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Rail Noise and Vibration Assessment

Proposed Mixed Use Development
Hollylea Road, Leumeah, NSW, 2560

REPORT No
6508-1.1R

DATE ISSUED
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Prepared For:
Duffy Law Group Law Practice Trust
C/ - Michael Brown Planning Strategies
PO Box 295
Camden NSW 2570

Attention: Mr Michael Brown

Revision History

Report	Date	Prepared	Checked	Comment
Draft	07/12/2018	Adam Shearer	Stephen Gauld	By email, for client review
Final	01/01/2019	Adam Shearer	Stephen Gauld	

Document R\6508-1.1R, 22 pages plus attachments

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1.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Michael Brown Planning Strategies on behalf of Duffy Law Group Law Practice Trust to carry out a rail noise and vibration assessment for the proposed mixed-use development at Hollylea Road, Leumeah, NSW.

The scope of work is as follows:

- Inspect the proposed development site and environs
- Measure rail noise and vibration levels across 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 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 Assessment Report.

2.0 PROJECT DESCRIPTION AND SUMMARY OF FINDINGS

A mixed-use development is proposed on the south-east side of Hollylea Road, Leumeah, NSW. The mixed-use development will be constructed over a 40,500 m^2 area and will comprise retail and residential premises, with buildings up to seven storey in height.

The T8 Airport and South Rail Line is located directly south-east of the proposed development site, as shown in Figure 1.

Short term rail noise and vibration levels have been measured at three locations adjacent to the approximate façade location of the proposed development site, as shown in Figure 1. The results of each measurement are presented Section 4.

The acoustic assessment was based on a letter detailing project specifics provided by *Michael Brown Planning Strategies,* 21 dated February 2018, attached as Appendix B.

Noise controls will be required for some locations on the development site to reduce the external rail noise levels to acceptable internal noise levels, and are detailed in Section 5 of this report.

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

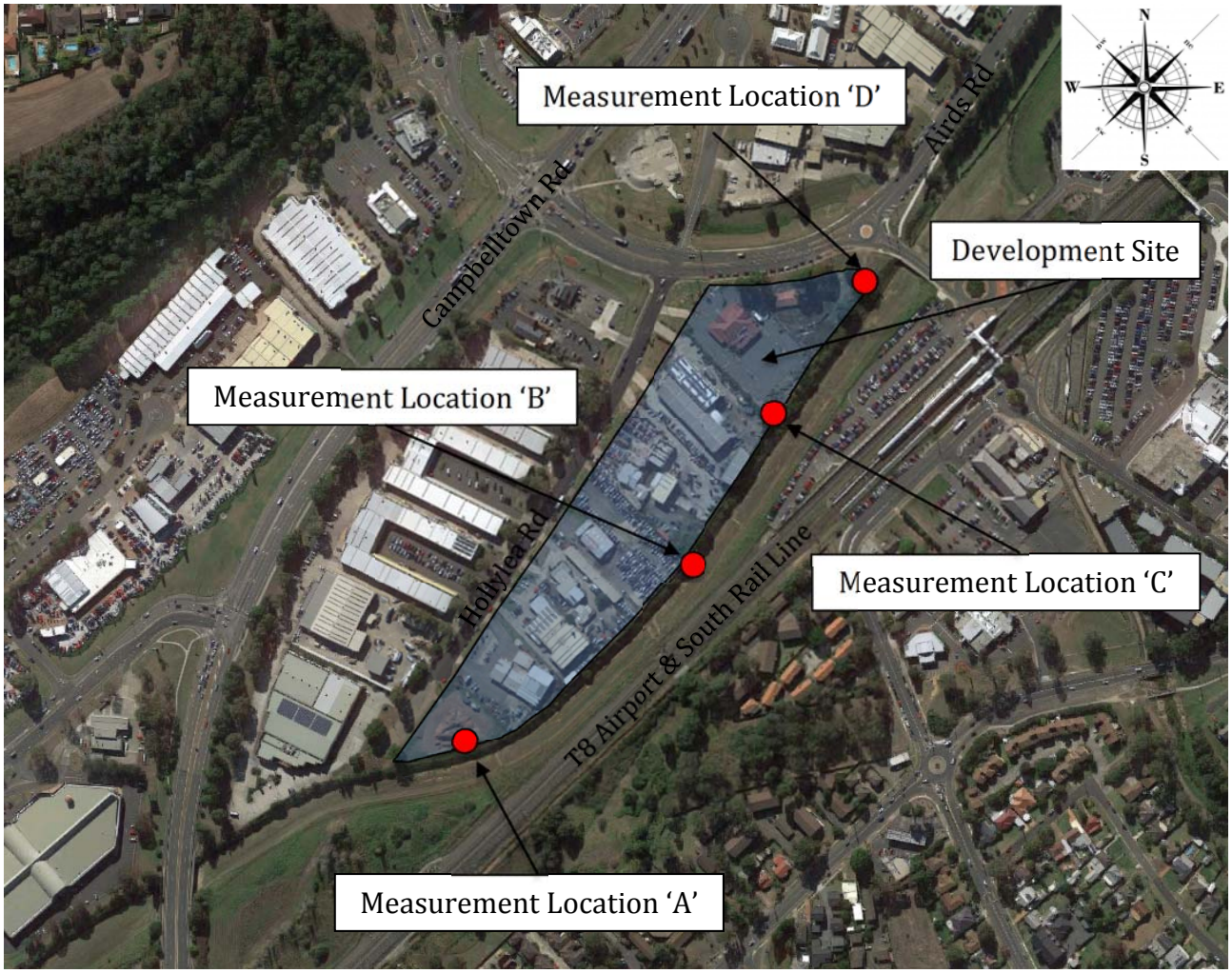

Figure 1. Location Plan – Hollylea Road, Leumeah, NSW

3.0 ACCEPTABLE TRAIN NOISE INTRUSION LEVELS

3.1 Campbelltown City Council

Campbelltown City Council in its Campbelltown (Sustainable City) Development Control Plan (DCP) 2015, Volume 1, Part 3.4 – General Requirements for all Type of Residential Development, states the following in regard to developments near railway corridors:

'3.4.3 Acoustic and Visual Privacy

Objective:

- *Provide adequate visual and acoustic privacy for residents of new and existing development.*

3.4.3.1Acoustic Privacy

Requirements

a) Development that adjoins significant noise sources, (such as main roads, commercial/industrial development, public transport interchanges and railways) shall be designed to achieve acceptable internal noise levels, based on recognised Australian Standards and any criteria and standards regulated by a relevant State Government Authority.

b) Development shall incorporate noise attenuation measures that are compatible with the scale, form and character of the street.

d) Multi dwelling housing and attached dwellings near railway corridors and major roads shall demonstrate to Council's satisfaction compliance with the requirements under the Guidelines entitled Development Near Rail Corridors and Busy Roads – Interim Guideline, 2008).'

In addition Part 5.4 – General Requirements for Residential Flat Buildings & Mixed Use Development, states the following:

'5.4.4 Acoustic Privacy

a) Residential flat buildings, and the residential component of a mixed use development shall provide noise mitigation measures to ensure that the following L_{Aeq} levels are not exceeded:

i) in any bedroom in the building—35 dBA ,

ii) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dBA.

b) Residential flat buildings, and the residential component of a mixed-use development near railway corridors and major roads shall demonstrate to Council's satisfaction compliance with the requirements under the Guidelines entitled Development Near Rail Corridors and Busy Roads – Interim Guideline, 2008).'

3.2 DoP and NSW SEPP (Infrastructure) 2007

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

"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 in Section 3.6.1 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".

The DoP Guideline also recommends maximum internal L_{Aeq} noise levels for non-residential buildings. The recommended L_{Aeq} noise levels below in Table 1 are taken from Table 3.1 of the Guideline.

Table 1 Required Indoor Design Noise Levels

Non-Residential Buildings		
Type of Occupancy		**Recommended Max Level, dBA**
Educational Institutions including child care centres		40
Places of Worship		40
Hospitals	– Wards	35
	– Other noise sensitive areas	45

Note: airborne noise is calculated as L_{eq} (9h)(night) and L_{eq} (15hr)(day). Ground borne noise is calculated as L_{max} (slow) for 95% of rail pass-by events

3.3 Train Vibration Criteria

The NSW Environment Protection Authority (EPA) published "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.

3.4 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 below details VDV's which indicate that, for residential applications, vibrations below those stated would be considered acceptable.

Table 2 Acceptable VDV's for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

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

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.

3.5 Retail Receptor Intrusion Criterion

The recommended internal noise criterion for any retail suites of the development from train noise is < $L_{eq,\ 1\ hour}$ 50 dBA based on AS2107:2016.

3.6 Acceptable Noise and Vibration Criteria

Given the above documents and policies, we find that the most stringent internal noise criteria are as follows:

3.6.1 Residential Receivers

With Windows Closed:

- $L_{eq,\ 9\ hour}$ 35 dBA inside bedrooms at night (10 pm to 7 am); and
- $L_{eq,\ 15\ hour}$ 40 dBA inside other habitable rooms during the day (7 am to 10 pm).

With Windows Open:

- $L_{eq,\ 9\ hour}$ 45 dBA inside bedrooms at night (10 pm to 7 am); and
- $L_{eq,\ 15\ hour}$ 50 dBA inside other habitable rooms during the day (7 am to 10 pm).

The acceptable Vibration Dose Values for a residential dwelling are to be:-

- 0.20 $m/s^{1.75}$ for all habitable areas during the day (15 hour); and
- 0.13 $m/s^{1.75}$ for all habitable areas during the night (9 hour).

3.6.2 Retail Receivers

- ≤ $L_{eq,\ 1\ hour}$ 50 dBA inside retail suites at any time during operation.

The acceptable Vibration Dose Values for a residential suite are to be:

- 0.40 $m/s^{1.75}$ for all retail suites at any time.

4.0 MEASURED NOISE AND VIBRATION LEVELS

4.1 Instrumentation

The instrumentation used in this assessment is listed in Appendix A.

4.2 Measured Train Noise & Vibration Levels

Train pass-by noise levels were measured in three locations along the eastern boundary of the development site and in one location approximately 15 metres to the east of the development site boundary, on Monday 21 May 2018, shown as Measurement Location 'A', 'B', 'C' and 'D' in Figure 1. The noise level of 12 passenger trains and five freight trains were measured with levels ranging from 50 to 69 dBA for passenger trains and 55 to 75 dBA for the freight trains.

Ground vibration levels were also measured simultaneously at Measurement Location 'A' and 'C'.

The measured train noise levels are shown in Tables 3 to 6 with the measured vibration levels shown in Tables 3 and 5.

Table 3 Attended Train Measurements – Measurement Location 'A'

Train Time	L_{eq} (dBA)	Duration (s)	LAE (dBA)	L_{max} (dBA)	Acceleration (mm/s²)
1:04 pm	60	13.71	71	64	1.0
1:08 pm	58	20.56	71	62	0.7
1:18 pm	57	19.58	70	60	0.7
1:23 pm	56	29.38	71	59	0.7
1:28 pm*	73	28.40	87	77	1.2
1:33 pm	59	19.58	72	62	0.7
1:38 pm	57	21.54	71	61	0.7
1:43 pm*	66	24.48	80	72	1.1
1:48 pm	59	14.69	71	62	0.7
1:53 pm	56	20.56	69	58	0.7

**Freight train pass-by.*

Table 4 Attended Train Measurements – Measurement Location 'B'

Train Time	L_{eq} (dBA)	Duration (s)	LAE (dBA)	L_{max} (dBA)	Acceleration (mm/s²)
1:18 pm	50	14.69	62	54	n/a
1:23 pm	50	32.29	66	55	n/a
1:28 pm*	75	47.98	92	85	n/a
1:33 pm	52	40.15	69	66	n/a
1:38 pm	52	23.50	66	55	n/a
1:43 pm*	68	22.52	82	77	n/a
1:48 pm	52	40.15	68	56	n/a
1:53 pm	52	37.21	68	58	n/a

**Freight train pass-by.*

Table 5 Attended Train Measurements – Measurement Location 'C'

Train Time	L_{eq} (dBA)	Duration (s)	LAE (dBA)	L_{max} (dBA)	Acceleration (mm/s²)
2:09 pm*	55	39.17	71	61	0.9
2:19 pm	69	25.46	84	86	1.0
2:22 pm	52	24.48	66	58	0.8
2:27 pm*	67	53.85	84	77	1.4
2:34 pm	51	31.3	66	54	0.8
2:37 pm	52	26.44	67	55	1.6
2:43 pm*	68	22.52	81	75	2.6

**Freight train pass-by.*

Table 6 Attended Train Measurements – Measurement Location 'D'

Train Time	L_{eq} (dBA)	Duration (s)	LAE (dBA)	L_{max} (dBA)	Acceleration (mm/s^2)
2:05 pm	57	65.60	75	64	n/a
2:09 pm*	56	42.10	72	61	n/a
2:19 pm	54	82.25	74	59	n/a
2:22 pm	56	65.60	74	61	n/a
2:27 pm*	65	51.90	83	73	n/a
2:34 pm	55	81.27	74	60	n/a
2:37 pm	55	27.42	69	61	n/a

According to the CityRail timetable, the daily number of passenger train pass-bys are as follows:

- 224 passenger trains during the day (7 am – 10 pm), and
- 57 passenger trains during the night (10 pm – 7 am).

Based on the above train movements, the equivalent day time $L_{eq,15\text{-}hr}$ and night time $L_{eq,9\text{-}hr}$ levels are calculated to be at the nearest façade of the proposed development:

Measurement Location 'A' –

- 55 $L_{eq,\ 15\ hour}$
- 51 $L_{eq,\ 9\ hour.}$

Measurement Location 'B' –

- 59 $L_{eq,\ 15\ hour}$
- 56 $L_{eq,\ 9\ hour.}$

Measurement Location 'C' –

- 56 $L_{eq,\ 15\ hour}$
- 52 $L_{eq,\ 9\ hour.}$

Measurement Location 'D' –

- 53 $L_{eq,\ 15\ hour}$
- 49 $L_{eq,\ 9\ hour.}$

Octave band noise levels established from site measurements are presented below in Table 7.

Table 7 $L_{eq,\ 15\ hour}$ & $L_{eq,\ 9\ hour}$ Octave Band Train Noise Levels

Train Noise Level	Measured sound pressure levels – dB								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Measurement Location 'A'									
Daytime $L_{eq,\ 15\ hr}$ – (7 am – 10 pm)	**55**	69	55	48	49	49	50	41	27
Night-time $L_{eq,\ 9\ hr}$ - (10 pm – 7 am)	**51**	65	51	45	45	46	46	38	23
Measurement Location 'B'									
Daytime $L_{eq,\ 15\ hr}$ – (7 am – 10 pm)	**59**	74	66	52	55	53	52	48	41
Night-time $L_{eq,\ 9\ hr}$ - (10 pm – 7 am)	**56**	70	62	48	51	50	49	44	37
Measurement Location 'C'									
Daytime $L_{eq,\ 15\ hr}$ – (7 am – 10 pm)	**56**	63	54	50	52	51	51	39	29
Night-time $L_{eq,\ 9\ hr}$ - (10 pm – 7 am)	**52**	59	50	46	49	48	47	35	25
Measurement Location 'D'									
Daytime $L_{eq,\ 15\ hr}$ – (7 am – 10 pm)	**53**	64	56	49	51	48	44	38	32
Night-time $L_{eq,\ 9\ hr}$ - (10 pm – 7 am)	**49**	60	52	46	47	45	41	34	29

Meteorological conditions during the testing typically consisted of partly cloudy skies with a temperature of approximately 22°C and wind speeds less than 5 m/s. Atmospheric conditions were ideal for noise monitoring. Noise measurements were therefore considered reliable and typical for the receptor area.

We are of the opinion that these noise levels are typical for this section of track, and have adopted these values in the design of noise insulation for this development.

4.3 Required Train Noise Reduction

4.3.1 Residential Receivers

For assessment against the SEPP (Infrastructure) 2007 document the required train noise reduction is therefore:

Based on Measurement Location 'A' – ***Lot*** *A/DP411499,* ***Lot*** *1/DP565611 &* ***Lot*** *1-5SP52179*

- (55 – 40 =) 15 dB for all living areas
- (51 – 35 =) 16 dB for all sleeping areas.

Based on Measurement Location 'B' – ***Lot*** *301/DP621274,* ***Lot*** *9/DP234601,* ***Lot*** *127/DP575482,* ***Lot*** *125/DP575481 &* ***Lot*** *27/611186*

- (59 – 40 =) 19 dB for all living areas
- (56 – 35 =) 21 dB for all sleeping areas.

Based on Measurement Location 'C' – ***Lot*** *1-4/SP70043,* ***Lot*** *16/D623923 &* ***Lot*** *12/DP845149*

- (56 – 40 =) 16 dB for all living areas
- (52 – 35 =) 17 dB for all sleeping areas.

Based on Measurement Location 'D' – ***Lot*** *3/DP258315 &* ***Lot*** *4/DP258315*

- (53 – 40 =) 13 dB for all living areas
- (49 – 35 =) 14 dB for all sleeping areas.

4.3.2 Retail Receivers

For assessment against AS2017:2016 the required train noise reduction is therefore:

Based on Measurement Location 'A' – ***Lot*** *A/DP411499,* ***Lot*** *1/DP565611 &* ***Lot*** *1-5SP52179*

- (55 – 50 =) 5 dB for all retail suites.

Based on Measurement Location 'B' – ***Lot*** *301/DP621274,* ***Lot*** *9/DP234601,* ***Lot*** *127/DP575482,* ***Lot*** *125/DP575481 &* ***Lot*** *27/611186*

- (59 – 50 =) 9 dB for all retail suites.

Based on Measurement Location 'C' – ***Lot*** *1-4/SP70043,* ***Lot*** *16/D623923 &* ***Lot*** *12/DP845149*

- (56 – 50 =) 6 dB for all retail suites.

Based on Measurement Location 'D' – ***Lot*** *3/DP258315 &* ***Lot*** *4/DP258315*

- (53 – 50 =) 3 dB for all retail suites.

4.4 Required Vibration Level Reduction

The maximum vibration level measured was 0.0012 m/s^2 at Measurement Location 'A' and 0.0026 m/s^2 at Measurement Location 'C'. This equates to a worst-case estimated VDV (eVDV) of 0.00046 $m/s^{1.75}$ per train at Measurement Location 'A' and 0.00047 $m/s^{1.75}$ per train at Measurement Location 'C'.

Based on the current train timetable, there are up to 21 passenger train pass-bys on the railway line during the busiest day time hour and 15 passenger train pass-bys during the busiest night time hour. Using these flow rates for the 15 hours during the daytime and 9 hours at night, this calculates to an eVDV of 0.0053 $m/s^{1.75}$ during the daytime and 0.0038 $m/s^{1.75}$ at night at Measurement Location 'A' and an eVDV of 0.0061 $m/s^{1.75}$ during the daytime and 0.0043 $m/s^{1.75}$ at night at Measurement Location 'C'.

This is a conservatively high prediction and is still well within the preferred level for daytime and night time for residential and retail premises and is therefore acceptable.

5.0 RECOMMENDED BUILDING CONSTRUCTION

The necessary noise reduction can be achieved if the following noise control recommendations are complied with, and there are no gaps at construction joints, around plumbing penetrations in external walls and floors, at window sills, door frames, etc., through which sound may penetrate.

5.1 External Walls

5.1.1 Masonry Walls

External walls may be constructed with any selected masonry wall system.

5.1.2 Pre-fabricated Wall Systems

External walls may be constructed with an AFS or Dincel wall system, or any other similar product.

5.1.3 Light Weight Walls

External walls may be of light weight constructed as follows:

- Selected cladding fixed to the outside of 90 mm timber studs;
- A single layer of 10 mm thick plasterboard on the internal side of studs; and
- The wall cavity is to be lined with 100 mm bulk insulation (min 10 kg/m^3 density).

5.2 Ceiling and Roof System

- All roofs may be of metal deck or ceramic tile construction;
- Thermal insulation and vapour barrier laid below the roof;
- The ceiling under the roof is to comprise of a single layer of 10 mm thick plasterboard; and
- Insulation batts are to be placed between the ceiling joist. The recommended insulation specifications are 160 mm thick glasswool (min 10 kg / m^3 density).

5.3 Windows and Glazed Doors

5.3.1 Lots - A/DP411499, 1/DP565611, 1-5SP52179, 1-4/SP70043, 16/D623923, 12/DP845149, 3/DP258315 & 4/DP258315

Standard windows and frames are acceptable.

5.3.2 Lots - 301/DP621274, 9/DP234601, 127/DP575482, 125/DP575481 & 27/611186

We recommend all glazing in installed in windows or doors have minimum 5 mm thick glass installed with a minimum weighted sound reduction index of R_w 28.

5.4 Entry Doors

Construction of entry doors may be to the architect's specification.

5.5 Mechanical Ventilation

The highest external noise levels will be at the façades of any buildings constructed on Lots - 301/DP621274, 9/DP234601, 127/DP575482, 125/DP575481 & 27/611186 (Measurement Location 'B'). The measured noise levels at Measurement Location 'B' are 59 dBA in the day time and 56 dBA at night.

With windows and doors left partially open (20% of the window area) the resultant internal noise levels are typically 10 dB less than the corresponding external noise levels.

In this instance, this equates to 49 dBA during the day and 46 dBA at night respectively.

It can be seen that the acceptable noise limit of 50 dBA during the day is complied with, however, the acceptable noise limit of 45 dBA at night (with windows and doors partially open) is exceeded by up to 1 dB.

The bedrooms of the mixed use development are to be ventilated to the standards set out in clause F4.5 of the Building Code of Australia and Australian Standards AS1668.2:1991.

An air conditioning system with fresh air supply may be used to achieve the required ventilation.

Alternatively, either of the following vent options may be used in conjunction with a toilet exhaust fan to provide the required ventilation. The toilet exhaust fan will draw air through these vents and thus facilitate ventilation.

- Silenced air relief intake duct built into the masonry wall of each room as shown in the attached datasheet AC810-6B.
- Silenced air relief intake duct built into the masonry wall of each room equal to Silenceair (www.silenceair.com).

Mechanical ventilation is not required for any other Lot on the development site.

5.6 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.

6.0 NOISE INTRUSION STATEMENT

Day Design Pty Ltd was engaged by Michael Brown Planning Strategies on behalf Duffy Law Group Law Practice Trust to assess the rail noise and vibration intrusion into the proposed mixed-use development at Hollylea Road, Leumeah, 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 5 of this report.

We are confident that once the recommended building constructions are satisfactorily implemented, the intrusive train noise and vibration level at Hollylea Road, Leumeah, NSW, will comply with the NSW Department of Planning and Environment's document *"Development Near Rail Corridors and Busy Roads – Interim Guideline* (2008) and State Environment Planning Policy (SEPP) (Infrastructure) 2007 and Campbelltown City Council's requirements, and be considered acceptable.

Adam Shearer, BCT (Audio), MDesSc (Audio and Acoustics), MAAS

Senior Acoustical Consultant

for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

APPENDICES

Appendix A – Noise Survey Instrumentation
Appendix B – Michael Brown Planning Strategies – Planning Document
AC108-1 to 4 – Glossary of Acoustical Terms
AC810-6B – Silenced Air Relief Intake

APPENDIX A – NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis in this report were made with instrumentation as follows:

Table A1 Noise Survey Instrumentation

Description	Model No	Serial No
Modular Precision Sound Analyser	B&K 2270 G4	301 1809
Condenser Microphone 0.5" diameter	B&K 4189	309 9836
Acoustical Calibrator	B&K 4231	302 1796
Modular Precision Sound Analyser	B&K 2270	264 4584
Condenser Microphone 0.5" diameter	B&K 4189	263 8722
Acoustical Calibrator	CAL200	3646
Accelerometer	B&K 4370	1228153
Accelerometer Calibrator	B&K 4294	2602961

The B&K 2270 G4 and 2270 Sound Analyser are real-time precision integrating sound level meters with octave and third octave filters, that sample noise at a rate of 10 samples per second and provides L_{eq}, L_{10} and L_{90} noise levels using both Fast and Slow response and L_{peak} noise levels on Impulse response time settings. The meter is frequency weighted to provide dBA, dBC or Linear sound pressure level readings as required. Results are normally downloaded to computer for rapid processing.

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 0.5 dB during attended measurements. No adjustments for instrument drift during the measurement period were warranted.

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PLANNING STRATEGIES

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21st February 2018

Your Ref:
Our Ref: 7/13

Mr Stephen Gauld
Day Design
Suite 17, 808 Forest Road
Peakhurst NSW 2210

Dear Stephen,

Re: Consultancy Services Proposal Mixed Use Development Planning Proposal (Rezoning Application) – Hollylea Road, Leumeah

We wish to invite you to provide a Consultancy Services Proposal to undertake an acoustic assessment having regard to State Environmental Planning Policy (Infrastructure) 2007 – Clause 87 – Impact of Rail Noise or Vibration on Non-Rail Development to support the subject Planning Proposal. Construction level detail is not required; however, relevant water quantity and quality modelling will be required for Council's ultimate review.

Background

By way of background the Precinct comprises principally light industrial/service industrial development. The broader Precinct includes food outlets, tourist facilities, recreation uses and major rail, road and stormwater drainage infrastructure. (Refer to **Figure 2** below).

This project proposal for Leumeah 2035, is a high-level design and renewal strategy for the integrated growth and development of the Hollylea Precinct, and may include the Leumeah local centre, over the next 20+ years, noting Council is embarking on a masterplan for Leumeah, which includes the Precinct shown in **Figure 3** below.

This project will seek to positively respond to the proposals for Leumeah, as described in the Campbelltown Residential Development Strategy (RDS), which supports the Draft Campbelltown Local Environmental Plan 2014 (CLEP 2014), now LEP 2015. Council's RDS proposes a number of infill 'growth nodes' that focus future development close to railway stations and existing commercial centres.

Leumeah is identified as one of the infill development growth nodes and this project seeks to inform the centre based structure planning / master planning proposed for the centre as part of the RDS.

In November 2017, the Department of Planning and Environment placed on public exhibition the Glenfield to Macarthur Urban Renewal Corridor. Leumeah is nominated as one of the Precincts. The subject lands have been identified for mixed-use retail & residential development, with buildings ranging from 7+ storeys in height (refer to **Figure 1** below).

Figure 1 – Precinct Plan Extract

Figure 2 – Locality Aerial Photograph Extract

Our client's own several parcels of land in Hollylea Road described as in **Table 1** below:

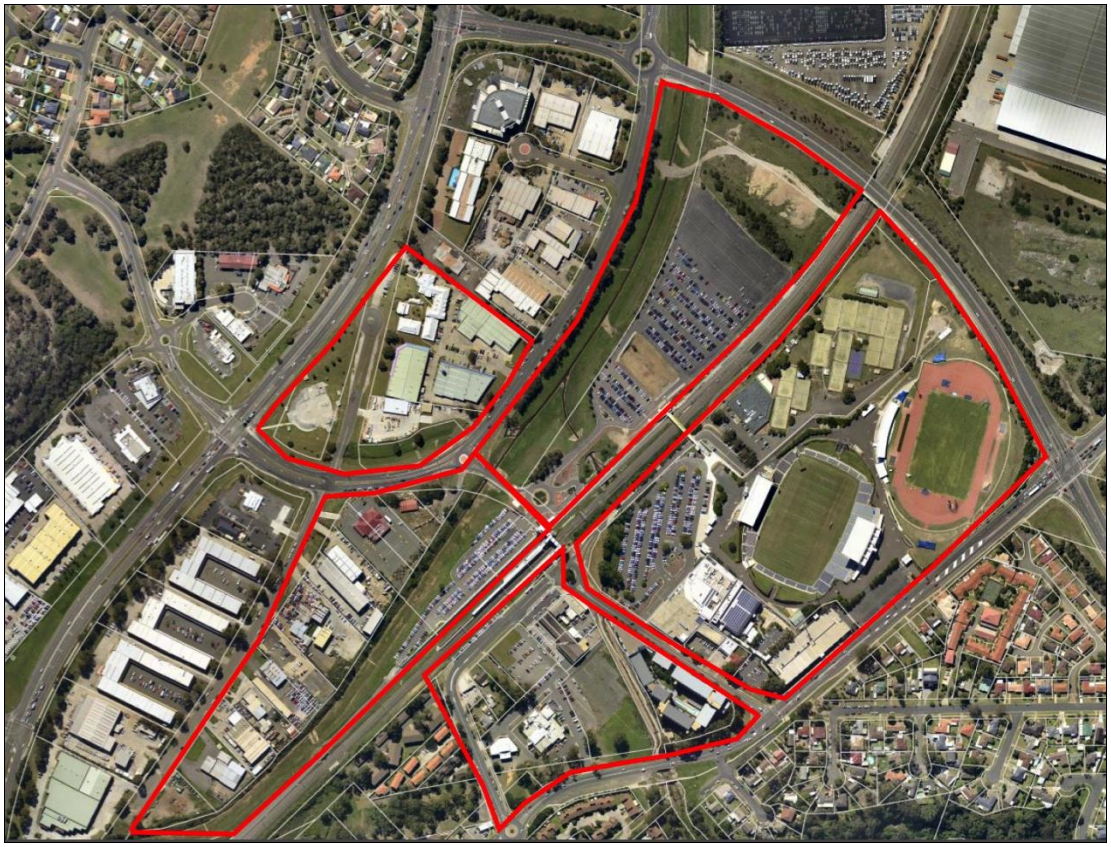
Table 1 – Property Details

Address	Lot/DP	Approx. area	Owner
2A Hollylea Rd	12/DP845149 3/DP258315 4/ DP258315	8,900m²	Banrun Pty Ltd
2B Hollylea Rd	16 /D623923	3140m²	Glenys and David Bird
4A Hollylea Rd	1-4/SP70043	3100m²	Lot 1 S R Collins Lot 2 Pacific Markets Pty Ltd Lot 3 Hoy and Campbell Lot 4 Barrett
4 Hollylea Rd	27/611186	6180m²	Callender, Mazuran
6 Hollylea Rd	125/DP575481	3023m²	Strathfield Auto Holdings Pty Limited
8 Hollylea Rd	127/DP575482	3088m²	Strathfield Auto Holdings Pty Limited
10 Hollylea Rd	301/DP621274 9/DP234601	3061m²	Nujubi Pty Limited
12 Hollylea Rd	1-5/SP52179	2942m²	Nujubi Pty Limited
14 Hollylea Rd	1/DP565611	4104m²	D A Andrews
Campbelltown Rd	A/DP411499	3,000m² Part lot	Campbelltown City Council
Total approximately		**40,500m²**	

It would be noted that the above includes a vacant parcel of land owned by Campbelltown City Council. Whilst we are not instructed to identify and request the Council land to be rezoned, this land abuts the major land holder group and it is good town planning practice to include lands that would form a nature catchment to the lands proposed to be rezoned.

The subject locality forms part of the proposed Leumeah Urban Renewal Precinct depicted in **Figure 3** below.

Figure 3 – Concept Precinct



A copy of the Leumeah Precinct Landuse and Infrastructure Analysis forms **Attachment "A".**

You are accordingly invited to submit a Consultancy services Proposal which:

- Outlines your approach to providing an acoustic assessment with underpinning data
- A proposed fee (inclusive of GST) with an itemised breakdown and preferred payment schedule.
- An earliest commencement date and timeframe for completion.

Submission Requirements

Your submission should include as a minimum:

<u>Understanding of the Project</u>

- Your understanding of the relevant requirements of the project.
- Your understanding of the site and constraints.
- Understanding of the relevant outputs and objectives to support the rezoning of the lands.

Consultation

- Nature and extent of consultation with relevant authorities

Staff resourcing

- Details of personnel to be employed in responding to the relevant project outputs and their resumes.

Past Work

- Examples of relevant past recent work.

Capacity to deliver on time

- Your ability to resource the project and respond to the project timeline objectives.

Administration

- Evidence of compliance with the administrative requirements of this project in respect of :
    - Insurances.
    - Conflicts of Interest.
    - Intellectual Property Rights.
    - Confidentiality.

Fee proposal

- A comprehensive fee proposal and hourly charge out rates of the team members.

Lodgement

Proposals should be marked to:

Michael Brown
Director
Michael Brown Planning Strategies Pty Ltd
PO Box 295
Camden NSW 2570

Acceptance of fee proposal

The Principal is not bound to accept the lowest or any fee proposal, or part of any quote, or give reasons why any fee proposal is not accepted.

As such, we would like invite you to make a fee submission based on above. We would appreciate such fee proposal to be submitted by 4.00pm on Friday 9th March 2018.

The fee proposal should also include a timeframe for commencing the project (upon successful appointment) and completing the necessary documentation to enable the submission of the technical documents.

Allowance should be made within the fee proposal for an inception meeting and at least two meetings with client and lead consultants and other successful consultants.

Should you require clarification of any aspect of this correspondence please do not hesitate to contact me.

Sincerely yours,

M J BROWN
DIRECTOR
MICHAEL BROWN PLANNING STRATEGIES PTY LTD

ATTACHMENT "A"
LEUMEAH PRECINCT LANDUSE AND INFRASTRUCTURE ANALYSIS (JULY, 2015)
(Department of Planning and Environment)'

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 µPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

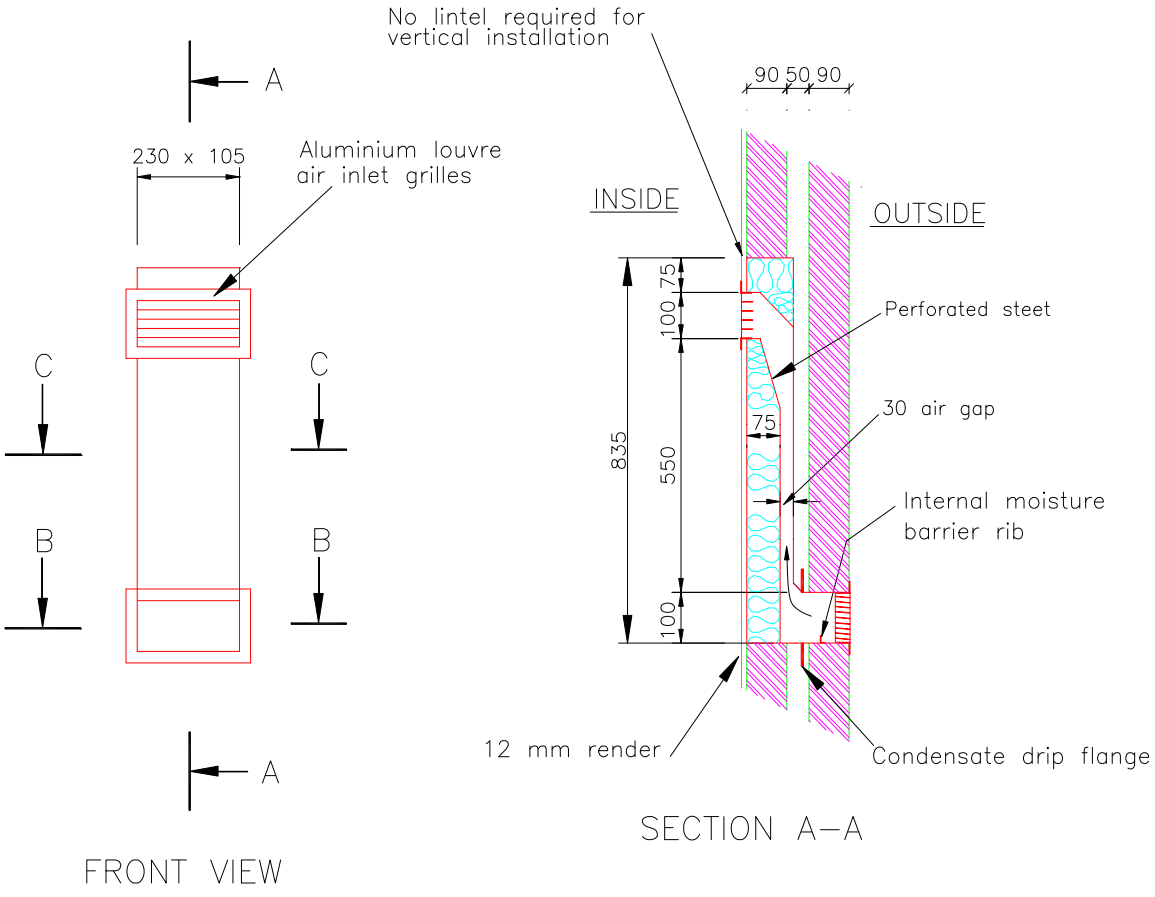
WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

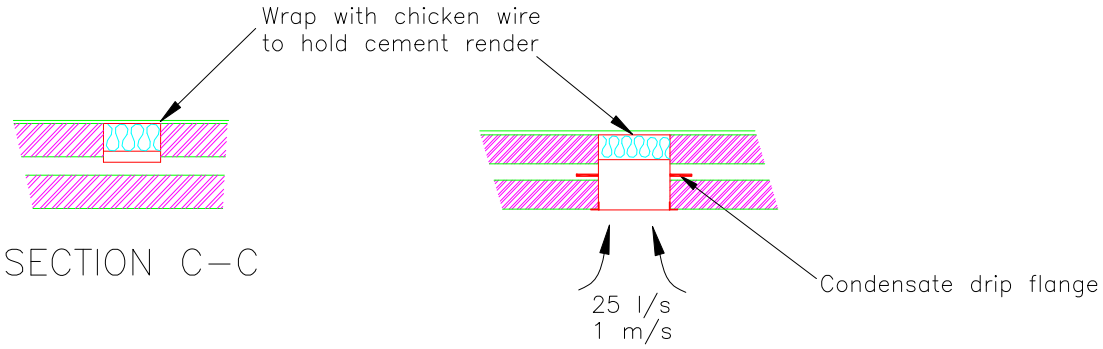
Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

SILENCED AIR RELIEF INTAKE
AIR DUCT SINGLE OUTLET

AC810-6B





NOTES

1. Air Intake Silencer 1.6mm galv. steel casing Not less than 32kg/m^3 density 75mm fibreglass wool insulation faced with 0.6mm 25% open area perforated galv. steel.
2. Duct to built into wall with no air gaps between bricks and duct.
3. Duct may be mounted vertically or horizontally