Noise Impact Assessment Planning Scheme Policy

Contents

1 Introduction

Generally, this planning policy is called up by the following Codes for impact and code assessable development:

- Industrial Amenity and Performance Code
- Residential Design Codes
- Centre Amenity and Performance Code
- Service Station Code
- Subdivision Code
- Structure Planning Code.

The Noise Impact Assessment Planning Policy (NIAPSP) seeks to assist with the decision making process for management of noise impacts through the planning process. The policy will be used to determine the noise impacts of, and on, development, to help achieve better planning outcomes by addressing potential noise impacts at the design stage.

The policy recognises that consideration of the potential impacts of noise at the planning stage is more effective than noise mitigation following development.

The policy identifies the legislative approach to noise, provides noise criteria that can be used to determine noise impacts from noise immissions and emissions. The policy is further supported by noise planning guidelines and technical papers, which provide further guidance on the application of NIAPSP. They are more specific and provide interpretation of policy objectives outlined in this policy.

1.1 Nature and character of noise

Noise is often described as unwanted sound, and, by its very nature, can cause varying degrees of nuisance. Some sounds are considered to be noise by some people but not by others, however, the louder a sound, generally, the greater the annoyance or nuisance caused. The nature and character of a sound, even at low levels, may also cause annoyance.

Sound can have a number of characteristics and can be described in many ways. It is not possible to fully categorise every form of sound however this policy is intended to provide guidance for the majority of commonly experienced sounds.

'Noise' has become synonymous with 'sound' in common language. In this policy, noise will generally mean sound. Furthermore, sound is defined in Queensland legislation to include vibration and therefore guideline levels of acceptable vibration are also included.

1.2 Legislation governing noise

The key environmental noise legislation in Queensland for planning is the *Environmental Protection Act 1994* and the *Environmental Protection (Noise) Policy 1997* (EPP Noise). The EPP Noise does not seek to reduce noise in the environment to a minimum. It is a statutory instrument to achieve a balance between competing and often incompatible interests within the broad community. The EPP Noise seeks to provide a process so informed decisions can be made to objectively balance the needs of the people making noise with the needs of the people who do not want the noise.

The EPP Noise identifies a range of tools which can be applied in order to meet the objectives of the Act. These tools include:

- Specifying a long term **Acoustic Quality Objective** of achieving an ambient level of 55 dB(A) or less for most of Queensland's population living in residential areas while not intending that, in achieving the acoustic quality objective, any part of the existing acoustic environment be allowed to significantly deteriorate.

  The 55 dB(A) however remains a broad overall guiding objective when there are no specific alternative guidelines.

- Providing a framework for:
  - making consistent and fair decisions that best protect Queensland's acoustic environment
  - developing noise management programs with the involvement of government entities, industry groups and the community
  - making accurate and consistent noise assessments
  - providing consumers with important information about noise

- Identifying acoustic environmental values to be enhanced or protected under the EPP Noise which are conducive to:
  - the wellbeing of the community or a part of the community, including its social and economic amenity
  - the wellbeing of an individual, including the individual's opportunity to have sleep, relaxation and conversation without reasonable interference from intrusive noise.

Note: the Environmental Protection Regulation 1998 sets noise levels to specifically deal with resolution of complaints, rather than setting planning criteria. It should therefore not be used in a planning and design context. However, the construction noise criteria in the Regulations will be used unless specific exemptions are given by Council in the development assessment process.

2 Application and object of NIAPSP

2.1 Policy Statement

The NIAPSP provides a basis upon which to make consistent and balanced planning decisions with regards to noise. Whilst maintaining alignment with state acoustic amenity objectives, it is slightly more prescriptive than the EPP Noise. This is intentional to provide greater guidance for a consistent framework in which accountable, co–ordinated and efficient planning decisions can be made in a timely manner.

NIAPSP also provides a basis upon which to achieve acceptable environmental solutions and performance criteria consistent with the City Plan Desired Environmental Outcomes.

2.2 Policy objectives

- To provide residents of development in *new* areas with a level of residential amenity which is sustainable for future generations
- To provide residents of development in *existing* areas with realistic expectations of acoustic amenity
- To provide industry with a level of certainty with respect to urban encroachment
- To facilitate appropriate development within the city through the application of a standard assessment process and set of criteria relating to acoustic amenity.

3 Noise sources

3.1 Noise emission & immission

In order to achieve the NIAPSP objectives, noise impacts must be assessed in terms of the effect that a development will have on the receiving environment. The receiving environment is both adjacent development (noise emission) and the internal environment of the proposed development (noise immission).

- **noise emission** is the noise emitted outwards (ie. the noise generated by the development).

  Noise Emission should be considered for all development, with all potential sources of noise identified, quantified and mitigated in the planning and design stages. These sources include, but are not limited to, sound from industry, outdoor entertainment areas, car parks, drive–throughs attached to commercial development, and standard building equipment such as air conditioners, pumps and generators.

- **noise immission** is the noise received by the development when it is **immersed** in an ambient sound environment (ie. noise received by, or impacting on, the development from the surrounding environment).

For noise sensitive developments (especially residential development) this is sound from sources such as industry, road, air and rail traffic noise. Certain commercial developments may also be sensitive to external noise sources.

Another impact to consider is the future constraining effect on the land use of the surrounding area. For example, an industrial area generally creates noise

from day–to–day operations. Development of a noise sensitive land use next to an area likely to generate noise, now or in the future, will have a constraining effect on the noise generator unless noise control is implemented to ensure appropriate noise levels at the development.

3.2 Intrusive noise

The EPP Noise and NIAPSP refer to Intrusive Noise. It is the intrusiveness of noise on the internal and/or external receiving environment of the development that the NIAPSP seeks to limit.

Intrusiveness can be measured by the increase in level of various noise measurement parameters or descriptors used to describe acoustic amenity. The change should not be such as to detrimentally alter acceptable levels of acoustic amenity, nor such as to impact on the well–being and environmental values of the community and individuals.

The intrusiveness, or impact, of noise emission can be assessed in a number of ways. The method will depend on the sensitivity of the receivers of noise from the development and the character of the ambient noise level *without* the development, compared to the character of noise level with the development. Situations may arise where the existing noise levels are already too high for an area, in which case, it may be prudent to ensure that the development does not make matters worse.

The nature and character of noise can relate to its frequency/repetitiveness, duration, level, tonal characteristics, impulsiveness or vibration and whether it is steady, fluctuating, intermittent, or any combination of these.

4 Noise characteristics

4.1 Noise measurement descriptors

The appropriate noise descriptor depends on the type of noise source. Noise sources may be assessed differently because intrusiveness or annoyance relates to sound pressure level perception. For example, road traffic is assessed differently to rail. A best fit of annoyance with noise parameters for road traffic can be found using the $L_{10(18\ hour)}$ descriptor or L_{eq}; rail traffic is generally less frequent than road traffic and two different descriptors, $L_{eq(24\ hours)}$ and $L_{Amax(pass–by)}$, are used to assess the level of annoyance.

Intrusive noise impact can be measured using a long–term (cumulative noise exposure) criteria and/or a short–term (emission or immission) criteria, depending on the receiving environment. The choice of criteria will depend on the sensitivity of the receiving environment at particular times of day; for example, a school will have a requirement for suitable noise levels within the classrooms only during their use. As a 24 hour criteria would not be appropriate for such a use a short–term criteria should be used.

4.1.1 Cumulative noise exposure criteria

Cumulative sound pressure level parameters or descriptors such as L_{eq} or statistical metrics such as L_1, L_{10}, L_{90} are defined or specified within predetermined time intervals, or the average of a number of time intervals.

For example, the $L_{10(18\ hour)}$ parameter is used as a criterion metric for road traffic noise. An $L_{10(18\ hour)}$ parameter is determined from the arithmetic average of 18 one–hour L_{10} levels from 6am to midnight. The choice of time interval will depend on the ambient noise environment, the type of sound source and the duration of the sound emitted or received by the development into or from that environment respectively.

Cumulative noise exposure criteria include, but are not limited to:

- a long–term background level, or the difference between background levels, which may be used for noise sources such as continuously operating air conditioning or refrigeration plant, or
- a long–term equivalent continuous sound pressure level (L_{eq}), or the difference between L_{eq} levels, which may be used for developments emitting sound throughout the day placed in an existing ambient receiving environment which has similar characteristics to the sound emitted by the development, or
- a long–term statistical level such as the L_{10} level, or the difference between like statistical levels, commonly used to represent general industrial noise or road traffic, or
- yearly day–night sound pressure level, sometimes used to assess the impacts of aircraft movements or operations.

4.1.2 Emission or immission noise exposure criteria

For the purposes of this policy, short–term measurements should be chosen to represent the use of a development, however measurement intervals shall not be less than 15 minutes.

Often, there will be more than one noise emission or immission criterion used to determine the noise impact associated with a development. Emission or immission noise exposure criteria include, but are not limited to:

- an average maximum sound pressure level, or the difference between such levels
- a background level (L_{90}), for relatively constant sound sources, or the difference between background levels
- an equivalent continuous sound pressure level (L_{eq}) or the difference between L_{eq} levels
- impulse or peak levels when considering such noise sources as shooting, pressure pulse operated bag filters or pile driving
- loudness or audibility rating scales for determining the impact on communication
- a maximum sound pressure level, often used in conjunction with an L_{eq}. For example, **noise** from a development may have a criteria that is to meet an Leq of 55dB(A) and a maximum sound pressure level of 70dB(A)
- a sound **exposure** level, or the difference between sound exposure levels, used to assess possible sleep disturbance
- a statistical level, such as the L_{10} level, or the difference between like levels (the choice of percentile statistic should be representative of the sound under consideration), or
- vibration levels conforming to a standard weighting or measurement procedure such as AS2670—1990 "Evaluation of human exposure to whole–body vibration".

5 Management of noise impacts

The preferred means of controlling noise impacts between incompatible land uses is the provision of suitable separation distances between those uses. Attenuation requirements vary with the time of occurrence of the noise and the characteristics and level of the noise. Noise generated at night would normally require a larger separation distance.

5.1 Design options

Reduction of noise impact from emission (protecting noise sensitive areas from noise generated by the development) can be achieved by:

- reducing the noise source sound pressure level
- enclosure of the noise source
- suitable location of the noise source taking advantage of any attenuation provided by barrier structures or by providing a buffer
- limiting the time and/or duration of the noise source.

Reduction of noise impact from immission (protecting the development from external noise sources) can be achieved by:

- devices such as sealed windows and/or double glazing
- minimising the window area facing a noise source
- barriers for low level receivers
- effective building orientation
- provision of an adequate separation distance between the development and noise source.

When considering noise immissions in relation to residential and other noise sensitive development adjacent to a railway corridor, regard should be had to noise contour information available from the Queensland Rail Noise Management Plan database. This information can assist in determining appropriate separation distances and measures.

When considering noise immissions in relation to residential and other noise sensitive development adjacent to main roads, regard should be had to Main Roads Department's *Road Traffic Noise Management: Code of Practice*. This information can assist in determining appropriate attenuation measures.

For development on land affected by the 20 ANEF contour or greater of the most recently endorsed ANEF plan, refer to the **Airports Planning Scheme Policy** for guidance on limitations on land uses, the appropriateness of any material change of use and design options for mitigating aircraft noise.

6 Planning assessment methodologies

Because the nature and character of noise is so varied, there is no single way to assess all possible impacts. This Planning Scheme Policy uses three fundamental assessment methodologies to determine the acoustic/vibration acceptability for a range of developments.

Any one or a combination of these methodologies may be needed to assess the acceptability of a particular development, depending on the nature and characteristics of the sound or vibration. Meeting the requirements of one particular methodology may not be an acceptable overall solution if another applicable methodology is not satisfied.

The three methodologies of assessment are:

- **Methodology One: Comparison of like parameters or descriptors**—Comparison, using a suitable sound descriptor, of the ambient sound character of an area without the development to that resulting with the development

- **Methodology Two: Application of *AS2107*—** Comparison with a defined set of sound pressure levels, for specified indoor areas occupied by people set out in Table 1 of *AS2107—1997*
- **Methodology Three: Sleep Awakenings—** Comparison with sleep levels.

Each of the three methodologies can be used to determine both emission levels and immission levels for a development but there will be a different emphasis depending on the type of development and its location. For example a residential block development application would focus more on the acceptable amenity that future occupants would have (immission) whereas industrial development would focus more on its emissions received by the adjacent uses. Refer to Council's Noise Planning Guidelines for further guidance.

6.1 Considerations when applying the assessment methodologies

The following issues need to be taken into consideration when using the three methodologies to assess noise impacts.

6.1.1 Noise emissions and background creep

One of the aims of the policy is to prevent background creep, i.e. the progressive increase in background noise levels as new noise emitting activities locate in the area. To achieve this aim, the outside noise levels arrived at after applying the above emission assessment methodologies must not exceed the levels detailed in the table below:

Noise area category Appendix A AS1055.2[(a)]	Permissable level of exceedance of $L_{A90,T}$ for the appropriate time of day		
	Where there is residential development	Where there is no residential development	Where background levels already exceed stated levels in AS1055.2 (i.e. without the proposed development)
R1	by 5dB(A)	N/A	The development's noise contribution must still comply with the stated levels in *AS1055.2*
R2	by 5dB(A)	N/A	
R3	by 0dB(A)	By 10dB(A)	
R4			
R5			
R6			

(a) Refer to Appendix A in AS1055.2 for $L_{A90,T}$ levels for the noise area categories

6.1.2 Environmental Protection (Noise) Policy limits

The EPP Noise specifies noise levels (planning levels) that may be used as a guide in deciding a reasonable noise level. These planning levels will be considered by Council, when determining the appropriateness of noise attenuation measures. However, they will not be used as limiting criteria.

There are variations to some criteria stated in the EPP Noise in the NIAPP. For example, the planning levels for roads and railways are not necessarily applicable to the planning issues involved in determining the land use allowed next to those beneficial assets. In some cases, the second and third methodologies may be the most appropriate.

However, planning decisions should strive to ensure that outdoor recreation areas are not exposed to unreasonable noise from existing surrounding land use. If the existing land use is:

- a beneficial asset such as a railway corridor, it is necessary to comply with recommended levels for those uses prescribed in the EPP Noise
- a non–beneficial asset, compliance should be with the acoustic quality objective of 55dB(A) $L_{eq\ 24hrs}$.

6.1.3 Future development, traffic growth and networks

When undertaking the noise assessment using the three methodologies, the assessment will need to take into account the:

- noise impacts from existing and proposed road and rail corridors, allowing for a 10 year traffic growth and changes to the transport network
- potential development types including building heights, such that internal noise levels meet *AS2107*.

6.2 Noise methodologies

The choice of assessment methodologies must be justified in the development application. The methodologies are:

6.2.1 Comparison of like parameters or descriptors

In comparison of like parameters, evaluate the receiving environment without the influence of the development using one or more of the noise exposure criteria, and compare to the noise characteristic of the resulting environment that includes noise from the development. Any chosen parameter/s must be justified based on the character of the ambient noise and the character of noise emitted from the development.

Comparison of like parameters will mostly be applicable to assessment of noise emissions, in which case, an acceptable environmental outcome using this methodology is achieved when the chosen parameter assessing the impact of the development does not exceed the same parameter describing the ambient noise by more than 3dB(A).

Note: in the case that amplified or live music is being emitted by the proposed development or by other uses in the vicinity of the proposed development, Council will accept the comparison of unlike parameter descriptors to assess noise impacts.

6.2.2 Application of *AS2107*

This methodology applies to assessment of noise emissions and immissions for steady–state or quasi–steady–state sound such as noise from air conditioning systems, and noise from continuous road traffic.

AS2107 Acoustics—Recommended design sound levels and reverberation times for building interiors specifies recommended internal ambient noise levels for occupied spaces. *AS2107* has two categories of noise criteria for residential areas to account for residences built within a noisy environment (i.e. inner suburbs, major roads and commerce/industry) and those built in a quieter environment (i.e. outer suburbs, minor roads and no commerce/industry).

For this Policy, noise area categories R1—R3 identified in *AS1055.2* are taken to be outer suburbs with minor roads and no commerce/industry; and noise categories R4—R6 are taken to be inner suburbs with major roads and commerce/industry. During the daytime, *AS2107* noise levels will apply to living areas and at night time levels will apply to sleeping areas.

6.2.2.1 Adjustment process to determine acceptable outside noise level

The limiting criterion for noise levels **outside** an affected building is the adjusted maximum recommended noise level for an occupied building derived from the following six step process using *AS2107*.

Step 1 *Answer both a) and b)*

a) Does the development or the operations of the development emit sound?

No – (assessment not required for emission)
Yes – Go to 2

b) Does the development or the operations of the development match the uses described in AS2107?

No – (assessment not required for immission)
Yes – Go to 2

Step 2 *Does the development emit or experience sound that is steady state or quasi steady state? (steady state or quasi steady state may describe the fan of an air conditioner or a pool pump)*

No – End (this methodology is not applicable)
Yes – Go to 3

Step 3 *Determine the noise area category appropriate to the description of the neighbourhood as follows:*

Noise area category	Description of Neighbourhood
R1	Area with negligible transportation (local access roads)
R2	Areas with low density transportation (neighbourhood access roads)
R3	Area with medium density transportation or some commerce or industry (district access roads)
R4	Area with dense transportation or some commerce or industry (suburban routes)
R5	Areas with very dense transportation or in commercial districts or bordering industrial districts (motorways and arterial routes)
R6	Area with extremely dense transportation or within predominantly industrial districts

Note: some industrial and commercial sites are not predominant sources of high background sound pressure levels and R5 and R6 may not always apply. Use noise area category R4 in such cases.

Step 4 *Determine the attenuation correction, **C**, from the following table.*

Air conditioned?	Sealed windows or no windows facing the sound source?	Attenuation correction, C
Yes	Yes	Add 20dB(A)
No	Yes	Add 15dB(A)
No	No	Add 5dB(A)

OR where an acoustic assessment report is submitted with the development application, which demonstrates that a higher level of attenuation correction can be achieved to that shown above, due to the design of the proposed development, a higher attenuation correction may be used.

Step 5 *Adjust for tonality or impulsiveness (does not apply to roads, railways or aircraft)*

Although *AS2107* uses steady state noise, further adjustments can be made to account for tonal or impulsive noise characteristics. Where sleep disturbance is not an issue (because of the time of the generation of the noise or because the receiving building does not contain beds) adjust the above method to determine the outside noise criterion as follows:

- if the noise is clearly *tonal*, reduce the limiting criterion by 5dB(A)
- if the noise is clearly *impulsive*, reduce the limiting criterion by 5dB(A).

Step 6 *Limiting Criterion (noise level not to be exceeded)*

The limiting criterion = *AS2107* recommended level + C (step 4)—adjustment for tonality or impulsiveness (step 5).

Note: the limiting criteria are in L_{Aeq} and would not represent an integration period shorter than 15 minutes. For road traffic, the integration period should be the maximum one hour L_{Aeq} for the time appropriate to the use taken from AS2107. For example, a bedroom limit would have a sensitive time at night between 10pm and 6am.

6.2.3 Sleep awakenings

Sleep awakening criteria may be used to assess the impact of a development on the receiving environment (emission) or if the development has uses that are sensitive to noise intrusion (immission).

One of the fundamental noise interference issues is sleep disturbance. In 1992, the US Federal Interagency Committee on Noise (FICON), now referred to as FICAN, recommended a dose–response curve to predict the percentage of the exposed population expected to be awakened as a function of the exposure to single event noise levels expressed in terms of sound exposure level (L_{AE}). Although the dose–response curve was determined from data relating to aircraft noise, it can be used in the assessment of other noise sources because it provides a 'field proven' method for quantifying the potential for sleep disturbance. In 1997 this curve was reviewed after seven years of field research and a new curve was adopted by FICAN.

The adopted curve represents the upper limit of the data presented and should be interpreted as predicting the 'maximum percent of the exposed population expected

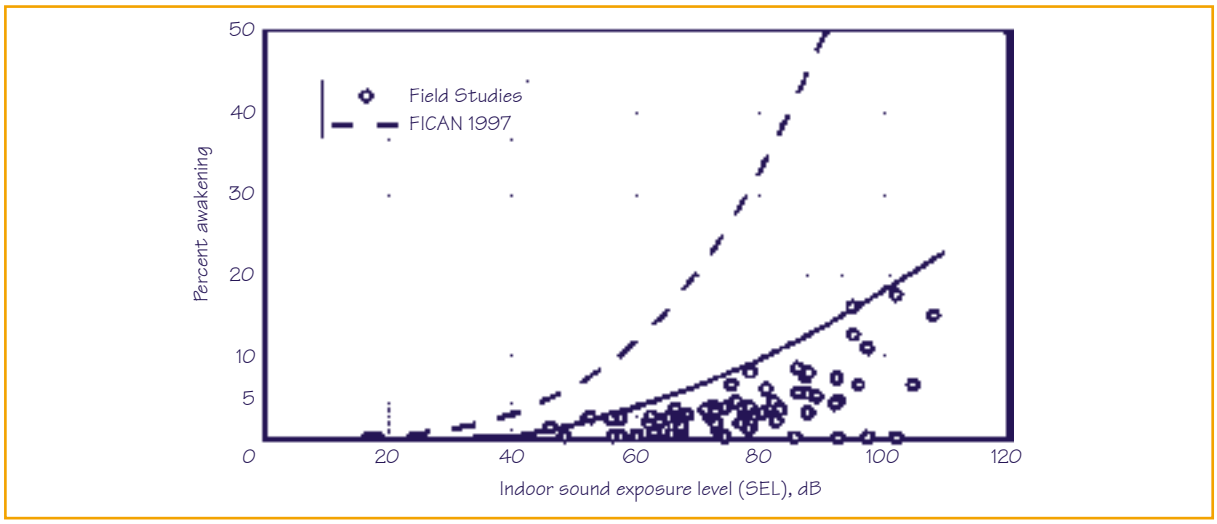

Figure a Recommended sleep disturbance dose—response relationship

to be behaviourally awakened', or the 'maximum % awakened'. Behaviourally awakened means woken up, not disturbed in their sleep.

Because this curve was based on long term residences it should not be applied to estimate sleep disturbance in camping grounds or other temporary residences. Nor should it be assumed that the curve could be generalised to include children, as only adults were included in the field studies. It is likely that the sleep disturbance curves are too low for children since they tend to sleep more soundly than adults. Also, these curves may be too high for noise sensitive populations, i.e. retirement villages and the like. However, notwithstanding these potential deficiencies, the assessment procedure outlined here should be used as an initial screen in the assessment of a development and in some cases more significant criteria may be applied.

The FICAN 1997 curve is represented by the following equation:

$$Percentage\ Awakenings = 0.0087 \times (L_{AE} - 30)^{1.79}$$

Note that the curve relates to indoor L_{AE} and generally a reduction of between 5dB(A) and 10dB(A) is applicable between the outside of a residence and a bedroom with open windows. The internal L_{AE} will be between 5dB(A) and 10dB(A) less than the values predicted for the outside of a residence.

Measurements of short duration events are made in terms of the sound exposure level (L_{AE}) observed for each activity/event. After correction for distance and other attenuating effects (for external noise measurements) these are compared with the published SEL(L_{AE})/percentage awakening curve.

The acceptable solution is the L_{AE} level representing 5% awakenings, which is a sound exposure level of approximately 65dB(A). [Actual L_{AE} for 5% awakenings is 64.801dB(A).]

7 Development application—noise impacts

Development that has the potential to generate noise (emission) or receive intrusive noise (immission) is required to address the issues outlined in the NIAPP and identify the noise impacts.

Listed below is a sequence of steps to be followed in determining the deemed acceptable solutions to noise impacts from and upon a development.

Each step should be addressed and documented in a report to Council by the applicant, although a justification of why the noise impact is not an issue may be all that is necessary.

7.1 Documentation required to accompany development application

Step 1 *For **both emission** (noise generated by the development) and **immission** (noise impacting on the development), identify:*

- noise source/s
- nature/character of the noise
- times of operation
- from *AS2107* the use categories chosen that may apply
- type and proximity of adjacent land uses
- details of any prescribed planning levels in the EPP Noise that may apply to the adjacent land uses
- whether any noise data exists for those adjacent land uses, e.g. railway corridor noise contours from Queensland Rail. If so, include the data.

Step 2 *Using the data collected in step 1 above, **select and justify** the appropriate noise planning assessment methodology(s) to determine the noise impacts on and from the development.* (From section 5—like parameter assessment, application of *AS2107*, or sleep awakenings).

Step 3 *Using the noise assessment methodologies from step 2 of this section (6.1), identify **if noise emission and/or immission complies with the calculated limiting criteria**. If noise may be unacceptable describe the control measures that will be used to ensure compliance.*

8 Vibration

8.1 Vibration impact assessment

Vibration is included in the definition of noise in the *Environmental Protection Act 1994*. However, the parameters used to define vibration are not the same as those used to describe sound.

Vibration can generally be described in terms of acceleration, velocity or displacement. The most commonly used descriptor for vibration for structural damage and human comfort criteria is velocity.

AS2187.2—Explosives—Storage Transport and Use, Part 2 Use of Explosives describes the commonly used damage criteria for buildings in terms of peak particle velocity (PPV) in mm/s. The peak particle velocity is the maximum vector sum of three time synchronised velocity components and it is measured at the ground surface.

The recommended maximum peak particle velocity for different types of structures is shown in *Table 1*.

Table 1 Recommended transient maximum peak particle velocity for cosmetic damage

Type of building	Peak particle velocity (mm/s)
Houses and low–rise residential buildings; commercial buildings not included below	10
Commercial and industrial buildings or structures of reinforced concrete or steel construction	25

Table 2 Transient vibration guide levels for cosmetic damage

Type of building	Peak particle velocity (mm/s)	
Reinforced or framed structures; industrial and heavy commercial buildings	50 at 4Hz and above	
Unreinforced or light framed structures; residential or light commercial type buildings	4Hz to 15Hz	15Hz and above
	15 at 4Hz increasing to 20 at 15Hz	20 at 15Hz increasing to 50 at 40Hz and above

The values shown take into consideration both human discomfort and structural integrity together with the effect of sensitive equipment located within buildings. The values shown in *Table 1* are for initial guidance only and are to be used to assess both emission and immission. When levels exceeding these amounts are observed, further, more detailed analysis will be required.

More detailed analysis is outlined in *BS7385.2 B 1993 Measurement and Evaluation of Vibration in Buildings, Part 2, Guide to Damage Levels From Groundborne Vibration* which provides frequency range vibration levels. Building damage is more closely related to stress, which is related to displacement. Constant peak to peak displacement levels at differing frequencies translate to vibration velocity, which increases with frequency. Because of this, the criterion allows greater vibration velocity levels at higher frequency.

Table 2 shows the criteria from *BS7385.2*. Vibration from sources such as piling, construction activities, machinery or road/rail traffic are covered in these standards. The values shown in this table are component levels, not PPV.

Values referred to are at the base of the building. For unreinforced/light framed structures/residential/light commercial buildings (last row *Table 2*) at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded.

For certain buildings, such as those of historical value or those containing equipment that is sensitive to vibration, vibration levels lower than those shown in the above tables may be required.

8.2 Human vibration comfort level assessment in buildings

Long term human exposure to vibration in buildings may cause annoyance. The levels at which annoyance occurs are much less than the structural damage criteria in buildings. *AS2670.2—1990—Evaluation of Human Exposure to Whole–body Vibration—Continuous and Shock–induced Vibration in Buildings (1 to 80 Hz)* describes a suggested vibration level in buildings for vibration in combined directions.

Vibration levels in one–third octave bands are acceptable if they are less than the following:

- 0.48mm/s at 1Hz, reducing to
- 0.18mm/s at 2Hz, then falling to
- 0.1mm/s at 8Hz and above to 80Hz.

If vibration levels exceed these values an acceptable environmental outcome may be to limit the occupation of the area or provide vibration isolation.

9 Australian Standards

Unless specified to the contrary, environmental noise and vibration must generally be assessed and measured in accordance with the guidelines outlined in the following *Australian Standards* or as updated:

- *AS1055—1997 Parts 1 to 3—Acoustics—Description and Measurement of Environmental Noise*
- *AS2107—1987—Acoustics—Recommended Design Sound Levels and Reverberation Times for Building Interiors*
- *AS2702—1984—Acoustics—Methods for the Measurement of Road Traffic Noise*

- *AS2021—1994—Acoustics—Aircraft Noise Intrusion —Building Siting and Construction*
- *AS/NZS3817—1998—Acoustics—Methods for the Description and Physical Measurement of Single Impulses or Series of Impulses*, which outlines appropriate ways to describe impulse noise
- *AS1259.1—1990—Acoustics—Sound level Meters —Non–integrating*
- *AS1259.2—1990—Acoustics—Sound level Meters —Integrating—Averaging*
- *AS2670.2—1990—Evaluation of Human Exposure to Whole–body Vibration—Continuous and Shock–induced Vibration in Buildings*
- *AS3671—1989 Acoustics—Road Traffic Noise Intrusion—Building Siting and Construction*.

The standards for measurement of noise are contained in *AS1055* and the Department of Environment and Heritage publication *Noise Measurement Manual*, 2nd edition.

10 Glossary

For the purposes of this Planning Scheme Policy, the following definitions apply:

Ambient noise: the all–encompassing noise at a point being a composite of sounds from near and far.

Background level ($L_{A\ 90,T}$): for a specified time interval, in relation to an investigation of a noise, means the A–weighted sound pressure level that is equalled or exceeded for 90% of that part of the interval in which the investigated noise is absent.

Dwelling: means any of the following structures or vehicles that are principally used as a residence:

- a house, unit, motel, nursing home or other building or part of a building
- a caravan, mobile home or other vehicle or structure on land
- a watercraft in a marina.

Impulsiveness: a single short burst or series of short bursts of sound pressure.

Intrusive noise: means noise that, because of its frequency, duration, level, tonal characteristics, impulsiveness or vibration:

- is clearly audible to, or can be felt by, an individual, and
- annoys the individual.

L_1: for a specified time interval, means the A–weighted sound pressure level obtained by using time weighting 'F' that is equalled or exceeded for 1% of the interval.

L_{10}: for a specified time interval, means the A–weighted sound pressure level obtained by using time weighting 'F' that is equalled or exceeded for 10% of the interval.

$L_{10(18\ hour)}$: for a specified day, means the arithmetic average of 18 individual L10 1 hour levels measured between 6am and midnight on the day.

$L_{A\ max,\ T}$ (average maximum A–weighted sound pressure level): for a specified time interval, means the arithmetic average of maximum A–weighted sound pressure level during the interval.

L_{OCT10}: for a specified time interval, means the linear (flat) frequency rating for a stated octave band that is equalled or exceeded for 10% of the interval.

L_{OCT90}: for a specified time interval, means the linear (flat) frequency rating for a stated octave band that is equalled or exceeded for 90% of the interval.

L_{max}: the maximum value of sound pressure level measured/estimated at a given location over a specified time interval.

Long term time interval: generally means a period of 8 hours or longer.

Noise:

- sound that a listener does not wish to hear
- sound from sources other than the one emitting the sound it is desired to receive, measure or record
- a class of sound of an erratic, intermittent or statistically random nature.

Noise immission: for noise at a place, means the receiving of the noise at the place from an external source.

Noise emission: noise from a particular source that may be emitted or transmitted.

Noise sensitive place: means any of the following places:

- a dwelling
- a library, child care facility, kindergarten, school, college, university or other educational institution
- a hospital, surgery or other medical institution
- a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*
- a marine park under the *Marine Parks Act 1982*
- a park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment.

Rating level ($L_{Ar,T}$): the time average A–weighted sound pressure level of a sound source during a specific time interval, plus specified adjustments for tonal and impulsive character of the sound.

Sound exposure level (L_{AE}): the instantaneous A–weighted sound pressure integrated over the specified time duration of the discrete noise event and referenced to a duration of 1 second.

Sound pressure level (weighted sound pressure level): the level of the frequency–weighted and time–weighted sound pressure, as determined by a sound pressure level meter.

Time average A–weighted sound pressure level ($L_{Aeq,T}$): also called the equivalent continuous A–weighted sound pressure level. The value of the A–weighted sound pressure level of a continuous steady state that, within a measured time interval (T), has the same mean square sound pressure as a sound under consideration whose level varies with time.

Tonal characteristic: presence of an audible tone that can be identified by third–octave or narrow–band analysis.