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Rail Noise and Vibration Assessment

All Saints Catholic Senior College
Leacocks Lane, Casula, NSW

REPORT No
6447-1.1R Rev A

DATE ISSUED
9 March 2018

Prepared For:

Sydney Catholic Schools
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Revision History

Report	Date	Prepared	Checked	Comment
Draft	05/03/2018	Alexander Mendoza	Stephen Gauld	By email, for client review
Final	09/03/2018	Alexander Mendoza	Stephen Gauld	
Rev A	09/03/2018	Alexander Mendoza	Stephen Gauld	

Document R\6447-1.1R REV A, 12 pages plus attachments

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1.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Fulton Trotter Architects on behalf of Sydney Catholic Schools to carry out a rail noise and vibration intrusion assessment for proposed alterations and additions to All Saints Catholic Senior College, an existing educational establishment at Leacocks Lane, Casula, NSW.

The scope of work is as follows:

- Inspect the proposed development site and environs.
- Measure rail noise and vibration levels at the proposed site.
- Prepare a site plan showing the location of the proposed residences to the railway line
- Determine acceptable noise levels in accordance with the NSW Department of Planning and Infrastructure's document *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* (2008) and SEPP (Infrastructure) 2007.
- Calculate the internal noise level due to rail noise affecting the site using the client's architectural drawings
- Provide recommendations for noise intrusion control (if necessary).
- Prepare a Rail Noise and Vibration Intrusion Report.

2.0 PROJECT DESCRIPTION

Alterations and additions to numerous buildings within the existing educational establishment are proposed, which include:

- Refurbishment and additions to join Block A (Administration) with Block B2 (General Learning Area (GLA)) into a new Administration Building
- Refurbishment of Block B5 (Art) into a new canteen
- Construction of a new Block B5 (Pavilion)
- Internal refurbishment of Block C (GLA) and Block D1 (GLA)
- Construction of new covered walkways around the internal perimeter of the school buildings
- Construction of a new covered outdoor learning area adjoining Block B5 pavilion
- A total gross floor area (GFA) of 5,820m2
- Increase the number of functional teaching spaces from 36 (existing) to 43 (proposed)
- Off street car parking for 88 cars (including one disabled space), with modified internal bus drop off zone and asphalt road to the north of Block P and N
- Tree removal and landscaping to the site
- Site and drainage works
- Identification signage.

No alterations to the existing vehicular and pedestrian entry points to the site are proposed.

No change is proposed to the current student and staff populations or hours of operation.

The T2 and T5 rail lines lie approximately 270 metres to the east of the site, as shown in Figure 1. The gradient of the land is such that the tracks are below the ground level of the site.

Noise and vibration measurements have been taken at the site and are presented in Section 5 of this report. Recommendations for the building construction are provided in Section 6 of this report.

Provided the recommendations in this report are satisfactorily implemented, the inside noise level from passing trains will be within the acceptable limits as detailed in the NSW Department of Planning document *"Development Near Rail Corridors and Busy Roads – Interim Guideline* (2008) and SEPP (Infrastructure) 2007.

Figure 1. Development Site – Leacocks Lane, Casula, NSW

3.0 NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis were made with instrumentation as follows in Table 1:

Table 1 Noise Instrumentation

Description	Model No.	Serial No.
Modular Precision Sound Analyser	B&K 2270	3011809
Condenser Microphone 0.5" diameter	B&K 4189	3099836
Acoustical Calibrator	B&K 4231	2095415
Accelerometer	B&K 4370	1228153
Accelerometer Calibrator	B&K 4294	2602961

The **B&K G4 Sound Analyser** is a real-time precision integrating two channel sound level meter with octave and third octave filters that samples noise and vibration at a rate of 8 samples per second. The B&K G4 provides L_{eq}, L_{10} and L_{90} statistical data over the desired monitoring period for noise measurements and rms acceleration, peak and maximum acceleration levels for vibration measurements.

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.3 dB during attended measurements. No adjustments for instrument drift during the measurement period were warranted.

4.0 ACCEPTABLE NOISE INTRUSION LEVELS

4.1 DoP and NSW SEPP (Infrastructure) 2007

The NSW Department of Planning published the *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* in 2008. The Guidelines refer to Clauses 87 (Rail) and 102 (Road) of the State Environment Planning Policy (Infrastructure) 2007 for the noise criteria for developments affected by railway noise or traffic noise, which states the following:

'87. Impact of rail noise or vibration on non-rail development.

1. This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

a. a building for residential use,

b. a place of public worship,

c. a hospital,

d. an educational establishment or child care centre.

3. If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

(a) in any bedroom in the building—35 dB(A) at any time between 10.00 pm and 7.00 am

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time."

In addition, it also states that:

"if internal noise levels with windows or doors open exceed the criteria by more than 10 dB, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia".

4.2 Train Vibration Criteria

Section 3.6.3 of the "Development Near Rail Corridor and Busy Roads – Interim Guidelines" requires vibration levels such as the intermittent vibration emitted by trains, to comply with the criteria in the NSW EPA's "Assessing Vibration: a technical guideline".

The NSW Environment Protection Authority (EPA) published the "Assessing Vibration: a technical guideline" in February 2006. This guideline is based on the British Standard BS6472:1992 "Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."

Compliance with this guideline will also ensure compliance with the Australian Standard AS2670 "Evaluation of human exposure to whole-body vibration".

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques.

The guideline sets limits for 'vibration dose values' to assess vibration from intermittent sources, such as passing trains.

4.3 Vibration Dose Value

Vibration dose values (VDV) are used to determine the overall effects of intermittent vibration over a day and night period. The VDV is calculated by root-mean-quad approach, making the vibration dose value more sensitive to any peaks within the acceleration waveform.

Table 2 details vibration dose values which indicate that, for educational institutions, vibration levels below those stated would be considered acceptable.

Table 2 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Educational Institutions	0.4	0.8	0.4	0.8

[1] Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.

4.4 Acceptable Noise and Vibration Criteria

Based on the above, we find that the most stringent internal noise and vibration criteria are as follows:

- L_{eq} 40 dBA for all habitable areas at any time.

The acceptable Vibration Dose Values for residential dwellings are:

- 0.4 $m/s^{1.75}$ for all habitable areas at any time.

5.0 MEASURED NOISE AND VIBRATION LEVELS

5.1 Measured Train Noise Levels

Noise levels from six train pass-by's were measured on site approximately 270 metres from the train line with levels ranging from 50 dBA to 56 dBA for passenger trains and 55 dBA to 59 dBA for freight trains.

Based on the maximum number of 207 passenger train pass-by's and up to 15 freight train pass-by's during the day, the equivalent day time $L_{eq,15\text{-}hr}$ level is calculated to be **49 dBA**.

We are of the opinion that this noise level is typical for this section of track, and have adopted this value in the design of noise insulation for this development.

Octave band noise levels established from site measurements are presented in Table 3 below.

Table 3 Train Noise Levels

Train Noise Level		Measured sound pressure levels – dB							
	dBA	63	125	250	500	1k	2k	4k	8k
Daytime $L_{eq,\ 15\ hr}$	**49**	54	50	49	46	45	38	40	32

The required train noise reduction is therefore (49 – 40 =) 9 dB for all areas.

5.2 Measured Vibration Levels

The vibration levels from six train pass-by's was measured on-site, approximately 270 metres from the rail line at the easternmost property boundary. The maximum vibration level measured was 0.0002m/s^2 during a passenger train pass-by.

Based on the current train timetable, there are approximately 18 passenger train pass-by's on the railway line adjacent to the site during the busiest hour and 207 passenger train pass-by's during the daytime between 7 am and 10 pm.

In consultation with Pacific National and from previous train noise assessments conducted by Day Design along the T2 and T5 rail lines, we make a conservative estimate of 15 freight train pass-by's during the day.

Using total train pass bys for each time period, this results in an eVDV of 0.003 m/s$^{1.75}$ during the daytime.

The calculated day time eVDV is well within the maximum VDV for educational institutions and is therefore acceptable.

6.0 RECOMMENDED ACOUSTICAL TREATMENT

We have modelled the proposed development based on architectural drawings by Fulton Trotter Architects and calculated the level of train intrusion through the roof, walls and windows.

The necessary noise reduction for the various areas within the College can be achieved if the following noise control recommendations are complied with.

6.1 External Walls

- All new external walls may be constructed using standard construction.

6.2 Ceiling and Roof System

- All new roofs and ceilings may be of standard construction.

6.3 Glazing

- Glazing to all areas within the educational institution may comprise of standard construction.

6.4 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claim of expertise in other areas and draw your attention to the possibility that our recommendations may not meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. For example, a small crack between the top of a wall and a ceiling can reduce the effective sound transmission loss of a wall from R_w 50 to R_w 40. Therefore the use of contractors that are experienced in acoustic construction is encouraged. Furthermore, two insulation products may have the same thermal R rating but the sound absorption of one may be entirely deficient, therefore the use of materials and equipment that are supported by acoustic laboratory test data is encouraged.

7.0 NOISE INTRUSION STATEMENT

Day Design Pty Ltd was engaged by Fulton Trotter Architects on behalf of Sydney Catholic Schools to investigate the rail noise and vibration intrusion on proposed alterations and additions to the existing All Saints Catholic Senior College, Leacocks Lane, Casula, NSW

Existing levels of rail noise and vibration have been measured at the site. We are confident that the noise and vibration levels used in our assessment are typical of this area.

Building constructions found to be acoustically acceptable in reducing the level of train noise are detailed in Section 6 of this report.

We are confident that once the recommended building constructions are satisfactorily implemented, the intrusive train noise and vibration level at All Saints Catholic Senior College, Leacocks Lane, Casula, NSW will comply with the NSW Department of Planning document *"Development Near Rail Corridors and Busy Roads – Interim Guideline* (2008) and SEPP (Infrastructure) 2007 as described in Section 4.0 of this Report.

Alexander Mendoza, MDesSc (Audio and Acoustics)

Acoustic Consultant

for and on behalf of Day Design Pty Ltd

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