

Association of Australian Acoustical Consultants Acoustical Star Ratings For Apartments and Townhouses

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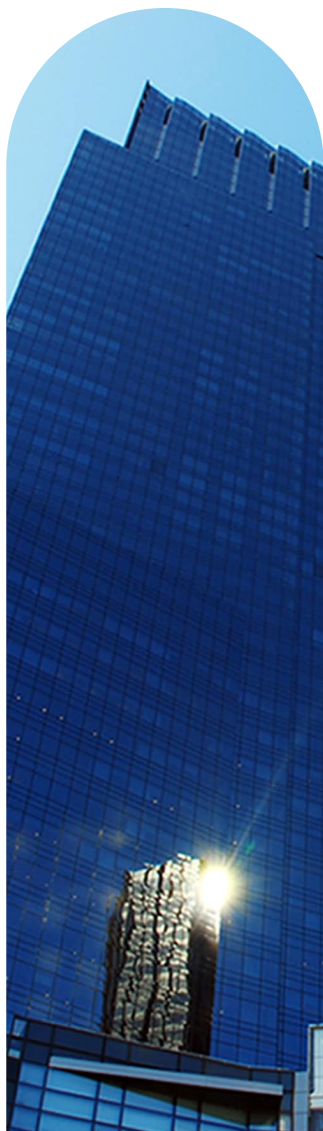
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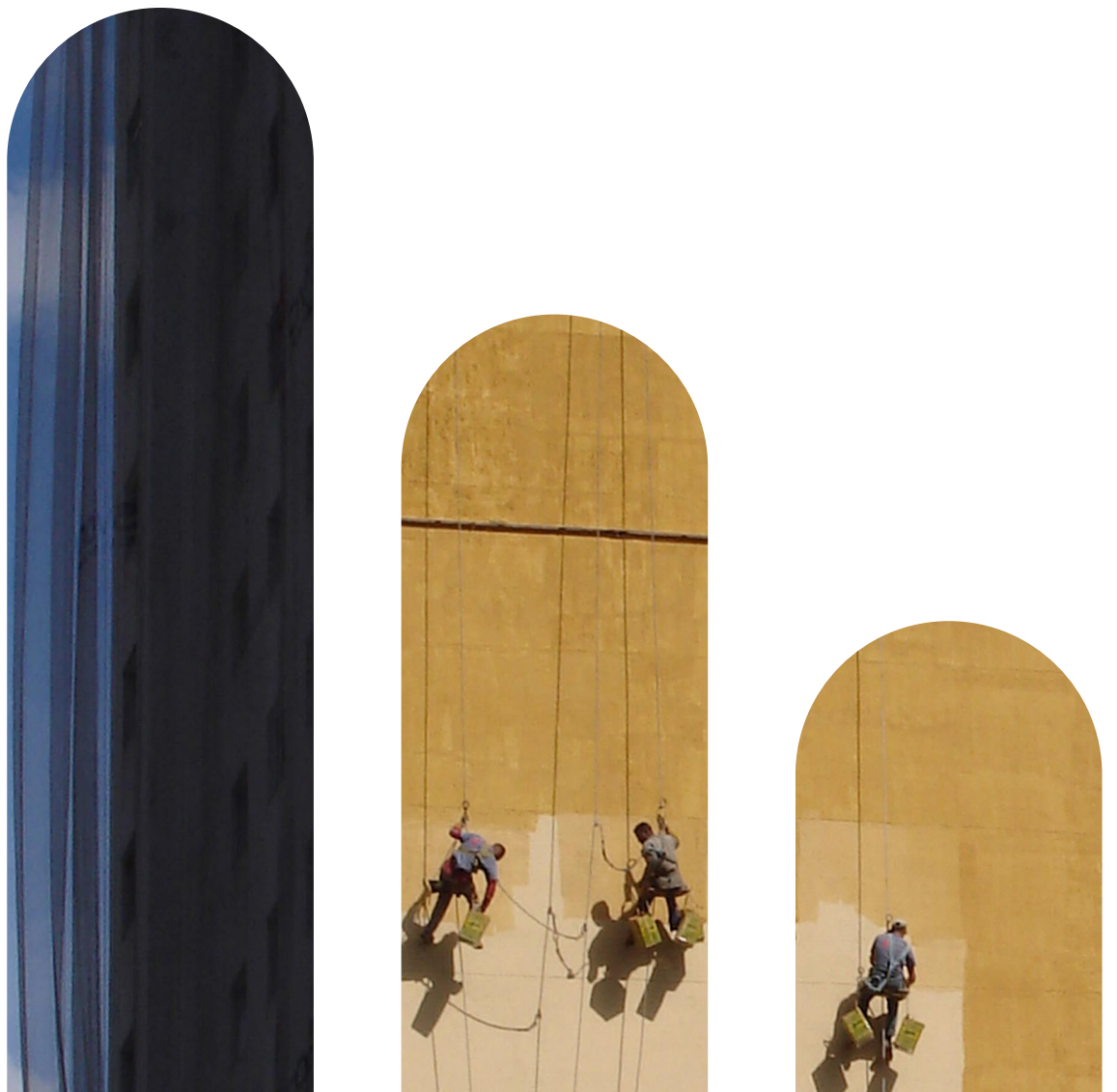


1.0 INTRODUCTION

Members of the AAAC have been concerned for some time that there are no building regulations or standards that encompass all aspects of the acoustical qualities of apartments, townhouses and other multi-tenancy dwellings.

The Building Code of Australia (BCA) regulates minimum acceptable construction standards for buildings. Part F of this document sets minimum requirements for party walls and floors between apartments and for ducts or bulkheads enclosing hydraulic waste pipes. However it does not deal with other acoustical issues such as noise intrusion from outside or noise generated by building services.

Although the BCA sets minimum standards for privacy, many members of the housing industry have interpreted these as absolute requirements, applicable to all types of dwelling. The result has been that owners of luxury apartments built to BCA standards have become dissatisfied with acoustic performances, which in their view are not commensurate with the price they have paid.



2.0 THE STAR RATING SYSTEM

To fulfil a need identified by the community, the housing industry and by member firms of the AAAC, a rating system has been prepared to rank the acoustical quality of apartments. This has been done to promote better standards of acoustical quality in apartments. This guide has been prepared principally by and for AAAC members, but it is anticipated that it will also be of use to others involved in the design, development and purchase of apartments/townhouses.

The objectives of the AAAC Star Rating system are:

- To provide guidance in the design process so that all important acoustical attributes are properly addressed.
- To encourage consistency between the apparent quality of the design of apartments and the underlying acoustical quality of the structure.
- To allow a vendor or purchaser to apply an acoustical rating to a property for sale.

The intent of the rating system is to quantify and communicate the opinions of AAAC members on the design of residential buildings. It deals with the major issues, including the intrusion of external noise, noise generated by building services and appliances and noise transfer between apartments.

The rating system will not compete with established statutory or advisory codes such as the Building Code of Australia, AS/NZS Standards or local authority building ordinances. It is intended to be complementary to all of these.

This rating system is based on the current experience and opinions of AAAC members. The ratings will be reviewed periodically in order to reflect changing community expectations.

An AAAC Rating Certificate can only be issued by an AAAC member firm.

Since the rating system is subject to change, it is recommended that an intending user should check with an AAAC member to confirm that the most recent release of this guide is being used. AAAC members are listed on the back page of this guide.

The rating system considers the following aspects that influence the acoustic environment of an apartment/townhouse.



3.0 EXTERNAL NOISE INTRUSION

This is most commonly caused by transportation systems such as road, rail and air traffic. In some instances, plant noise intrusion from adjoining industry, commerce or even from an adjoining residential building can also be a problem.

Intrusive noise can generally be classified as either continuous or intermittent. Continuous noise, even though it might vary from time to time, is measured using a procedure to determine its equivalence over a representative time period. In this document the continuous measurement is expressed as $(L_{A_{eq}})$ whereas intermittent noise is measured as the average of the maximum sound level readings expressed as $(\bar{L}_{A_{max}})$.

4.0 INTERNAL BUILDING SERVICES

Internal building services include a range of plant and equipment; all of which have the potential to generate noise within an apartment. These include air-conditioning and ventilation systems, lifts, hydraulic waste and water supply systems, garbage chutes, car-park roller doors etc.

These noises can be continuous as in the case of air-conditioning plant, or intermittent such as flushing toilets or lift pass-by. They can intrude into an apartment by a combination of airborne and structure-borne transmission paths. It is therefore necessary to insulate these services against airborne noise and isolate them at mounting points against structure-borne noise.

There is a concern that if the background noise level is made very low then other sounds normally masked might become audible. The rating system takes this into account.

5.0 RESIDENTIAL ACTIVITIES

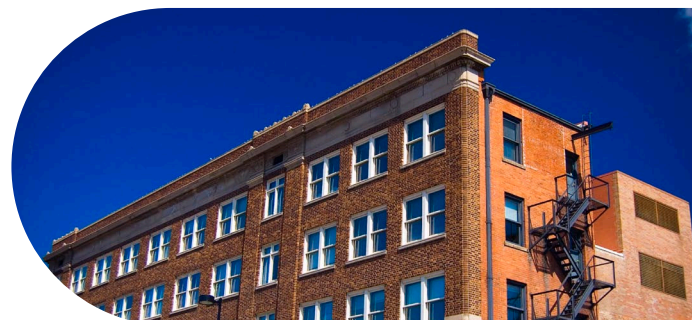
A wide range of different noises is generated by residential activities, again broadly classified into airborne and structure-borne noise.

Airborne noise sources include voices, TV sets, hi-fi equipment and home theatre systems. Because of the nature of entertainment noise sources it is important that the sound insulation between two spaces also includes good sound insulation of the lower frequencies.

The star rating system measures the actual installed performance of the wall or floor system. The expression for effective sound insulation between two adjacent spaces is $D_{nT,w}$. This is the sound level difference, which is adjusted to simulate a typical furnished room. To this value is added a correction factor C_{tr} that helps to quantify the low frequency performance of the wall or floor. The C_{tr} factor is a negative value.

$D_{nT,w}$ is an international measure and is described as the weighted standardised level difference. It has been adopted by Australia and New Zealand and is used in this rating system. A high value of $D_{nT,w} + C_{tr}$ indicates increased acoustic performance.

The 5 Star rated wall or floor is close to the maximum achievable in normal building construction.



The following table gives an indication of the sound insulation performance of the various Star Ratings in respect to controlling typical noise sources within the domestic environment.

Sound Insulation expressed as $D_{nT,w} + C_{tr}$

Type Of Noise Source	35 2 Star	40 3 Star	45 4 Star	50 5 Star	55 6 Star
Normal Speech	Audible	Just Audible	Not Audible	Not Audible	Not Audible
Raised Speech	Clearly Audible	Audible	Just Audible	Not Audible	Not Audible
Dinner Party/ Laughter	Clearly Audible	Audible	Just Audible	Not Audible	Not Audible
Shouting	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Small Television/ Small Entertainment System	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Large Television/ Large Hi-fi Music System	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Just Audible
DVD With Surround Sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible
Digital Television With Surround Sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible

6.0 STRUCTURE BORNE NOISE

Structure borne noise includes footsteps on hard floors, scraping chairs and dropping objects. For this type of noise, Australia and New Zealand have adopted the measurement called the weighted standardised impact sound pressure level $L_{nT,w}$. A reduction in this parameter corresponds to an improvement in impact isolation. This replaces Impact Insulation Class (IIC), which is in common use in Australia. The AAAC rating system uses $L_{nT,w}$. There is an approximate relationship between $L_{nT,w}$ and IIC. Either value can be subtracted from 110 to approximately indicate the other.

Other sources of structure borne noise are wall mounted clothes driers, or operating a kitchen appliance on a bench connected to a common wall. While there exists a standardised impact test for floors, there is currently no accepted method for testing impact performance of walls. This guide recognises the need for impact isolation of walls, but refrains from nominating quantitative criteria for walls until test methods are available. Separated wall construction is the current best solution for these situations.

Household equipment installed after the rating measurements is not covered by the rating certificate. Owners Corporations may need to be mindful of how owners and tenants can adversely affect the Star Rating of their and other apartments/townhouses if they add or modify appliances without appropriate attention to isolation details.



7.0 SCORING

The tables in this guide assign quantitative values for each acoustical attribute, corresponding to each star rating. The values relate to the actual performance achieved in a completed apartment. Using these tables, it is possible to score a rating for each design attribute.

With acoustical design, it is important to achieve a balance of performance across all of the design attributes. Each attribute is separately rated. For some owner/occupiers an otherwise well-designed apartment can be devalued in their perception, even if it is deficient in only one attribute. For this reason we recommend that any potential owner/occupier ask for a copy of the rating certificate so that they can assess the apartment/townhouse in terms of their expectations.

Interpolations and half-stars are not used. Rather than describing an attribute as 3½ stars, the preferred description is "3 star with some 4 star attributes".

Designers may also choose performance beyond the limits prescribed for 6 star, however it must be pointed out that in some aspects 6 star in itself is very hard to achieve. In this case the preferred description for such dwellings would be "better than 6 star".

Scoring System

Each acoustical attribute is separately rated (noise intrusion, services noise or sound and impact isolation). The overall rating is determined by the lowest score awarded to each attribute within that classification. The Certificate will show the rating for each attribute within the classification and the overall rating for each classification. An overall rating is assigned that is the average of all the three classifications. This can be used to indicate the overall acoustic performance of the apartment.



8.0 STAR RATINGS FOR VARIOUS ATTRIBUTES OF ACOUSTIC PERFORMANCE

External Noise Intrusion	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Bedrooms					
Continuous Noises $L_{Aeq} \leq$	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
Intermittent Noises $L_{ave} L_{Amax} \leq$	50dB(A)	50dB(A)	45dB(A)	40dB(A)	35dB(A)
(b) Other Habitable Rooms Including Open Kitchens					
Continuous Noises $L_{Aeq} \leq$	41dB(A)	40dB(A)	37dB(A)	35dB(A)	32dB(A)
Intermittent Noises $L_{ave} L_{Amax} \leq$	55dB(A)	55dB(A)	50dB(A)	45dB(A)	40dB(A)

External Noise Intrusion is most commonly caused by transportation systems such as road, rail and air traffic. This category also includes plant noise from adjoining industry, commerce or even from an adjoining residential building.

Measurements are made in bedrooms and any nominated habitable rooms. Bedrooms are measured over a period between 2200hrs and 0700hrs. Noise measurements in other habitable rooms are undertaken between 0600 to 2400hrs. In any event the measurement period must be representative of the noise being measured. Measurements must include L_{Aeq} and L_{Amax} .

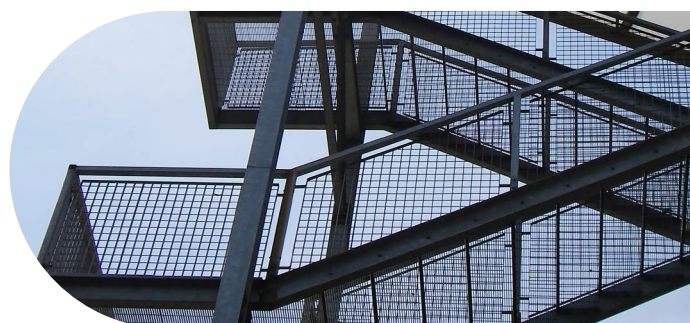


Internal Building Service and Appliances	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Bedrooms					
Continuous Noises $L_{Aeq\ adj} \leq$	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
Intermittent Noises $ave\ L_{Amax} \leq$	45dB(A)	40dB(A)	35dB(A)	30dB(A)	27dB(A)
(b) Other Habitable Rooms Including Open Kitchens					
Continuous Noises $L_{Aeq\ adj} \leq$	41dB(A)	40dB(A)	35dB(A)	30dB(A)	27dB(A)
Intermittent Noises $ave\ L_{Amax} \leq$	55dB(A)	45dB(A)	40dB(A)	35dB(A)	32dB(A)
(c) Wet Areas Including Bathrooms, Ensuites And Laundries					
Continuous Noises $L_{Aeq\ adj} \leq$	55dB(A)	50dB(A)	45dB(A)	42dB(A)	40dB(A)
Intermittent Noises $ave\ L_{Amax} \leq$	60dB(A)	55dB(A)	48dB(A)	42dB(A)	40dB(A)

Internal Building Services include a range of plant and equipment; all of which have the potential to generate noise within an apartment. These include air-conditioning and ventilation systems, lifts, hydraulics wastes and water supply systems, garbage chutes, spa baths and appliances of adjacent apartments. Appliances such as spa baths and dishwashers in the same tenancy are excluded.

Measurements shall be carried in accordance with Section 6.1 Measurement of ambient sound level given in AS/NZS2107: 2000. Noise measurements are made at relevant positions but no closer than 1.5 metres from the noise source.

Many noises contain pronounced tonal or impulsive characteristics, which increase their annoyance. Such noises need to have a penalty adjustment (adj) to account for the annoying characteristics. If these characteristics are clearly audible a 5dB(A) penalty shall be applied. If the characteristics are just audible then a 2dB(A) penalty shall be applied.



Intertenancy Activities	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Airborne Sound Insulation For Walls And Floors					
Between Separate Tenancies $D_{nT,w} + C_{tr} \geq$	35	40	45	50	55
Between A Lobby/Corridor & Bedroom $D_{nT,w} + C_{tr} \geq$	30	40	40	45	50
Between A Lobby/Corridor & Living Area $D_{nT,w} + C_{tr} \geq$	25	40	40	40	45
(b) Corridor, Foyer To Living Space Via Door(s) $D_{nT,w} \geq$					
	20	25	30	35	40
(c) Impact Isolation Of Floors					
Between Tenancies $L_{nT,w} \leq$	65	55	50	45	40
Between All Other Spaces & Tenancies $L_{nT,w} \leq$	65	55	50	45	40
(d) Impact Isolation Of Walls					
Between Tenancies	No	Yes	Yes	Yes	Yes
Between Common Areas & Tenancies	No	No	No	Yes	Yes

Intertenancy Activities generate a wide range of different noises, which can be broadly classified into airborne and structure borne noise.

Airborne sound insulation is measured in accordance with Australian Standard AS: 2253 and rated in accordance with AS: 1276. (ISO 140-4 and ISO 717.1)

The nominated $D_{nT,w} + C_{tr}$ values are considered as minimums and there is no site tolerance applicable.

Floor impact transmission is measured in accordance with ISO 140-7 and rated in accordance with ISO 717.2



