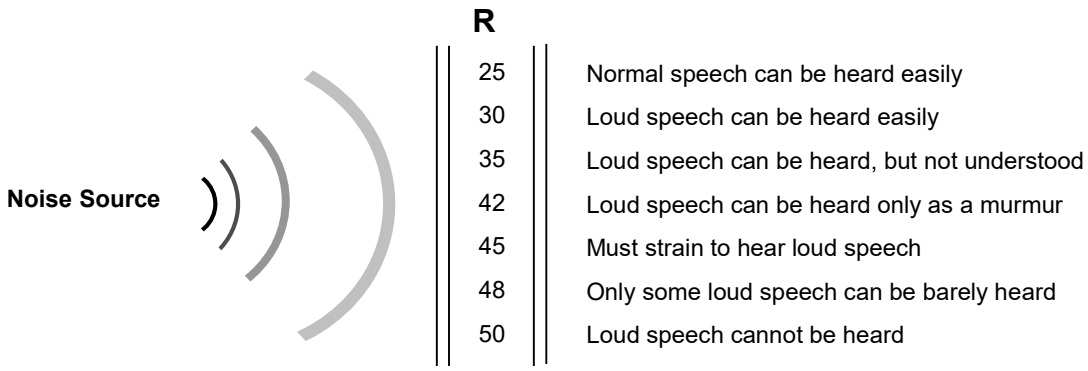
NRC - Noise Reduction Coefficient

Noise Reduction Coefficient is a measure of sound absorbed by a material. The single number represents an average of the sound absorption coefficients at 250, 500, 1000 & 200 Hz rounded to 0.05. Values approaching 1.0 have the highest levels of absorption.

R_w

R_w is the Weighted Sound Reduction Index which is a measure of the sound insulation performance of a single building element (such as walls, windows etc.), measured in controlled laboratory conditions. The higher the R_w rating, the better the sound insulation.

Some typical R_w ratings of a building element and their subjective performances are shown below.



Source: Boral Selector - Plasterboard Systems

**Note: when the building element is installed, the subjective performances may be degraded due to other flanking paths and/or incorrect installation. On site measurements of the acoustic performance of a system is the $D_{nT,w}$ rating (see above). The BCA allows a 5 dB reduction from the laboratory performance (R_w) to the filed performance ($D_{nT,w}$) to allow for flanking and the technical difference in the ratings. Therefore, it should be expected that the installed performance of a building element ($D_{nT,w}$) be at least 5 dB less than the laboratory performance (R_w).*

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$R_w + C_{tr}$

C_{tr} is a "spectrum adaptation term" or adjustment factor to account for low frequency noise. The combination $R_w + C_{tr}$ is useful for representing noise sources such as urban road traffic, distant jet aircraft and low speed rail traffic.

The adaptation factor is a negative number and therefore $R_w + C_{tr}$ is lower than R_w. This is the appropriate measurement for internal sound insulation. *Note: the C_{tr} value is not a constant and will vary from system to system.

STC (Sound Transmission Class)

The Sound Transmission Class (STC) terminology has been superseded and the current terminology in the BCA and Australian Standards is now R_w.

**Note: the R_w rating is approximately equivalent to the STC rating.*

Building and Construction Terminology

Building Elements

A building element is a single building part such as a wall, door or window.

Chasing

A groove or channel in a building element for the purposes of laying pipes and/or wiring. This is generally created in masonry elements such as floors, ceilings and walls.

Damping

The ability of a building component to diminish the intensity of vibration energy passing through it, and to minimise any vibration being transmitted to a connected element. It is analogous to the absorption of sound in air.

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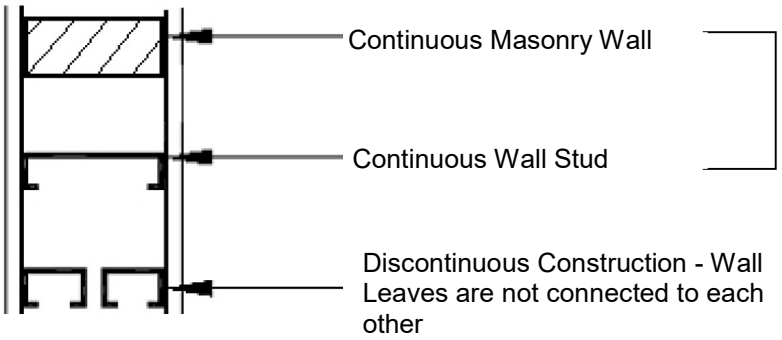
Discontinuous Construction

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 connections between wall leaves except at the wall periphery.

A staggered stud wall is not deemed to be discontinuous as the two wall studs are in the same track and are thus connected.

With discontinuous construction the two wall leaves (linings) are isolated from each other, so that sound vibration is not as easily transmitted through the structure as there is no connection through which the sound can travel.



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

Fire Collar

The building component used to seal and fire-rate penetrations created for ducts and plumbing.

Flexible Caulking Compound/Mastic

A heavy-consistency compound that may remain adhesive and pliable with age. This term is typically given to a number of bonding substances used for a variety of purposes such as:

- Waterproof compound applied to exterior walls and roof surfaces; and
- Construction adhesive applied from a caulking gun.

**Note: the use of expanding foam sealants around the perimeter of a building element is not acoustically acceptable.*

Glazing

Glazing is the glass panes or panelling used in windows and doors.

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Lagging

Insulation used to prevent heat diffusion and reduce noise made by building services such as air conditioning and plumbing. Generally it comes in the form of plasterboard or loaded vinyl lining that fits over the service ducts or piping.

Plenum or Ceiling Void

The cavity created between an actual ceiling and a suspended ceiling, which is often used for placing building services such as heating and air conditioning ducts. It can also be used for electrical, telephone and network wires.

Purlins

In timber roof construction, a secondary horizontal component parallel to the ridge and supported at each end by a rafter.

Resilient Mounts

Resilient mounts are used as damping or isolation between building elements. This term refers to any connecting device that provides some level of resilience between components such as rubber or damping springs. Resilient mounts are predominantly used when installing an isolated building component such as a floating floor or suspended ceiling. They can also be used when attaching devices such as air conditioners and wall-mounted dryers.

Reveal

The area of wall at the side of a window or door opening that is at right angles to the general face of that wall.

Soffit

The underside of any architectural element such as a beam, arch, staircase, cornice or eaves.

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

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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

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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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The Fact Sheet contains content sourced directly from the City of Melbourne's City Sounds 2 Noise Fact Sheets, which can be viewed at www.melbourne.vic.gov.au/noise and copyright in this material remains the property of the City of Melbourne. City of Adelaide gratefully acknowledges the assistance of the City of Melbourne in the use of this material in the preparation of the Fact Sheets.

Contact Us

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