



REPORT 8051-R1
Draft 5 - Final

Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development

Prepared for

Hornsby Shire Council
296 Pacific Highway
HORNSBY NSW 2077

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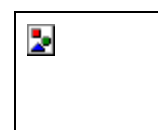


Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development



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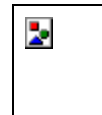


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PART A: NOISE AND VIBRATION POLICY DEVELOPMENT AND BACKGROUND

1 INTRODUCTION

This document contains guidelines for the submission of acoustic reports for proposed developments within the Hornsby Shire which have the potential to generate offensive noise and/or vibration.

The Policy and Guidelines for Assessment of Noise and Vibration from Development provides a framework and criteria for the assessment of noise and vibration impacts from development upon potentially sensitive receivers and describes the procedure to be followed in the preparation of an acoustical assessment report. Where possible, recommendations have been included for indicative control measures, which can be incorporated into a development to reduce the potential noise and vibration impact on the surrounding environment.

2 OBJECTIVES FOR THE POLICY AND GUIDELINES

The function and objectives of the Policy and Guidelines for Noise and Vibration Generating Development are:

- To define Council's role and responsibilities in the assessment and control of noise and vibration from development.
- To define the procedures for the assessment of noise and vibration emission issues.
- To enable controls for noise and vibration emission to be implemented at the planning stage through the existing approvals framework.
- To provide for ongoing management of noise and vibration emissions.
- To establish planning guidelines to prevent an escalation of background noise and vibration levels.
- To provide guidance to the public concerning the assessment of noise and vibration from development.



3 NOISE AND VIBRATION GENERATING DEVELOPMENT - DRAFT POLICY STATEMENT

Hornsby Shire Council is committed to ensuring that development and other activities within the Shire take place in an environmentally sustainable manner that does not unreasonably impact upon other members of the community.

In regard to noise and vibration emission from developments:

- o It is Council's policy to restrict the location of noise and vibration generating activities to appropriate areas by means of land zoning and planning mechanisms.
- o It is Council's policy to utilise the existing approvals process to control noise and vibration emission from developments.
- o It is Council's policy to apply its *Guidelines for Assessment of Noise and Vibration from Development* across all forms of noise and vibration generating development, with due regard to the key issues of local community amenity, the social worth of developments and the feasibility of noise and vibration control.
- o It is Council's policy to make its guidelines for acoustical assessment available to applicants and the community. Where possible, these guidelines will be consistent with those of the NSW Environment Protection Authority and with community expectations.
- o It is Council's policy to require an acoustical assessment for any development proposal that may adversely affect the acoustical amenity of the community. These assessments must be in accordance with Council's *Guidelines for Assessment of Noise and Vibration from Development*.
- o It is Council's policy to enforce Consent Conditions through routine inspections.



PART B: GUIDELINES FOR ASSESSMENT OF NOISE AND VIBRATION FROM DEVELOPMENT

1 INTRODUCTION

Hornsby Shire Council is responsible for planning for development within the Hornsby Shire and has environmental planning instruments and legislative powers to control noise and vibration emissions. Whilst some industrial and commercial developments are scheduled and require the preparation of an environmental impact statement, all require development approval from Council prior to proceeding.

The following guidelines have been developed to provide a clearly defined process for acoustical assessment of developments that have potential to generate noise and/or vibration. Council has separate guidelines for assessing the acoustical adequacy of noise and vibration sensitive developments (such as residential developments adjacent to major roads or railways).

Where developments have little potential to cause offensive noise and/or vibration or noise and/or vibration emissions are well regulated under existing Acts of Parliament, the process of acoustical assessment has been kept as simple as possible.

Where potential for offensive noise and/or vibration exists, the proponent will be required to submit an acoustical report with the development application. Reporting requirements and criteria for acoustical assessment are set out in the following guidelines.

Acoustical reports shall be prepared by a recognised consultant in acoustics. The consultant shall be a member firm of the Association of Australian Acoustical Consultants (AAAC), or other suitably qualified practitioner in the field of acoustics as deemed acceptable to Council.

In all instances, Council reserves the right to request an acoustical report, and to request additional supporting information if the initial report is considered inadequate.



2 SUMMARY OF ACOUSTICAL ASSESSMENT REQUIREMENTS

The **Table 2.1** lists the form of assessment and reporting required for various types of development. This table may be used to quickly identify which sections of the Guidelines are applicable in each case.

Table 2.1 Summary of Acoustical Assessment Requirements

Type of Development or Noise /Vibration Source	Classification ²	Form of Assessment to be Submitted with DA	Refer to Guideline Section
Industrial, Commercial and Residential			
Industrial	Low Risk	Letter of Certification	4.1.1, 4.15
	Other than Low Risk	Acoustical Report	4, 5, 4.2
Commercial	Signs, offices in existing office complexes, shops in existing shopping centres	Nil, except as requested by Council	
	Low Risk	Letter of Certification	6.2, 6.4
	Other than Low Risk	Acoustical Report	6, 4, 5, 4.2
Residential	Less than 10 dwellings or main road access	Nil, except as requested by Council	
	More than 10 dwellings with access via a local road	Acoustical Report	5
Community Noise			
Amplified music		Nil, other than for commercial operations (see above)	7.2.1, 6
Barking dogs		Nil, other than for commercial operations (see above)	7.2.2
Child Care Centres		Nil, other than for commercial operations (see above)	7.2.3, 7.3, 6
Churches and Religious Development		Acoustical Report	7.2.4, 7.3, 5
Community and Multi-purpose Halls		Acoustical Report	7.2.5, 7.3, 5
Domestic Air-conditioners		Nil, except as requested by Council	7.2.6
Domestic or Caged Birds		Nil, except as requested by Council	7.2.7
Home Industry	Low Risk	Letter of Certification	7.2.8, 7.3
	Other than Low Risk	Acoustical Report	7.2.8, 7.3, 4, 5, 4.2
Lawnmowers		Nil, except as requested by Council	7.2.9
Learn-to-Swim Schools on Residential Premises		Acoustical Report	7.2.10, 7.3, 5, 7.2.12
Schools	Low Risk	Letter of Certification	7.2.11, 7.3
	Other than Low Risk	Acoustical Report	7.2.11, 7.3, 5
Swimming Pool Pumps		Nil, except as requested by Council	7.2.12
Tennis Courts on Residential Premises	Low Risk	Letter of Certification	7.2.13, 7.3
	Other than Low Risk	Acoustical Report	7.2.13, 7.3
Outdoor Activities			
Open Air Concerts		Nil, except as requested by Council	8.2.1
Recreational Facilities		Acoustical Report	8.2.2, 8.3, 5, 4.2
Recreational Vehicles		Acoustical Report	8.2.3, 8.3, 5
Shooting Ranges		Acoustical Report	8.2.4, 8.3, 5

Notes: 1. Additional assessment or supporting documentation may be requested by Council at its discretion.

2. The term "Low Risk" refers to developments which can be classified as Low Noise Risk and Low Vibration Risk under the relevant sections of these guidelines.



3 STATUS OF GUIDELINES

The following guidelines have been prepared with the intention of providing consistent and equitable assessment of noise and vibration impacts from development. They apply to operational noise and vibration and are not intended to be applied to construction activities.

In some instances, it may be necessary for Council to impose more or less stringent criteria in the interests of local amenity or broader community benefit. Such instances will be examined on a case by case basis by Council officers.

Where the control of noise and vibration to meet the guideline criteria is not economically feasible, or has a negative impact on other aspects of local amenity, Council will consider applications to apply alternative criteria. Applications of this nature will be considered in the light of the public benefit of the development, and with a view to Council's responsibility to adequately protect the local amenity.

In addition to the specific criteria, Council may limit the hours of operation of a development or the number of events, particularly if a development is unable to comply with the guideline levels.

The Guidelines will also be used by Council officers to evaluate noise and vibration emissions from existing developments, with appropriate recognition given to existing development consents, where applicable.

4 NOISE AND VIBRATION FROM INDUSTRIAL DEVELOPMENT

4.1 Assessment and Control of Industrial Noise

In January 2000 the NSW Environment Protection Authority published its *NSW Industrial Noise Policy*. The policy applies to the assessment of noise impact from industrial developments that are scheduled under the *Protection of the Environment Operations Act 1997*. The EPA states that Councils may also wish to use the policy to assess and control noise from non-scheduled industrial noise sources under their control.



Hornsby Shire Council's procedure for assessing noise impact from industrial developments is therefore a simplified version of the procedure set out in the *NSW Industrial Noise Policy*. As the majority of developments to be assessed by Council will fall into the low noise risk category as defined in the EPA policy, some of the more involved procedures required under the EPA policy are not mandatory. Any assessment conducted in accordance with the EPA's documented procedure is, however, acceptable to Council.

The assessment procedure has two main components:

- Controlling intrusive noise impacts in the short term.
- Maintaining noise level amenity for particular land uses in the long term.

The assessment must take both components into account, but in most cases one of them will become the limiting criterion.

In low noise areas, controlled increases in ambient noise levels are permitted, up to the point where the noise level limit appropriate to the particular land use is reached. This increase is usually limited to 5 dBA above the background noise level.

In developed areas with higher levels of ambient noise, the noise limit that would be applied could be either:

- 5 dBA above the background noise level, or
- The noise limit set for the appropriate land use designed to preserve amenity, whichever is lower.

In highly developed areas with high existing ambient noise levels, the new policy specifies different levels that are dependent upon whether ambient noise is likely to be reduced in the future.

- Where ambient noise levels are likely to be reduced, the policy recommends design limits intended to return the noise environment to the levels appropriate to the particular land use.
- Where ambient noise levels are unlikely to be reduced, the policy does not allow any increase above the existing noise environment.



4.1.1 Assessment Stage 1 - Noise Risk Classification

The first stage in the assessment procedure is to determine if the development is low or high noise risk. The two classifications are defined as follows:

Low Noise Risk

- The development will only affect the properties immediately adjacent, and
- The intrusive noise level (L_{Aeq}) clearly exceeds the background (L_{A90}) by less than 5 dBA at any residential boundary or by less than 10 dBA at any commercial boundary.

High Noise Risk

- The area affected by the development extends beyond the immediate adjoining properties, or
- The intrusive noise level (L_{Aeq}) exceeds the background noise level by more than 5 dBA.

Developments in the Low Noise Risk category will not require further assessment unless requested by Council. Developments in the High Noise Risk category will require Stage 2 and Stage 3 assessments.

4.1.2 Assessment Stage 2 - Intrusiveness

The second stage in the assessment procedure is to determine the noise intrusiveness using the following criterion:

Approval shall not be granted for an industrial development involving processes which give rise to noise of a continuous nature unless it can be demonstrated to the satisfaction of Council that the $L_{Aeq(15\text{minute})}$ noise level contribution from the development (with adjustments) measured over any 15 minute period will not exceed the repeatable minimum ambient L_{A90} sound level by more than 5 dBA when measured at the boundary of any residential premises or by more than 10 dBA in the case of a commercial premises.

The criterion shall apply under prevailing weather conditions.

Adjustments should be made for noise emissions with the characteristics as shown in **Table 4.1.2.1**.



Table 4.1.2.1 Modifying Factor Corrections

Factor	Assessment/ Measurement	When to Apply	Correction ¹	Comments
Tonal Noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands by: -5 dB or more if the centre frequency of the band containing the tone is above 400Hz -8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive -15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB ²	Narrow band frequency analysis may be required to precisely detect occurrence
Low Frequency Noise	Measurement of C-weighted and A-weighted level	Measure C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB ²	C-weighting is designed to be more responsive to low frequency noise
Impulsive Noise	A-weighted fast response and impulse response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s
Intermittent Noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for night-time only
Duration	Single event noise duration may range from 1.5 min. to 2.5 hrs	One event in any 24-hour period	0 to -20 dBA	The acceptable noise level may be increased by an adjustment depending on duration of noise (See Table 4.1.2.2)
Maximum Adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10 dBA ² (excluding duration correction)	

Notes: 1. Corrections to be subtracted from the criteria or added to the measured or predicted levels.

2. Where a source emits tonal and low frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.



An adjustment for duration may be applied where a single-event noise is continuous for a cumulative period of less than two and a half hours in any 24-hour period. The acceptable noise level may be increased by the adjustment shown in **Table 4.1.2.2**. This adjustment is designed to account for unusual and one-off events, and does not apply to regular high-noise levels that occur daily.

Table 4.1.2.2 Adjustments for Duration

Duration of Noise (one event in any 24 hour period)	Increase in Acceptable Noise Level at Receptor (dBA)	
	Daytime and Evening (0700 hrs - 2200 hrs)	Night-time (2200 hrs - 0700 hrs)
1.0 to 2.5 hours	2	Nil
15 min to 1 hour	5	Nil
6 min to 15 min	7	2
1.5 min to 6 min	15	5
Less than 1.5 min	20	10

The maximum correction to be applied to the criteria or the measured level where two or more modifying factors are present. The maximum adjustment is 10 dBA where the noise contains two or more modifying factors (excluding the duration correction).

4.1.3 Assessment Stage 3 - Noise Amenity

The third stage of the assessment procedure is to determine whether the development will impact upon the noise amenity of the area.

Noise amenity is considered in order to prevent the continuing escalation in ambient noise levels which would otherwise occur with successive development. The maximum ambient noise levels within an area should not normally exceed the levels specified in **Table 4.1.3.1**.



Table 4.1.3.1 Amenity Criteria - Recommended LAeq Noise Levels from Industrial Noise Sources

Type of Receiver	Area (see Note 6)	Time of Day (see Note 7)	Recommended LAeq Noise Level (dBA) (see Note 8)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface - for existing situations only	Day	65	70
		Evening	55	60
		Night	50	55
School Classroom - Internal	All	Noisiest 1-hour period when in use	35 (see Note 10)	40
Hospital Ward - Internal - External	All	Noisiest 1-hour period	35	40
	All	Noisiest 1 hour period	50	55
Place of Worship - Internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Notes to Support the Noise Level Tables

1. The recommended maximum noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.
2. In assessing noise levels at residences, the noise level is to be assessed at the most-affected point on or within the residential property boundary or, if this is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence.
3. In assessing noise levels at commercial or industrial premises, the noise level is to be assessed at the most-affected point on or within the property boundary.
4. Where internal noise levels are specified in Table 4.1.3.1, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and are to apply with windows opened sufficiently to provide adequate ventilation. In cases where the gaining of internal access for monitoring is difficult, then external noise levels 10 dB above the internal levels apply.
5. In assessing noise levels at passive and active recreational areas, the noise level is to be assessed at the most-affected point within 50 metres of the area boundary.



6. Types of receivers are defined as follows.

Rural - Means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic, usually defined as rural, rural-residential, environment protection zone or scenic protection zone on a Council zoning map (Local Environmental Plan - LEP). Such areas may include:

- an agricultural area, except those used for intensive agricultural activities
- a rural recreational area such as resort areas
- a wilderness area or national park
- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources).

Suburban - An area defined as rural, rural residential or residential on an LEP that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- decreasing noise levels in the evening period (1800 - 2200); and/or
- evening ambient noise levels defined by the natural environment and infrequent human activity.

Urban - An area defined as rural, rural-residential or residential on an LEP with an acoustical environment that is:

- dominated by “urban hum” or industrial source noise
- has through traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above, where “urban hum” means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

Urban/industrial interface – An area defined as for ‘urban’ above that is in close proximity to industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB. Beyond this region the amenity criteria for the ‘urban’ category applies. This category may be used only for existing situations.

Commercial - An area defined as a business zone, except neighbourhood business zone, on an LEP.

Industrial - An area defined as an industrial zone on an LEP. For isolated residences within an industrial zone the industrial amenity criteria would usually apply.

7. Time of day: Day - The period from 7.00 am to 6.00 pm Monday to Saturday; or 8.00 am to 6.00 pm on Sundays and public holidays
Evening - The period from 6.00 pm to 10.00 pm
Night - The remaining periods.

Consideration may be given to extending the daytime period to commence from 6.00 am in certain situations.

8. The L_{Aeq} noise level for a specific period represents the L_{Aeq} level calculated or measured over the applicable day, evening or night period except where otherwise stated (for example, school classroom, hospital).
9. If existing noise levels from industrial noise sources already approach or exceed the recommended acceptable noise levels in **Table 4.1.3.1**, any increase in these levels would be strictly limited, as described in **Table 4.1.3.2**.
10. In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} Noise Level may be increased to 40 dB $L_{Aeq}(1hour)$.
11. The acceptable and recommended maximum L_{Aeq} noise levels can provide a guide to applying the negotiation process set out in Section 8 of the NSW Industrial Noise Policy. While negotiation between the proponent and the community for an agreed noise level can occur at any time, typically the proponent would negotiate with Council (or the EPA) where noise-level emissions fall between the acceptable and recommended maximum. For site levels beyond the recommended maximum levels, the proponent would need to negotiate directly with the community.

Where the existing noise level from development is close to the maximum recommended level, the noise contribution from any new development must be controlled to ensure that ambient noise does not exceed the levels considered appropriate for the particular area and land use.



If, as a result of development, the existing noise environment of the area already exceeds the maximum recommended level, the LAeq noise level contribution from any new development should not be greater than:

- o 10 dB below the maximum recommended level if it is possible that existing levels may be reduced in the future.
- o 10 dB below the existing level if there is no possibility that existing levels will fall and no significant changes to land use are envisaged.

The required criteria for preserving amenity are shown in **Table 4.1.3.2**.

Table 4.1.3.2 Modification to Acceptable Noise Level (ANL) to Account for Existing Level of Industrial Noise

Total Existing LAeq Noise Level from Industrial Sources (dBA)	Maximum LAeq Noise Level for Noise from New Sources Alone (dBA)
≥ANL + 2	If existing noise level is likely to decrease in future: ANL - 10 If existing noise level is unlikely to decrease in future: Existing Level - 10
ANL + 1	ANL - 8
ANL	ANL - 8
ANL - 1	ANL - 6
ANL - 2	ANL - 4
ANL - 3	ANL - 3
ANL - 4	ANL - 2
ANL - 5	ANL - 2
ANL - 6	ANL - 1
<ANL - 6	ANL

* ANL = Recommended Acceptable LAeq Noise Level for the specific receiver, area and time of day from Table 4.1.3.1.

4.1.4 Determination of Noise Levels

The LAeq noise emission level from the industrial operation shall be determined by means of prediction using a recognised calculation or modelling procedure.



4.1.5 Acoustical Design Report

An Acoustical Design Report prepared by a recognised consultant in acoustics (as defined in **Section 1**) and detailing compliance with the specified acoustic criteria shall accompany the development application submitted to Council for approval. In the case of “Low Noise Risk” developments, a letter of certification from a recognised consultant in acoustics (see **Appendix A**) may suffice.

The full Acoustical Design Report shall present the following information:

- o A description of the industrial development outlining the major noise sources involved in operations on which the assessment of noise impact is based.
- o The times of operation of the development.
- o A description of the area and surrounding land uses and details of nearest potentially affected receiver locations.
- o A site plan showing distances between plant and potentially affected receiver locations and detailing intervening topography which may affect noise propagation.
- o Plans and elevations of building layouts and any enclosures of noise sources. Descriptions of building construction and means of ventilation should be included.
- o Details of existing background levels during the proposed times of operation and the means by which these levels were obtained.
- o Details of any control measures incorporated into the development to mitigate noise emissions.
- o Noise level data for all major noise sources, either as the sound pressure level at a specified distance or the sound power level in A-weighted decibels and preferably octave band levels.
- o A description of the method used to determine the L_{Aeq} noise level emission.
- o The predicted L_{Aeq} cumulative dBA level at the potentially sensitive receiver locations considered.
- o A comparison of the predicted L_{Aeq} noise level emissions from industry with the relevant design criteria at each potentially sensitive receiver location considered.



- Any other significant or relevant acoustical information concerning the project.
- A Statement of Opinion confirming compliance with the acoustical design criteria requirements and detailing any mitigation measures required in order to achieve the required criteria.

4.1.6 Inspections and Compliance Certificate

Where specific acoustical detailing is required, the acoustical consultant shall conduct such inspections as necessary to verify compliance with the requirements of the Acoustical Design Report.

Council may require a Certificate of Compliance when the industrial development becomes operational.

4.1.7 Implementation of Control Guidelines

Council's requirements for compliance with the criteria for industrial noise control shall be included in the Conditions of Development Approval, as appropriate.

4.2 Guidelines for the Control of Vibration

The impacts of vibration generated as a result of industrial development can be divided into two main categories; those in which the occupants or users of nearby premises are inconvenienced or possibly disturbed and those in which the integrity of the premises or structure may be prejudiced.

Satisfactory Levels in Terms of Peak Vibration Velocity

Satisfactory magnitude of peak vertical vibration velocity (ie below which the probability of "adverse comment" is low) are shown in **Table 4.2.1** (for generally sinusoidal vibration).



Table 4.2.1 Satisfactory Levels of Peak Vertical Vibration Velocity (8 Hz to 80 Hz)

Type of Space Occupancy	Time of Day	Satisfactory Peak Vibration Levels in mm/s Over the Frequency Range 8 Hz to 100 Hz			
		Continuous Vibration		Impulsive Vibration with up to 3 Occurrences per Day	
		Vertical	Horizontal	Vertical	Horizontal
Critical working areas (eg some hospital operating theatres, some precision laboratories, etc)	Day	0.14	0.4	0.14	0.4
	Night	0.14	0.4	0.14	0.4
Residential	Day	0.3 to 0.6	0.8 to 1.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8
Offices	Day	0.6	1.6	18	51
	Night	0.6	1.6	18	51
Workshops	Day	1.2	3.2	18	51
	Night	1.2	3.2	18	51

Source - After British Standard 6472-1992

In residences, satisfactory magnitudes of continuous vertical floor vibration during daytime are in the order of 0.3 mm/s to 0.6 mm/s, and the probability that “adverse comment” may arise begins to increase at higher levels. At night-time, the satisfactory magnitudes for residences is equivalent to a vertical peak vibration level of only 0.2 mm/s. This latter level is barely above the threshold of human perception.

Satisfactory Magnitudes for Intermittent Vibration

The vibration levels given in **Table 4.2.1** for continuous vibration apply to a 16 hour exposure period or 8 hour night-time period.

Where vibration is intermittent, a vibration dose value (eVDV) may be calculated by the following formula using vibration measured in weighted rms acceleration:

$$eVDV = 1.4 \times a_{rms} \times t^{0.25} \text{ m/s}^{1.75}$$

Where a_{rms} = rms acceleration (m/s²)
t = time (seconds)



Over the frequency range 8 Hz to 80 Hz, the formula may also be expressed in terms of unweighted peak vibration velocity (assuming approximately sinusoidal motion):

$$eVDV = 0.05 V_{ppv} \times t^{0.25} \text{ mm/s}^{1.75}$$

Where V_{ppv} = peak particle velocity (mm/s)
 t = time (seconds)

The permissible peak velocity (or rms acceleration) levels corresponding to the vibration dose value varies according to the duration of exposure. **Table 4.2.2** shows the satisfactory vibration dose values and the doses above which various degrees of adverse comment may be expected in residential buildings.

Table 4.2.2 Vibration Dose Values ($\text{m/s}^{1.75}$) Versus Degrees of Adverse Comment Expected in Residential Buildings

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential Buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential Buildings 8 hour night	0.13	0.26	0.51

Source - British Standard BS6472-1992

Structural Damage

In rare circumstances, Council may approve vibration limits above those applicable to human comfort. Applications for such approvals would only be considered where it can be demonstrated that affected structures are not occupied or where the vibration is of a temporary or transient nature and is necessary to the successful operation of the development.

The levels of vibration generated by the development, when measured at any potentially sensitive premises, shall generally comply with the requirements of the British Standard 7385:Part 2-1993. This is a definitive standard against which the likelihood of building damage from ground vibration can be assessed.



Although there is a lack of reliable data on the threshold of vibration-induced damage in buildings both in countries where national standards already exist and in the UK, BS 7385:Part 2 has been developed from an extensive review of UK data, relevant national and international documents and other published data. The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extraction or construction excavation), demolition, piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

As strain imposed on a building at foundation level is proportional to the peak particle velocity but is inversely proportional to the propagation velocity of the shear or compressional waves in the ground, this quantity (ie peak particle velocity) has been found to be the best single descriptor for correlating with case history data on the recurrence of vibration-induced damage.

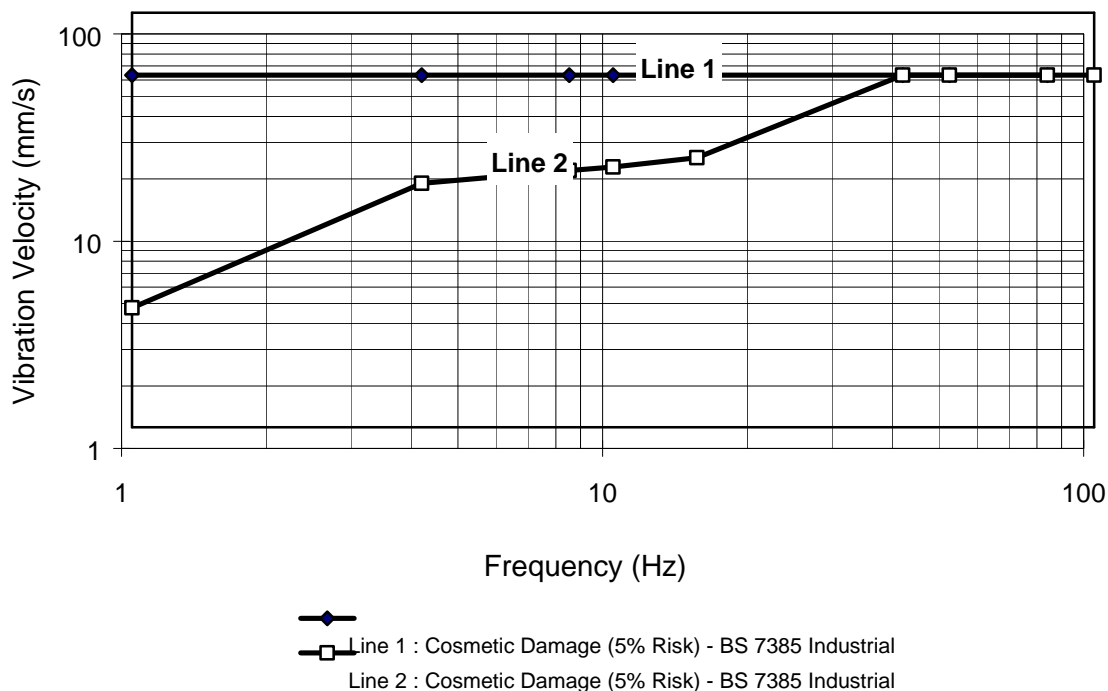
The guide values from this standard for transient vibration judged to result in a minimal risk of cosmetic damage to residential buildings and industrial buildings are presented numerically in **Table 4.2.3** and graphically in **Figure 4.2.1**.

Table 4.2.3 Transient Vibration Guide Values for Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above



Figure 4.2.1 Graph of Transient Vibration Guide Values for Cosmetic Damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard goes on to state that minor damage is possible of vibration magnitudes which are greater than twice those given in **Table 4.2.3**, and major damage to a building structure may occur at values greater than 4 times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of low reversals is significant (in respect of the fatigue life of building materials) than the guide values in **Table 4.2.3** should not be reduced from fatigue considerations.



It is noteworthy that extra to the guide values nominated in **Table 4.2.3**, the standard states that:

“Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.”

4.3 Determination of Vibration Levels

Determination of the levels of vibration shall be by means of measurement and/or calculation by a recognised consultant in acoustics and vibration (as defined in **Section 1**).

4.3.1 Acoustical Design Report

Assessment of the impact of vibration generated by the development shall be included in an Acoustical Report prepared by a recognised Consultant in acoustics and vibration (as defined in **Section 1**). This report shall document the extent of compliance with the criteria as specified and shall accompany the development application.

The Acoustical Design Report shall present the following information:

- Details of all vibration-generating plant and equipment and the levels of vibration associated with each item.
- Details of potentially affected premises.
- Predictions of vibration levels at all potentially sensitive premises.
- Details of any control measures incorporated into the development to mitigate the impact of vibration.
- A Statement of Opinion confirming compliance with the specified criteria requirements.

In cases where the development is Low Vibration Risk, a letter of certification (see **Appendix A**) from a recognised consultant in acoustics may suffice.



4.3.2 Implementation of Control Guidelines

Council's requirements for assessment of vibration impacts upon potentially sensitive premises and/or receivers may be included as a Condition of Development Approval at the discretion of Council.

5 GUIDELINES FOR THE ASSESSMENT AND CONTROL OF ROAD TRAFFIC NOISE GENERATED BY DEVELOPMENT

5.1 Assessment Procedure

The preferred hours for heavy vehicle movements are set out in **Table 5.1.1**.

Table 5.1.1 Heavy Vehicle Movements

Frequency of Movement	Preferred Hours of Operation	
	Monday to Saturday	Sunday and Public Holidays
Normal frequency	7.00 am to 6.00 pm	Minimal movement subject to individual assessment
At substantially reduced frequency	6.00 am to 7.00 am 6.00 pm to 10.00 pm	8.00 am to 6.00 pm
Minimal or isolated occurrence	10.00 pm to 6.00 am	6.00 pm to 8.00 am

The criteria for road traffic noise generated by development is presented in **Table 5.1.2** and **Table 5.1.3**.

Table 5.1.2 Criteria for Road Traffic Noise Generated by Development

Type of Development	Criteria		
	Day (7 am-10 pm) dBA	Night (10 pm-7 am) dBA	Where Criteria are Already Exceeded
7. Land use developments with potential to create additional traffic on existing freeways/arterials	LAeq(15hour) 60	LAeq(9hour) 55	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.



Table 5.1.2 Criteria for Road Traffic Noise Generated by Development (Continued)

Type of Development	Criteria		
	Day (7 am-10 pm) dBA	Night (10 pm-7 am) dBA	Where Criteria are Already Exceeded
8 Land use developments with potential to create additional traffic on collector road	LAeq(1hour) 60	LAeq(1hour) 55	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using “quiet” vehicles, and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.
9. New local road corridor in a metropolitan area	LAeq(1hour) 55	LAeq(1hour) 50	The new road should be designed so as not to increase existing noise levels by more than 0.5 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use; restricted access for sensitive areas or during sensitive times to low-noise vehicles; improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards, and alternative methods of freight haulage.
10. New local road corridor in a rural area	LAeq(1hour) 50	LAeq(1hour) 45	
12. Redevelopment of existing local roads	LAeq(1hour) 55	LAeq(1hour) 50	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles; limitations on exhaust brake use; restricted access for sensitive areas or during sensitive times to low-noise vehicles, improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards; and alternative methods of freight haulage.



Table 5.1.2 Criteria for Road Traffic Noise Generated by Development (Continued)

Type of Development	Criteria		
	Day (7 am-10 pm) dBA	Night (10 pm-7 am) dBA	Where Criteria are Already Exceeded
13. Land use development with potential to create additional traffic on local roads	LAeq(1hour) 55	LAeq(1hour) 50	<p>Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using “quiet” vehicles; and using barriers and acoustic treatments.</p> <p>In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.</p>



Table 5.1.3 Road Traffic Noise Criteria

Sensitive Land Use	Criteria		
	Day (7.am - 10 pm) dBA	Night (10 pm-7 am) dBA	Noise Mitigation Measures
1. Proposed school classrooms (For existing schools see Technical Note x)	LAeq(1hour) 40 (internal)	-	To achieve internal noise criteria in the short term, the most practicable mitigation measures are often related to building or facade treatments.
2. Hospital wards	LAeq(1hour) 35 (internal)	LAeq(1hour) 35 (internal)	In the medium to longer term, strategies such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or during sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system. Other measures include improved planning, design and construction of sensitive land use developments; reduced new vehicle emission standards; greater use of public transport; and alternative methods of freight haulage. These medium-to long-term strategies apply equally to mitigating internal and external noise levels.
3. Places of worship	LAeq(1hour) 40 (internal)	LAeq(1hour) 40 (internal)	
4. Active recreation (for example, golf courses)	Collector and local roads: LAeq(1hour) 60 Freeway/arterial roads: LAeq(15hour) 60	-	
5. Passive recreation and school playgrounds	Collector and local roads: LAeq(1hour) 55 Freeway/arterial roads: LAeq(15hour) 55	-	Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5 dBA for new roads and 2 dBA for redeveloped roads or land use development with potential to create additional traffic.

Source - After NSW Environmental Criteria for Road Traffic Noise, May 1999

5.2 Determination of Noise Levels

The required criteria shall be determined by means of prediction using a recognised calculation procedure such as the calculation of Road Traffic Noise (CORTN 1988) method or FHWA method and the latest available traffic volume figures.



The development may be regarded as Low Noise Risk in regard to road traffic noise if it:

- Does not increase the percentage of heavy vehicle movements by more than 10% and
- Complies with the preferred hours for heavy vehicles, and
- Does not increase the total number of vehicle movements by more than 20%.

5.3 Acoustical Design Report

An assessment of the impact of road traffic, including all heavy vehicle movements, shall be included in an Acoustical Report prepared by a recognised consultant in acoustics (as defined in **Section 1**) and submitted to Council for development approval.

The Acoustical Report shall present the following information:

- Details of traffic generation during operation of the development
- Details of times of significant traffic generation and hours of operation of heavy vehicles
- Details of the prediction method used to calculate the noise level generated by road traffic
- The predicted levels of road traffic noise at potentially sensitive receiver locations with and without the development
- A statement of opinion regarding compliance with the acoustical design criteria requirements.

In cases where the development is Low Noise Risk, a letter of certification (see **Appendix A**) from a recognised consultant in acoustics may suffice.

5.4 Implementation of Control Guidelines

Council's requirements for compliance with the criteria for road traffic noise generated by industrial development shall be included in the conditions of Development Approval.



6 NOISE FROM COMMERCIAL PREMISES

6.1 Jurisdiction

Council is responsible for administering the control of noise from most commercial premises. In most instances, the noise sources of concern consist of mechanical plant and equipment associated with air-conditioning, exhaust and refrigeration systems.

Where a premises holds a liquor licence, primary responsibility for the control of noise lies with the Police Department and the Liquor Administration Board. These departments may however, liaise with local Council for assistance with the measurement of noise levels and for advice on noise control treatment. Council may take action against a licenced premises before a Licensing Court under the Liquor Act or the Registered Clubs Act but initially such action would normally be taken through the Police Department or the Liquor Administration Board. Council may lodge an objection when the premises applies to the Licensing Court for a new licence or to change existing licence conditions.

6.2 Discussion

Retail establishments are generally not considered to be potential sources of excessive noise generation, although the use of public address systems or amplified music may cause annoyance to nearby commercial premises.

Mechanical plant and equipment associated with ventilation and refrigeration systems requires consideration to ensure that its operation does not cause disturbance at other commercial premises, and particularly at any nearby residential premises.

Licensed premises, particularly hotels and clubs, can give rise to complaints regarding disturbance caused by noise, as residential premises are often located nearby. Amplified music and noise associated with patron departure when trading hours extend past 10.00 pm are frequently cited as sources of complaint. Whilst noise emissions from amplified music are more easily controlled, noise from patron departure is difficult to address satisfactorily when the premises is situated near residences.



The primary means of control is by restricting trading hours to prevent sleep disturbance at nearby residential premises. Consideration of locality is taken into account in any application to the licensing court for extended trading hours. Implementing managerial practices to ensure patron departure is achieved with a minimum of disruption to neighbouring premises is another effective means of control.

6.3 Recommended Control Guidelines

Commercial Premises

Assessment of noise and vibration from commercial premises shall be conducted as outlined for industrial developments in **Section 4**.

Licensed Premises

The L_{Aeq} noise level emitted from the licensed premises when measured at the boundary of the most affected residence, should not exceed the background noise level up to midnight and should not exceed a level 5 dBA below the background level after midnight when measured at any bedroom window.

Noise associated with patron departure, particularly after 10.00 pm should be given due consideration by management. Points of access and egress should be restricted wherever possible to minimise adverse impact upon noise sensitive receivers. Noise emissions from carparking facilities shall be monitored by management to ensure patrons arrive and/or depart in the quietest manner possible.

6.4 Determination of Noise Levels

The L_{Aeq} noise level from the commercial operation shall be determined by means of prediction (using a recognised calculation or modelling procedure) or measurement at the boundary of the nearest or most affected premises.

For the purpose of investigating a complaint regarding noise associated with patron departure, measurement of the L_{Aeq} noise level shall be conducted at the boundary of the most affected premises.



6.5 Acoustical Design Report

An Acoustical Design Report prepared by a recognised consultant in acoustics (as defined in **Section 1**) and detailing the extent of compliance with the specified acoustic criteria shall be required to accompany the development application submitted to Council for approval. For non-licensed premises categorised as Low Noise Risk, a letter of certification (see **Appendix A**) from a recognised consultant in acoustics may suffice.

The full Acoustical Design Report shall present the following information:

- A description of the commercial development outlining the major noise sources involved in operations on which the assessment of noise impact is based.
- The times of operation of the development.
- A description of the area and surrounding land uses and details of nearest potentially affected receiver locations.
- A site plan showing distances between plant and potentially affected receiver locations and detailing intervening topography which may affect noise propagation.
- Plans and elevations of building layouts and any enclosures of noise sources. Descriptions of building construction and means of ventilation should be included.
- Details of existing background levels during the proposed times of operation and the means by which these levels were obtained.
- Details of any control measures incorporated into the development to mitigate noise emissions.
- Noise level data for all major noise sources, either as the sound pressure level at a specified distance or the sound power level in A-weighted decibels and preferably octave band levels.
- A description of the method used to determine the L_{Aeq} noise level emission.
- The predicted L_{Aeq} cumulative dBA level at the potentially sensitive receiver locations considered.
- A comparison of the predicted L_{Aeq} noise level emissions from the development with the relevant design criteria at each potentially sensitive receiver location considered.



- In the case of a licensed premises, details of access and egress arrangements in use after 10.00 pm. In addition, the applicant shall supply a statement detailing the means by which noise associated with patron arrival and departure is proposed to be controlled.
- Any other significant or relevant acoustical information concerning the project.
- A Statement of Opinion confirming compliance with the acoustical design criteria requirements and detailing any mitigation measures required in order to achieved the required criteria.

6.6 Inspections and Compliance Certificate

Where specific acoustical detailing is required, the acoustical consultant shall conduct such inspections as necessary to verify compliance with the requirements of the Acoustical Design Report.

6.7 Implementation of Control Guidelines

Council's requirement for compliance with the criteria for commercial noise control shall be included in the Conditions of Development Approval, as appropriate.

7 COMMUNITY NOISE

7.1 Discussion

Within residential communities there are various facilities and activities which can give rise to significant levels of noise generation. Whether the noise levels emitted are perceived by other community members as “annoying” is very much dependent upon the relevance of the facility or activity to the receiver, the level of the noise, and the time at which it is made.

For this reason, many of the noisy activities or articles frequently operated in residential communities (such as lawnmowers, air-conditioners and swimming pool pumps) have time restrictions applying. By limiting the hours of operation of these noisy items, the potential for disturbance at neighbouring premises is greatly reduced.



The potential noise impacts of other sources of community noise, such as schools, are outweighed by the community benefit provided by such facilities and community acceptance is generally widespread. The importance of educational establishments is recognised by the majority of the community and the limited hours of operation generally serves to mitigate noise impact.

Other community facilities, such as religious establishments, together with community halls and the like, often do not meet with the same degree of widespread acceptance as is generally encountered with schools. Frequently, the religious observance, or activities within community or church halls bear little relevance to the neighbouring properties and if the noise is generated at sensitive times, residents can become annoyed. A similar lack of tolerance is also commonly associated with barking dogs and domestic birds.

It is therefore important for Council to identify the various sources of neighbourhood noise and establish criteria or management techniques by which noise impact can be minimised.

7.2 Recommended Control Guidelines

7.2.1 Amplified Music

Under the Protection of the Environment Operations Act, 1997 the use of amplified sound equipment is restricted between the hours of midnight and 8.00 am any day. Where the sound is audible in a neighbour's residence during this time and a warning to this effect is ignored, the person operating the sound equipment is guilty of an offence under the Act.

Between the hours of 8.00 am and midnight, the sound must be deemed offensive before a noise control notice can be served. To minimise the likelihood of disturbance, the L_{Aeq} noise level due to the operation of amplified sound equipment shall not exceed the background L_{A90} sound level when measured in the immediate vicinity of the external structure of any nearby residence.

7.2.2 Barking Dogs

Complaints in regard to barking dogs most commonly arise as the result of sleep disturbance. Where a barking dog continually causes disturbance to the sleep of neighbours, it is a source of concern. Dogs which bark during the daytime may also be a source of annoyance to residents at home during the day.



A dog shall be deemed to cause offensive noise where barking can be heard within a habitable room in any affected residence between the hours of 10.00 pm and 7.00 am.

The L_{Aeq} noise level due to the dog barking shall not exceed the background L_{A90} sound level by more than 5 dBA when measured at any time in a habitable room of an affected residence.

Dog barking can be due to a variety of factors with perhaps the two most common being boredom and visual stimulation. Owners of barking dogs should be encouraged to exercise the animal regularly for a sufficient period and to reduce the visual stimulation of the dogs, particularly at night.

7.2.3 Child Care Centres

Child care centres provide an invaluable service to working parents in the community. Unlike schools, however, the hours of operation can be from 7.00 am to 7.00 pm (in the case of long day care) and many centres operate 52 weeks per year.

The major noise emissions from these uses occur when the children are involved in outdoor play or sporting activities. However, the impact from such activities is generally considered to be controlled by the relatively short periods throughout the day when outdoor play is timetabled. In addition, the strict daytime hours of operation, generally only from Monday to Friday in itself minimises the potential for noise disturbance.

Council may restrict the areas in which pre-schools and day care centres will be permitted to occur. Factors of non-acoustical nature will play a large part in the determination of appropriate zonings, such as traffic volumes on local roads, proximity to potential health hazards, safety concerns and the like.



By implementing such an approach, Council recognises that such developments do generate noise but the emissions are adequately controlled by the time restrictions imposed by the facility's timetable and by the hours of operation. The community benefit of such development should outweigh any negative effect on nearby residential amenity. In addition to zoning restrictions, Council can impose noise control measures as part of the conditions of consent. Where a child care development is proposed, the application shall be determined in consultation with the adjacent property owners and the following noise control measures shall be incorporated where appropriate:

- A screen fence of solid and continuous construction should be erected along the property boundaries adjacent to neighbouring residences. The fence shall be free of gaps and cracks.
- A minimum separation distance of 5 metres between the active outdoor play area (as opposed to passive activities such as sand pits, painting, storytelling etc) and the facade of any neighbouring premises.
- Outdoor activities shall be supervised by centre staff at all times with due consideration of the acoustical amenity of neighbouring properties.
- For larger centres outdoor activities to be staged to reduce the number of children playing outdoors at any one time.
- Internally, walls should be covered for the maximum area possible with absorptive treatments such as open-weave fabric-covered fibreglass or polyester which can function as pinboards whilst reducing the build up of reverberant sound.
- For larger centres in quiet residential areas, mechanical ventilation can be required if in some instances to enable windows and doors to remain closed.

7.2.4 Churches and Religious Developments

Churches and religious establishments, whilst an acknowledged part of a residential community, can be a source of offensive noise where noise emissions due to the operation cause disturbance to neighbouring residents.

Where neighbouring properties may be adversely impacted by noise generated by the arrival and departure of the congregation or during the service, the church should be encouraged not to hold services prior to 7.00 am Monday to Saturday and 8.00 am on Sundays, except on occasions of special religious significance (typically less than six per year).



Where sound reinforcement is used, the L_{Aeq} noise level shall not exceed the background L_{A90} sound level when measured within a habitable room of any affected residence.

7.2.5 Community and Multipurpose Halls and Facilities

The operation of any community or multipurpose hall or similar facility (including church halls) shall not give rise to offensive noise at any nearby residential premises.

The L_{Aeq} noise level due to the activities or mechanical plant associated with the operation of the facility shall not exceed the L_{A90} background sound level by more than 5 dBA when measured in a habitable room of any affected residence. Where tonality can be established at the receiver location, a 5 dBA penalty shall apply.

Where a hall is deemed to be of significant community benefit (eg scout halls, church halls and the like) Council may apply time restrictions in lieu of the above noise criterion. This concession should not be applied to noise emission from mechanical plant or amplified music.

In determining the approved hours of operation, Council shall give consideration to traffic generation and noise impact due to patron departure.

7.2.6 Domestic Air-conditioners

Under the Protection Of the Environment Operations Act, 1997 the use of domestic air conditioners is restricted between the hours of 10.00 pm to 7.00 am weekdays and 10.00 pm to 8.00 am on weekends and public holidays. Where the operation of the air-conditioner is audible in a neighbour's residence during this time, and a warning to this effect is ignored, the person operating the air-conditioner is guilty of an offence under the Act.

Outside the restricted hours, the operation of the unit must be deemed offensive before a noise control notice can be served. To minimise the likelihood of disturbance, the L_{Aeq} noise level due to the operation of the air-conditioner shall not exceed the background L_{A90} sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any nearby residence. Where tonality can be established, a 5 dBA penalty shall be applied.



7.2.7 Domestic or Caged Birds

Domestic and caged birds kept upon any premises shall be deemed to cause offensive noise when the noise from the birds can be heard within a habitable room in any affected residence between the hours of 10.00 pm and 7.00 am.

The L_{Aeq} noise level due to the domestic and caged birds shall not exceed the background LA_{90} sound level by more than 5 dBA when measured at any time in a habitable room of an affected residence.

7.2.8 Home Industry

Approval shall not be granted for the operation of a home industry unless it can be established to the satisfaction of Council that the L_{Aeq} noise level due to noise level emissions of a continuous or semi-continuous nature from the home industry operation will not exceed the background LA_{90} sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any nearby residence. Where tonality or impulsiveness can be established at the receiver location, a 5 dBA penalty shall be applied.

7.2.9 Lawnmowers

Under the Protection of the Environment Operations Act, 1997 the use of lawnmowers is restricted between the hours of 8.00 pm and 7.00 am Monday to Saturday and 8.00 pm and 8.00 am Sundays and Public Holidays. Where the operation of the lawnmower is audible in a neighbour's residence during this time, and a warning to this effect is ignored, the person operating the lawnmower is guilty of an offence under the Act.

7.2.10 Learn-to-Swim Schools on Residential Premises

These facilities are of significant benefit to the community, however, when located within a residential area, their operation may result in some acoustic impact on neighbouring properties. The hours of operation and the numbers of children attending classes should be considered in relation to the suitability of the subject site and the nature of neighbouring properties.



The major noise emissions from these facilities involve children arriving and departing the site, raised voices from instructors or children during lessons, splashing noises, the possible use of amplified sound and in some larger operations, traffic generation on the residential street in which the facility is located.

Council may restrict the areas in which such facilities are permitted to occur. Factors of non-acoustical nature will play a part in the determination of appropriate zonings, such as the size of the site, location of surrounding premises, traffic volumes on local roads, safety concerns, size and frequency of classes and the like.

By implementing such an approach, Council recognises that such developments do generate noise but such emissions can be controlled by the time restrictions imposed on the facility's hours of operation. In addition to zoning restrictions, Council can impose noise control measures as part of the conditions of consent. Where such a facility is proposed, the application shall be determined in consultation with the adjacent property owners and the following noise control measures shall be incorporated where appropriate:

- Hours of operation should be restricted to between 7.00 am to 7.00 pm Monday to Friday and 8.00 am to 5.00 pm Saturday with no classes on Sundays or public holidays.
- A screen fence of solid and continuous construction should be erected along the property boundaries adjacent to neighbouring residences. The fence shall be free of gaps and cracks.
- The applicant shall demonstrate to the satisfaction of Council that a strategy for noise management has been prepared.
- Where the facility is likely to increase vehicular traffic on local roads by more than 20%, traffic noise generation should be considered.
- The L_{Aeq} noise level due to the use of amplified sound shall not exceed the background L_{A90} sound level by more than 5 dBA when measured in a habitable room of an affected residence.



7.2.11 Schools

Schools are an essential part of any residential community. Although they have the potential to generate significant levels of noise, the restricted hours of operation generally serve as a sufficient ameliorative measure. In addition, the periods when students are outside en masse are limited to a short time before school, recess and lunch.

Public school buildings are designed in accordance with Public Works Department requirements, of which noise emissions to the boundary are a consideration.

Generally, building design should ensure that rooms in which noise generating activities will be conducted, such as woodwork, metalwork, music, etc, are located as remotely from the boundaries as possible. The L_{Aeq} noise emissions from these activities and the operation of any mechanical plant and equipment should not exceed the background LA_{90} sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any neighbouring premises.

7.2.12 Swimming Pool Pumps

Under the Protection of the Environment Operations Act, 1997 the operation of swimming pool pumps is restricted between 8.00 pm and 7.00 am Mondays to Fridays and 8.00 pm and 8.00 am weekends and public holidays. Where the operation of the pump is audible in a neighbour's residence during this time, and a warning to this effect is ignored, the person operating the pool pump is guilty of an offence under the Act.

Outside these restricted hours, the noise must be deemed offensive before a noise control notice can be served to minimise the likelihood of disturbance, the L_{Aeq} noise level due to the operation of the swimming pool pump shall not exceed the background LA_{90} sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any nearby residence.

Where there is a likelihood of objectionable noise emissions beyond the property boundary, filtration motors and pumps must be housed in a suitably constructed, sound-proofed structure.



7.2.13 Tennis Courts on Residential Premises

Attempting to regulate noise emissions from residential tennis courts by applying noise level limits is inappropriate due to the nature and duration of the noise source. As in the case of backyard swimming pools, some degree of noise must be expected at neighbouring premises from the activities conducted. Unless lit, the use of tennis courts on residential premises is restricted to daylight hours, which is generally considered sufficient in terms of noise control.

However, where an application is made to install illumination to permit court use outside of daylight hours, the following restrictions shall be imposed upon the development.

- Hours of operation shall be restricted to between 7.00 am to 10.00 pm Monday, Tuesday, Wednesday and Thursday; 7.00 am to 11.00 pm Friday and Saturday; and 8.00 am to 10.00 pm Sunday.
- A guideline minimum distance of 10 m shall be maintained between the edge of the court and the window of any habitable room in an adjacent premises, or an alternative form of noise mitigation shall be employed.

7.3 Acoustical Design Report

An Acoustical Design Report prepared by a recognised consultant in acoustics (as defined in **Section 1**) and detailing compliance with the specified acoustic criteria shall accompany the development application submitted to Council for approval. In the case of “Low Noise Risk” developments, a letter of certification from a recognised consultant in acoustics (see **Appendix A**) may suffice.

The full Acoustical Design Report shall present the following information:

- A description of the development outlining the major noise sources involved in operations on which the assessment of noise impact is based.
- The times of operation of the development.
- A description of the area and surrounding land uses and details of nearest potentially affected receiver locations.
- A site plan showing distances to potentially affected receiver locations and detailing intervening topography which may affect noise propagation.



- Plans and elevations of building layouts and any enclosures of noise sources. Descriptions of building construction and means of ventilation should be included.
- Details of existing background levels during the proposed times of operation and the means by which these levels were obtained.
- Details of any control measures incorporated into the development to mitigate noise emissions.
- Noise level data for all major noise sources, either as the sound pressure level at a specified distance or the sound power level in A-weighted decibels and preferably octave band levels.
- A description of the method used to determine the L_{Aeq} noise level emission.
- The predicted L_{Aeq} cumulative dBA level at the potentially sensitive receiver locations considered.
- A comparison of the predicted L_{Aeq} noise level emissions from the development with the relevant design criteria at each potentially sensitive receiver location considered.
- In the case of multipurpose halls, details of access and egress arrangements in use after 10.00 pm. In addition, the applicant shall supply a statement detailing the means by which noise associated with patron arrival and departure is proposed to be controlled.
- Any other significant or relevant acoustical information concerning the project.
- A Statement of Opinion confirming compliance with the acoustical design criteria requirements and detailing any mitigation measures required in order to achieved the required criteria.

8 NOISE FROM OPEN AIR ENTERTAINMENT AND OUTDOOR FACILITIES

8.1 General

The following guidelines for the control of noise from open air entertainment and outdoor facilities have been devised in order to minimise the likelihood of disturbance to the surrounding community. In some instances, however, where an event or activity is determined to be of particular social or cultural benefit, more relaxed criteria may be applied at Council's discretion.



8.2 Recommended Control Guidelines

8.2.1 Open Air Concerts

Unless otherwise approved by an administering authority, the L_{Aeq} noise level measured over any 5 minute period during the broadcast of amplified music shall not exceed 55 dBA when measured in the immediate vicinity of the external structure of any residential premises.

Events shall generally be completed by 10.00 pm.

In cases of special cultural or social significance, exceedance of the recommended criterion may be permitted by the administering authority subject to the preparation of a Noise Management Plan addressing stage orientation, foldback monitors, speaker stack height, location and orientation and implementation of noise control measures.

In such cases the maximum permissible noise level measured in the immediate vicinity of the external structure of the nearest and most potentially affected residential premises shall not exceed 70 dBA L_{Amax} . Ideally, warning should be issued to the mixing desk when the maximum level reaches 65 dBA at the nearest or most potentially affected residential premises.

8.2.2 Recreational Facilities

Unless otherwise approved by an administering authority, the L_{Aeq} noise level due to the operation of the recreational facility including the operation of any public address system shall not exceed the background L_{A90} sound level by more than 5 dBA when measured over a sufficiently representative period in the immediate vicinity of the external structure of any residential premises.

Where an event is deemed to be of particular social or cultural benefit to the wider community, a 10 dBA exceedance of the background L_{A90} sound level may be permitted.



8.2.3 Recreational Vehicles

Approval shall not be granted for the operation of a facility for recreational vehicle use unless it can be demonstrated to the satisfaction of Council that the LAeq noise level at any time during vehicle operation will not exceed the background LA90 sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any residential premises.

The approved operating hours for such facilities are:

Monday to Friday	7.00 am to 6.00 pm
Weekends and Public Holidays	8.00 am to 6.00 pm

8.2.4 Shooting Ranges

The requirements in this section shall also apply to “paintball” facilities and the like.

Approval shall not be granted for the operation of any such facility unless it can be demonstrated to the satisfaction of Council that the following levels will not be exceeded when measured in the immediate vicinity of the external structure of any residential premises.

Residential Level - dB (Lin) Peak Hold											
	60	65	70	75	80	85	90	95	100	105	Over 105
Maximum Usage - Days (Nights) per Week											
Existing Range Daytime Use	7	7	7	7	7	7	5	4	3	2	1
Existing Range Night-time Use	3	3	2	2	2	1	-	-	-	-	-
Future Range Daytime Use	7	5	5	4	3	2	1	-	-	-	-
Future Range Night-time use	3	2	1	-	-	-	-	-	-	-	-

For assessment purposes, daytime is defined as 8.00 am to 6.00 pm Monday to Saturday. Night-time is defined as 6.00 pm to 10.00 pm Monday to Saturday.



Shooting on Sundays and Public Holidays is only permitted between the daytime hours of 10.00 am to 6.00 pm.

8.2.5 Sporting Activities

Outdoor sporting activities shall not result in an L_{Aeq} noise level, measured over a representative period which exceeds the background LA_{90} sound level by more than 10 dBA when measured in the immediate vicinity of the external structure of any residential premises.

The approved hours of operation are:

Monday to Friday	7.00 am to 6.00 pm
Weekends and Public Holidays	8.00 am to 6.00 pm

Outdoor sporting activities are permitted between the hours of 6.00 pm and 10.00 pm, seven nights per week provided the L_{Aeq} noise level, measured over a representative period, does not exceed the background LA_{90} sound level by more than 5 dBA.

8.3 Acoustic Design Report

An Acoustical Design Report prepared by a recognised consultant in acoustics (as defined in **Section 1**) and detailing compliance with the specified acoustic criteria shall accompany the development application submitted to Council for approval.

The full Acoustical Design Report shall present the following information:

- A description of the development outlining the major noise sources involved in operations on which the assessment of noise impact is based.
- The times of operation of the development.
- A description of the area and surrounding land uses and details of nearest potentially affected receiver locations.
- A site plan showing distances to potentially affected receiver locations and detailing intervening topography which may affect noise propagation.
- Plans and elevations of building layouts and any enclosures of noise sources. Descriptions of building construction and means of ventilation should be included.



- Details of existing background levels during the proposed times of operation and the means by which these levels were obtained.
- Details of any control measures incorporated into the development to mitigate noise emissions.
- Noise level data for all major noise sources, either as the sound pressure level at a specified distance or the sound power level in A-weighted decibels and preferably octave band levels.
- A description of the method used to determine the L_{Aeq} noise level emission.
- The predicted L_{Aeq} cumulative dBA level at the potentially sensitive receiver locations considered.
- A comparison of the predicted L_{Aeq} noise level emissions from the development with the relevant design criteria at each potentially sensitive receiver location considered.
- Any other significant or relevant acoustical information concerning the project.
- A Statement of Opinion confirming compliance with the acoustical design criteria requirements and detailing any mitigation measures required in order to achieved the required criteria.

9 REFERENCES

British Standard 6472-1992 - *Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*, British Standards Institution, London.

British Standard 7385-1993:Part2 - *Evaluation and Measurement for Vibration in Building. Part 2: Guide to Damage Levels from Ground-borne Vibration*, British Standards Institution, London.

Draft NSW Protection of the Environment Operations (Noise Control) Regulation 2000, NSW Government Information Service.

Environmental Criteria for Road Traffic Noise, NSW Environment Protection Authority, May 1999.

Environment Protection Authority (1994) *Environmental Noise Control Manual*, EPA, Sydney.

NSW Industrial Noise Policy, NSW Environment Protection Authority, January 2000.



NSW Protection of the Environment Operations Act, 1997, NSW Government Information Service.

UK Department of Transport (1988) *Calculation of Road Traffic Noise (CORTN)*, HMSO, London.