SOUTHERN SYDNEY REGIONAL ORGANISATION OF COUNCILS

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

VERSION B

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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 protect sleep and amenity. 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 an initial assessment of the facade noise levels. Where the noise level acquired in accordance with Part 2.3.1 exceeds L_{Aeq} 60 dB(A) or the property is located within 100 metres of the boundary of a land corridor accommodating a rail line the requirements of the plan have been triggered.

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.

The plan describes a method to quantify the external noise environment at appropriate locations and over appropriate times, sets satisfactory internal noise levels or goals 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 plan is applicable for parcels of land that experience road traffic noise levels at exposed facades exceeding a logarithmic average of $L_{Aeq,1hr}$ 60 dB(A) day time and $L_{Aeq,1hr}$ 55 dB(A) night time or the parcel is within 100m of the boundary of a land corridor accommodating a rail line. 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.

To identify the applicability of the plan, development applications for multi unit residential developments will be required to be accompanied with a Preliminary Report from a suitably qualified acoustic consultant providing the results of preliminary measurements taken at the most exposed residential facade location to road & rail traffic noise. Preliminary measurements will consist of an $L_{Aeq,1hr}$ taken between the periods 7.00 am - 9.00 am or 4.30 pm - 6.30 pm. A sound pressure level exceeding $L_{Aeq,1hr}$ 60 dB(A) will trigger the requirements of the plan. Where the site is located within 100 metres of the boundary of a land corridor accommodating a rail line the Preliminary Report will include an assessment of rail noise in accordance with Section 2.1.2 of this plan.

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 $10Log_{10}((\hat{A}10^{0.1SPL...N})/Number\ in\ the\ set)$

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

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 acoustical 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 were 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 i.e. 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).

The L_{Amax} noise levels of the rail event measurements should be acquired at the same time for use in the sleep disturbance analysis. Where it is determined that the rail line under consideration is used for freight purposes, L_{Amax} and L_{Cmax} data shall be acquired for that particular class of movement.

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:

   Energy Average = $10Log_{10}$ ((Â$10^{0.1L_{AE...N}}$)/Number in the set)

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 (i.e. freight & passenger) and the frequency of occurrence obtained from the line authority.

   $L_{Aeq,1hr}$ = $10Log_{10}$ (Â$10^{0.1L_{AE(1)}}$) – 35.6 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 (or 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 event only) for the period nominated. This information is required for design purposes. Validation measurements could 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) 55 (disturbance)	35 (amenity) 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.

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 Preliminary Report

Development Applications for multi unit residential developments will be required to be accompanied with a Preliminary Report from a suitably qualified acoustic consultant providing the results of preliminary measurements taken at the most exposed residential facade location to road traffic noise. Preliminary measurements will consist of an $L_{Aeq,1hr}$ taken between the periods 7.00 am - 9.00 am or 4.30 pm - 6.30 pm. A sound pressure level exceeding $L_{Aeq,1hr}$ 60 dB(A) will trigger the requirements of the plan. Where the site is located within 100 metres of a land corridor accommodating a rail line, the Preliminary Report should include an assessment of rail noise in accordance with Section 2.1.2 of this plan.

2.4.2 Design Report

The design report shall be submitted with the development application when the preliminary report has demonstrated that the plan is applicable, i.e. the preliminary measurements have demonstrated a potential facade exposure level exceeding $L_{Aeq,1hr}$ 60 dB(A).

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.

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.