# NOISE AND VIBRATION CONSIDERATIONS DISCUSSION REPORT

**City of Yarra**

**Prepared for:**

City of Yarra
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## BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with City of Yarra (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

## DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|
| 640.10090.99990 Planning Review -R01-v0.3 | 31 October 2019 | Dianne Williams | Jim Antonopoulos | Jim Antonopoulos |
| 640.10090.99990 Planning Review -R01-v0.2 | 31 October 2019 | Dianne Williams | Jim Antonopoulos | |
| 640.10090.99990 Planning Review -R01-v0.1 | 10 February 2017 | Dianne Williams | Jim Antonopoulos | |

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# 1 Introduction

**This report provides a technical discussion and summary of previously provided advice to City of Yarra on planning related noise and vibration issues and forms the basis of the *Guidelines – managing noise impacts in urban development, Guidance for planning permit and related decisions under the Yarra Planning Scheme 2019.***

# 1 Road Traffic Noise

## 1.1 Background Information

Road traffic is a significant and major source of noise impact to dwellings on main roads. The issue has been acknowledged and addressed in new *Better Apartments Design Standards*, 2016. The document provides decibel targets for day and night average road traffic noise levels, and applies to apartment developments on roads carrying more than 40,000 vehicles, or within 300 m from a freeway. The design targets are 40 dBA Leq,16h for all habitable rooms and 35 dBA Leq,8h for bedrooms

It is of note that the time classifications used in *Better Apartments* document place the 6 am to 7 am period in the 'day' rather than the 'night' category. This classification is not consistent with those we have been applying to City of Yarra projects, and is not consistent with the classifications usually used in Victoria (e.g. SEPP N-1 and the Vic EPA Noise Control Guidelines (Publication 1254)).

In our opinion the *Better Apartments* document should be modified as follows:

- the 6 am to 7 am period should be included in the 'night' period rather than the 'day' period;
    - application of the targets 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 targets should be applied to all residential developments, not just apartments.

## 1.2 Mandatory Requirements

The Victorian Planning Provisions were amended in March 2017 with Clause 58, Apartment Developments, objectives and Standard D16 which adopted the *Better Apartments Design Standards*. This introduced the design targets of 40 dBA Leq,16h for living rooms and 35 dBA Leq,8h for bedrooms in developments within 300 m of a freeway on roads carrying more than 40,000 vehicles.

## 1.3 Other Potentially Useful 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 traditionally been called up in planning permits to address road traffic noise impacts. However the provision in the Standard of a decibel range instead of a specific design target has led to uncertainty with regard to actual design targets (most consultants design to the upper end of the range). Furthermore the assessment methodology is not defined (it is unclear whether traffic noise should be quantified as an average or worst case level, e.g. the loudest hour of traffic noise). In our reviews of acoustic reports for the City of Yarra, and in our own planning noise assessments, we have interpreted the AS/NZS2107 design levels to be as follows: the day and night average noise levels are assessed to the lower end of the AS/NZS2107 range (35 dBA bedrooms and 40 dBA living rooms), and the loudest hour of road traffic noise during the day and night periods are assessed to the upper end of the AS/NZS2107 range (40 dBA bedrooms and 45 dBA living rooms).

The NSW *Road Noise Policy,* 2011 provides internal targets for road traffic noise of 35 dBA in bedrooms at night and 40 dBA in all habitable rooms during the day period (NSW Road Noise Policy, 2011, C10). These targets are elaborated in the NSW guideline document *Development Near Rail Corridors and Busy Roads - Interim Guideline*, 2008. The NSW targets are generally consistent with the *Better Apartments Design Standards* (with the exception that the 6 am to 7 am period is classified as 'night' in the NSW Road Noise Policy – as per our preference and consistent with the SEPPs).

*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 guidelines documents for road and rail noise.

## 1.4 SLR Recommendations

Our office recommends designing to the following levels for road traffic noise:

- 40 dBA Leq,16h to all habitable rooms and 35 dBA Leq,8h in bedrooms, and
- Loudest hour of road traffic noise is 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 following morning. The basis for the loudest hour targets 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 Better Apartment Design Standards.
- These targets should apply to all residential development where there is a reasonable expectation that traffic noise may impact the land (i.e. not just those formally triggered by Clause 58 of the planning scheme).

Reporting should generally be in accordance with NSW guideline document *Development Near Rail Corridors and Busy Roads - Interim Guideline* Appendix D – Acoustic Consultant Reports, Methodology for Testing and Compliance Reporting.

# 2 Rail Noise

## 2.1 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. However if the threshold levels are not exceeded, rail noise impacts may still need to be considered as a 'secondary matter'. In the context of a proposed residential development, we understand this to mean that the issue of rail noise should be dealt with by the individual developer and local government.

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 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 targets. The design targets to be met are the same as those for road traffic noise: 40 dBA Leq,16h and 35 dBA Leq,8h.

Prior to the release of the Apartment Developments, Standard D16, a common approach has been to assess rail noise to $L_{max}$ targets of 60 dBA 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 (2016)
- 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 on some projects, and are cited by acoustical consultants on those grounds.

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

- Leq is primarily a noise descriptor used to quantify steady or quasi-steady state noise. So 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 / regular as traffic noise. While there are no trains passing by, the occupant experiences little or no noise, yet while the train passes, there is a short term high noise event which can only be quantified via an Lmax descriptor; to clarify, the Lmax is the actual highest level that someone experiences as the train goes past. In contrast, the long term Leq's are not easily related to the actual objective experience of an occupant when the train passes by.
- Lmax levels are often used to address sleep disturbance targets.
- On suburban rail corridors where there may only be one line in each direction, relatively infrequent trains and no trains during some of the night period, the $L_{max}$ targets become more important and are likely to drive the assessment. If these targets are not in place it is possible for the $L_{eq}$ targets to be met, and rail noise to exceed sleep disturbance $L_{max}$ targets by appreciable amounts.

- Very short term noise events, such as train horns, are not well quantified using long term $L_{eq}$ targets.

It may be of consideration that in the City of Yarra, where all rail lines carry significant numbers of trains, it is less likely that the assessment will be driven by the $L_{max}$ targets.

## 2.2 Mandatory Requirements

Clause 58, Apartment Developments, objectives and Standard D16 has been incorporated into the planning scheme.

## 2.3 Other Potentially Useful Standards and Guidelines

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

## 2.4 SLR Recommendations

Our office recommends designing to the following levels for road traffic noise:

- Clause 58, Apartment Developments, Standard D16 - 40 dBA Leq,16h and 35 dBA Leq,8h, and
- Train generated Lmax levels, including horn noise, should not exceed 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).

Reporting should generally be in accordance with NSW guideline document *Development Near Rail Corridors and Busy Roads - Interim Guideline* Appendix D – Acoustic consultant Reports, Methodology for Testing and Compliance Reporting.

# 3 Rail Vibration – Trains and Trams

## 3.1 Background Information

In Victoria, there are no guidelines, standards or policies that address transportation vibration impacts.

The only time that vibration assessments are typically undertaken is when a local council perceives there may be a vibration issue and calls up a vibration assessment in a permit condition, or larger scale projects where a Planning Panel or VCAT may require consideration of the issue.

The lack of guidelines and policy leads to enormous variability and inconsistency in addressing vibration in Victoria

## 3.2 Other Potentially Useful Standards and Guidelines

NSW has significantly more noise and vibration related planning guidance documents than Victoria does.

Their main planning guideline document relating to new developments is the *Development Near Rail Corridors and Busy Roads – Interim Guideline* (Department of Planning, State Government of NSW, 2008) and provides some guidance on vibration assessment methodology, including a basic preliminary screening process.

Section 3.5.1 of the NSW Interim Guideline provides a basic buffer distance within which a rail vibration assessment should be undertaken, and is reproduced below:

**Figure 1 NSW Interim Guideline Rail Vibration Assessment Zones**

**Rail Vibration**

The vibration assessment zone for typical development sites adjacent to rail corridors or above rail tunnels is shown in **Figure 3.2**. The assessment zone may need to be increased for specific areas where vibration issues are known to already exist. Refer to section 3.6.3 vibration criteria for additional information. Developments within this zone will need a vibration assessment.

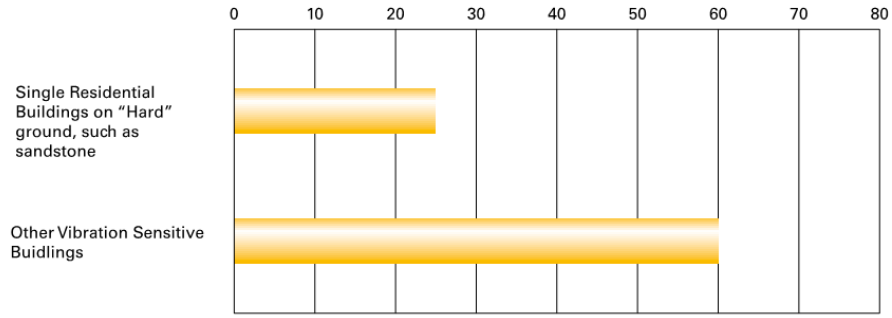


**Figure 3.2**: Distance from the nearest operational track (m)

So from the above any multi-level development within 60 m of a railway line will require a vibration assessment. This is a particularly large assessment zone. It should be noted that this relates to railway lines, not trams (which we discuss further below).

The NSW Interim Guideline does not provide the technical requirements of the assessment; it instead refers to another NSW Technical Guideline; *Assessing Vibration: a technical guideline* (DECC 2006).

The Technical Guideline includes all necessary details of the testing / or prediction of vibration and also provides the assessment targets. The assessment methodology and targets are based on British Standard BS6472 which uses the 'Vibration Dose Value' measurement (VDV) for intermittent vibration assessment.

The VDV is a long term averaged 'dose' based parameter (a little like a long term Leq), and is a relatively new measurement parameter. The equipment used to measure VDV is more advanced than traditional vibration measuring equipment, however, is readily available and most of the larger acoustical consulting firms have the necessary equipment.

The VDV is assessed for the day (16 h) and night (9 hour) with different criteria applicable for each period and for different uses. The following excerpt from the NSW Technical Guideline shows the criteria:

**Table 2.4 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)**

| Location | Daytime[1] | | Night-time[1] | |
|---|---|---|---|---|
| | Preferred value | Maximum value | Preferred value | Maximum value |
| Critical areas[2] | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences | 0.20 | 0.40 | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | 0.40 | 0.80 | 0.40 | 0.80 |
| Workshops | 0.80 | 1.60 | 0.80 | 1.60 |

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
Source: BS 6472–1992

It is normally necessary to monitor for at least a 24 hour period to obtain the VDV value (although it is possible to estimate using shorter measurements). There are also some further complicated calculations necessary when the vibration transmits to the upper floors of a building.

One of the most significant issues relating to the assessment is what to do if the criteria are exceeded. There are really only two options – do not build the building in that location, or design in complicated building vibration isolation into the footings. Both are of major concern to any application / developer.

***Trams***

There is a large gap in knowledge and information on tram vibration impacts, primarily because it has not been considered historically in any assessments.

We have minimal reference data upon which to draw indicative buffer distance triggers, however, from our experience in CoY, it is clear that trams operate in very close proximity to existing and proposed residential / office buildings. In addition, there are many additional variables such as track condition, joint locations in the track, and the speed of pass-bys, that would affect the vibration level in the building.

## 3.3 SLR Summary and Recommendations

Rail and tram vibration presents one of the most difficult challenges in relation to planning assessments.

There are no Victorian policy or guideline documents, and no precedent for assessing vibration (with many historical and new developments constructed in close proximity to rail with no formal assessment undertaken).

The further complicating issue is that if vibration impacts are found to exceed the British Standard BS 6472 criteria at a particular building, it has drastic implications; either further setback is required, or the building is required to be designed with vibration isolation within the footings – potentially making the development financially not-viable.

Overall, due to the lack of formal guidance in any Victorian policy or guideline and the large extent of variables that can affect a vibration assessment, it is considered that this issues is not specifically addressed at this point in time.

# 4 SEPP N-1 Assessable Commercial Noise

Commercial and industrial noise assessable to SEPP N-1 is considered in the following section.

## 4.1 Background Information

This is a critical 'tier one' planning issue from our perspective. Noise from existing commercial and industrial premises to residential developments needs to be addressed to ensure that:

- The SEPP N-1 compliance status of the business 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 occupants is addressed.

The main issue with SEPP N-1 assessable noise pertains to whether or not the noise should be assessed at the façade of the proposed residential development, or within the residence with windows and doors closed. The latter approach is not strictly in accordance with the SEPP, which requires noise to be assessed externally unless noise enters the dwelling via a non-openable section of the façade (solid wall, fixed window etc.).

Whereas SEPP N-1 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.

Our approach has been largely consistent with the City of Yarra's, however we have encouraged the following exceptions / modifications:

- Where commercial noise is to be assessed internally, we recommend that the targets are equal to the lower of:
  - The effective SEPP N-1 internal noise limit, taking into consideration any relevant corrections for noise character (corrections for character are required under SEPP N-1), and
  - The lower end of the original AS/NZS2107:2000 ranges, which was 35 dBA in living rooms and 30 dBA in bedrooms. However, in the 2016 release of AS/NZS2107, the lower end of the allowable ranges for apartments near major roads has increased to 35 dBA in all rooms

## 4.2 Mandatory Requirements

Compliance with SEPP N-1 is mandatory, however strictly speaking the onus of compliance is on the business, rather than the developer.

The *Better Apartments Design Standards* / Clause 58, Apartment Developments, Standard D16 also potentially also applies to commercial noise however the targets provided in this document are generally likely to be less stringent than SEPP N-1 indoor limits.

## 4.3 Other Potentially Useful Standards and Guidelines

The Association of Australian Acoustical Consultants (AAAC) *Guideline for Acoustical Star Ratings for Apartments and Townhouses* provides indoor design targets for commercial noise. Assuming 'three star' (i.e. average) apartments the targets would be:

- Bedrooms: 35 dBA Leq and 50 dBA Lmax

- Living rooms: 40 dBA Leq and 55 dBA Lmax

## 4.4 SLR Recommendations

All residential developments should be designed to ensure that existing commercial uses formally comply with SEPP N-1 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 internal targets for commercial / industrial noise (windows closed) are to be met if noise is assessed internally:

- SEPP N-1 indoor limits, being the outdoor limits less 15 dB, and
- Not more than 30 dBA Leq in bedrooms and 35 dBA Leq in living rooms, and
- Not more than 45 dBA Lmax in bedrooms 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 SEPP N-1 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 SEPP N-1 procedure.

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 SEPP N-1.

# 5 Music Noise

The following 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 straightforward one, and need not revisited here. Consistent with the SEPP N-2 policy, all new venues need to comply with SEPP N-2 external noise limits at existing dwellings.

## 5.1 Background Information

This is a critical 'tier one' planning issue for acoustics, with existing music venues being at risk of SEPP N-2 non-compliance 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 VC120 4 September 2014 Clause 52.43 – Live Music and Entertainment Noise.

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 (i.e. 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 the following

- Clause 52.43 applies to live music venues only. Many existing music venues are not live music venues, and these are explicitly excluded from consideration under Clause 52.43.
- Clause 52.43 only applies to venues within 50 m from a proposed residential development.

The amendment requires new dwellings at which a SEPP N-2 excess is established, and which cannot be managed in any other way, to be constructed such that SEPP N-2 noise limits are met indoors. However the means by which compliance is to be achieved in doors has not, in our opinion, been thought through. A brief outline of the issues is provided below

### 5.1.1 SEPP N-2 Compliance Indoors

SEPP N-2 compliance is achieved by either designing for a 'background + margin' target (as defined in the Policy), or the SEPP N-2 'base noise limits'. The issues are that the 'background + margin' target can rarely be reached when a dwelling's façade is upgraded – the same upgrades that control music noise ingress also work to reduce the ambient noise and effectively lower the noise targets.

By contrast, the 'base noise limits' are fixed targets. However 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 generally exceeds the base noise limits the most (i.e. in the 63 Hz and 125 Hz octave bands).

The planning practice note provides options for upgrading a noise sensitive dwelling on page 3 of the May 2016 revision, however the options are inadequate in the context of controlling significant levels of bass music noise.

In practice, to achieve compliance with SEPP N-2 indoors when music levels are 10 dB or more above the SEPP N-2 external limit, the following approaches would be necessary:

- 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 wintergardens to all balconies and windows – this is effectively 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). The masking should preferably not be controlled or varied by the user.

As the SEPP currently stands we expect consultants to adopt one or more of the above approaches to ensure that music within an apartment does not exceed SEPP N-2 limits.

### 5.1.2 What Needs to be Done

In our opinion there is still a lot of work to do before Clause 52.43 is workable.

**Review of SEPP N-2 indoor limits**

- Are the base noise limits appropriate for all environments? It may be reasonable to apply higher limits in an inner urban environment and particularly in one that is acknowledged as an entertainment district or on a very busy road.

***And specifically with regard to noise making:***

- What level of noise masking is acceptable? The masking should not cause occupants discomfort (ideally it should not even be noticed).
- What level of music is acceptable above the noise masking? i.e. should the masking be equal in level to the music, or should the masking be treated as the background noise level, and higher levels of music allowed in accordance with the SEPP N-2 'background +' targets.
- Could 'user controlled' masking systems be used? As the SEPP N-2 legislation currently stands, masking would need to be continuous and centrally controlled if it is part of a solution to ensure compliance with the SEPP.

The above questions cannot be simply answered, and should ideally be explored in the context of a review of SEPP N-2.

## 5.2 Mandatory Requirements

Compliance with SEPP N-2 is mandatory, however strictly speaking the onus of compliance is on the venue rather than the developer.

Compliance with Clause 52.43 is also mandatory, but only for developments within 50 m of a live music venue.

## 5.3 Other Potentially Useful Standards and Guidelines

Acoustic rating curves (NR, RC or NC) are provided in acoustic literature for quantifying noise intrusion. The curves define acceptable levels of noise in octave measurement bands, not dissimilar to the SEPP N-2 octave band night noise limits.

From recent experience on projects incorporating masking for music noise, use of 'Noise Criteria' or NC curves is considered the most appropriate for domestic use.

## 5.4 SLR Recommendations

Until such time that the SEPP is reviewed and updated, we recommend that formal compliance with SEPP N-2 noise limits is demonstrated, using any of the methods described in **Section 5.1.1** of this review. Effectively this means achieving:

- SEPP N-2 base noise limits within apartment habitable rooms with doors and windows closed, OR
- SEPP N-2 '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 $L_{90}$ and the Leq of the masking to no greater than NC20 $L_{90}$ + 5 dB.
- These indoor targets 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.

# 6 Patron Noise – New Outdoor Patron Areas

## 6.1 Background

SEPP N-1 and SEPP N-2 specifically exclude patron 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 mandatory 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.

### 6.1.1 Noise Targets

As part of any planning application for an outdoor patron area we expect an assessment of patron noise to 'Leq' and Lmax targets. 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 Lmax targets 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:

- SEPP N-1 – while the SEPP N-1 policy does not strictly apply to patron noise, the policy nevertheless provides a useful assessment methodology and we find it valuable for quantifying 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 we have found that the day and evening limits can be impractically low.
- Sleep disturbance targets of 55 dBA $L_{max}$ in bedrooms with windows open (usually assessed as 65 dBA $L_{max}$ externally, outside openable windows).
- Marshall Day in-house targets for patron noise. MDA have developed patron noise targets based on background noise levels plus a variable margin, being:
  - Background + 10 dB during the day and evening period (including weekends)
  - Background + 5 dB at night (after 10 pm)

  The MDA approach is generally supported however the following is noted:
  - The evening noise target 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 targets 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.

### 6.1.2 Predicting Patron Noise Levels

Unless the application 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.
- 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 can be appropriate to use a 3D computer noise modelling program to predict noise to receiver locations.

There is enormous variability in how acoustical consultants predict patron noise and we have been particularly disturbed by the recent use of patron sound power data derived from restaurants and non-drinking venues to beer garden environments. Most patron noise assessment we review are delayed during the review process due to differences in opinion with regard to the amount of noise produced in outdoor patron areas.

## 6.2 Mandatory Requirements

There are no mandatory requirements for patron noise.

## 6.3 Other Potentially Useful Standards and Guidelines

None.

## 6.4 SLR Recommendations

Regarding noise limits, or targets for patron noise, we support the following:

- SEPP N-1

  OR

- MDA based assessment approach of:
  - 'night' targets (background + 5 dB)
  - 'evening' and 'day' targets (background + 10 dB) where they can be demonstrated to be reasonable, and where they align with the SEPP N-1 definition of evening (that is including Saturday afternoon and Sunday daytimes).
  - 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 targets of 55 dBA Lmax in bedrooms with windows open (65 dBA Lmax externally, outside openable windows).

# 7 Patron Noise – New Residential Development Near Existing Outdoor Patron Areas

## 7.1 Background

The issue of existing noise from outdoor patrons areas to new developments should be assessed in any planning application to protect future residents from noise. Due to the fact that there are no mandatory requirements for patron noise, we are generally comfortable with the developer designing to meet appropriate patron noise targets indoors with windows closed. Some consideration should also be given to patron noise to balconies.

### 7.1.1 Noise Targets

Our approach to date has been to require patron noise to be designed to meet the 'satisfactory' levels provided in AS/NZS2107:2000. These were 35 dBA in living rooms and 30 dBA in bedrooms near major roads. The recently reissued version of the Standard proposes higher minimum noise levels in bedrooms (35 dBA). In our opinion these are not appropriate for voice noise and we recommend adoption of the 30 dBA target in bedrooms which also aligns with the WHO recommendations for sleep disturbance during the night (WHO 1996). Patron noise is a very distinctive, potentially annoying and variable noise source. Patron noise levels equal to 35 dBA Leq will include frequent levels of over 40 dBA Lmax, which we believe are unacceptable in sleeping areas.

With regard to acceptable patron noise levels to balconies, this is a complicated issue given that:

- By adopting indoor targets we are effectively accepting high levels of noise externally, and in many cases these will occur on balconies
- It can be difficult to avoid having balconies overlooking the noise source (many apartment developments only have one external façade).
- Unavoidably high levels of noise on balconies can occur in the context of road traffic noise.
- Patron noise levels on balconies above 60-65 dBA Leq would, in our opinion make the outdoor space unusable for most 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 (small reduction in noise level to seated position on balcony).

### 7.1.2 Predicting Patron Noise Levels

Patron noise from existing venues should ideally be measured at a location representative of 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, however, still take into consideration the actual patron noise levels at the venue during worst case operating conditions. This may involve monitoring noise over a busy weekend period, with a logger located above the outdoor patron area. In our opinion it is not appropriate to use theoretical patron noise data to predict patron levels from an existing outdoor area

## 7.2 Mandatory Requirements

None.

## 7.3 Other Potentially Useful Standards and Guidelines

The *Better Apartments Design Standards, 2016* provides indoor targets of 40 $L_{Aeq,16h}$ and 35 $L_{Aeq,8h}$. As indicated above, we believe these are too high for patron noise. The long term averaging component (16h and 8h) is also not relevant. To provide for a reasonable level of amenity we would expect patron noise to meet the nominated targets at all times, not just over a long averaged period.

The SEPP N-1 effective indoor limits (external SEPP N-1 noise limit less 15 dB) can be used as indoor targets for patron noise however there is a risk that the resultant limits will be unreasonably high in some instances.

## 7.4 SLR Recommendations

We recommend that new residential developments exposed to noise from outdoor patron areas be designed to achieve the following targets:

- 35 $L_{Aeq,30mins}$ in living rooms
- 30 $L_{Aeq,30\ mins}$ in bedrooms
- 45 dBA, $L_{max}$ in bedrooms at night
- 60-65 $L_{Aeq,30\ mins}$ to balconies, 1.2 m high (We are still considering exact target for this issue)

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.

# 8 Noise from Apartment Developments to Existing Dwellings

## 8.1 SEPP N-1 Assessable Noise

Communal mechanical plant, car stackers, carpark entrance gates and the like are required to comply with SEPP N-1 at existing and proposed dwellings.

In our opinion as much advice as practical should be provided by the consultant at 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 setdowns to accommodate vibration isolation mounts.

Noise from mechanical plant cannot usually 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, we recommend that more guidance be provided for achieving SEPP N-1 compliance. 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 ratings for air conditioning condenser units.

## 8.2 Sleep Disturbance

Noise from operation of carpark equipment should also be designed to comply with sleep disturbance targets outside openable windows of nearby dwellings. Noise levels should not be in excess of 65 dBA $L_{max.}$

## 8.3 Apartment Common Areas

There are no mandatory limits for voice noise from apartment common areas such as communal decks, gardens, pools and spas. In our opinion these should be assessed similarly to any other patron noise (see **Section 6** of this document).

# 9 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. We consider this a 'second tier' planning issue because, theoretically, any issues due to noise within the development can be addressed in the future by the Body Corporate. However, it is preferable to address these items during the planning stage particularly as they can be costly and difficult to rectify post construction.

The following is a summary of the relevant potential impacts. City of Yarra should consider if their planning documents should require assessment of these '2nd tier' issues.

## 9.1 Communal outdoor areas, including decks, outdoor pools, gardens, carpark entrance etc.

Facade upgrades should be provided to apartments within the development that are potentially impacted by noise from voice and vehicles in communal outdoor areas. From our perspective moderate glazing upgrades, as opposed to a full patron noise assessment, are appropriate in the context of outdoor communal areas. If, after reasonable upgrades, occupants are still annoyed by voice noise, the Body Corporate should manage impacts through restricted access to the communal facilities.

Appropriate moderate upgrades may include, for example, calling up double glazing comprising 10.38 mm thick laminated glass, 12 mm airgap, 6 mm glass to the most affected windows.

## 9.2 Communal enclosed areas, including cinemas, gyms, indoor pools etc.

The main issue with regard to gyms and pools is vibration and structure-borne noise due to running machines, free weights, and weight machines.

The degree of vibration control appropriate for a development will depend on the size of the gym, the proximity of the closest apartments, and the equipment proposed for use. For small gyms, it may be sufficient to install a 50 mm thick dense rubber matt throughout the gym and to restrict the use of free weights and running machines. For more elaborate gyms a full acoustic floating floor may be required.

## 9.3 Noise transfer between apartments via lightwells

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

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

There are two basic scenarios:

a. Lightwells that contain non-openable windows to habitable rooms, and openable windows to bathrooms / toilets only

b. Lightwells that have openable window from habitable room.

**Scenario A** is not a major concern, because, provided reasonable 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 Rw = 30 dB (eg. 6 mm thick glass to windows of all habitable rooms onto the lightwell).

**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. We recommend glazing to habitable rooms be rated not less than Rw = 38 dB in this situation (e.g. double glazing comprising 10.38 mm thick laminated glass, 12 mm airgap, 6 mm glass).

The above advice will not be optimum for all situations – very large lightwells or light courts, for example, may be less critical because more sound attenuation will take place between apartments. A lesser upgrade would be reasonable in these areas.

## 9.4 Carpark entrance gates and car stackers

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

**Noise**

Carpark entrance gates and carstackers need to comply with SEPP N-1 effective indoor limits within apartments and should also be designed to achieve appropriate $L_{max}$ levels indoors for sleep disturbance and general annoyance.

The SEPP N-1 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. In our measurements of car stackers we have found that a 5 dB impulsive correction always applies; a 2 dB correction for tonality is often appropriate and intermittency corrections apply to the day and evening periods.

Regarding sleep disturbance, as a minimum, we recommend that the AAAC internal targets for $L_{max}$ levels in three star apartments are met with windows closed (40 dBA $L_{max}$ in living rooms and 35 dBA $L_{max}$ in bedrooms). Lower noise levels should be targeted by the developer if they classify the apartment as moderately high to high quality.

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

**Structure-borne Sound and Vibration**

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

# 10 AAAC Guideline for Acoustical Star Ratings for Apartments and Townhouses

SLR have often advised on the use of the AAAC Acoustic Star Rating design targets because these address many sources of noise in apartments that are not always captured or assessable under existing guidelines, standards and policies.

The AAAC recommended indoor targets for internal and external noise, and for discrete events (quantified using the 'Lmax' acoustical descriptor) and steady state noise are provided in the sections below. We have generally advised targeting for not less than 3 stars in City of Yarra reports. If a development is advertised as moderately high to high quality, a higher star rating should be targeted by the developer.

These targets are a useful fall-back for many sources of noise, however we do not recommend using them for:

- Noise from existing outdoor patron areas - the Guideline would result in targets of 35 dBA Leq in bedrooms and 40 dBA Leq in living rooms, which is too high for patron noise.

## 10.1 External noise intrusion

Examples of external Lmax sources of noise include: individual truck pass-bys, crashing and banging due to deliveries or rubbish collection.

**Table 1 External Noise Intrusion Design Targets (AAAC Star Rating Guide), Lmax 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 |

**Table 2 External Noise Intrusion Design Targets (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 |

## 10.2 Internal Noise Intrusion

Examples of internal Lmax sources of noise include: mechanical plant and equipment serving the building or commercial tenancies and hydraulic noise.

**Table 3 Internal Noise Intrusion Design Targets (AAAC Star Rating Guide), Lmax day and night levels**

| Internal noise intrusion | 2 star | 3 Star | 4 Star | 5 Star | 6 Star |
|---|---|---|---|---|---|
| Bedrooms | 45 | 40 | 35 | 30 | 27 |

| Internal noise intrusion | 2 star | 3 Star | 4 Star | 5 Star | 6 Star |
|---|---|---|---|---|---|
| Other habitable rooms | 55 | 45 | 40 | 35 | 32 |

Examples of internal Leq sources of noise include: mechanical plant and equipment serving the building or commercial tenancies and hydraulic noise.

A decibel penalty should be added to the measured noise level where the source is deemed to include annoying characteristics. Penalties are typically equal to +2 dB for just audible characteristics, and +5 dB for clearly audible characteristics

**Table 4 Internal Noise Intrusion Design Targets (AAAC Star Rating Guide), Leq day and night levels**

| Internal 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 |

# 10 Bibliography

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