

Basic Guidelines

REDUCING THE IMPACT OF AIRCRAFT NOISE INSIDE RESIDENTIAL BUILDINGS

File 88/2143 – November 1989

NOTE: These guidelines are for advice only and relate to land which is within the 20–25 ANEF noise zone. The information is based on a report prepared for Council by acoustic engineers.

Development on land above the 25 ANEF level will, however, require an assessment by an accredited practising acoustical engineer (who is a current member of, or is eligible for membership of, the Association of Australian Acoustical Consultants) stating that the proposed residential development conforms with Australian Standard AS2021 – 1985.

Refer to Council's Planning Department for further details on development of land above the 25 ANEF level.

BACKGROUND

The Department of Defence has issued a noise contour map for RANAS Nowra (Royal Australian Naval Air Station – HMAS *Albatross*) which identifies land subject to various forecast noise exposure levels from aircraft using that facility.

These levels are called ANEF units (Australian Noise Exposure Forecast) and typically range from 20 to 35+ ANEF. The higher the ANEF level the greater the noise exposure level and likely occurrence of discomfort or problems.

Areas outside (below) the 20 ANEF contour are generally regarded as not being significantly affected by noise, although a small percentage of people may find aircraft noise to be a problem. Above 25 ANEF aircraft noise exposure becomes progressively more severe.

Surveys by the Commonwealth National Acoustic Laboratories have found that the major effects from aircraft noise are disturbance to watching television, listening to home music systems/radio, conversation and sleeping.

The Standards Association of Australia has published a standard which relates to building on land affected by 20+ ANEF values (AS2021–1985: “Acoustics – Aircraft Noise Intrusion – Building Siting & Construction”).

AS2021 provides guidelines for determining:

- a. whether the extent of aircraft noise intrusion makes indoor spaces unacceptable for certain activities;
- b. extent of noise reduction required to provide acceptable noise levels indoors for certain activities;
- c. the type of building construction necessary to provide the noise reduction required, provided that windows and doors are closed.

AS2021, together with information from a number of other sources with expertise in this field, has been used to help prepare Council's policy for residential development within the ANEF Noise Zones, as detailed in Development Control Plan No. 38 (Refer to the Planning Department for details).

ACOUSTIC INSULATION – GENERAL

The insulation of residential buildings can reduce the internal noise levels from aircraft.



For more information contact: Shoalhaven City Council's PLANNING SERVICES DIVISION
Administration Centre, Bridge Road Nowra • Telephone (02) 4429 3111 • Fax (02) 4429 3178 • Post: PO Box 42 Nowra 2541
Southern District Office – Deering Street, Ulladulla • Telephone (02) 4429 8999 • Fax (02) 4429 8939 • Post: PO Box 737 Ulladulla 2539

Sound travelling from outside to inside a building may involve several sound paths, eg through walls, windows, roofs, doors, chimneys, etc. The effectiveness of insulation to reduce noise depends

on the Sound Transmission Class (STC) and the effective area of each such building element. The **higher the STC number** the better the insulation properties of the element (see Figure 1).

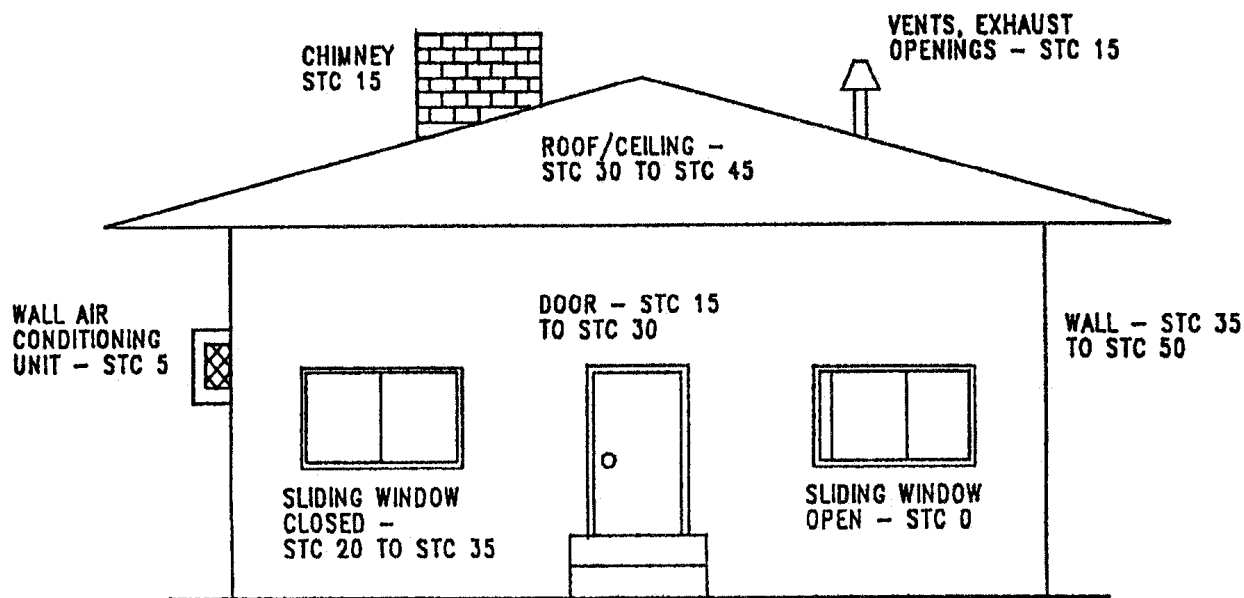


Figure 1: Schematic illustration of significant sound transmission paths in the building envelope of a residence and corresponding sound transmission class (STC) values.

Notes:

1. Windows are usually the ‘weak link’. Most buildings provide a noise reduction of only about 10 dBA with windows open.
2. Wall air-conditioning units can also readily transmit exterior sound into the building.

Because closing the windows of a house automatically increases the noise reduction by at least 10 dBA, one of the most effective first steps in reducing interior noise levels from aircraft is to provide air-conditioning or some other form of forced ventilation to allow windows to be maintained closed for noise reduction purposes. Air-conditioning can be provided either for noise-sensitive rooms such as bedrooms or for the whole house.

Many wall or window mounted air-conditioning units, however, provide little reduction of exterior noise and their use should be avoided in these situations. “Split” systems which use wall-mounted fan/coil units inside the building in conjunction with external compressor/condensers are quite suitable. Fully ducted systems can also be used but need to be designed carefully in situations requiring a high degree of noise reduction in order to maintain the effectiveness of the ceiling as a noise barrier.

The next step in reducing interior noise levels is to upgrade the window construction either to heavier, single-glazed plate or laminated glass windows (which still need to be operable in residential buildings but must be well sealed when closed), or to double-glazed windows comprising two sets of sliding, aluminium-framed single-glazed windows at the maximum possible spacing (preferably not less than 100mm).

Bedrooms are normally the most noise-sensitive rooms in a dwelling. In areas **not directly** beneath the flight paths the building orientation can sometimes be used to advantage to screen bedroom windows from aircraft noise.

Solid-core timber exterior doors, fitted with acoustical sealing strips, can also be provided; this is particularly desirable in cases where the exterior doors open directly into living areas. Aside from its thermal insulation properties, ceiling insulation at

least 75mm thick is also a cost-effective means of improving the sound attenuation of the roof/ceiling structure. Wall cavity insulation can also be of benefit, particularly in timber stud-framed exterior walls, although brick walls will generally provide a higher degree of sound insulation.

The additional cost of implementing a **full** noise control package, including air-conditioning, has been estimated as typically 20% of the cost of the dwelling itself, excluding the land. Thus, the additional expense of acoustically insulating a house normally costing, say, \$60,000 to build in the Nowra area, could be in the order of \$12,000. This would, however, provide a high degree of noise reduction of up to 35 dBA to 40 dBA right throughout the dwelling to give a comfortable internal living environment.

Although this is an acceptable noise exposure, applicants wishing to build in the 20 to 25 ANEF zone around RANAS Nowra who may require some additional degree of sound insulation against aircraft noise may, however, decide on just insulating certain parts of their home, for example, bedroom areas. It is also possible to opt for heavy, single-glazed windows rather than double-glazed. With this approach, the additional cost of noise control could be a far smaller proportion of the total building costs.

Alternative building styles, such as earth covered or below ground houses, could also be considered in noise-impacted zones. Although this type of construction has the advantage of minimising the number of effective sound transmission paths, it will still be necessary to provide windows and entrance doors with high sound insulation properties and to air-condition the building. Orientation of the exposed parts of the building is important. Whilst it may be desirable to orientate to the north, for those areas facing the runways this may not be appropriate.

GUIDELINES FOR THE 20 TO 25 ANEF ZONE

***NOTE:** The following information is offered as a guide to the sound insulation of residences. Individuals should make their own assessment on the provision of sound insulation which may include expert advice, prior to committing themselves financially.*

Applicants wishing to construct residential buildings in the 20–25 ANEF noise zone around RANAS Nowra should note that whilst this noise

level is generally held to be acceptable some people may find aircraft noise levels unacceptably high in this zone. This will be dependent upon their sensitivity to aircraft noise. Applicants should consider insulating their proposed buildings against aircraft noise, either by incorporating some or all of the following guidelines or, where a particularly high degree of sound insulation is required, by employing the services of a qualified and accredited acoustical engineer. Note that, although these measures will provide some degree of additional insulation against aircraft noise, they will not result in total “sound-proofing”.

- a. Air-condition those parts of the building that are to be insulated against aircraft noise (to allow windows to be kept closed during noisy periods). Do **not** use wall or window mounted air-conditioning units as they can readily transmit exterior noise into the building. Use fully ducted air-conditioning or, preferably, “split” air-conditioning systems with separate fan/coil units for each room.
- b. Minimise the window area as far as possible (strict compliance with natural light and ventilation requirements of ord. 70 (Bldg. Regs.) is required, and use heavy single-glazed (eg with 6mm laminated glass or 10mm plate glass) windows or, if a higher degree of insulation is required, use double-glazed windows comprising two sets of single-glazed (with at least 4mm thick plate glass) aluminium framed sliding windows spaced at least 100mm apart. All windows must be well sealed in the closed position.
- c. Where possible use the building orientation to screen bedroom windows from aircraft noise.
- d. Airtight seals on all exterior construction joints, window frames, door frames etc.
- e. Avoid the use of exhaust vents, chimneys etc. in noise-sensitive areas.
- f. Use solid-core timber entrance doors fitted with acoustical sealing strips.
- g. Insulate the complete ceiling area with standard grade building insulation at least 75mm thick.
- h. Fully insulate timber stud-framed exterior walls with standard grade building insulation at least 75mm thick.

Because aircraft noise can be transmitted into a building via a number of different paths, it is **not possible to tabulate the benefit of each individual**

measure in terms of overall noise reduction. For example, there will be very little, if any, additional benefit gained by insulating the ceiling and walls and providing solid-core entrance doors, if the windows are not upgraded.

An effective building insulation package should, therefore, incorporate most, if not all, of the measures summarised in Table 1. This can result in an overall noise reduction of up to 35 dBA to 40

dBA, a very significant increase from the noise reduction of only 10 dBA achieved by virtually any building construction if the windows are open. It should also be noted that some of the measures summarised in Table 1 can provide increased thermal insulation.

NOTE: Contact Council's Development & Environmental Services Division if you require clarification of these guideline

Table 1: Approximate Additional Cost (as a Percentage of the Cost of the House, Excluding Land) and Effectiveness of Various Aircraft Noise Insulation Measures

Measure	Approximate Additional Cost	Effectiveness
Partial or complete air conditioning	8% to 12%	Allows windows to be maintained closed for noise reduction purposes.
Heavy single-glazed or wide-spaced double-glazed windows	4% to 8%	Increases Sound Transmission Class (STC) ratings of windows by up to 10 to 15 points.
Use of building orientation to screen windows of noise \ sensitive rooms	–	Reduces aircraft noise levels at windows by 5 dBA to 8 dBA (if complete line-of-sight screening is achieved).
Air-tight sealing of construction joints	<1%	Allows full noise reduction potential of building elements to be achieved by eliminating 'flanking'/sound transmission.
Avoid exhaust vents and chimneys in noise-sensitive areas	–	Allows full noise reduction potential of roof/ceiling to be achieved.
Solid-core timber, acoustically-sealed entrance doors	<1%	Increases STC ratings of doors by typically 10 to 15 points.
Ceiling insulation	2%	Increases STC rating of roof/ceiling by approximately 5 points.
Wall insulation	2%	Increases STC rating of wall by approximately 5 points.

The estimated additional costs shown in Table 1 should be regarded as approximate only and should be used merely as a guide to assessing the cost-effectiveness of various building insulation measures.