ACOUSTIC SOLUTIONS P/L
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Acoustic Noise and Vibration near Railway Lines.

For new development at

No. 1, 3 & 5 The Crescent, Yagoona.

Prepared by: Moussa Zaioor (M.I.E. Aust), CPENG,
Australian Acoustical Society (sub).

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Document Control

Date	*Revision History*	*Prepared By*	*Reviewed and Authorised by*
01/12/10	Initial Report	Domeniki Tsagaris	M.Zaioor

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1.0 SCOPE OF THIS REPORT

The aim of this report is to determine the building materials to be used and the construction methods to be adopted such that the new development at No. 1, 3 & 5 The Crescent, Yagoona is built to achieve the internal noise and vibration levels required. The development is located at No. 1, 3 & 5 The Crescent, Yagoona (Figure 1 – Site Location). Plans are by Mackenzie Architects dated 26/10/2010. The railway corridor is located approximately 25 metres from building line.

2.0 RAIL NOISE CRITERIA

The development is to comply with the Department of Planning's document titled "Development near Rail Corridors and Busy Roads – Interim Guideline". According to the Section 3.5.1 Figure 3.1 of the above reference, the acoustic assessment zone is Zone A and a full noise assessment should be taken.

The noise criteria for residential buildings in Table 2.1 for both road and rail are specified in the Infrastructure SEPP. Other values in Table 3.1 are based on the Environmental Criteria for Road and Traffic Noise (EPA1999)

Table 2.1 – Noise Criteria

Residential Buildings		
Type of occupancy	**Noise Level dBA**	**Applicable time period**
Sleeping areas (bedroom)	35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time
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 Leq (9h) (night) and Leq (15h) (day).

The proposed development to comply with the Department of Planning's document titled "Development near Rail Corridors and Busy Roads – Interim Guidelines". Section 3.6.2 – Ground-borne Noise of the above mentioned standard states that residential buildings should be designed such that the 95th percentile of train pass-bys complies with the rail noise criterion for day and night time periods as below:

- **Daytime** period indoor rail noise levels for sleeping and living areas is an L_{Amax} limit of 40dB(A).

- **Night time** period indoor noise levels for living and sleeping areas is an L_{Amax} limit 35dB(A).

Ground borne noise is calculated as LAmax (slow) which refers to the maximum noise level not exceeded for 95% of rail pass-by events and is measured using the 'slow' response setting on a sound-level meter.

In addition floor vibration levels in habitable rooms should comply with the criteria in British standard BS6472:1992 Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80 Hz).

Further, when windows and doors are left open, indoor sound levels should not exceed the nominated noise criteria by more than 10 dBA. If noise levels exceed the nominated rail noise criteria by more than 10 dBA, then the provision of mechanical ventilation should be incorporated in the design of the building.

3.0 ACOUSTICAL STUDY

3.1 RAIL NOISE SURVEY

A rail noise survey was undertaken on the 15th of November, 2010 at Point A along the building line (Figure 2 – Noise Reading Location). Rail noise measurements were taken with a SVAN 957 which has the following features:

- Type 1 sound level measurements meeting IEC 61672:2002
- General vibration measurements (acceleration, velocity and displacement) and HVM meeting ISO 8041:2005 standard
- Three parallel independent profiles
- 1/1 and 1/3 octave real time analysis
- Acoustic dose meter function
- FFT real time analysis (1920 lines in up to 22.4 kHz band)
- Reverberation Time measurements (RT 60)
- Advanced Data Logger including spectra logging
- USB Memory Stick providing almost unlimited logging capacity
- Time domain signal recording
- Advanced trigger and alarm functions
- USB 1.1 Host & Client interfaces (real time PC "front end" application supported)
- RS 232 and IrDA interfaces
- Modbus protocol

Calibration Date 03/08/2010 (Figure 3 – Certificate of Calibration)

A series of train noise levels were measured at the building line of the proposed development between 8.00 am and 9.00 am. During this period there are predominately commuter train movements and the external rail noise levels LAmax, 1 hour (daytime) is 65.0dB (A).

The calculated external noise levels occurring between 10.00 pm and 11.00 pm found to be 67.0dB (A). Commuter trains for this site are generally audible for up to 38seconds and the average period was about 25 seconds based on 15 commuter train movements per hour between 8:00 & 9:00.

3.1 NOISE SURVEY RESULTS

Rail Noise Survey Results, Noise Criteria and Noise Reduction Required

LAmax, Period dB(A), which refers to the maximum noise level not exceeded for 95% of rail pass-by events and is measured using the 'slow' response setting on a sound-level meter.					
Day Time			**Night Time**		
Outdoor Rail Noise	**Noise Criteria**	**Noise Reduction**	**Outdoor Rail Noise**	**Noise Criteria**	**Noise Reduction**
65.0	**40.0**	**25.0**	**67.0**	**35.0**	**32.0**

3.2 RAIL VIBRATION SURVEY

The floor vibration levels in habitable rooms should comply with the criteria in British Standard BS 6472:1992 Evaluation of Human Exposure to Vibration in Buildings (1 to 8 Hertz). The site is located around 25m away from the corridor rail line. BS 6472:1992 considers the eVDV levels for daytime and night time. The probability of adverse effects will be low when the eVDV is less than 0.4 during the daytime and less than 0.24 for the night time periods.

The calculated eVDV found to be 0.234 during the daytime and the calculated eVDV found to be 0.139 during the night time. During these train movements, ground vibration levels were only just noticeable to the touch of the palm of the hand. The palm of the hand can perceive ground vibrations as low as 0.3mm/s. Based on the survey results, vibration levels are well within the low probability of adverse effects. Any vibration emission will not cause building damage to the proposed development.

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Calculations are as follows:

eVDV = $1.4 \times a_{rms} \times t^{0.25}$

a_{rms} = weighted rms acceleration of train (m/s2); average = 14mm/sec2= 0.014m/sec2. (varies between 13 & 15 mm/sec2)

t in sec= total cumulative time of the vibration; say 12 train passes per hour for 12 hrs (1 day time) & each train pass is felt for 140 seconds.
Thus t = 12*140*12=20160 secs.
eVDV (day) = $1.4 \times 0.014 \times (20160)^{0.25}$
eVDV (day) = 0.234 < 0.4 Ok.
Similarly eVDV for night time (say 5 train passes per hour for 6 hrs & each train pass is felt for 140 seconds)
eVDV (night) = 0.158 < 0.24 therefore Ok.

4.0 MATERIAL SPECIFICATION

4.1 RECOMMENDATIONS (WALLS)

- **External walls** – equivalent to double skin cavity brick walls, minimum 270/250 mm double brick/brick veneer construction.

4.2 RECOMMENDATIONS (WINDOWS)

- All bedroom, lounge and dining windows facing the eastern boundary are to be 10mm laminated awning type with approved acoustic seals.
- All bedroom, lounge and dining sliders facing the eastern boundary are to be 10mm laminated with approved acoustic seals.
- All bedroom, lounge and dining windows and sliders facing the northern and southern boundary are to be 6mm laminated with approved acoustic seals.
- All other windows (laundry/ bathroom/ kitchen) are unrestricted in accordance with AS 2047 (Windows in Buildings).

4.3 RECOMMENDATIONS (ROOF)

- 150mm Concrete Roof **or** Galvanised Steel Trough Roofing (0.5mm), on 10mm gypsum plaster board ceiling & 75mm thick, 85kg/m³ mineral wool batts between ceiling joists.

4.4 RECOMMENDATION (DOORS)

- External Doors (Solid Core 35mm thick, soft plastic gasket around sides, top & drop seal at base or any other combination having an STC of minimum 29).

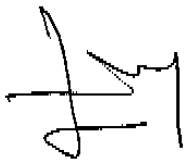
Note: This report is to be read in conjunction with the BASIX certificate and any other related building specification.

5.0 CONCLUSION

The construction of the proposed development at No. 1, 3 & 5 The Crescent, Yagoona if carried out as recommended in plans and specifications and including the acoustic recommendations in this report then it will meet the required noise measures.

Should you require further explanations, please do not hesitate to contact us.

Yours sincerely,



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6.0 APPENDIX

- **Figure 1- Site Location**
- **Figure 2- Reading Location**
- **Figure 3 – Certificate of Calibration**

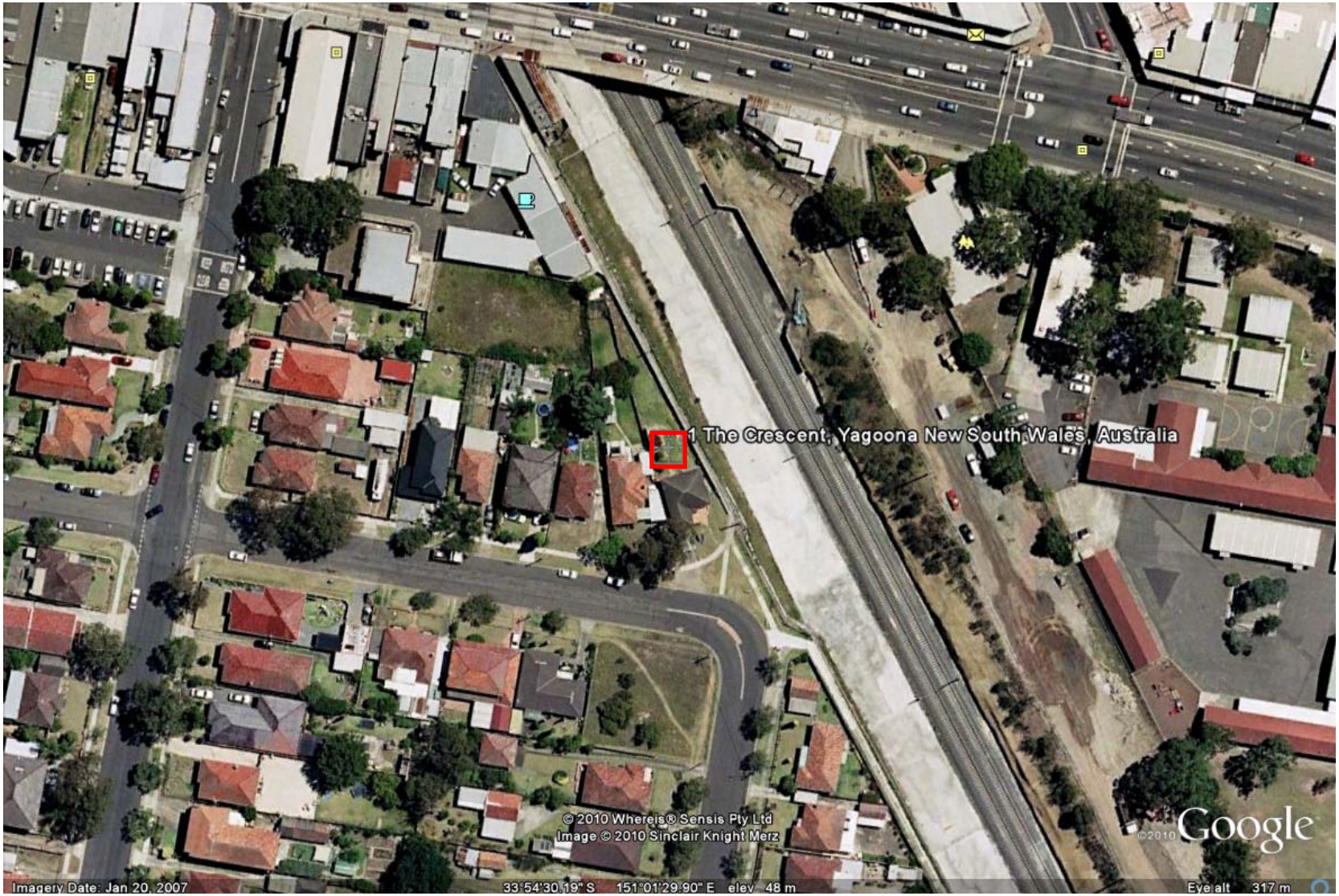


Figure 1 Site Location

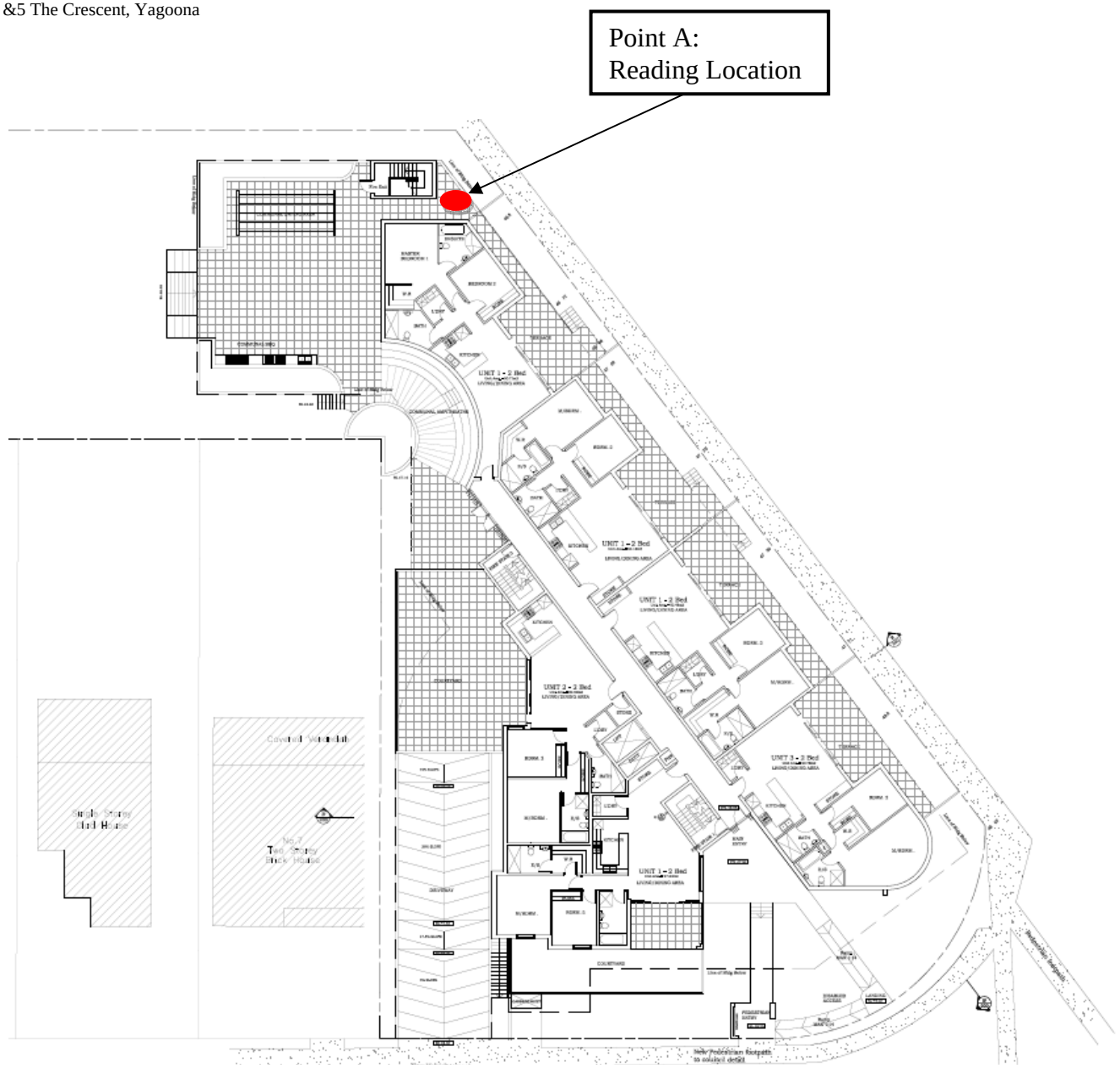
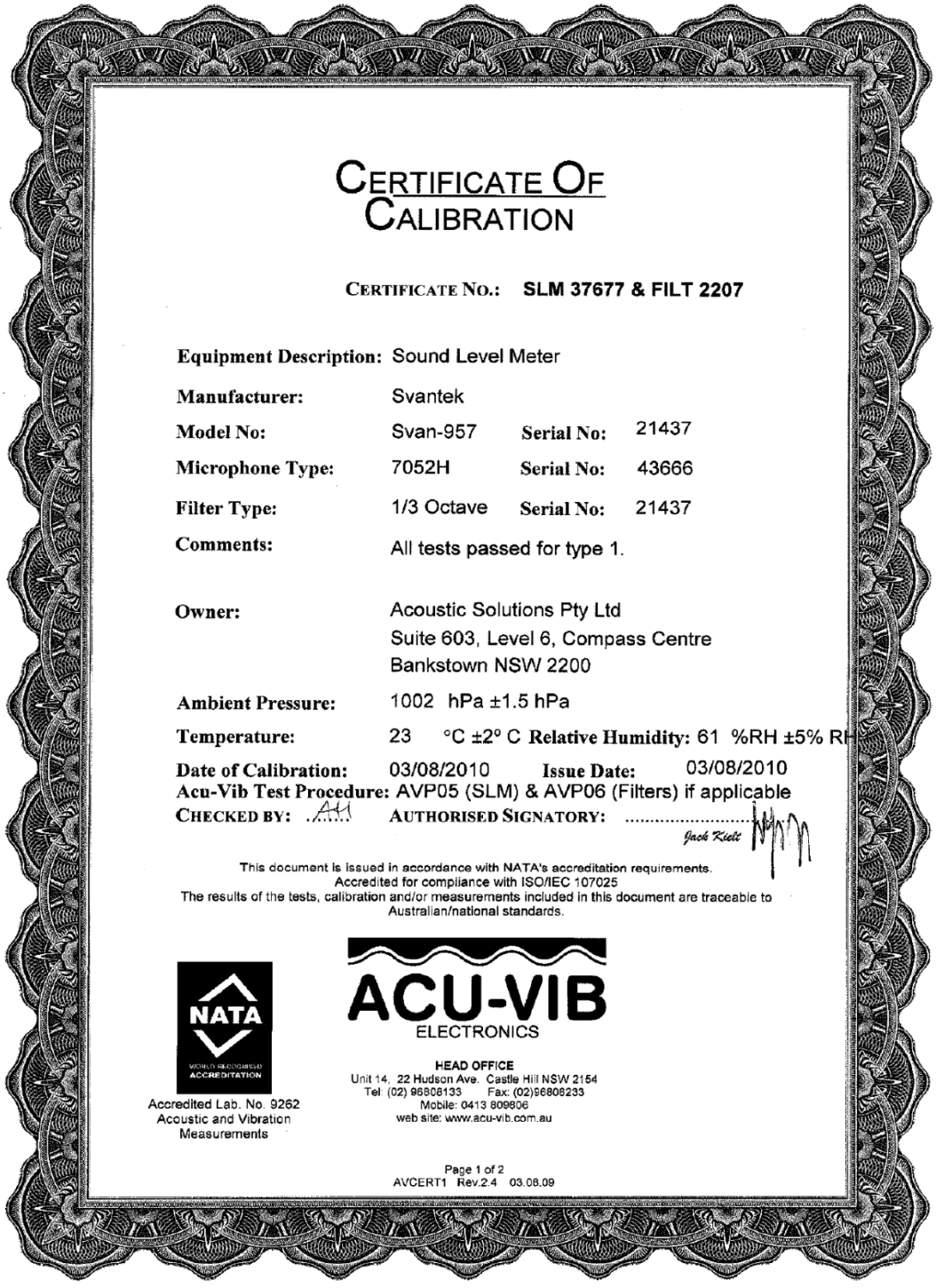


Figure 2 Noise Reading Location



CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 37677 & FILT 2207

Equipment Description:	Sound Level Meter		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	21437
Microphone Type:	7052H	**Serial No:**	43666
Filter Type:	1/3 Octave	**Serial No:**	21437
Comments:	All tests passed for type 1.		
Owner:	Acoustic Solutions Pty Ltd Suite 603, Level 6, Compass Centre Bankstown NSW 2200		
Ambient Pressure:	1002 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	61 %RH ±5% RH
Date of Calibration:	03/08/2010	**Issue Date:**	03/08/2010

Acu-Vib Test Procedure: AVP05 (SLM) & AVP06 (Filters) if applicable

CHECKED BY: ..... **AUTHORISED SIGNATORY:** .....

Jack Kielt

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Accredited for compliance with ISO/IEC 107025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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AVCERT1 Rev.2.4 03.08.09

Figure 3 Certificate of Calibration