

Guidelines - managing noise impacts in urban development

Guidance for planning permit and related
decisions under the Yarra Planning Scheme

March 2022



1 Purpose

This document provides guidance for planning scheme related decisions when considering noise impacts from urban development and activity. Acoustic assessment reports issued to Council should consider the various matters discussed in this document as relevant to the application.

1.1 Scope

These guidelines deal with noise (and in some cases vibration) impacts from:

- Road traffic
- Rail and tram
- Commercial and industrial plant and equipment
- Music
- Patrons
 - New outdoor patron areas
 - New residential development near existing outdoor patron areas
- Apartments
 - Noise from apartment developments to existing dwellings
 - Noise from apartment common areas to apartments within the development

1.2 Introduction – technical advice

This document was prepared by Yarra City Council based on the City of Yarra - Noise and Vibration Considerations Discussion Report – October 2019 (updated March 2022) by SLR Consulting Australia Pty Ltd.

2 Building siting and internal layout

Noise sensitive rooms (in particular bedrooms) and private open spaces are to be located away from existing and potential noise sources wherever practical. Siting and orientation to minimise noise exposure of these spaces will reduce requirements for onerous façade upgrade treatments and will result in an improved level of acoustic amenity generally.

3 Road traffic noise

3.1 Background information

Road traffic is a significant source of noise impacts to dwellings on and near main roads. The issue has been acknowledged and addressed in recently introduced Apartment Developments provisions at Clause 58 and specifically at 58.04-3 Noise impacts objectives and Standard D16. Planning Practice Note PPN83 *Assessing external noise impacts for apartments* provides further guidance to these Clauses. These provisions include criteria for day and night average road traffic noise levels, and apply to apartment developments on roads carrying more than 40,000 vehicles, within 300 m from the nearest lane. The criteria are 40 dBA Leq,16h for all habitable rooms and 35 dBA Leq,8h for bedrooms.

The time classifications used in Apartment Developments provisions place the 6 am to 7 am period in the 'day' rather than the 'night' category. This classification is not consistent with recent planning scheme practice in the City of Yarra, and is not consistent with the classifications commonly used in Victoria (Victorian EPA Environment Protection Regulations 2021, Part 5.3-Noise, and the Victorian EPA Noise Control Guidelines (Publication 1254)).

The Apartment Developments provisions should be adjusted to better address local conditions:

- the 6am to 7am period should be considered as a night period impact;

- application of the criteria should be extended to all developments affected by road traffic noise (not just those near freeways or on roads carrying more than 40,000 vehicles), and
- the criteria should be applied to all residential developments, not just apartments.

3.2 Other standards and guidelines

AS/NZS2107:2016 Acoustics – Recommended design sound levels and reverberations times for building interiors, provides recommended noise level ranges for dwellings near major and minor roads. This standard has commonly been referred to in planning permit decisions to address road traffic noise impacts. The provision in the standard of a decibel range rather than a specific recommended maximum noise level has led to uncertainty about actual design levels (with proponents designing to meet the upper end of the range). The assessment methodology is not defined; it is unclear whether traffic noise should be quantified as an average or worst case level, such as the loudest hour of traffic noise.

The NSW Road Noise Policy, 2011 provides recommended maximum noise levels for road traffic noise of 35 dBA for bedrooms at night and 40 dBA in all habitable rooms during the day period (NSW Road Noise Policy, 2011, C10). These criteria are elaborated in the NSW guideline document Development Near Rail Corridors and Busy Roads - Interim Guideline, 2008. The NSW criteria are generally consistent with the Clause 58, Apartment Developments, Design Standard D16 (with the exception that the 6 am to 7 am period is classified as 'night' in the NSW Road Noise Policy).

The NSW Development Near Rail Corridors and Busy Roads - Interim Guideline also provides clear and practical guidance for measuring and reporting. This information is missing from the Victorian policy and guideline documents for road and rail noise.

3.3 Guideline

New residential development should be designed to comply with the following recommended maximum noise levels for road traffic noise:

- Clause 58, Apartment Developments, Standard D16 of 40 dBA Leq,16h (6 am to 10 pm) in habitable rooms and 35dBA Leq,8h (10 pm to 6 am) in bedrooms and
- Loudest hour of road traffic noise not to exceed 45 dBA Leq,1h in habitable rooms from 7 am to 10 pm, and 40 dBA Leq,1h in bedrooms from 10 pm to 7 am. The basis for the loudest hour recommended maximum levels is AS/NZS2107:2016, with the day and night periods defined in accordance with Victorian EPA legislation and guidelines rather than in accordance with the Clause 58 Apartment Developments Standard D16 (58.04-3 Noise impacts objectives).
- These recommended maximum noise levels should be applied to all residential development where there is a reasonable expectation that traffic noise may impact the land.

Where night period internal amenity is achieved via building façade upgrades, the building must be designed to ensure adequate fresh air provision in accordance with the National Construction Code and other relevant standards, without compromising the acoustic amenity outcome (i.e. with windows to the affected room closed).

4 Rail noise

4.1 Background information

The Victorian Government Passenger Rail Infrastructure Noise Policy, 2013 provides screening levels for rail noise. The policy is a high level document and it is designed for transport bodies and planning authorities. Where existing rail noise exceeds the threshold levels specific consideration of rail noise is required before the project proceeds. If the threshold levels are not exceeded, rail noise impacts may still be considered as a 'secondary matter'. In the context of a proposed residential development, this can be interpreted to mean that the issue of rail noise should be dealt with by proponents and local planning authorities.

Until recently there was no government guidance about how to assess rail noise impacts on apartment developments. The Clause 58, Apartment Developments, objectives and Standard D16 (and associated guidance provided in Planning Practice Note PPN83) address both rail and road traffic noise. Standard D16 requires that all apartment developments within 80 m of a passenger line or 135 m of a freight rail line, are designed to internal criteria. The design levels to be met are the same as those for road traffic noise: 40 dBA Leq,16h and 35 dBA Leq,8h.

Prior to the introduction of the Apartment Developments, Standard D16, a common approach was to assess rail noise to recommended maximum noise levels of 60 dBA Lmax in living rooms and either 50 or 55 dBA Lmax in bedrooms. These design levels broadly align with:

- The minimum acoustic standard (2-3 star) for external noise intrusion provided in the Association of Australasian Acoustical Consultants (AAAC) Guideline for Apartment and Townhouse Acoustic Ratings, v4(2017)
- Aircraft noise design levels provided in Australian Standard AS 2021:2015 Acoustics – Aircraft noise intrusion – Building siting and construction
- General sleep disturbance criteria provided in the NSW Road Traffic Policy and sleep disturbance studies.

The levels of 60 dBA (living rooms) and 55 dBA (bedrooms) have been accepted at VCAT and Planning Panel hearings on some projects, and are cited by acoustical consultants on those grounds.

The use of long term day and night average criteria for rail noise, in the Apartment Developments Standard D16 provides a clear standard. There is, however, benefit in also incorporating Lmax criteria for rail noise for the following reasons:

- Leq is primarily a noise descriptor used to quantify steady or quasi-steady state noise. This is appropriate for sources such as mechanical plant noise, and reasonably applied to traffic noise which has a fairly regular and consistent noise level. Train noise is not as constant or regular as traffic noise. While there are no trains passing, the occupant experiences little or no noise, but when the train passes, there is a short term high noise event which can only be quantified using an Lmax descriptor (or a very short Leq measurement potentially). The Lmax is the highest noise level that someone experiences as the train goes past. In contrast, the long term Leqs are not related to the actual objective experience of an occupant when the train passes by.
- Lmax levels are often used to address sleep disturbance.
- On suburban rail corridors where there may only be one line in each direction, with relatively infrequent trains and no trains during some of the night period, the Lmax criteria become more important and are likely to drive the assessment. If these criteria are not in place it is possible for the Leq criteria to be met, and rail noise to exceed sleep disturbance Lmax levels by appreciable amounts.
- Very short term noise events, such as train horns, are not well quantified using long term Leq criteria.

4.2 Other standards and guidelines

The NSW guideline document Development Near Rail Corridors and Busy Roads - Interim Guideline, 2008 provides average day and night criteria for road and rail noise that are similar to the levels included in the Apartment Developments, Standard D16.

The Association of Australasian Acoustical Consultants (AAAC) Guideline for Apartment and Townhouse Acoustic Ratings provides acoustic quality ratings for external noise intrusion. A 3 star rating is considered an appropriate minimum standard for developments during the planning stage.

4.3 Guideline

New residential development should be designed to ensure that rail traffic noise does not exceed:

- Clause 58, Apartment Developments, Standard D16 - 40 dBA Leq, 16h (6 am to 10 pm) in habitable rooms and 35 dBA Leq, 8h (10 pm to 6 am) in bedrooms, and
- Lmax levels from rail and trams, including horn noise, no greater than 60 dBA Lmax in living rooms or 55 dBA Lmax in bedrooms. Lmax levels to be achieved for 95% of train pass-by events (a minimum of 20 trains to be measured).

Where night period internal amenity is achieved via building façade upgrades, the building must be designed to ensure adequate fresh air provision in accordance with the National Construction Code and other relevant standards, without compromising the acoustic amenity outcome (i.e. with windows to the affected room closed).

5 Commercial and Industrial Plant and Equipment Noise

Commercial and industrial noise assessable to the Victorian EPA Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, Part I: Commercial, industrial and trade premises (Noise Protocol, Part I). is considered in the following section.

5.1 Background information

This is an important issue in the City of Yarra where there are many interfaces between residential and commercial uses or industrial precincts. Noise from existing commercial and industrial premises to residential developments needs to be addressed to ensure that:

- The compliance status of the business with the Noise Protocol is not changed by the residential development. If the business is forced into non-compliance by introduction of new noise receptors, it may be required to undertake significant and costly noise control works.
- The amenity of future residential occupants is addressed.

The formal assessment location under the Noise Protocol is typically outside residential dwellings; the measurement location for assessment is in an outdoor private space, or outside any openable window. As such, it is not often possible to design a new building to achieve formal compliance externally where there are existing high levels of commercial noise impacting the site.

This has been a significant challenge in the City of Yarra where many apartment developments are built in

mixed use zones in close proximity to existing roof mounted commercial mechanical plant.

While the Noise Protocol, Part I requires commercial noise to be assessed externally, the City of Yarra (and other Councils) has often allowed for an internal assessment location. This is seen as a reasonable amenity compromise in an inner city environment, where insisting on an external assessment location would effectively make many sites impossible to develop.

Where formal compliance with the Noise Protocol, Part I cannot be achieved, and commercial noise is to be assessed internally, the recommended maximum noise levels are the lower of:

- The effective Noise Protocol internal noise limit, and
- 35 dBA in habitable rooms and 30 dBA in bedrooms at night.

The 35 dBA and 30 dBA recommended maximum noise levels can be more stringent than the Noise Protocol internal recommended maximum noise levels. This is considered appropriate to further protect the existing commercial uses from complaint.

In addition to the above, there still needs to be some consideration of maximum acceptable external noise levels to apartments, even if good internal amenity recommended maximum noise levels can be met. Extremely high noise levels outside a building could still raise complaints, and will limit the ability for occupants to open their windows or use external private spaces.

5.2 Other standards and guidelines

Planning Scheme Clause 58, Apartment Developments, Standard D16 (and associated guidance provided in Planning Practice Note PPN83) also applies to commercial noise however the criteria provided in Standard D16 are likely to be less stringent than the Noise Protocol indoor limits, and the averaging intervals (16 h and 8 h) are considered too long to address commercial plant noise impacts.

The WHO 1996 Guidelines for Community Noise recommend 30 dBA within bedrooms during the night.

The Association of Australasian Acoustical Consultants (AAAC) *Guideline for Acoustical Star Ratings for Apartments and Townhouses* provides indoor recommended maximum noise levels for commercial noise. Assuming 'three star' standard, internal recommended maximum noise levels would be:

- Bedrooms at night: 35 dBA Leq and 50 dBA Lmax
- Living rooms: 40 dBA Leq and 55 dBA Lmax

5.3 Guideline

All residential developments should be designed to ensure that existing commercial uses formally comply with the EPA Noise Protocol, Part I external to the development wherever possible. Where it is demonstrated that external compliance cannot practically be achieved, including treatment of the source of noise in consultation with the commercial operator, an internal assessment may be considered. The following recommended maximum noise levels for commercial / industrial noise (windows closed) are to be met if noise is assessed internally:

- Noise Protocol, Part I indoor limits, being the outdoor limits less 20 dB, and
- Not more than 30 dBA Leq in bedrooms at night and 35 dBA Leq in living rooms (30 min.).
- Not more than 45 dBA Lmax in bedrooms at night and 50 dBA Lmax in living rooms.

In addition to the above, commercial plant and equipment noise levels should not exceed the following levels externally:

- Not more than 10 dBA above any Noise Protocol, Part I period noise limits, outside any openable windows or doors, and
- For balconies and other private open spaces:
 - Not more than 65 dBA during the day
 - Not more than 55 dBA during the evening and night

All assessment methodologies should apply corrections for character in accordance with the Noise Protocol, Part I procedure.

Where night period internal amenity is achieved via building façade upgrades, the building must be designed to ensure adequate fresh air provision in accordance with the National Construction Code and other relevant standards, without compromising the acoustic amenity outcome (i.e. with windows to the affected room closed).

The above is aimed at providing a reduced risk of complaint from new sensitive receivers in the City of Yarra. The above does not represent a formal compliance outcome to the requirements of the Noise Protocol, Part I.

6 Music noise

This section considers the issue of music noise impacts from existing venues to new dwellings only. The issue of music from proposed new venues to existing dwellings is a straightforward one, and is not revisited here. Consistent with the Noise Protocol, Part II, all new venues need to comply with external noise limits at existing dwellings.

6.1 Background information

This is a critical planning issue for acoustics, with existing music venues risking non-compliance with the Noise Protocol, Part II due to residential encroachment. Yarra City Council has, in recent times, adopted an 'Agent of Change' approach to new dwellings in the vicinity of existing music venues. This approach is both supported and complicated by the planning scheme amendment VC183 28/09/2020 Clause 53.06 – Live Music and Entertainment Noise (previously VC120 / Clause 52.43) and the Planning Practice Note PPN81 *Live Music and Entertainment Noise* 2016 which provides further technical guidance on the Clause. The Explanatory Report for Amendment VC120 states:

The Amendment implements the 'agent of change principle' for live music entertainment venues and noise sensitive residential use in their vicinity. It requires an applicant for a live music entertainment venue or a noise sensitive residential use near a venue to include appropriate noise attenuation measures as part of an application for use or buildings and works that requires a planning permit under any zone of a planning scheme.

The amendment provides support for the assessment of music to indoor locations. Prior to the amendment, there was no formal recognition that building upgrades to control music noise would protect existing venues from residential encroachment (upgrades could be adopted, but the assessment location was still formally outdoors).

The issue of music noise impacts to new residential development is complicated by:

- Clause 53.06 applies to live music venues only. Many existing music venues are not live music venues, and these are explicitly excluded from consideration under Clause 53.06.
- Clause 53.06 only applies to venues within 50 m from a proposed residential development.

6.1.1 Compliance with the Noise Protocol, Part II indoors

Compliance with the Noise Protocol, Part II is achieved by either designing for a 'background + margin' recommended maximum noise level (as defined in the Noise Protocol), or the 'base noise limits' (as defined in the Environment Noise Regulations 2021, Part 5.3, paragraph 125, subregulation (2)). The 'background + margin' level can, however, rarely be reached when a dwelling façade is upgraded – the same upgrades that control music noise ingress also work to reduce the ambient noise and effectively lower the indoor noise limit.

The 'base noise limits' are fixed levels. They are very low, and can in practice be extremely difficult to achieve. Most high performance acoustic glazing, for example, performs poorly in the region of the acoustic spectrum where music noise is most likely to exceed the base noise limits (i.e. in the 63 Hz and 125 Hz octave bands).

The Planning Practice Note PPN81, May 2016, *Live Music and Entertainment Noise*, provides options for upgrading a noise sensitive dwelling on page 3, however the options are inadequate in the context of controlling significant levels of bass music noise.

In practice, to achieve compliance with the Noise Protocol, Part II indoors when music levels are 10 dB or more above the external limit, the following methods or combinations of them can be required:

- Design the dwelling so that there are no windows or lightweight walls or roof exposed to high levels of music noise. This can represent significant architectural constraints on a site.
- Include winter-gardens (enclosed glazed spaces) to all balconies and windows – this is effectively a very large cavity double glazing (e.g. 10 mm glass, 1.2 m airgap, 12 mm glass).
- Incorporate controlled noise masking into the design (relying on air conditioning systems to provide masking is not sufficient as the masking noise provided in this way will vary with the weather).

6.2 Other standards and guidelines

Acoustic rating curves (NR, RC or NC) are often used for quantifying ambient noise. The curves define acceptable levels of noise in octave measurement bands. Octave bands are also used in the Noise Protocol, Part II night period assessments.

Based on review of all ratings curves, the use of 'Noise Criteria' or NC curves is considered the most appropriate for domestic use.

6.3 Guideline

Compliance with the Noise Protocol, Part II noise limits should be demonstrated, using any of the methods described above. This means achieving:

- base noise limits within apartment habitable rooms with doors and windows closed, OR
- 'background + margin' noise limits with continuous noise masking installed in habitable rooms of all apartments. The masking system should be set to no more than NC20 L₉₀ and the Leq of the masking to no greater than NC20 L₉₀ + 5 dB.
- Where noise masking is used to achieve compliance:
 - The masking system is to be designed to enable masking levels in all rooms to be individually controlled.
 - Future occupants are to be informed that compliance with the relevant music noise limits relies on the masking system operating at the pre-determined level.
 - Commissioning testing is to be conducted to demonstrate that the masking system meets the above requirements and is deemed acceptable for domestic use by the acoustical consultant.

Note: Noise masking must not be relied on as the sole measure to address music noise exceedances. It can, however, be implemented on a project in conjunction with other reasonable and practical façade upgrades.

- These indoor criteria for music noise should be applied to all existing sources of music, not just live music.
- The requirements should be met at apartments where any significant music noise impacts are identified, not just due to venues within 50 m of the proposed residential use.
- Where night period internal amenity is achieved via building façade upgrades, the building must be designed to ensure adequate fresh air provision in accordance with the National Construction Code and other relevant standards, without compromising the acoustic amenity outcome (i.e. with windows to the affected room closed).

7 Patron noise

This section deals with:

- New outdoor patron areas
- New residential development near existing outdoor patron areas

7.1 Patron noise – new outdoor patron areas

7.1.1 Background

The Noise Protocol specifically excludes voice noise, but with the significant increase in outdoor patron area applications, there have been major noise issues associated with this source.

While there are still no policy requirements for patron noise, there is general acknowledgement that this source of noise needs to be considered in the context of proposed dwellings near existing outdoor patron areas, and in the context of proposed new outdoor patron areas near existing dwellings. New outdoor patron areas are considered in this section.

7.1.2 Recommended maximum noise levels

As part of any planning application for an outdoor patron area an assessment of patron noise to 'Leq' and L_{max} criteria should be considered. The Leq descriptor quantifies the average level of patron noise over an interval, and is particularly important for outdoor areas that are proposed to accommodate appreciable numbers of people (say more than 10). The L_{max} criteria are useful for quantifying impacts from smaller outdoor areas, where the steady state noise emissions may be low, or variable, and the most intrusive impacts are due to isolated loud voices.

The following noise criteria are typically used in assessments:

- Noise Protocol, Part I – while the Noise Protocol does not strictly apply to patron noise, it nevertheless provides a useful assessment methodology and is considered a good tool for assessing patron noise impacts.
- 'Background + 5 dB' – this is a standard basis for quantifying the intrusiveness of noise. It is a useful assessment tool for patron noise although day and evening limits can be impractically low.

- Sleep disturbance recommended maximum noise levels of 55 dBA L_{max} in bedrooms with windows open (usually assessed as 65 dBA L_{max} externally, outside openable windows).
- Marshall Day Acoustics (MDA) have developed their own patron noise criteria based on background noise levels plus a variable margin:
 - Background + 10 dB during the day and evening period (including weekends)
 - Background + 5 dB at night (after 10 pm)
 - Minimum noise limits are also provided for each of these time

periods. The MDA approach is generally supported however the following is noted:

- The evening recommended maximum noise level of 'background + 10 dB' can be too high in some circumstances where there is little other ambient noise (for example for dwellings that back onto an outdoor patron area, but are not exposed to general street noise).
- MDA are careful to emphasise that these levels are not 'noise limits', and that modelling or predictions that show the recommended maximum levels will be exceeded represent a risk of nuisance rather than grounds for stopping a project from going ahead.
- The MDA approach appears to allow for long term averaging of background levels. This can lead to a misrepresentation of the impact during, for example, the last hour of operation of a venue when background levels in an area are at their minimum.

7.1.3 Predicting patron noise levels

Unless the proposal is for the expansion of an existing outdoor patron area, patron noise levels need to be predicted to the nearest receivers. The prediction involves two steps:

- Quantification of the amount of noise produced in the outdoor area. This should take into consideration both the level of noise in the outdoor area, the size of the outdoor area and the number of patrons. Ideally the overall noise level should be expressed as a sound power level. It is critical that appropriate sound emission levels are used for the specific type of crowd.
- Prediction of acoustic attenuation or losses, between the outdoor patron area and the receiver location due to distance, shielding and the like. For complicated built environments it is often appropriate to use a 3D computer noise modelling program to predict noise to receiver locations.

7.1.4 Policy Requirements

There are no policy requirements for patron noise.

7.1.5 Other standards and guidelines

None.

7.1.6 Guideline

Assessment of patron noise areas is to be based on:

- Noise Protocol or
- Background noise based assessment approach of:
 - 'background + 5 dB for the night period
 - 'background + 10 dB' for the 'evening' and 'day' periods where these criteria can be demonstrated to be reasonable, and with definitions of 'evening' in accordance with the Environment Noise Regulations 2021, Part 5.3, Division 3, paragraph 116 (that is, including all day Sunday as evening).
 - Background levels to be based on the minimum 15 minute to 1 hour interval and conducted during a time that is representative of potential worst case noise impacts (long term averaging of background levels is not appropriate).

and

- Sleep disturbance criteria of 55 dBA L_{max} in bedrooms with windows open (65 dBA L_{max} externally, outside openable windows).

7.2 Patron noise – new residential development near existing outdoor patron areas

7.2.1 Background

The issue of noise from existing outdoor patron areas to new developments should be assessed in any planning application to protect future residents from noise. There are no explicit policy requirements for patron noise. In these circumstances the proponent should design to meet appropriate patron noise criteria indoors with windows closed. Some consideration should also be given to the impacts of patron noise to balconies.

7.2.1.1 Recommended maximum noise levels

Patron noise is a very distinctive, potentially annoying and variable noise source. For this reason, conservative indoor recommended maximum noise levels are proposed, based on consideration of AS/NZS2107, WHO Guidelines and the AAAC Acoustic Star Rating design recommendations.

Determining acceptable patron noise level impacts for external balcony areas and private open spaces, is a complicated issue:

- Adopting indoor criteria effectively means accepting high levels of noise in these external locations, and in many cases this will occur on balconies.
- It may be difficult to avoid locating balconies on facades exposed to the noise source (the external façades for many apartment developments may be restricted to one or two orientations).
- Unavoidably high levels of noise on balconies can occur as a result of road traffic noise.
- Patron noise levels on balconies above approximately 60-65 dBA Leq would make the outdoor space unusable for many residents.
- Options for controlling noise to balconies are limited to:
 - Wintergardens (high level of control but effectively an enclosed space), OR
 - Solid balcony balustrades in combination with sound absorption to the underside of the balcony ceiling (providing a small reduction in noise level to seated position on balcony).

7.2.1.2 Predicting patron noise levels

Patron noise from existing venues should ideally be measured for the most exposed new dwelling. Where this is not practical, for example where a proposed multi-level residential development will overlook an existing outdoor area, it may be necessary to predict patron noise to the new façade. The predictions should take into consideration the actual patron noise levels at the venue during worst case operating conditions. This would likely involve monitoring noise over a busy weekend period, with a logger located above the outdoor patron area. Real rather than theoretical patron noise data should be used, where possible, to predict patron levels from an existing outdoor area.

7.2.2 Policy requirements

There are no policy requirements for patron noise.

7.2.3 Other standards and guidelines

The Apartment Developments provisions at Clause 58 of Planning Schemes, and specifically at 58.04-3 Noise impacts objectives and Standard D16 provides indoor criteria of 40 LAeq,16h and 35 LAeq,8h. These levels are too high and the long term averaging (16h and 8h) is not appropriate for patron noise.

The Noise Protocol, Part I effective indoor limits (external noise limit less 20 dB) can be used as recommended maximum noise levels indoors for patron noise but there is a risk that the resulting limits will be unreasonably high in some instances.

7.2.4 Guideline

New residential developments exposed to noise from outdoor patron areas should be designed to achieve the following recommended maximum noise levels:

- 35 dBA Leq, 15 mins in habitable rooms
- 30 dBA Leq, 15 mins in bedrooms at night
- 45 dBA, Lmax in bedrooms at night
- 65 LAeq, 15 mins to balconies, 1.2 m above balcony floor level

Noise from existing outdoor patron areas should be measured in order to quantify the worst case impacts to the subject site. Where measurements cannot be undertaken at a location representative of the proposed

new receptors, they should be made closer to the venue. The measured levels should be adjusted for the size of the outdoor patron area, and for the distance to the development façade.

Where night period internal amenity is achieved via building façade upgrades, the building must be designed to ensure adequate fresh air provision in accordance with the National Construction Code and other relevant standards, without compromising the acoustic amenity outcome (i.e. with windows to the affected room closed).

8 Apartments

This section deals with:

- Noise from apartment developments to existing dwellings
- Noise from apartment common areas to apartments within the development
- Acoustic star ratings for apartments and townhouses - Association of Australasian Acoustical Consultants (AAAC)

8.1 Noise from apartment developments to existing dwellings

8.1.1 Noise Protocol, Part I assessable noise

Communal mechanical plant, car stackers, carpark entrance gates and the like should comply with the Noise Protocol, Part I at existing and proposed dwellings.

Expert advice on managing noise should be sought early in the planning stage, particularly with regard to items that have structural implications for the project, such as carpark entrance doors and car stackers. Effective control of noise and vibration can, for example, require full enclosure of the carpark and/or set-downs to accommodate vibration isolation mounts.

Noise from mechanical plant cannot be fully addressed during the planning stage because equipment is rarely specified at this time, and equipment location may not be finalised. On larger projects, where an acoustical consultant is retained during the detailed design, it is reasonable for the consultant to state that these issues will be addressed during the detailed design.

On smaller projects, where it is unlikely that a consultant will be retained after the planning phase, more guidance should be provided for achieving compliance with the Noise Protocol, Part I. This could entail providing a maximum overall sound power level for any mechanical plant proposed to be installed on a roof top plant deck, and / or maximum rating for air conditioning condenser units.

8.1.2 Sleep Disturbance

Noise from operation of car-park equipment should be designed to comply with sleep disturbance criteria outside openable windows of bedrooms of nearby dwellings. Noise levels should not be in excess of 65 dBA L_{max}.

8.1.3 Apartment Common Areas

There are no mandatory limits for voice noise from apartment common areas such as communal decks, gardens, pools and spas. These should be assessed similarly to any other patron noise (see Section 7 of this document).

8.2 Noise from apartment common areas to apartments within the development

Noise to apartments from common areas within and outside the development buildings has the potential to cause nuisance. This is a lower tier planning issue because such issues within the development are not normally assessable to any noise policy or guideline, and can be addressed by the Body Corporate. However, these are still amenity quality issues and it is preferable to address these items during the planning stage particularly because they can be costly and difficult to rectify after construction. In addition, the Body Corporate approach is usually to limit times of usage of such areas, which can lead to a poor outcome for other areas of amenity.

The following is a summary of the relevant potential impacts.

8.2.1 Communal outdoor areas, including decks, outdoor pools, gardens, carpark entrance

Facade upgrades should be provided to apartments within the development that are potentially impacted by noise from voice in communal outdoor areas, carpark entry areas and outdoor pools and the like. A practical approach to addressing these sources would be to adopt moderate glazing upgrades.

Appropriate moderate upgrades may include, for example, calling up double glazing to achieve an R_w 39 dB rating (eg. 10.38 mm thick laminated glass, 12 mm airgap, 6 mm glass) to the most affected windows.

If, after reasonable upgrades, occupants are still annoyed by voice noise, the Body Corporate should manage impacts through restricted access to or use of, the communal facilities.

8.2.2 Communal enclosed areas, including cinemas, gyms, indoor pools.

Pools and gyms in particular can generate vibration and structure-borne noise in apartment buildings. Appropriate siting or treatments to control adverse amenity impacts from these uses should be considered in the planning acoustic report.

The degree of noise and vibration control will depend on the size and proximity of the gym / pool relative to the closest apartments, and the equipment proposed for use. For small gyms, it may be sufficient to install a 25-50 mm thick rubber/foam isolation matt throughout the gym and to restrict the use of free weights and running machines. For larger gyms a full acoustic floating floor may be required. Pools can also be vibration isolated with rubber or spring mounts.

Cinemas also require some care if they are directly adjacent or above / below an apartment. Upgrades to the walls and floor / ceiling systems would typically be necessary. The National Construction Code (NCC) minimum requirements for walls and floors is not sufficient to address cinema noise transfer.

8.2.3 Noise transfer between apartments via light-wells

Noise transfer between apartments that share a light-well should be addressed in the acoustic report because this issue is not covered under the National Construction Code (NCC).

Noise transfer can be a particular problem in instances where the light-well is enclosed on all sides, because the ambient noise within the light-well is low, and sound attenuation within the light-well is minimal. Sound emanating from one apartment (which may have their windows open) will reflect off the walls and windows of the light-well, potentially causing nuisance to other occupants.

There are two basic scenarios:

- Light-wells that contain non-openable windows to habitable rooms, and openable windows to bathrooms / toilets only
- Light-wells that have openable windows from habitable room

Scenario A is not a major concern, because, provided reasonably well sealed glazing is fitted to all windows of habitable rooms, noise between apartments will typically travel through two widely spaced panes of glass. We recommend that glazing to habitable rooms in this situation be not less than R_w = 30 dB (typically 6 mm thick glass to windows of all habitable rooms onto the light-well).

Scenario B is the greater concern because the noise generating apartment may have their window open. In that instance, there is only one window separating affected apartments from the noise source. Glazing to habitable rooms should be rated not less than R_w = 39 dB in this situation (typically double glazing comprising 10.38 mm thick laminated glass, 12 mm airgap, 6 mm glass).

This approach will not be optimum for all situations – very large light-wells or light courts, for example, may be less critical because more sound attenuation will take place between apartments. A lesser upgrade may be reasonable in these areas.

8.2.4 Carpark entrance gates and car stackers

These items are potential sources of airborne noise, structure-borne noise and vibration.

8.2.4.1 Airborne Noise

Carpark entrance gates and car-stackers need to comply with the Noise Protocol, Part I outdoor limits as well as indoor limits (where noise is transmitted through the building structure) and should also be designed to achieve appropriate L_{max} levels indoors for sleep disturbance and general annoyance.

The Noise Protocol assessment should take into consideration typical frequency of use during various times of day and night; the duration of the event, and any relevant corrections for impulse, tonality and intermittency. Recent acoustic assessments of car stackers suggest that impulsive, tonality and intermittency corrections can apply.

When assessing sleep disturbance, as a minimum, the 3 star AAAC Acoustic Star Rating design levels for L_{max} levels should be met with windows closed (45 dBA L_{max} in living rooms and 40 dBA L_{max} in bedrooms). Lower noise levels should be targeted by the proponent if they classify the apartment as moderately high to high quality.

Requirements for apartments potentially affected by noise from the carpark typically include glazing upgrades and / or floor ceiling upgrades (particularly for lightweight/non-masonry floor construction).

8.2.4.2 Structure-borne sound and vibration

Car stackers and carpark entrance gates should be vibration isolated to ensure that the recommended maximum noise levels are met in potentially affected apartments.

8.3 AAAC Guideline for acoustical star ratings for apartments and townhouses

The AAAC Acoustic Star Rating design levels (*Association of Australasian Acoustical Consultants Guideline for Apartment and Townhouse Acoustic Rating*) provide a useful tool for assessment because they address many sources of noise in apartments that are not captured or assessable under existing guidelines, standards and policies.

The AAAC recommended indoor levels for internal and external noise, for discrete events, (quantified using the 'L_{max}' acoustical descriptor) and steady state noise are provided in the sections below. Assessments should be to at least 3 stars in an inner urban setting. If a development is advertised or promoted as moderately high to high quality, a higher star rating should be targeted by the proponent.

The AAAC recommended maximum noise levels should not be used for noise from outdoor patron areas or noise from commercial / industrial operations.

8.3.1 External noise intrusion

Examples of external L_{max} sources of noise include: individual truck movements, crashing and banging due to deliveries or rubbish collection.

Table 1 External Noise Intrusion Design Levels (AAAC Star Rating Guide), L_{max} levels

External noise intrusion	2 star	3 Star	4 Star	5 Star	6 Star
Bedrooms	50	50	45	40	35
Other habitable rooms	55	55	50	45	40

Examples of external Leq sources of noise include: road traffic

Table 2 External Noise Intrusion Design Levels (AAAC Star Rating Guide), Leq day and night levels

External noise intrusion	2 star	3 Star	4 Star	5 Star	6 Star
Bedrooms	36	35	32	30	27
Other habitable rooms	41	40	35	30	27

8.3.2 Internal Noise Intrusion

Examples of internal L_{max} sources of noise include: mechanical plant and equipment serving the building or commercial tenancies and hydraulic noise.

Table 3 Internal Noise Intrusion Design Levels (AAAC Star Rating Guide), L_{max} day and night levels

Internal noise intrusion	2 star	3 Star	4 Star	5 Star	6 Star
Bedrooms	45	40	35	30	27
Other habitable rooms	55	45	40	35	32

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Terminology

Term	Description
'A' weighted	A frequency weighting representing the human response to sound and its variation with frequency.
dB	Decibel
dBA	'A' weighted decibel
Hz	Hertz
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L ₉₀ , L ₁₀ , etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
L _{Aeq} (dB) or L _{eq} (dBA)	The 'A' weighted equivalent noise level, measured in decibels. The equivalent noise level is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
L _{Amax} (dB) or L _{max} (dBA)	The 'A' weighted maximum sound pressure level of an event.
Low frequency	Noise containing energy in the low frequency range.
L _p or SPL	Sound Pressure Level
L _w or SWL	Sound Power Level
Noise Curves - NR, NC, RC	A set of reference curves used to rate the noise level taking into account the frequency content of the noise across the audible spectrum. The curves allow for the determination of a single number rating. The most commonly used curves are the Noise Rating (NR), Noise Criterion (NC), and Room Criteria (RC).
Octave-band	An octave is the interval between one frequency and its double or its half. Octave-band analysis is implemented in sound level measurements and assessment to allow for division of the audible frequency range into smaller defined regions or 'bands'. This provides for a more detailed and targeted analysis that is more effective in capturing the spectral characteristics of a sound source than the overall A-weighted level.
Sound Insulation	A reference to the degree of acoustical separation between any two areas.
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Tonality	Noise containing a prominent frequency.

APPENDIX B