

**SOUTHERN SYDNEY REGIONAL
ORGANISATION OF COUNCILS**

**External Noise Insulation
Requirements for Multi Unit
Residential Housing Against
Road & Rail Noise**

VERSION A

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PART 1 INTRODUCTION

This plan specifies the required sound insulation performance requirements for multi unit residential buildings against external road and rail noise. The purpose of the plan is to ensure that satisfactory internal noise levels are achieved within multi unit residential buildings to provide amenity and protect against sleep disturbance. The external noise amenity of the development should be considered in accordance with the guidelines contained in the NSW, Environment Protection Authority, 'Environmental Criteria for Road Traffic Noise'. This plan does not provide guidance with respect to the suitability of the site or development in terms of vibration and should be assessed in terms of current EPA guidelines.

The applicability of the plan is triggered through a geographical mechanism based on the development sites frontage to a main road designated as having an average annual daily traffic count (AADT) which is likely to result in facade noise exposure levels exceeding $L_{Aeq} 60$ dB(A) day time and/or $L_{Aeq} 55$ dB(A) night time (see Appendix 1) or the property is located within 100 metres of the boundary of a land corridor accommodating a rail line.

(i) The facade noise levels have been chosen based on the indoor design noise levels and empirical information assigning a nominal 20 dB(A) transmission loss across standard building facade design.

(ii) The 100 metre trigger distance from a rail line is based on standard urban situations where at distances approaching 100 metres intervening structures begin to provide acoustic shielding. In situations where a clear line of site between a rail line the development exists at distances greater than 100 metres consideration should be given to the impact of rail noise intrusion.

The plan describes a method to quantify the external noise environment at appropriate locations and over appropriate times, sets satisfactory internal noise levels or criteria and presents requirements for the compilation and submission of information to Council to accompany a development application.

1.1 TITLE

This plan is entitled **[insert Council name]** *Development Control Plan 2000: External Noise Insulation Requirements for Multi Unit Residential Housing against Road & Rail Noise.*

1.2 OBJECTIVES OF THIS PLAN

The objectives of this plan are:

- To ensure that new residential developments are designed to achieve a satisfactory internal acoustic quality.
- To provide a clear and transparent design criteria for indoor noise levels against external road and rail noise.
- To encourage passive acoustic design through the provision of less stringent criteria for normal domestic spaces thereby supporting the principals of ecologically sustainable development (ESD) through design.

1.3 SITUATIONS WHERE THIS PLAN APPLIES

This Development Control Plan (DCP) applies to part of the land within **[insert Council name]** where a multi unit residential housing development is proposed.

The applicable land is identified as having frontage to a road designated under this plan or which lies within 100m to the boundary of a land corridor accommodating a rail line. The designated roads and rail corridors are shown in Appendix 1. The applicable land has been identified as potentially having external noise levels likely to result in internal noise levels exceeding the indoor design noise levels of this plan. Hence the layout, design and construction of multi unit residential housing developments on the land will require special attention to achieve the required indoor design noise levels.

1.4 DEFINITIONS

Facade Noise Level: the sound pressure level experienced from measurements taken within 1m of the facade of the building or free field measurements adjusted by a correction of +2.5 dB(A) to account for facade reflections.

Logarithmic average: the average obtained using the following formula
 $10\text{Log}_{10}((\bar{A}^{10^{0.1\text{SPL}...N}})/\text{Number in the set})$

Day time/night time: day time is defined as between 7.00 am to 10.00 pm and night time is defined as 10.00 pm to 7.00 am.

Sound exposure level	(L_{AE}) is defined in lay terms as the time integral (amount of acoustic energy over time) of a noise event compressed or normalised to a one (1) second period and expressed in dB(A).
L_{Aeq}	the value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval has the same mean square sound pressure level as a sound under consideration.
ESD	ecologically sustainable development. Has the same meaning as prescribed in the Environmental Planning & Assessment Act, 1979.
AADT	average annual daily traffic count.
L_{Amax}	the maximum A-weighted sound pressure level recorded or observed in a given assessment period.
L_{Cmax}	the maximum C-weighted sound pressure level recorded or observed in a given assessment period.

PART 2 SOUND INSULATION AGAINST EXTERNAL NOISE

Part 2 of the DCP sets out the technical requirements and data acquisition methods acceptable to Council to demonstrate compliance with the requirements of the DCP.

2.1 Quantifying the existing acoustic environment

The external acoustic environment shall be quantified using the methods outlined below. Methods departing from the procedural requirements outlined shall be supported by a scientifically valid rationale to demonstrate that the method is no less accurate than described.

2.1.1 Road Noise

Road noise shall be quantified over a period of not less than three consecutive days of measurement using an instrument complying with the Type 2 requirements of AS1259.2-1990 'Acoustics-Sound Level Meters-Integrating Averaging'. The measurements shall be undertaken when traffic movements are relatively indicative of normal volumes. The consultant should note any variations to normal movements that may be caused by road works or school holidays and the like and make valid adjustments where practicable. Weather conditions shall be noted and conducive to the acquisition of valid data. Periods of inclement weather may be deleted from the data set while not reducing the overall period of the measurement.

The data shall be collected as either consecutive $L_{Aeq, 1hr}$ periods or in shorter periods that may be manipulated to provide $L_{Aeq, 1hr}$ measurements. The design external sound pressure level shall be the highest logarithmic mean (energy average) of the acquired measurements over the day time and night time period as calculated to be experienced at the relevant residential facades. Where the measurements acquired are free field a facade correction factor of +2.5 dB(A) shall be applied.

The measurements shall be made at positions that either represent the relevant facade sound pressure levels or in positions where accurate extrapolation may be made of the facade noise exposures. In any case the positions of the sound logging meters shall be clearly shown and justified.

2.1.2 Rail Noise

Due to the potential for intermittent movements of rail traffic, rail movements shall be assessed in terms of both amenity and sleep disturbance. This will require the acquisition of acoustic data capable of quantifying the acoustic parameters of L_{Amax} and $L_{Aeq, 1hr}$. Where the rail line features freight traffic the L_{Cmax} shall also be acquired to assess the need for a low frequency correction factor.

The sleep disturbance analysis may be dispensed with where it can be demonstrated that the number of rail movements does not indicatively exceed 2 per day and one per night (day time being 7.00 am – 10.00 pm and night time being 10.00 pm – 7.00 am).

The following procedures may be adopted to quantify the rail noise exposure of the relevant facade/s in terms of amenity and sleep disturbance. Alternative methods may be considered where justification is valid.

The procedures of relevant Australian Standards may be adopted to quantify the rail noise exposure of the site without justification.

Amenity Evaluation

1. Measure a representative number of rail events at the site of the relevant residential facade using the acoustic measure of Sound Exposure Level (L_{AE}). The rail event measurements should be representative of the types of movements experienced on the line ie freight and passenger movements. The L_{AE} is defined in lay terms as the time integral (amount of acoustic energy over time) of a noise exposure event compressed or normalised to a one (1) second period and expressed in dB(A).
2. Derive the energy average (logarithmic average as opposed to arithmetic average) of the rail events. Where the line usage includes both freight and passenger movements, the energy average for both classes of movement should be derived. Energy averages can be simply derived in the following way:

$$\text{Energy Average} = 10\log_{10} \left(\frac{\sum 10^{0.1L_{AE...N}}}{\text{Number in the set}} \right)$$

3. Contact the responsible authority for the particular rail line and establish a schedule of movements per hour. Subjectively establish the average repeatable maximum hourly rail movements. Using the established energy average, L_{AE} and the rail movement number, the $L_{Aeq, 1hr}$ can be established using the following algorithm. Where the line usage includes both freight and passenger movements, the $L_{Aeq, 1hr}$ calculation shall have regard for the derived L_{AE} for each class of movement (ie freight & passenger) and the frequency of occurrence obtained from the line authority.

$$L_{Aeq, 1hr} = 10\log_{10} (\bar{A}10^{0.1L_{AE}(1)}) - 35.6 \text{ dB(A)}$$

4. The resultant $L_{Aeq, 1hr}$ can be used as the rail noise exposure for the development and used to establish the sound insulation requirements to satisfy the indoor amenity criteria of the policy.

Sleep Disturbance Evaluation

1. From the acoustic data acquired from the above procedures select the highest L_{Amax} measurement from the rail movements.

Where the line under consideration includes freight movements, a +5 dB(A) correction factor shall be applied to the relevant L_{Amax} levels where the L_{Cmax} exceeds the L_{Amax} by more than 15 dB(A).

2. The highest L_{Amax} shall be used to establish the sound insulation requirements to satisfy the indoor sleep disturbance criteria for bedrooms only.

2.2 Internal Noise Levels

Table 1 presents the indoor noise levels (criteria) required to satisfy the requirements of the DCP.

Day time is defined as 7.00 am to 10.00 pm and night time is defined as 10.00 pm to 7.00 am. The noise levels presented represent the maximum repeatable $L_{Aeq,1hr}$ (amenity) or the L_{Amax} (disturbance for rail events only) for the period nominated. This information is required for design purposes. Validation measurements can be acquired over a shorter check period.

Table 1: Required Indoor Design Noise Levels
 $L_{Aeq,1hr}$, dB(A) (amenity) & L_{Amax} (disturbance)

Type of Occupancy	Day time	Night time
Sleeping Areas	40 (amenity)	35 (amenity)
	55 (disturbance)	50 (disturbance)
Normal Domestic	45	40

The less stringent criteria for 'Normal Domestic' spaces is intended to promote passive acoustic design principals and to promote the consideration of the acoustic environment early in the design process. That is, a design that maximises shielding to bedrooms will result in less onerous requirements for glazing details and hence a sustainable saving in terms of materials.

2.3 Operating Conditions of the Building - Ventilation

Where the indoor design noise levels cannot be satisfied with windows open to 5% of the floor space of the room under consideration alternative means of ventilation are required. The following hierarchy of alternatives should be considered in the options analysis with (i) being most preferred and (ii) least preferred.

- (i) Design the building to ensure that passive ventilation will not seriously compromise the acoustic integrity of the building. Noise sensitive uses should be located as far as practicable from noise sources. Windows should be orientated away from noise sources.

- (ii) Provide the building with mechanical ventilation satisfying the requirements of the Building Code of Australia in terms of fresh air supply. Mechanical ventilation does not imply a need or requirement for comfort conditioning systems.

For the purpose of design analysis a room by room approach is acceptable and hence assumes that internal doors are closed and that negligible noise transfer between rooms occurs. If a perimeter approach is adopted the lower indoor design noise level shall be adopted for the composite space.

2.4 Acoustic Compliance Reporting

2.4.1 Design Report

The design report shall be submitted with the development application when the requirements of the DCP have been triggered as applicable to the development under Section 1.3.

The design report shall include;

- A site plan of the development proposal showing the location of the measurement points.
- A graphical representation of the acquired noise data over the minimum three day period (refer Section 2.1.1).
- A statement quantifying the measured or adjusted facade noise levels derived for design purposes for both road and rail noise as applicable.
- Recommendations for specific facade upgrades to satisfy the indoor design noise levels of the plan. Where appropriate the recommendations shall include a listing of suppliers of recommended elements.
- A statement indicating that the design noise levels will be achieved following the effective implementation of the required noise controls. The statement shall include the operating conditions of the building.

2.5 Validation requirements

Following completion of the building, a statement from a suitably qualified acoustic consultant will be required clearly indicating that the acoustic recommendations of the design report have been satisfactorily incorporated into the building. Periodic inspections by the acoustic consultant may be warranted to ensure that retrofitting of the acoustic recommendations is not required at the completion of the project. This statement is to be supported by validation measurements within at least two (2) bedrooms and one (1) living room for developments comprising up to ten (10) units. Additional rooms will be required to be validated on the basis of one (1) additional room per ten (10) additional units, or alternatively as nominated by Council.

The validation measurement period may be reduced to an $L_{Aeq,15min}$ per room. The time of the validation assessment shall be determined from an analysis of the acoustic data obtained under Part 2 of this DCP in order to determine the time of the maximum external noise period. The time of the validation measurements shall be clearly stated in the validation report and justified. External noise measurements may be used to justify the selected

time to demonstrate that the period selected was indicative of the maximum external noise used in the design process. The validation statement shall be submitted to the Principal Certifying Authority (PCA) and approved prior to the issue of occupation certificates.