RODNEY STEVENS ACOUSTICS
Acoustic Consultants

REPORT R190405R3

Revision 2

Traffic Noise Assessment

Proposed Residential Development

28 - 32 Evan Street, Penrith

PREPARED FOR:
Morson Group
PO Box 170
POTTS POINT NSW 2011

5 December 2019

PO Box 522
Wahroonga NSW 2076
P 02 9943 5057
F 02 9475 1019
mail@rodneystevensacoustics.com.au

ABN 78 149 311 455
rodneystevensacoustics.com.au

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PREPARED BY:

Rodney Stevens Acoustics Pty Ltd
Telephone: 61 2 9943 5057 Facsimile 61 2 9475 1019
Email: info@rodneystevensacoustics.com.au
Web: www.rodneystevensacoustics.com.au

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1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (here forth referred to as RSA) has been engaged by Morson Group to conduct a road noise impact assessment for development application (DA) lodgement of the proposed residential development at 28 - 32 Evan Street, Penrith.

This report addresses the road traffic noise impacts from Evan Street on the amenity of the proposed residential development.

This assessment is to form part of the supporting documentation for the DA submission to Penrith Council. Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix A.

2 PROJECT DESCRIPTION

2.1 Site Location

The proposed development site is located at 28 - 32 Evan Street, Penrith. The site will be bounded by residential dwellings to the north and south, a cemetery to the east, Evan Street to the west & Lethbridge Street to the south. The site and its surroundings are shown in Figure 2-1.

Figure 2-1 Site Location

Aerial image courtesy of Near Map © 2019

2.2 Proposed Development

The proposal is to construct a new 5 storey multi residential development. The floor plans of the proposed residential development are presented in Appendix C.

3 BASELINE NOISE SURVEY

3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area, unattended noise monitoring was conducted between Wednesday 21st August and Wednesday 28th August 2019 at the logging location shown in Figure 2-1. 2 noise loggers were set up on site. The first logger was located in the front yard of the site overlooking Evan Road, this location is representative of the traffic noise levels that the site will be exposed to.

The second logger was located on the rear yard of the site, noise monitoring at this location is representative of the typical acoustic environment of the site.

Logger locations were selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

Instrumentation for the survey comprised of 2 RION NL-42 environmental noise loggers (serial numbers 133010 and 572559) fitted with microphone windshields. Calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Measured data has been filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM).

The logger determines LA1, LA10, LA90 and LAeq levels of the ambient noise. LA1, LA10, LA90 are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions in Appendix A). Detailed results at the monitoring location are presented in graphical format in Appendix B. The graphs show measured values of LA1, LA10, LA90 and LAeq for each 15-minute monitoring period.

3.2 Ambient Noise Results

In order to establish the ambient noise criteria of the area, the data obtained from the noise logger has been processed in accordance with the procedures contained in the NSW Environmental Protection Authority's (EPA) Noise Policy for Industry (NPfI, 2017) to establish representative noise levels that can be expected in the residential vicinity of the site. The monitored baseline noise levels are detailed in Table 3-1.

Table 3-1 Measured Baseline Noise Levels Corresponding to Defined NPfI Periods

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime 7 am - 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
Logger at eastern boundary of site	LAeq	49	46	42
	RBL (Background)	39	36	32

Notes: All values expressed as dB(A) and rounded to nearest 1 dB(A);

LAeq Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

LA90 Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

3.3 Noise Intrusion (State Environmental Planning Policy (Infrastructure) 2007)

To assess noise intrusion into the proposed multi residential development, the data obtained from the first logger location has been processed to establish representative ambient noise levels at the facades most exposed to Evan Road.

The time periods used for this assessment are as defined in the State Environmental Planning Policy (Infrastructure) 2007and the Development near Rail Corridors and Busy Roads Interim Guideline. Results are presented below in Table 3-2.

Table 3-2 Traffic Noise Levels Corresponding to Defined SEEP 2007 Periods

Location	Period	External Noise Levels dB(A)
Approximately 15m from Evan Road	Day Time 7:00 am - 10:00 pm	$L_{Aeq(15hour)}$ 62
	Night Time 10:00 pm - 7:00 am	$L_{Aeq(9hour)}$ 55

4 NOISE GUIDELINES AND CRITERIA

4.1 Road Noise Criteria

The determination of an acceptable level of traffic noise impacting the internal residential spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities.

As sleep is the activity most affected by rail noise, bedrooms are considered to be the most sensitive internal living areas. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to the television etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries etc. can be higher.

4.2 Penrith City Council Requirements

Penrith City Council in their DCP 2014 Part C, Section 12.1 – Road Traffic Noise, Item C. Controls - Noise Impact Statements - Specific Requirements, Part A requires the following criteria for developments near road corridors.

> *Noise Impact Statements - Specific Requirements*
>
> *a) Where a site is likely to be affected by unacceptable levels of road traffic noise, the applicant is required to provide a Noise Impact Statement prepared by a qualified acoustic consultant in accordance with the requirements set out in the DA Submission Requirements Appendix of this DCP.*
>
> *b) The Noise Impact Statement should demonstrate acoustic protection measures necessary to achieve an indoor environment meeting residential standards, in accordance with EPA and Department of Planning Criteria, as well as relevant Australian Standards.*

4.2.1 State Environmental Planning Policy (Infrastructure) 2007

The NSW Government's State Environmental Planning Policy (Infrastructure) 2007 (SEPP (Infrastructure) 2007) was introduced to facilitate the delivery of infrastructure across the State by improving regulatory certainty and efficiency. In accordance with the SEPP, Table 3.1 of the NSW Department of Planning and Infrastructure's "*Development near Rail Corridors and Busy Roads - Interim Guideline"* (the DP&I Guideline) of December 2008 provides noise criteria for residential and non-residential buildings. These criteria are summarised in Table 4-1.

Table 4-1 DP&I Interim Guideline Noise Criteria

Type of occupancy	Noise Level dB(A)	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

Note 1: Airborne noise is calculated as $L_{Aeq(15hour)}$ daytime and $L_{Aeq(9hour)}$ night-time

The following guidance is also provided in the DP&I Guideline:

> *"These criteria apply to all forms of residential buildings as well as aged care and nursing home facilities. For some residential buildings, the applicants may wish to apply more stringent design goals in response to market demand for a higher quality living environment.*

The night-time "sleeping areas" criterion is 5 dB(A) more stringent than the "living areas" criteria to promote passive acoustic design principles. For example, designing the building such that sleeping areas are less exposed to road or rail noise than living areas may result in less onerous requirements for glazing, wall construction and acoustic seals. If internal noise levels with windows or doors open exceed the criteria by more than 10 dB(A), 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 noise criteria presented in Section 0 and in Table 4-1 apply to a 'windows closed condition'. Standard window glazing of a building will typically attenuate noise ingress by 20 dB(A) with windows closed and 10 dB(A) with windows open (allowing for natural ventilation). Accordingly, the external noise threshold above which a development will require mechanical ventilation is an $L_{Aeq(9hour)}$ 55 dB(A) for bedrooms and $L_{Aeq(15hour)}$ 60 dB(A) for other areas.

Where windows must be kept closed, the adopted ventilation systems must meet the requirements of the Building Code of Australia and Australian Standard 1668 – The use of ventilation and air conditioning in buildings.

4.3 Operational Noise Project Trigger Noise Levels

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the EPA. The EPA oversees the Noise Policy for Industry (NPfI) October 2017 which provides a framework and process for deriving project trigger noise level. The NPfI project noise levels for industrial noise sources have two (2) components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

4.3.1 Intrusiveness Noise Levels

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness noise level essentially means that the equivalent continuous noise level (LAeq) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15 minute period.

4.3.2 Amenity Noise Levels

The amenity noise level is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The noise levels relate only to other industrial-type noise sources and do not include road, rail or community noise. The existing noise level from industry is measured.

If it approaches the project trigger noise level value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the project trigger noise level.

4.3.3 Area Classification

The NPfI characterises the "Suburban" noise environment as an area with an acoustical environment that:

- has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry.
- This area often has the following characteristic: - evening ambient noise levels defined by the natural environment and human activity

The area surrounding the proposed development falls under the "Suburban" area classification.

4.3.4 Project Specific Trigger Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific project trigger noise level. The intrusive and amenity project trigger noise level for nearby residential premises are presented in Table 4-2. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive project trigger noise levels are adopted. These are shown in bold text in Table 4-2.

Table 4-2 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL [1] $L_{Aeq(15min)}$	Measured		Project Trigger Noise Levels	
			RBL [2] $L_{A90(15min)}$	Existing $L_{Aeq(Period)}$	Intrusive $L_{Aeq(15min)}$	Amenity $L_{Aeq(15min)}$
Residential	Day	55	39	49	**44**	58
	Evening	45	36	46	**41**	48
	Night	40	32	42	**37**	43

Note 1: ANL = "Amenity Noise Level" for residences in Suburban Areas.

Note 2: RBL = "Rating Background Level".

4.4 Sleep Disturbance Criteria

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

Noise Policy for Industry provides the following guidelines on the project trigger noise levels:

Where the subject development/premises night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

For planning purposes, the assumed level of background noise for the night-time period is taken to be the night-time Rating Background Level, as given in Table 4-2 resulting in a sleep disturbance criterion of:

- $L_{Aeq(15min)}$ 40 dBA (NPfI requirement, RBL+5)
- L_{AFmax} 52 dBA (NPfI requirement, RBL+15)

4.5 Road Noise Policy

RTA Road Noise Policy (Table 3) sets out the assessment criteria for residences to be applied to particular types of project, road category and land use. These criteria are for assessment against façade corrected noise levels when measured in front of a building façade.

Table 4-3 Road Noise Policy – Criteria

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq, (15\ hour)}$ 55 (external)	$L_{Aeq, (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq, (15\ hour)}$ 60 (external)	$L_{Aeq, (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

The RNP noise criteria for the additional traffic on Evan Street is categorized as Type 6. This has an assessment criterion of $L_{Aeq(1hour)}$ 60 dB(A) for Day and $L_{Aeq(1hour)}$ 55 dB(A) for Night.

The Traffic and Parking Assessment Report (19 December 2017, Ref 17142) provided by Varga Traffic Planning for 28 – 32 Evan Street, Penrith shows a net increase in traffic due to the development shown below:

Figure 4-1 Projected Net Traffic Increase

Projected Nett Increase in Peak Hour Traffic Generation Potential of the Site as a Consequence of the Development Proposal

	AM	PM
Projected Future Traffic Generation Potential:	10.3 vph	8.1 vph
Less Existing Traffic Generation Potential:	-2.9 vph	-3.0 vph
NETT INCREASE IN TRAFFIC GENERATION POTENTIAL:	**7.4 vph**	**5.1 vph**

5 NOISE IMPACT ASSESMENT

5.1 Vehicle Noise Impact Assessment

Noise sources associated with the proposed development includes the operation of cars and trucks. Specific activities includes:

- Resident and visitor movements including entering and exiting onsite parking, idling and reversing.
- Garbage truck movements including idling, reversing and entering and exiting the front of the site.

Noise associated with the operation of vehicles can cause disturbance to the identified receptors to noise. Noise will be generated by activities associated with vehicles arriving and leaving the premises (opening and closing of doors, starting, maneuvering, accelerating etc).

Typical sound power levels for low speed vehicle activities are included in Table 5-1 along with the corresponding predicted noise levels at the closest sensitive. The calculations include noise attenuation provided by existing building façades, distance and height of the residential receivers.

Table 5-1 Vehicle Related Noise Assessment

Noise Source	Typical Maximum Sound Power Level L_w(dBA)	Resultant Noise Level at Sensitive Receiver ($L_{Aeq(1h)}$)	Noise Criteria	Compliance (Y/N)
Residential: 34 Evan Street				
Car Accelerating Car Starting Door Closing Car Moving	93-95 91-93 88-91 83-85	Day $L_{Aeq(15min)}$ 28 dBA Evening $L_{Aeq(15min)}$ 30 dBA Night $L_{Aeq(15min)}$ 27 dBA	Daytime: 54 dBA Night: 37 dBA Sleep Disturbance: L_{AFmax} 52 dBA	Yes
Garbage Truck Reversing, Garbage Truck idle	108-110	Day $L_{Aeq(15min)}$ 28 dBA Evening $L_{Aeq(15min)}$ 33 dBA Night $L_{Aeq(15min)}$ 29 dBA		
Residential: 26 Evan Street				
Car Accelerating Car Starting Door Closing Car Moving	93-95 91-93 88-91 83-85	Day $L_{Aeq(15min)}$ 28 dBA Evening $L_{Aeq(15min)}$ 33 dBA Night $L_{Aeq(15min)}$ 29 dBA	Daytime: 54 dBA Night: 37 dBA Sleep Disturbance: L_{AFmax} 52 dBA	Yes
Garbage Truck Reversing, Garbage Truck idle	108-110	Day $L_{Aeq(15min)}$ 18 dBA Evening $L_{Aeq(15min)}$ 21 dBA Night $L_{Aeq(15min)}$ 17 dBA		

Residential: 33 Evan Street				
Car Accelerating Car Starting Door Closing Car Moving	93-95 91-93 88-91 83-85	Day $L_{Aeq(15min)}$ 21 dBA Evening $L_{Aeq(15min)}$ 25 dBA Night $L_{Aeq(15min)}$ 21 dBA	Daytime: 54 dBA Night: 37 dBA Sleep Disturbance: L_{AFmax} 52 dBA	Yes
Garbage Truck Reversing, Garbage Truck idle	108-110	Day $L_{Aeq(15min)}$ 32 dBA Evening $L_{Aeq(15min)}$ 36 dBA Night $L_{Aeq(15min)}$ 37 dBA		

5.2 RNP Noise Assessment

The addition of traffic on Evans road from the proposed development is required to be assessed to RMS Road Noise Policy which looks at the noise impact to the existing residences from the additional traffic. The following assessment is based on the data provided in Figure 4-1. The following noise levels have been calculated for residences 16 – 34 Evan Street from the potential developments increase of traffic:

- $L_{Aeq(1hour)}$ 33 dB(A) for Day and $L_{Aeq(1hour)}$ 31 dB(A) for Night

The assessment shows compliance at all periods of the day & night and should not make a significant increase to the road traffic noise levels already present on Evan Road.

5.3 Traffic Noise Assessment

In order to ascertain the existing traffic noise levels from Evan Road & Lethbridge Road, the measured noise logger data was processed in accordance to the NSW Department of Planning and Infrastructure's "*Development near Rail Corridors and Busy Roads - Interim Guideline"* assessment time periods as shown in Table 3-2.

The final façade noise levels were predicted for each time period taking into account the distance attenuation from each respective source, virtual source, façade's orientation and any barrier effects.

The required noise reduction via the building façade for each respective room for each time period will be compared to determine the appropriate design criteria levels.

It is typically accepted that an open window (fractionally open to meet ventilation requirements) results in an attenuation of external noise by 10 dB. This reduction has been used to predict the room noise level in the window open condition.

5.4 Recommended noise control treatment

The calculation procedure establishes the required noise insulation performance of each surface component such that the internal noise level is achieved whilst an equal contribution of traffic noise energy is distributed across each component. Building envelope components with a greater surface area must therefore offer increased noise insulation performance.

The recommended acoustic treatment is based on the following floor finishes:

- Bedrooms: Carpet and underlay
- Living Room Hard Flooring
- Kitchen/Wet Areas: Tiles

The acoustic requirements shown in this report will increase further where the bedroom floor finishes are tiled or timber.

All recommendations must be checked by others to ensure compliance with other non-acoustic requirements that Council or other authority may impose (e.g. Thermal requirements for BASIX compliance).

5.5 Glazing

The R_w rating required for each window will vary from room to room. Recommendations for windows also apply to any other item of glazing located on the external facade of the building in a habitable room unless otherwise stated.

Note that the R_w rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required R_w rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the requirements in Table 5-2

The window systems must be tested in accordance with both of the following:

- Australian Window Association Industry Code of Practice Window and Door – Method of Acoustic Testing; and
- AS 1191 Acoustics – Method for laboratory measurement of airborne sound insulation of building elements.

It is necessary to submit such Laboratory certification for the proposed glazing systems (i.e. windows and framing systems) (e.g. NAL or CSIRO) for approval by RSA prior to ordering or commitment.

The entire frame associated with the glazing must be sealed into the structural opening using acoustic mastics and backer rods. Normal weather proofing details do not necessarily provide the full acoustic insulation potential of the window system. The manufacturers' installation instructions for the correct acoustic sealing of the frame must be followed.

It is possible that structural demands for wind loading or fire rating or the like may require more substantial glass and framing assemblies than nominated above. Where this is the case the acoustic requirements must clearly be superseded by the structural or fire rating demands.

Table 5-2 presents the minimum recommended R_w (weighted noise reduction) for glazing elements.

Table 5-2 Minimum Acoustic Rating (R_w) Required for Glazing Elements

Floor	Unit	Facade	Bedroom	Living
Ground	01	West	Rw 30	Rw 26
		South	-	Rw 26
	02	West	Rw 30	Rw 26
	03	West	-	Rw 30
		North	Rw 25	Rw 30
First Floor	11 - 13	West	Rw 30	Rw 26
		South	-	Rw 26
	14	West	-	Rw 30
		North	Rw 25	Rw 25
Second Floor	21 - 23	West	Rw 31	Rw 27
		South	-	Rw 27
	24	West	-	Rw 31
		North	Rw 26	Rw 26
Third Floor	31 - 33	West	Rw 32	Rw 28
		South	-	Rw 29
	34	West	-	Rw 32
		North	Rw 27	Rw 27
Fourth Floor	41	West	-	Rw 30
		South	Rw 25	-
	42	West	Rw 32	Rw 28
	43	West	Rw 32	Rw 30
		North	-	Rw 25

A glazing thickness guideline is presented in Appendix E for further reference

5.6 Detailing

Note that well-detailed construction and careful installation is needed to achieve the required R_w acoustic ratings. All gaps are to be minimised and fully sealed with an acoustic rated sealant, such as FireBan One by Bostik or Sikaflex Pro 2HP by Sika.

5.7 Mechanical Plant Noise Assessment

A specific mechanical plant selection has not been supplied at this stage. It is anticipated that the building will be serviced by typical mechanical ventilation/air conditioning equipment.

Typical equipment and corresponding noise data that can be expected includes:

- Car park exhaust: L_w 70 dB
- Car park supply fan: L_w 70 dB
- Stairwell pressure fan: L_w 50 dB

Based on the above conditions, the following noise levels can be expected at the nearby sensitive receivers.

Table 5-3 Mechanical Noise Assessment

Noise Source	Typical Maximum Sound Power Level L_w(dBA)	Resultant Noise Level at Sensitive Receiver ($L_{Aeq(1h)}$)	Noise Criteria	Compliance (Y/N)
Residential: 34 Evan Street				
Car park exhaust	70	31 dBA	Daytime: 54 dBA Night: 37 dBA	Yes
Car park supply fan	70			
Stairwell pressure	50			
Residential: 26 Evan Street				
Car park exhaust	70	25 dBA	Daytime: 54 dBA Night: 37 dBA	Yes
Car park supply fan	70			
Stairwell pressure	50			
Residential: 31 Evan Street				
Car park exhaust	70	23 dBA	Daytime: 54 dBA Night: 37 dBA	Yes
Car park supply fan	70			
Stairwell pressure	50			

6 CONCLUSION

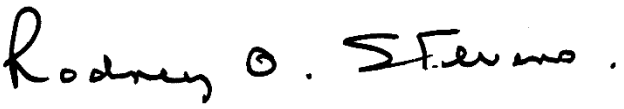
RSA has conducted a traffic noise impact assessment of the proposed residential development at 28 - 32 Evan Street, Penrith. The assessment has comprised the establishment of noise criteria and assess noise impacts with regard to relevant statutory requirements.

A noise survey has been conducted and the processed data has been used to determine traffic noise from Evan Road & Lethbridge Road at the project site.

Based on the noise impact study conducted, the proposed development is assessed to comply with the SEPP (Infrastructure) 2007 noise criteria with recommendations from this report. It is therefore recommended that planning approval be granted for the proposed development on the basis of acoustics.

Noise emissions criteria for mechanical plant have not been stablished at this stage, a future noise survey may be required once the mechanical plan schedules are available.

Approved:-



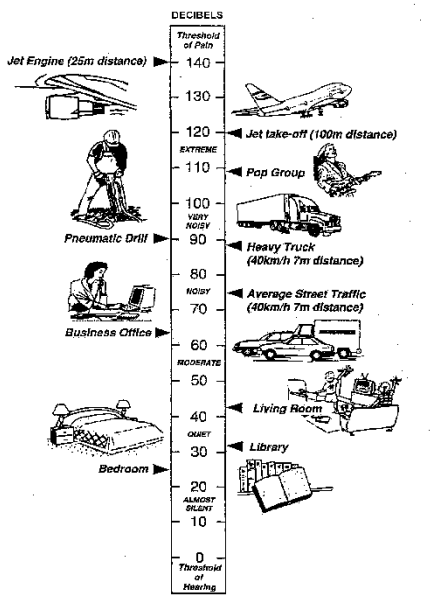
Rodney Stevens

Manager/Principal

Appendix A Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) character of the environment (e.g. very quiet suburban, suburban, urban, near industry) miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: Noise mitigation benefits (amount of noise reduction provided, number of people protected). Cost of mitigation (cost of mitigation versus benefit provided). Community views (aesthetic impacts and community wishes). Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10th percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

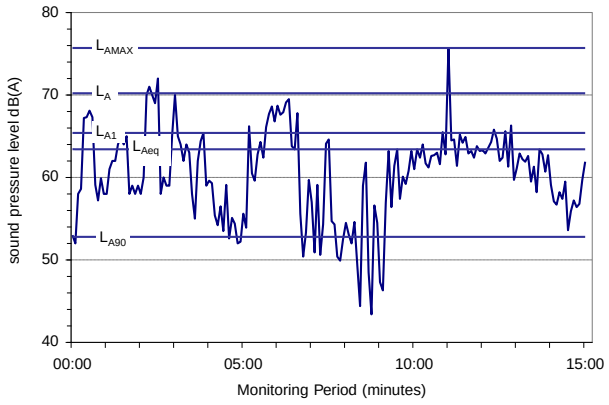
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:

L_{Amax} Maximum recorded noise level.

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.

L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

Threshold

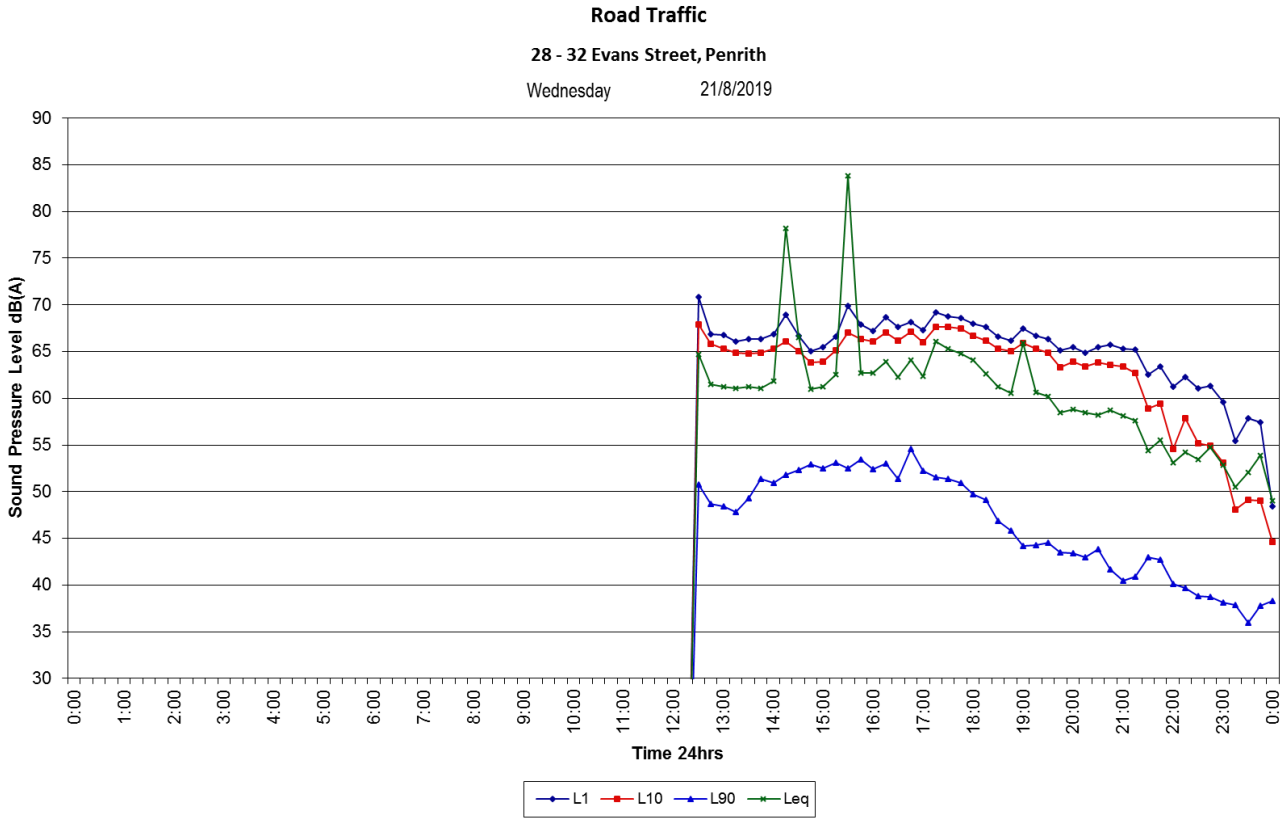
The lowest sound pressure level that produces a detectable response (in an instrument/person).

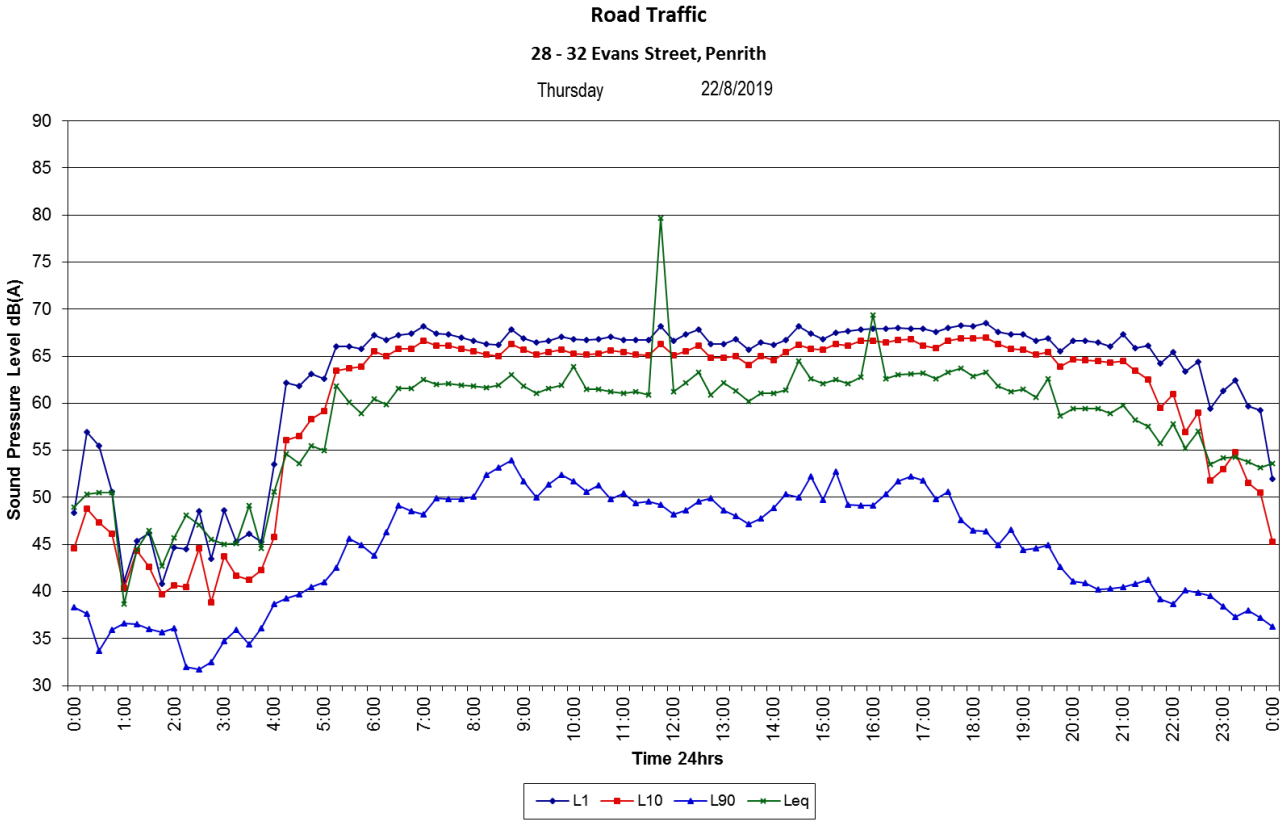
Tonality

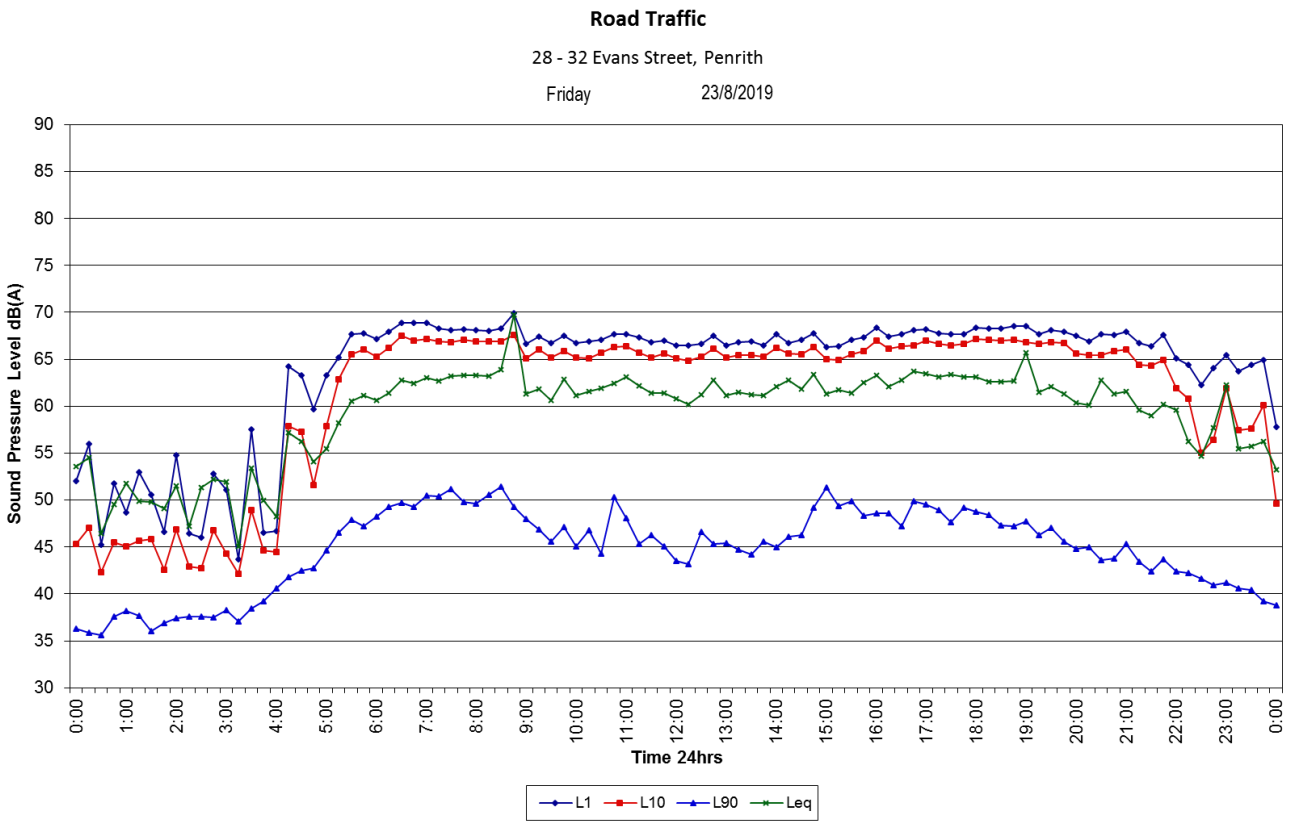
Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics

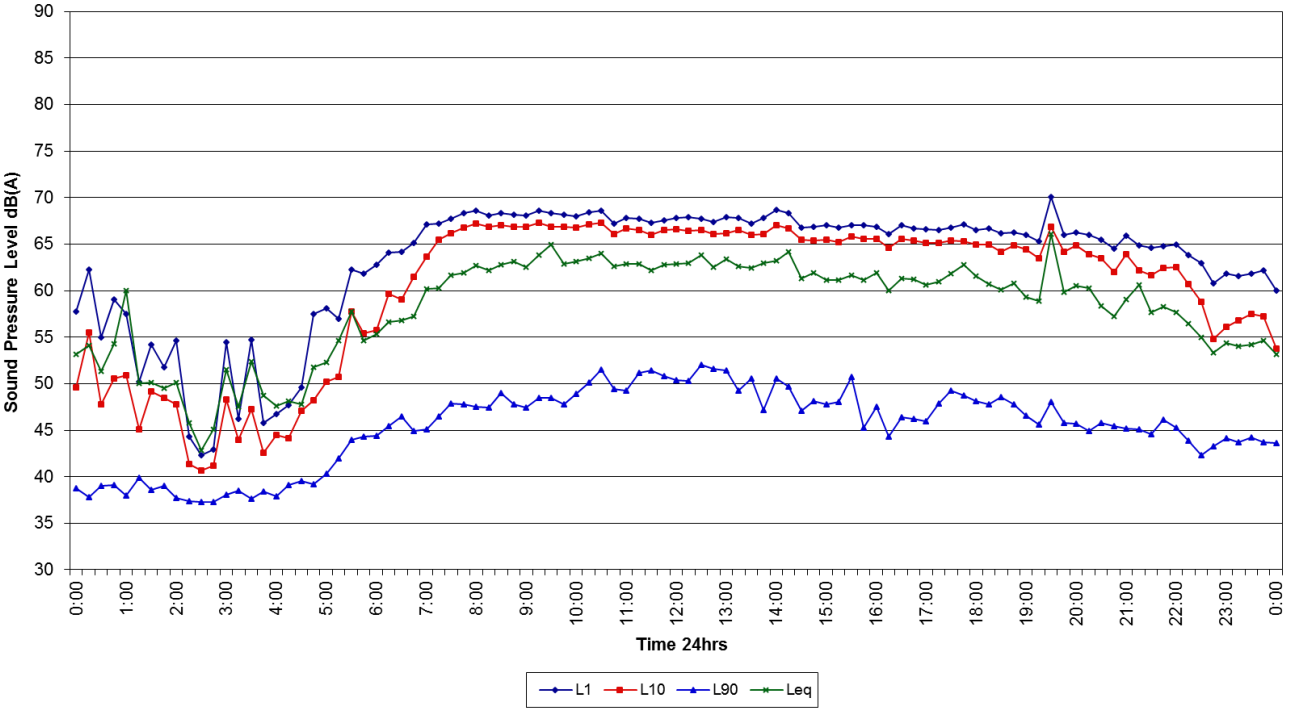
Appendix B Logger Graphs

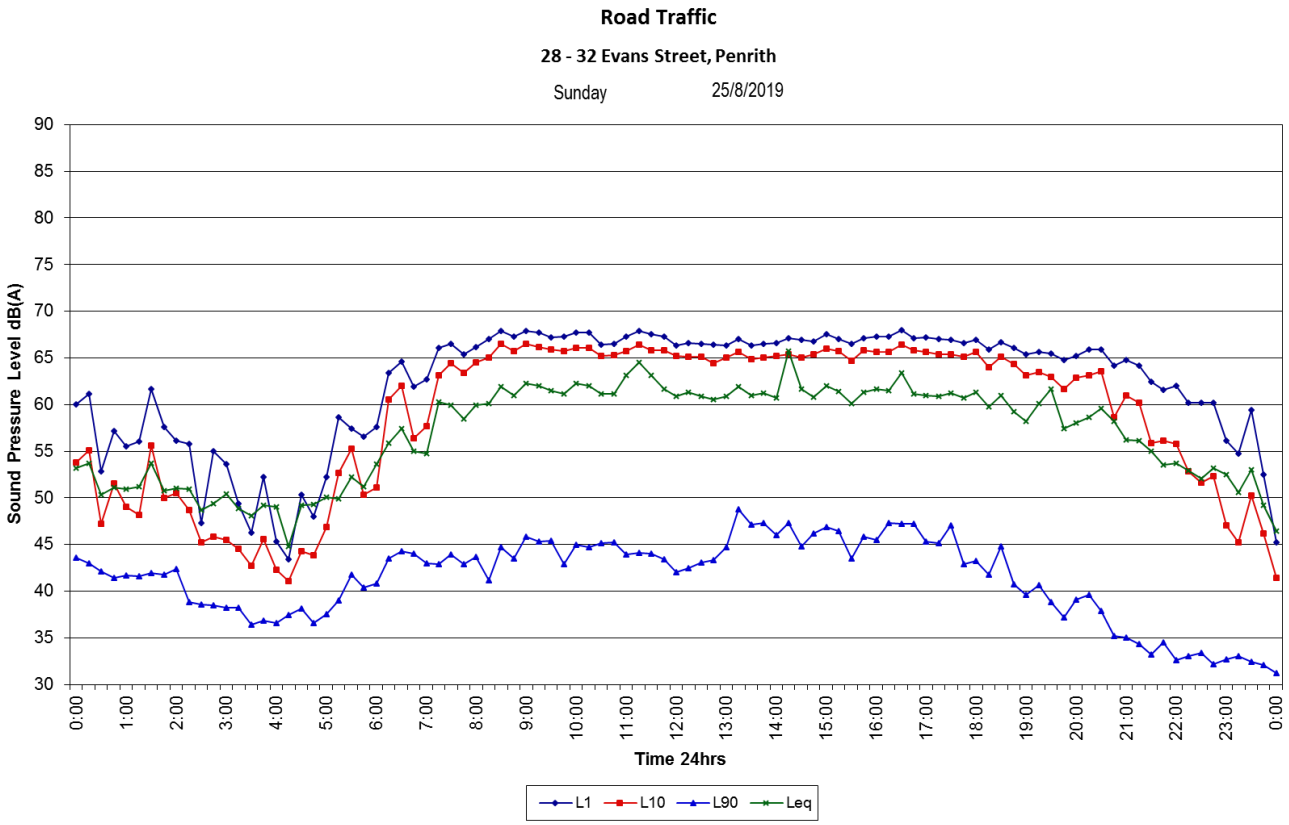
Traffic Logger

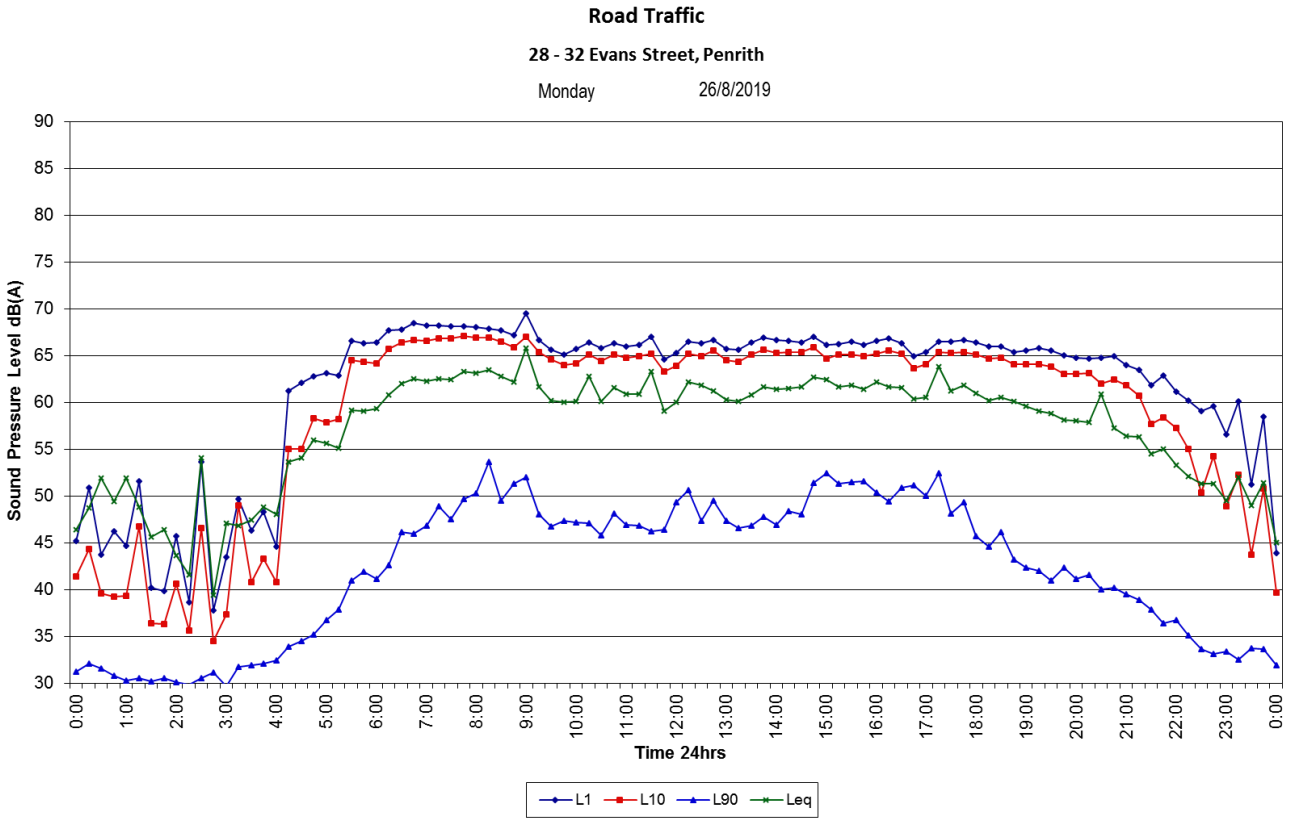


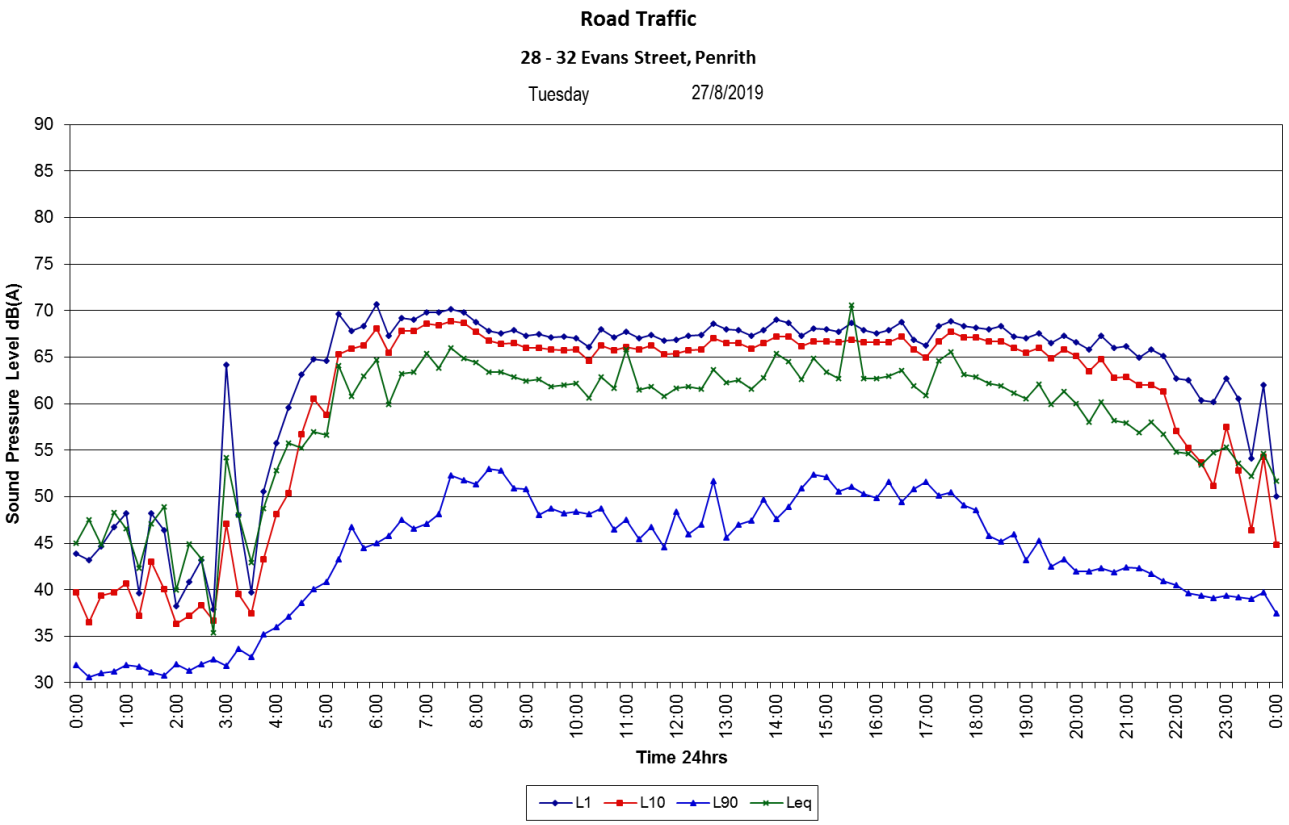


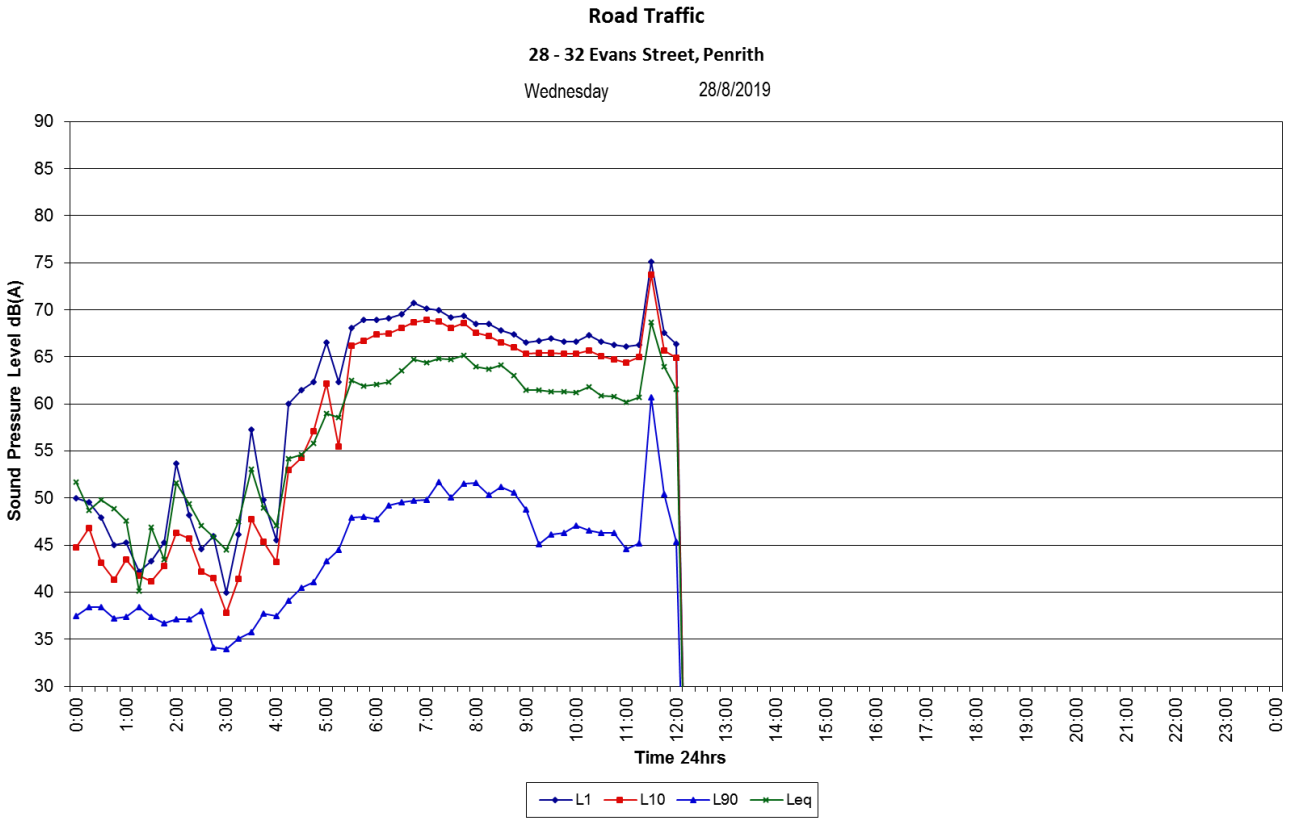




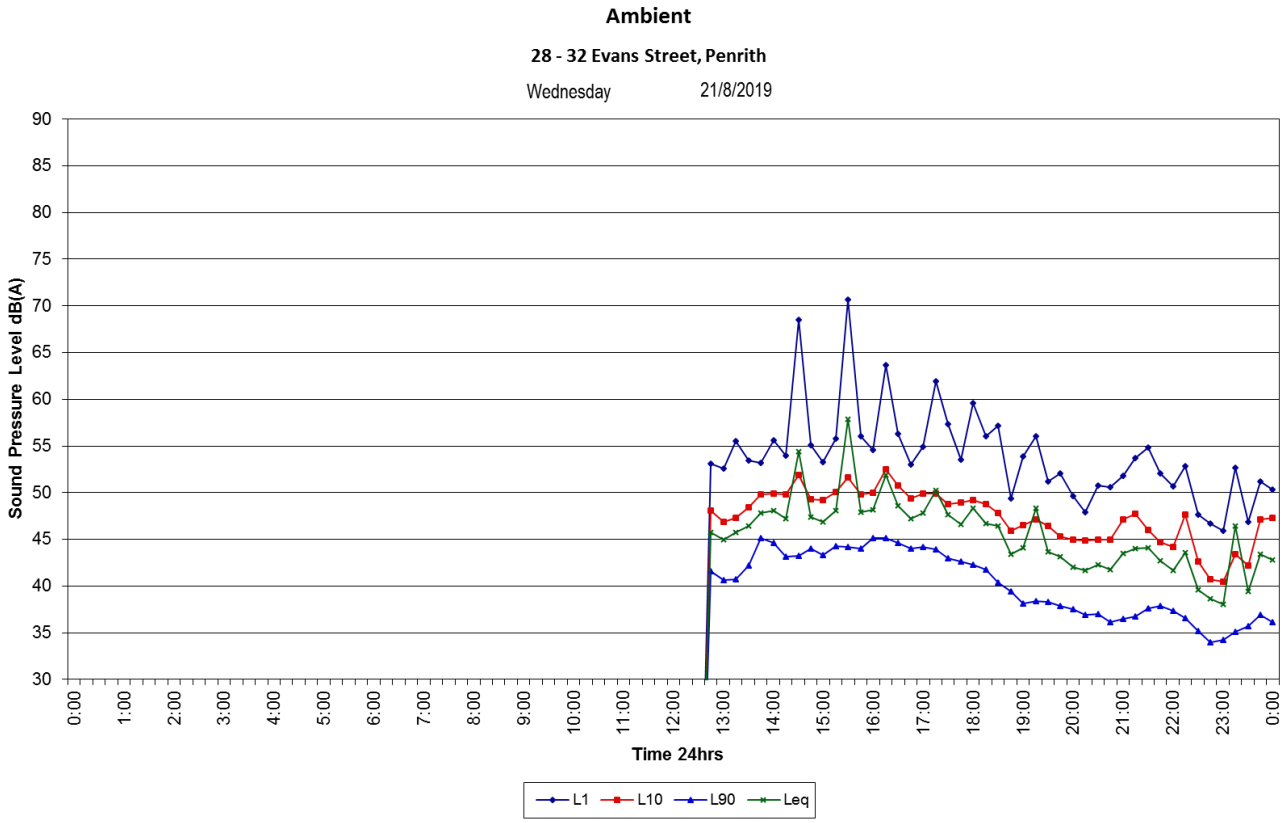


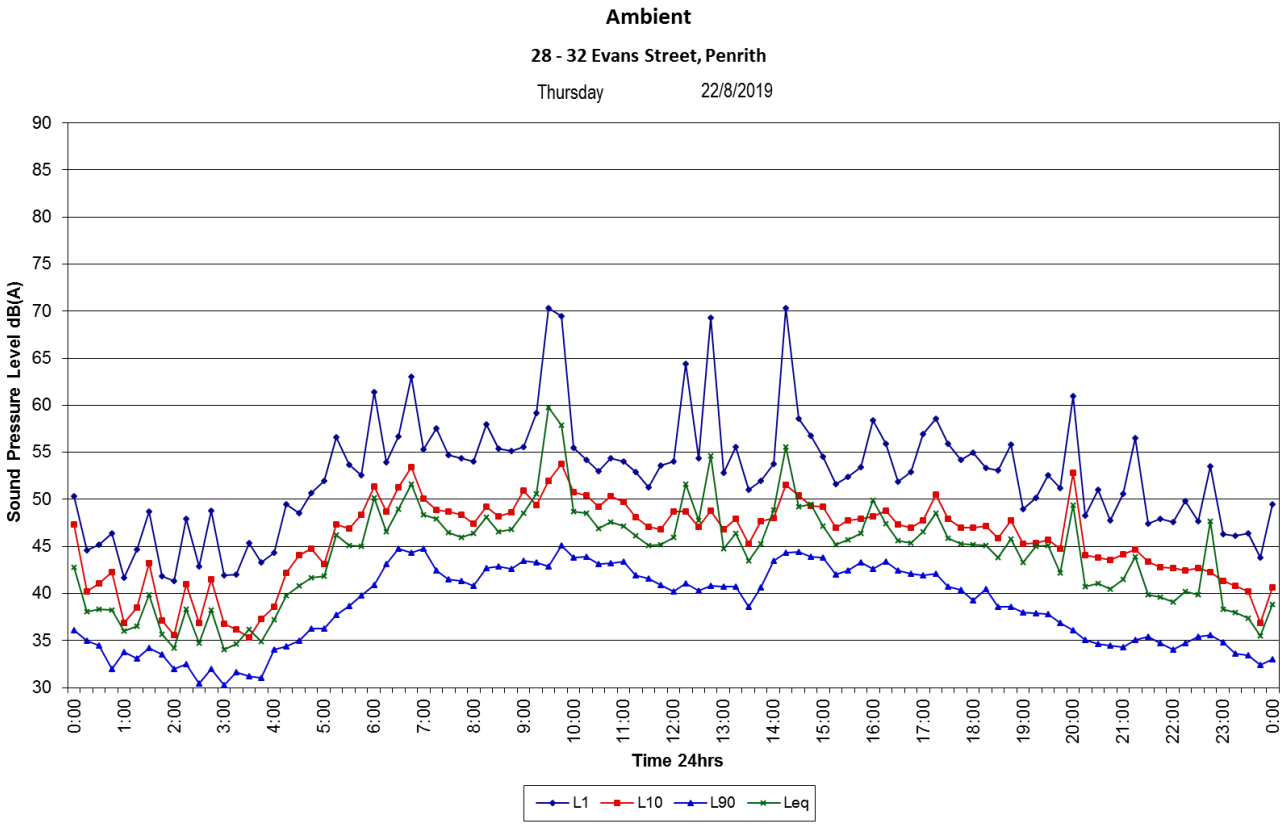


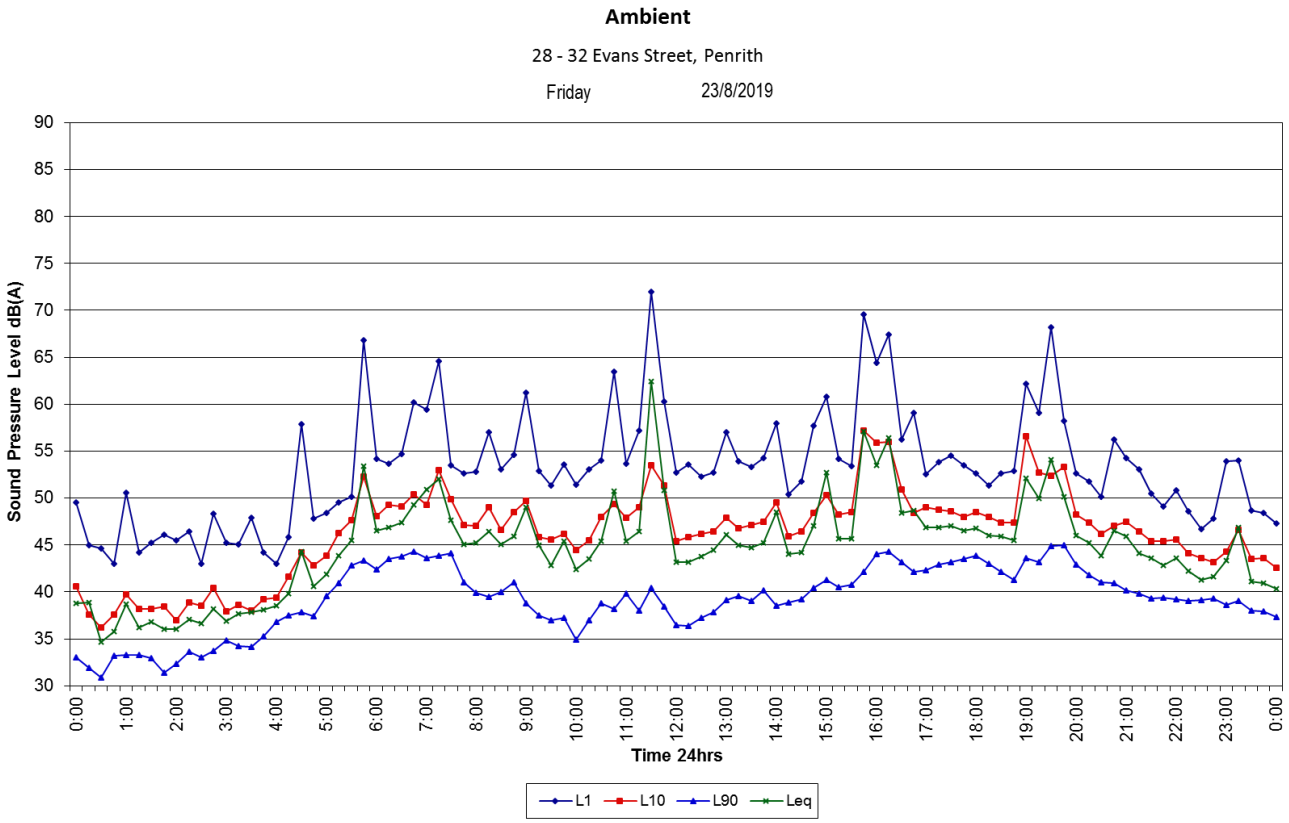


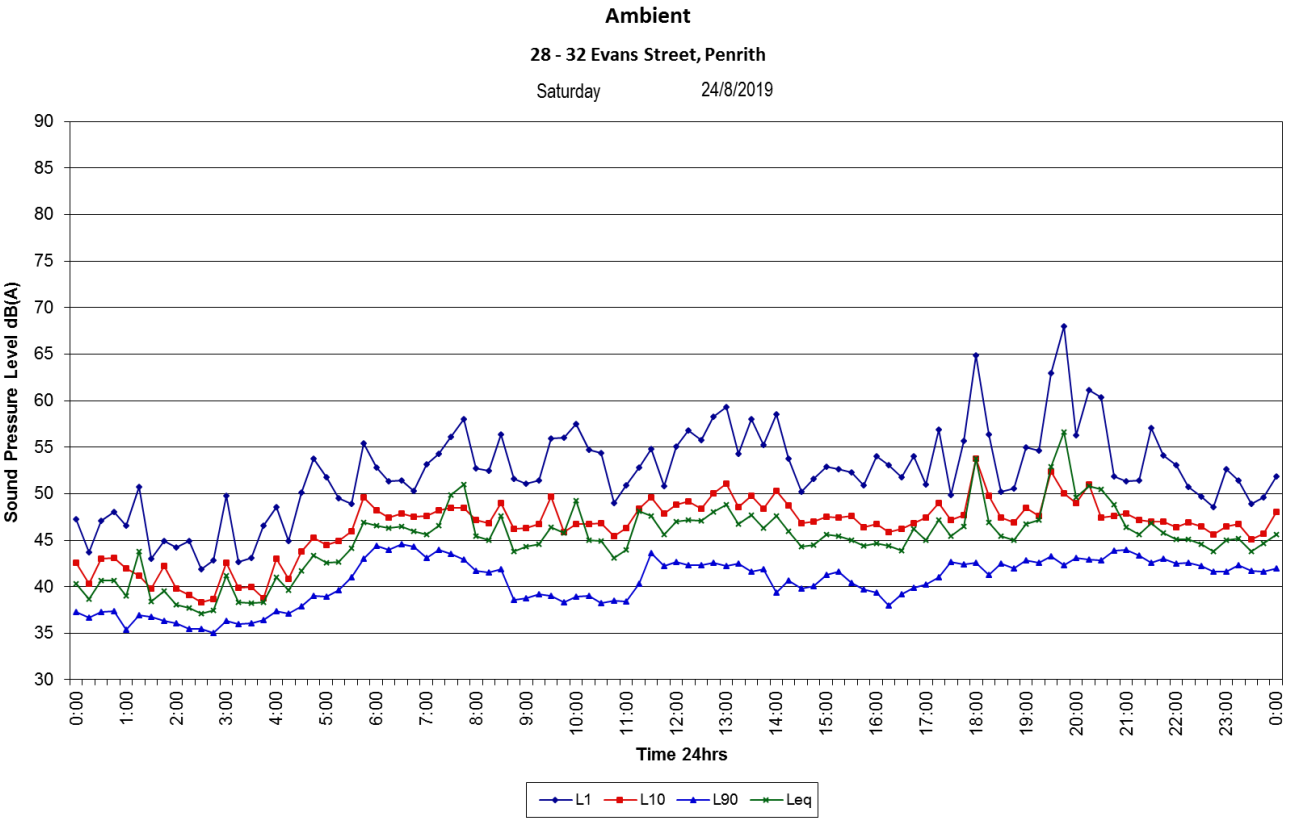


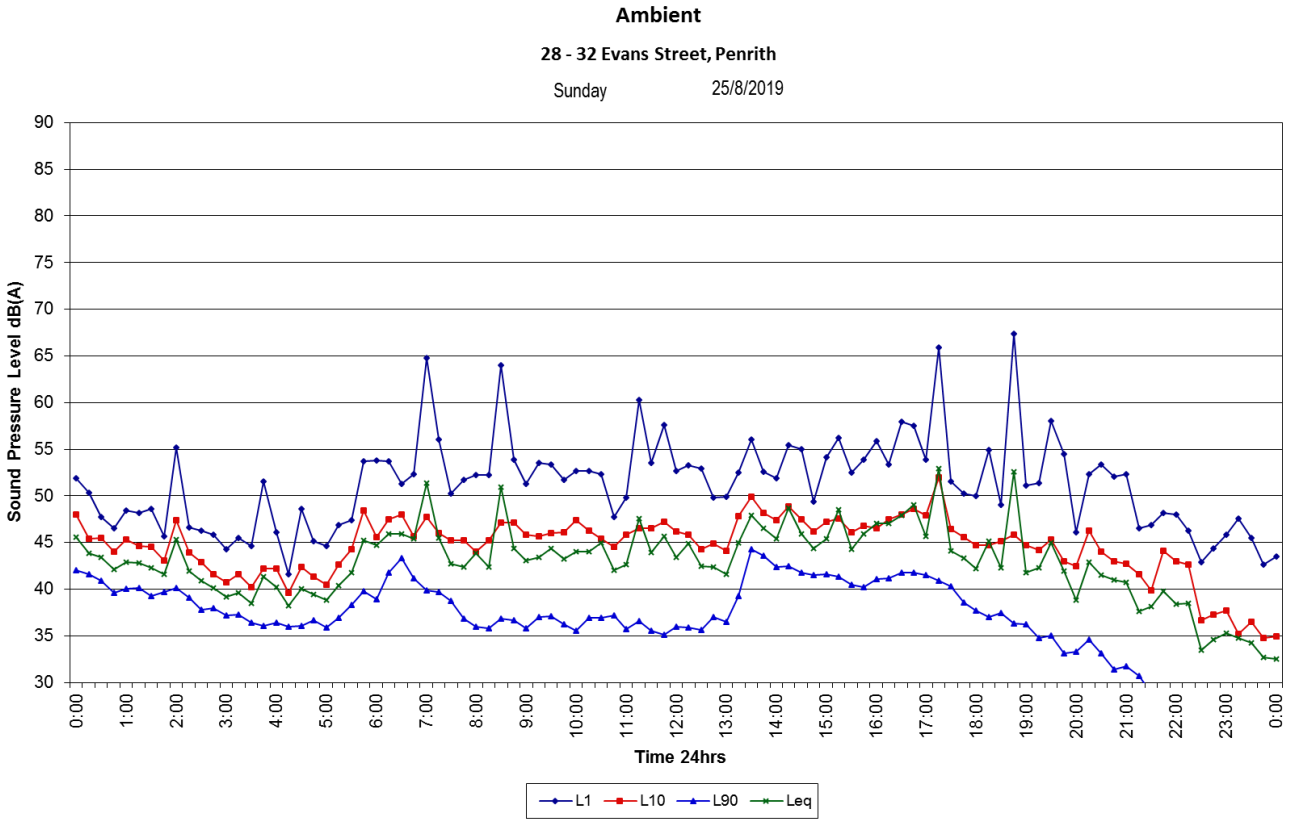
Ambient Logger

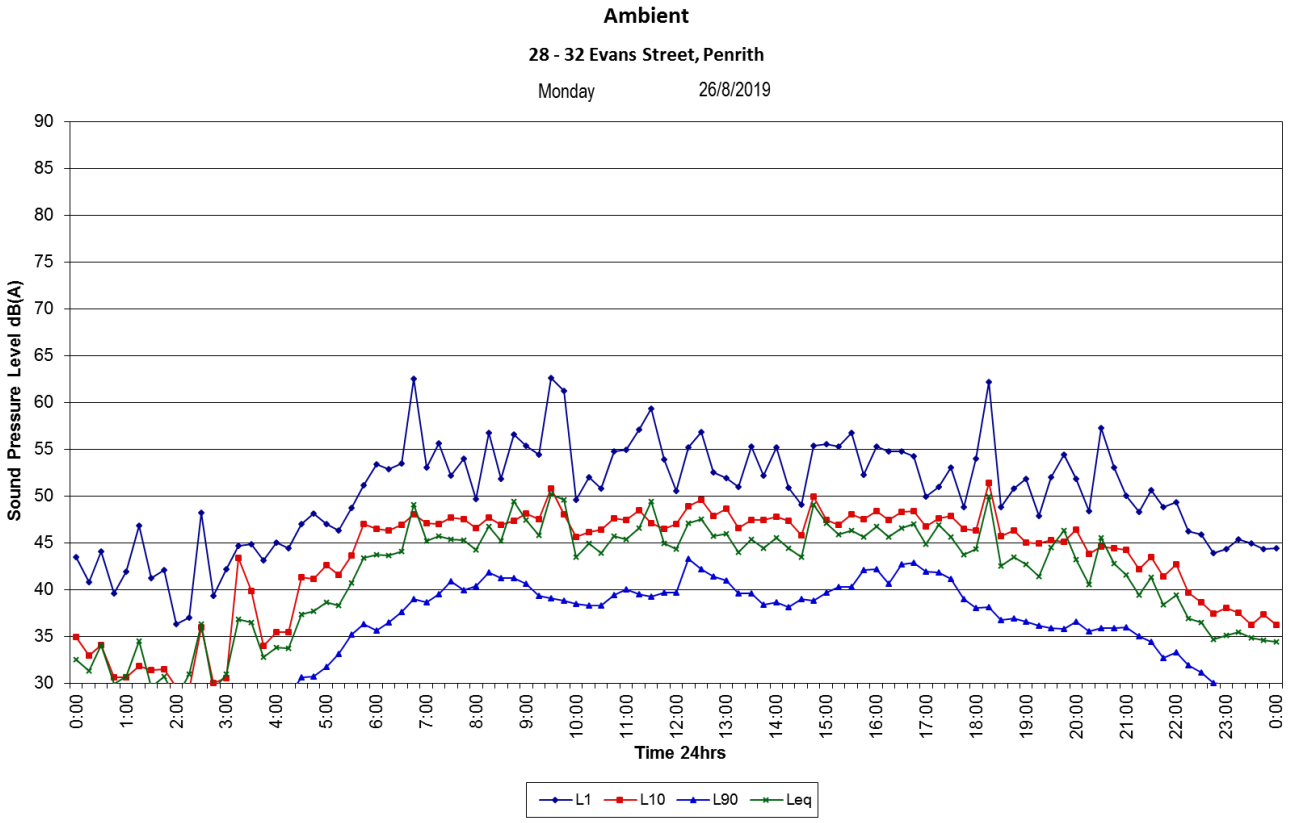


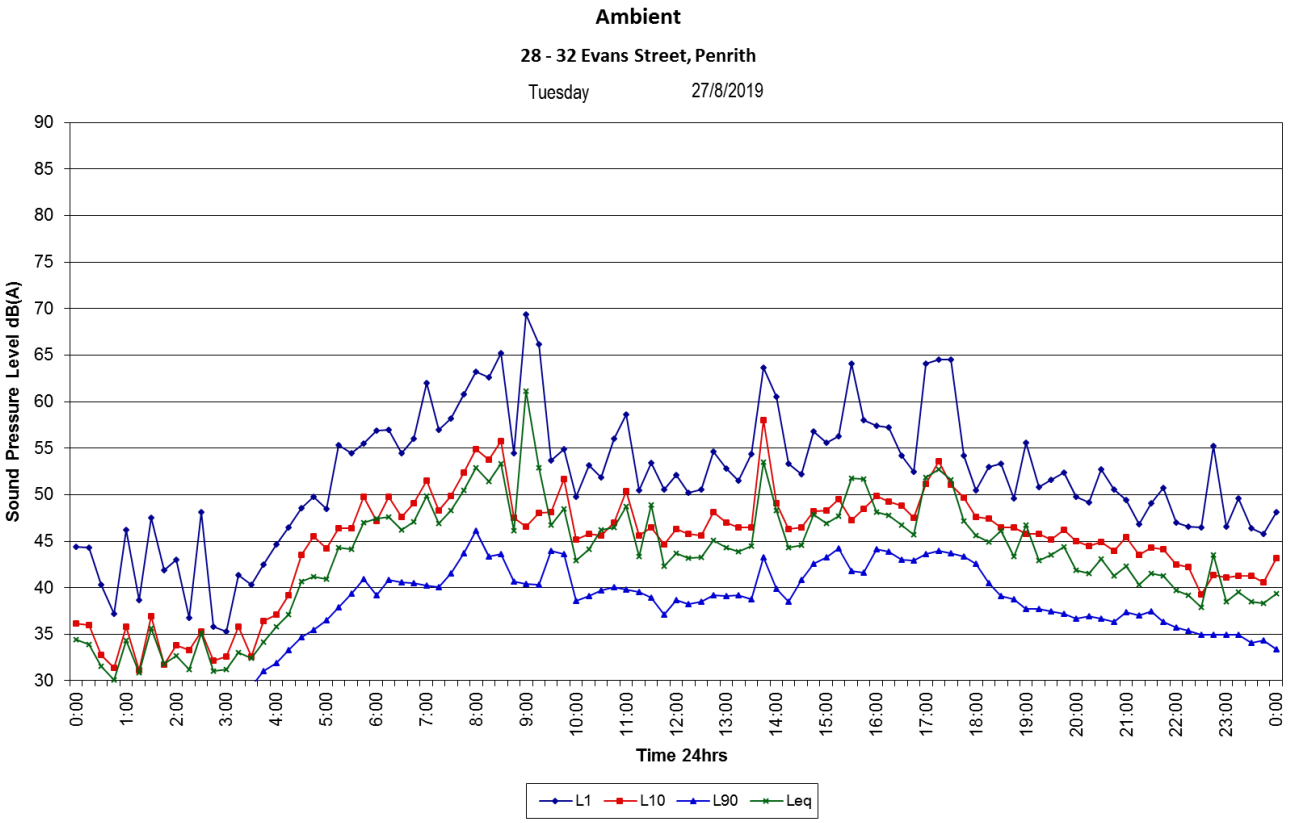


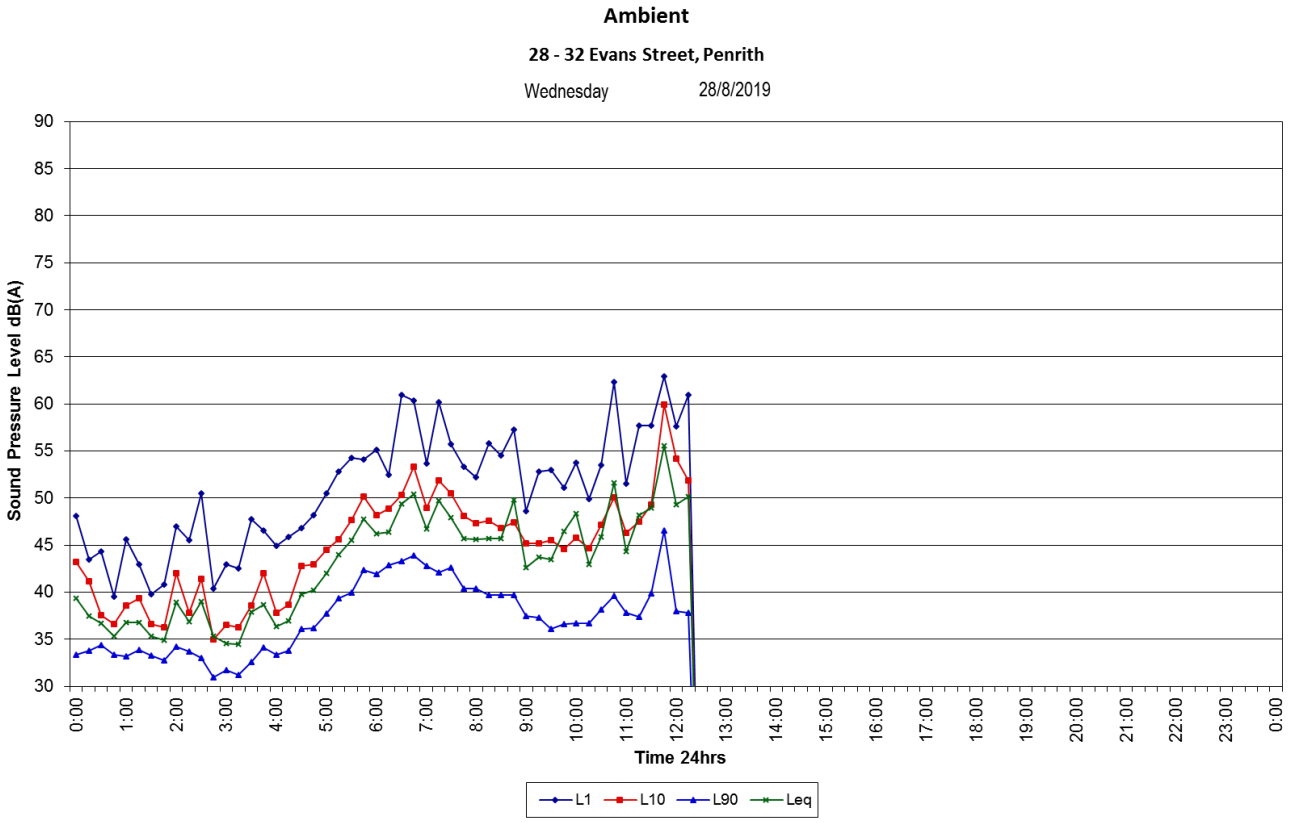












Appendix C Calibration Certificate

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C19389

Client Details	Rodney Stevens Acoustics Pty Ltd 1 Majura Close St Ives Chase NSW 2075
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00133010
Microphone Serial Number :	144601
Pre-amplifier Serial Number :	23060

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	25°C	**Ambient Temperature :**	24.8°C
Relative Humidity :	41.7%	**Relative Humidity :**	41.5%
Barometric Pressure :	100.8kPa	**Barometric Pressure :**	100.8kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 2 Jul 2019
Secondary Check: Eloise Burrows
Report Issue Date : 8 Jul 2019

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -

		Environmental Conditions	
Acoustic Tests		*Temperature*	*±0.2°C*
31.5 Hz to 8kHz	*±0.15dB*	*Relative Humidity*	*±2.4%*
12.5kHz	*±0.2dB*	*Barometric Pressure*	*±0.015kPa*
16kHz	*±0.29dB*		
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

PAGE 1 OF 1

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C19414

Client Details	Rodney Stevens Acoustics Pty Ltd 1 Majura Close St Ives Chase NSW 2075
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00572559
Microphone Serial Number :	170395
Pre-amplifier Serial Number :	72897

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24°C	**Ambient Temperature :**	24.2°C
Relative Humidity :	42.9%	**Relative Humidity :**	42.1%
Barometric Pressure :	99.94kPa	**Barometric Pressure :**	99.9kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 11 Jul 2019
Secondary Check: Eloise Burrows
Report Issue Date : 15 Jul 2019
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.21dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

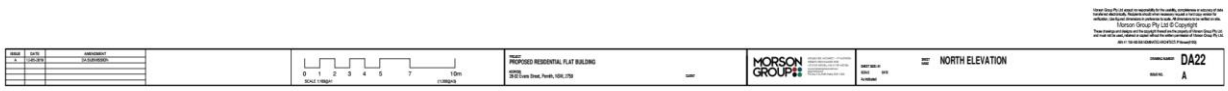
This calibration certificate is to be read in conjunction with the calibration test report.

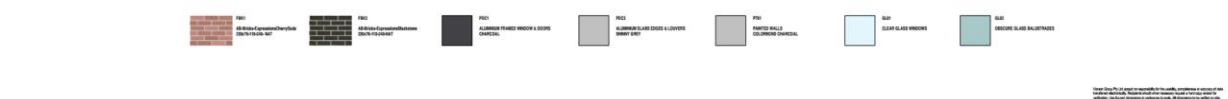
Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Appendix D Architectural Plans

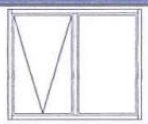




Appendix E Glazing Guideline

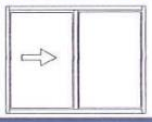
A table showing typical glass thicknesses and their Rw Values is provided in Appendix E. Please note that these table must be used as a GUIDE only, please note that the R_w rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required R_w rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the requirements in

Aluminium Awning Window



Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals	Standard	Qlon	Qlon	Qlon
STC	28	33	34	34
RW	29	33	33	34

Aluminium Sliding Window



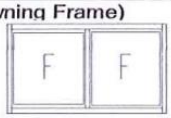
Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals	Standard	Fin	Fin	Fin
STC	23	24	25	25
RW	22	24	25	25

AluminiumDouble Hung

Glass	5mm Float	6.38 Laminated		
Seals	Standard	Fin		
STC	24	27		
RW	24	26		

AluminiumFixed Window

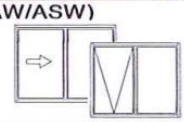
(Awning Frame)



Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals	-	-	-	-
STC	28	32	33	34
RW	28	33	33	33

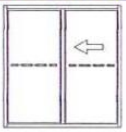
Secondary Glazing - Sound Barrier Window

(AAW/ASW)



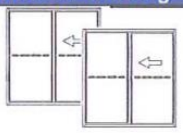
Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals		Qlon	Qlon	Qlon
STC		44	45	46
RW		44	45	45

Aluminium Sliding Door



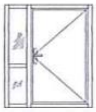
Glass	4mm Toughened	6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals	standard	Fin	Fin	Fin
STC	22	30	33	33
RW	21	29	33	33

Aluminium Glazing - Sound Barrier Door



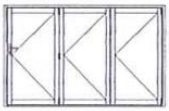
Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals		Fin	Fin	Fin
STC		44	45	46
RW		44	44	45

Aluminium Hinged Door*



Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals		Qlon	Qlon	Qlon
STC		29	30	30
RW		29	30	30

Aluminium Bifold Door*



Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
Seals		Qlon	Qlon	Qlon
STC		25	29	29
RW		27	29	29