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Acoustic Report
- Traffic & Environmental Noise -

For proposed development at

No. 1 Station Lane, Penrith

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Date: July 6th, 2018
Reference No.: 2018-253

DOCUMENT CONTROL

Date	*Revision History*	*Prepared By:*	*Reviewed and Authorised by:*
30/05/2018	Initial Report	Domeniki Tsagaris	Moussa Zaioor
06/07/2018	Final Report	Domeniki Tsagaris	Moussa Zaioor

TABLE OF CONTENTS

Document Control 2
Table of Contents 3
1.0 Scope of Work 4
2.0 Noise Survey and Instrumentation 4
1.0 Acoustical Study (AS/NZS 2107:2016) 5
2.0 Acoustical Study (AS 3671-1989) & Clause 102 of the State Environmental Planning Policy – (Infrastructure) 2007 6
5.0 Sleep Arousal 7
6.0 RECOMMENDATIONS 8
6.1 Windows/Sliders, Walls, Door & Roof 8
7.0 PROPOSED MECHANICAL PLANT, CAR PARK MECHANICAL VENTILATION & GARAGE ROLLER DOOR 9
8.0 ACCEPTABLE NOISE LEVEL FROM PROPOSED DEVELOPMENT 9
8.1 Noise Guide for Local Government 9
8.2 NSW Noise POLICY FOR INDUSTRY (2017) 10
8.2.1 Amenity Noise Criteria 10
8.2.2 Intrusiveness Noise Criteria 11
8.2.3 PROJECT NOISE TRIGGER LEVEL 12
9.0 MECHANICAL PLANT & ROLLER DOOR NOISE CONTROL 13
10 Discussion and Conclusion 14
11 Appendix 15

1.0 Scope of Work

The aim of this report is to determine the building materials to be used and the construction methods to be adopted such that the proposed development at No. 1 Station Lane, Penrith is built to achieve acceptable internal noise levels a per Penrith City Council Council Requirements.

Noise intrusion levels are to be within the limits adopted by the Building Code of Australia, NSW Road Noise Policy, AS 3671 'Road Traffic Noise Intrusion – Building Siting and Construction', AS 2107 'Acoustics – Recommended Design Sound Levels and Reverberation Times', Clause 102 of the State Environmental Planning Policy – (Infrastructure) 2007 and Penrith City Council requirements, such that all habitable rooms in the proposed development shall be designed to limit internal noise levels.

The site is located Station Lane in the suburb of Penrith (Figure 1 – Site Location). The architectural plans by Antoine J. Saouma dated the 20th February 2018 are for the proposed construction of a six (6) storey residential building including two (2) levels of basement parking

2.0 Noise Survey and Instrumentation

On the 25th June, 2018 an engineer from this office went to the above address to carry out acoustic measurements near the proposed building line of the proposed development facing Union Road and Station Street (Figure 2 – Noise Reading Location). The unattended environment noise monitoring was conducted for seven (7) days from Monday 25th March to Monday 2nd July, 2018. All sound pressure levels are rounded to the nearest whole decibel. All measurements were taken in accordance with the Australian Standards AS 1055 "*Acoustics- Description and Measurements of Environmental Noise*".

The noise survey was conducted to determine a conservative reading of the existing day and evening noise levels [15hrs- 7:00 -22:00] $L_{(A90,\ 15\ minutes\ [1hr])}$ and $L_{(Aeq,\ 15\ minutes\ [1\ hr])}$ and to determine a conservative reading of existing night and early morning noise levels [9hrs-22:00-7:00] $L_{(A90,\ 15\ minutes\ [1hr])}$ and $L_{(Aeq,\ 15\ minutes\ [1\ hr])}$.

The measurement procedure and the equipment used for the noise survey are described below. All sound pressure levels are rounded to the nearest whole decibel. All sound level measurements and analysis carried throughout this report are carried with Svantek 957 Noise and vibration level meter 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

Machine was calibrated prior to reading. Any noise readings affected by strong wind or rain have been disregarded. The Full Average Statistical Noise Parameters **$L_{(Aeq,\ 15\ minutes)}$, $L_{(A90,\ 15\ minutes)}$, $L_{(A10,\ 15\ minutes)}$, $L_{(A1,\ 15\ minutes)}$** are presented in Figure 3 – Noise Survey. A Summary of those readings is presented in the table below:

Table 2.1- Summary of Noise Readings 25th June, 2018 – 2nd July, 2018

At Point A	**$L_{(Aeq,\ 15\ minutes)}$**	**$L_{(A90,\ 15\ minutes)}$**
Day & Evening Time – 7:00am-10:00pm	51 dB(A)	46dB(A)
Night & Early Morning Time – 10:00pm-7:00am	41 dB(A)	35dB(A)

1.0 Acoustical Study (AS/NZS 2107:2016)

The above standard has formulated the criteria for developments situated in urban areas. The levels have been derived from relevant Australian Standards, the measurements and analysis of noise conditions in other similar developments and standards established in completed projects.

As traffic noise levels are not constant, a L_{eq} noise level descriptor is used when assessing this type of noise source. The L_{eq} is the mean energy level of noise being measured and has been found to accurately describe the level of annoyance caused by traffic noise.

It is usual practice, when we find it necessary to recommend internal sound levels in buildings to refer to Australian/New Zealand Standard AS/NZS 2107:2016 "Acoustics – Recommended Design Sound Levels and Reverberations times for Building Interiors".

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and industrial noise. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.

The standard recommends the following noise levels for residential buildings.

AUSTRALIAN STANDARD AS/NZS 2107:2016 RECOMMENDED DESIGN NOISE LEVELS, LAeq

Type of occupancy	Recommended Design Sound Level	
Activity	Satisfactory	Maximum
Houses in areas with negligible transportation		
Sleeping Areas	25	35
Houses and Apartments near minor roads		
Living Areas	30	40
Sleeping Areas	30	35
Work Areas	35	40
Apartment common areas (e.g. foyer, lift lobby)	45	50
Houses and Apartments near major roads		
Living Areas	35	45
Sleeping Areas	35	40
Work Areas	35	45
Apartment common areas (e.g. foyer, lift lobby)	45	50

2.0 Acoustical Study (AS 3671-1989) & Clause 102 of the State Environmental Planning Policy – (Infrastructure) 2007.

Australian Standard 3671 "Traffic noise intrusion building siting and construction" is used to determine the type of building materials required to satisfactorily attenuate traffic noise so that internal traffic noise levels recommended in Australian Standard 2107-2000 "Recommended design sound levels and reverberations for building interiors" and Clause 102 of the State Environmental Planning Policy – (Infrastructure) 2007, can be achieved.

By taking in to consideration that the proposed development is considered to be "sensitive to traffic noise or vehicle emissions", it must be "appropriately located and designed, or include measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development" arising from Union Road, Station Street and the basement carpark of No. 15 Station Road.

Under Clause 102, where the development is for residential use and is located in or adjacent to a relevant road corridor, a consent authority must not grant consent unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- in any bedroom in the building – 35dB(A) at any time between 10.00p.m. and 7.00a.m.
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40dB(A) at any time.

Maximum design sound level is defined as the level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive. In this assessment, satisfactory design sound levels were used where practically possible.

In accordance with Section 3.4.2.6 of AS 3671 the traffic noise attenuation (TNAc) required for each building component (walls, windows, ceiling,…etc) is determined from the following equation:

$$TNAc = TNR + 10 \log 10 [(Sc / Sf) \times (3/h) \times 2T60 \times C] \quad \text{……..……..4.1}$$

Where *TNAc* = the traffic noise attenuation required of the component, in decibels.
TNR = the traffic noise reduction, determined in Clause 3.3;
Sc/Sf = area ratio of the component
h = ceiling height of room, in metres
T60 = reverberation time of room, in seconds
C = number of components.

The tables provided in the relative Australian standards for selecting building materials **(**walls, windows, ceiling etc) are expressed in terms of their Rw (weighted sound reduction index) or STC. Section 3.4.3.1 defines the relation between Rw and TNAc calculated in [4.1] as follows:

$$Rw \text{ (or } STC) \approx TNAc + 6 \quad \text{……..….4.2}$$

This formula approximate all allowances made for the spectral composition of the noise.

5.0 Sleep Arousal

Section 5.4 of the NSW Road Noise Policy mentions the Environment Protection Authority NSW 1999 guideline which aims at limiting the level of sleep disturbance due to environmental noise. It states that the $L_{A1,\ 1\ minute}$ level of any noise should not exceed the ambient L_{AF90} noise level by more than 15dB. This guideline takes into account the emergence of noise events, but does not directly limit the number of such events or their highest level, which are also found to affect sleep disturbance.

Applying the above thus the sleep disturbance criteria for the above project is $L_{A1,\ 1\ minute}$ and should not be exceeded by [L_{A90} =46 dB(A) plus 15]= 61 dB(A).

There are other studies on sleep disturbance like the one carried the enHealth Council (2004) and the guidelines published by the World Health Organisation (1999) were reviewed and analysed in terms of the guidance on noise exposure and sleep disturbance. The enHealth report states that:

‘ as a rule for planning for short-term or transient noise events, for good sleep over 8 hours the indoor sound pressure level measured as a maximum instantaneous value not exceed approximately 45 dB(A) $L_{A,(Max)}$ more than 10 or 15 times per night’.

6.0 RECOMMENDATIONS

6.1 Windows/Sliders, Walls, Door & Roof

Building Component	Rw Rating to be Achieved
Windows & Sliding Doors in Kitchen Area, Study Room and All Bedroom Areas of all Units are to be 6mm laminated type with full perimeter Schlegel Q-Lon acoustic seals (Ph: 8707-2000). (1)	30-32
Windows in Bathrooms/Ensuites/Laundries etc in all Units are to be unrestricted and to be in accordance with AS 2047 (Windows in Buildings). (1)	-
External Walls are to be 270/250 mm double brick, brick veneer construction or any other method of wall construction with an Rw of 44.	40-44
Roof of all Units is to be Minimum 150mm Concrete Roof AND/OR Galvanised Steel Trough Roofing (0.5mm), on 10 gypsum plaster board ceiling with 75mm thick, 11kg/m³ mineral wool batts between ceiling joists.(2)	39-41

NB: This report is to be read in conjunction with the BASIX certificate and any other related building specification. (1). No weep holes in windows/sliders. All gaps between window & door frames and the masonry alls are to be sealed using acoustic foam Hilti CP620 or similar. Glass wool batts can be applied prior to the application of the foam to seal larger gaps. (2). All gaps are to be acoustically sealed.

7.0 PROPOSED MECHANICAL PLANT, CAR PARK MECHANICAL VENTILATION & GARAGE ROLLER DOOR

A range of mechanical plant, equipment and ventilation will be included in the proposed development at No. 1 Station Lane, Penrith. Noise emitted by the use of the proposed mechanical plant is assessed by the NSW Industrial Noise Policy.

The proposed level of basement parking is located below ground level and that makes providing natural ventilation not possible and a mechanical extract system should be used. The mechanical ventilation system needs to achieve six air changes per hour for exhaust fume extract and ten air changes per hour for smoke clearance.

A garage roller door may also be located at the entry of the Car Park. Predicted noise levels from the operation of garage roller doors have been estimated according to typical rollers doors installed at other developments. The average time duration for a garage roller door to fully open or close is approximately 30 seconds.

8.0 ACCEPTABLE NOISE LEVEL FROM PROPOSED DEVELOPMENT

8.1 Noise Guide for Local Government

The Department of Environment and Conservation (NSW) published the amended *Noise Guide for Local Government* in October 2010. The policy is specifically aimed at assessing noise from light industry, shops, entertainment, public buildings, air conditioners, pool pumps and other noise sources in residential areas.

The appropriate regulatory authority (Local Council) may, by notice in writing given to such a person, prohibit the person from causing, permitting or allowing:

1. any specified activity to be carried on at the premises, or
2. any specified article to be used or operated at the premises.

or both, in such a manner as to cause the emission from the premises, at all times or on specified days, or between specified times on all days or on specified days, of noise that, when measured at any specified point (whether within or outside the premises,) is in excess of a specified level.

It is an offence to contravene a noise control notice. Prior to being issued with a noise control notice, no offence has been committed.

The Protection of the Environment Operations Act 1997 defines “Offensive Noise” as noise:

1. (a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
2. (i) is harmful to (or is likely to be harmful to) a person who is outside the

premises from which it is emitted, or

3. (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

2. (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 regulation.

8.2 NSW Noise POLICY FOR INDUSTRY (2017)

The above policy seeks to promote environmental well-being through preventing and minimizing noise by providing a frame work and process for deriving noise limits conditions for consent and licenses.

The Noise Policy for Industry 2017 recommends two separate noise criteria to be considered, the Intrusive Noise Criteria and the Amenity Noise Criteria. A project noise trigger level being the lowest of the amenity and the intrusiveness noise level is then determined.

If the predicted noise level L_{Aeq} from the proposed project exceeds the noise trigger level, then noise mitigation is required. The extent of any 'reasonable and feasible' noise mitigation required whether at the source or along the noise path is to ensure that the predicted noise level L_{Aeq} from the project at the boundary of most affected residential receiver is not greater than the noise trigger level.

8.2.1 Amenity Noise Criteria

The amenity noise levels presented for different residential categories are presented in Table 2.2 of the Noise Policy for Industry 2017. These levels are introduced as guidance for appropriate noise levels in residential areas surrounding industrial areas.

For the proposed development at No. 1 Station Lane Penrith the recommended amenity noise levels are presented in table 8.2.1 below:

Table 8.2.1- Recommended Amenity Noise levels

TYPE OF RECIEVER	AREA	TIME PERIOD	RECOMMENDED Leq NOISE LEVEL, dB(A)
Residence	Suburban	Day	60
		Evening	50
		Night	45

Where a noise source contains certain characteristics such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, a correction is to be applied which is to be added to the measured or predicted noise levels at the receiver, before comparison with the criteria. Shown below are the correction factors that are to be applied:

Table 8.2.1 – Modifying Factor Corrections as per Fact Sheet C (Noise Policy for Industry 2017)

FACTOR	CORRECTION
Tonal Noise	+ 5 dB
Low Frequency Noise	+ 5 dB
Impulsive Noise	Apply difference in measured fast and impulse response levels, as the correction, up to a maximum of 5 dB.
Intermittent Noise	+ 5 dB

According to Section 2.4 of the above policy, the project amenity noise level is determined as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

To convert from a period level to a 15 minute level, a plus 3 is added as per section 2.2 of the policy.

Therefore, the project amenity noise level for the proposed development at No. 1 Station Lane, Penrith is as follows:

Daytime: 60- 5+ 3=58 dB(A)
Evening: 50 -5+ 3=48 dB(A)
Night-time: 45- 5+ 3=43 dB(A)

8.3.0 Intrusiveness Noise Criteria

Section 2.2.1 of the Noise Guide for Local Government states that a noise source is generally considered to be intrusive if the noise from the source when measured over a 15 minute period exceeds the background noise by more than 5 dB(A). Similarly, The Noise Policy for Industry in Section 2.3 summarizes the intrusive criteria as below:

$L_{Aeq,\ 15\ minute} \leq$ rating background level plus 5

While the background noise level known as $L_{A90,15\ minutes}$ is the Noise exceeded 90% percent of a time period over which annoyance reactions may occur (taken to be 15 minutes). The RBL is defined as the overall single-figure $L_{A90,15\ minutes}$ background level representing each assessment period (day/evening/night) over the whole monitoring period.

For the short-term method, the rating background noise level is simply the lowest measured LAF90,15min level.

For the long-term method, the rating background noise level is defined as the median value of:

- all the day assessment background levels over the monitoring period for the day
- all the evening assessment background levels over the monitoring period for the evening, or
- all the night assessment background levels over the monitoring period for the night.

Therefore, the acceptable L_{eq} noise intrusiveness criterion for the proposed development during the day & night is as follows:

- **46 + 5 = 51 dB (A)** during the day and
- **35+ 5 = 40 dB (A)** during the night.

8.3.1 PROJECT NOISE TRIGGER LEVEL

A summary of intrusiveness and amenity noise levels as determined in sections 8.2.2 & 8.2.3 are shown in table 8.3.2 below:

Table 8.3.2 - Summary of Intrusiveness and project amenity noise levels

Period	Intrusiveness Noise Level	Project Amenity Noise level
Day Time & Evening (7:00am-10:00pm)	51	58
Night & Early Morning (10:00pm – 7:00am)	40	43

The project noise trigger level is the lower (that is, the most stringent) value of the amenity and intrusiveness noise levels for the day, evening and night time. Therefore, the project noise trigger levels for the proposed development are as shown below

Daytime & Evening: $L_{Aeq,15\ min}$ **51 dB(A)**
Night-time: $L_{Aeq,15\ min}$ **40 dB(A)**

The proposed boarding house and its activities including all mechanical plant will not exceed the project noise trigger level at the most sensitive location (boundary of No. 28A Union Rd), provided all noise control recommendations in Section 9.0 are adhered to.

9.0 MECHANICAL PLANT & ROLLER DOOR NOISE CONTROL

A range of mechanical plant, equipment and ventilation will be included in the proposed development at No.1 Station Lane, Penrith. Noise emitted by the use of the proposed mechanical plant is assessed by the Noise Policy for Industry 2017, and Council conditions/requirements.

Air-conditioning might also be installed in the proposed development. Typical noise levels for air-conditions, car park exhaust fans and security roller door sound power levels are presented in the table below:

Table 9.1 – Typical Mechanical Plant Leq Sound Power Levels

FREQUENCY [Hz]	63	125	250	500	1000	2000	4000	8000	dBA
Typical Car park Exhaust fan	80	82	84	87	86	83	78	71	90
Typical Condensing Unit	71	69	67	61	58	54	47	44	64
Leq, 15 mins Car-Park security roller door.	62	57	60	60	68	63	62	57	77

In order for the operation of the car park & basement garage door to meet NSW Industrial Noise Policy, we recommend the following:

- Ensure maintenance and lubrication of motor bearings, door tracks and joints.
- The proposed security door fitted to the car parking area entrance must be independently mounted on rubber pads to prevent vibration noise transmission through the concrete walls and/or columns.

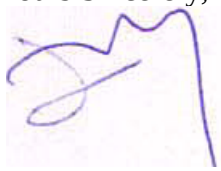
We recommend acoustic assessment of all proposed Mechanical Plant & Equipment once the development has been approved and Mechanical Services Plans have been prepared. In general, we recommend that all new external air-conditioning units are to be acoustically enclosed or set away by more than 3.0m from any boundary. The assessment of the Mechanical Plans once available will recommend proper silencer/(s) and duct lagging such that noise levels emitted from the mechanical plant servicing the proposed development at No.1 Station Lane, meet the requirements of section 8.2.3 of this report.

10 Discussion and Conclusion

The construction of the proposed development at No. 1 Station Lane, Penrith if carried out as recommended in the plans and specifications and including the acoustic recommendations in this report, will meet the required noise reduction levels as required in Clause 102 of the State Environmental Planning Policy – (Infrastructure) 2007, NSW Road Noise Policy, Australian Standards AS 3671 'Traffic Noise Intrusion Building Siting and Construction', AS 2107 'Acoustics – Recommended Design Sound Levels and Reverberation Times' and Penrith City Council Conditions/Requirements.

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

Yours Sincerely,



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11 Appendix

Figure 1 - Site Location 16
Figure 2 - Noise Reading Location 17
Figure 3 - Noise Survey 18

Figure 1 - Site Location

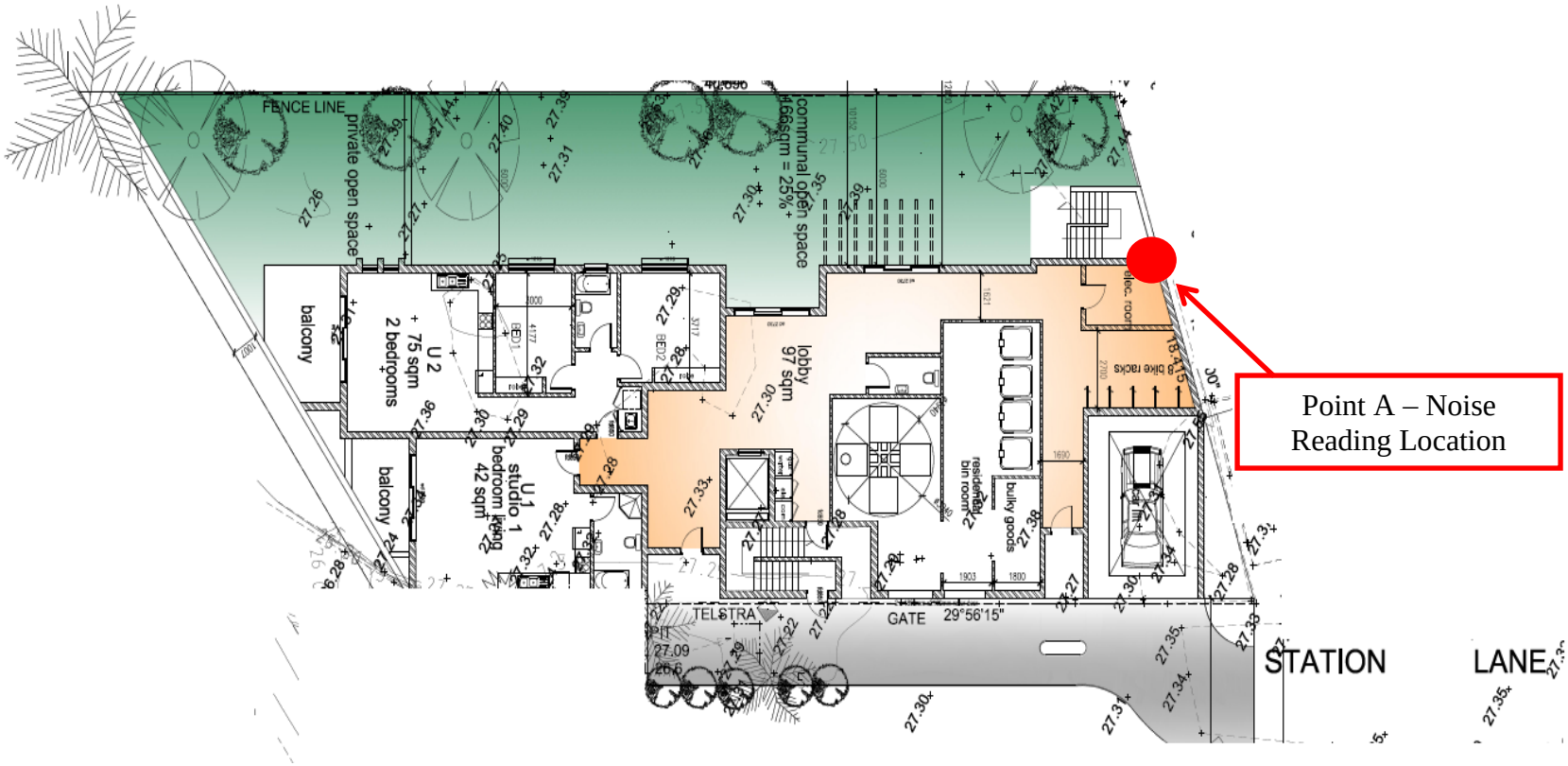

Figure 2 - Noise Reading Location

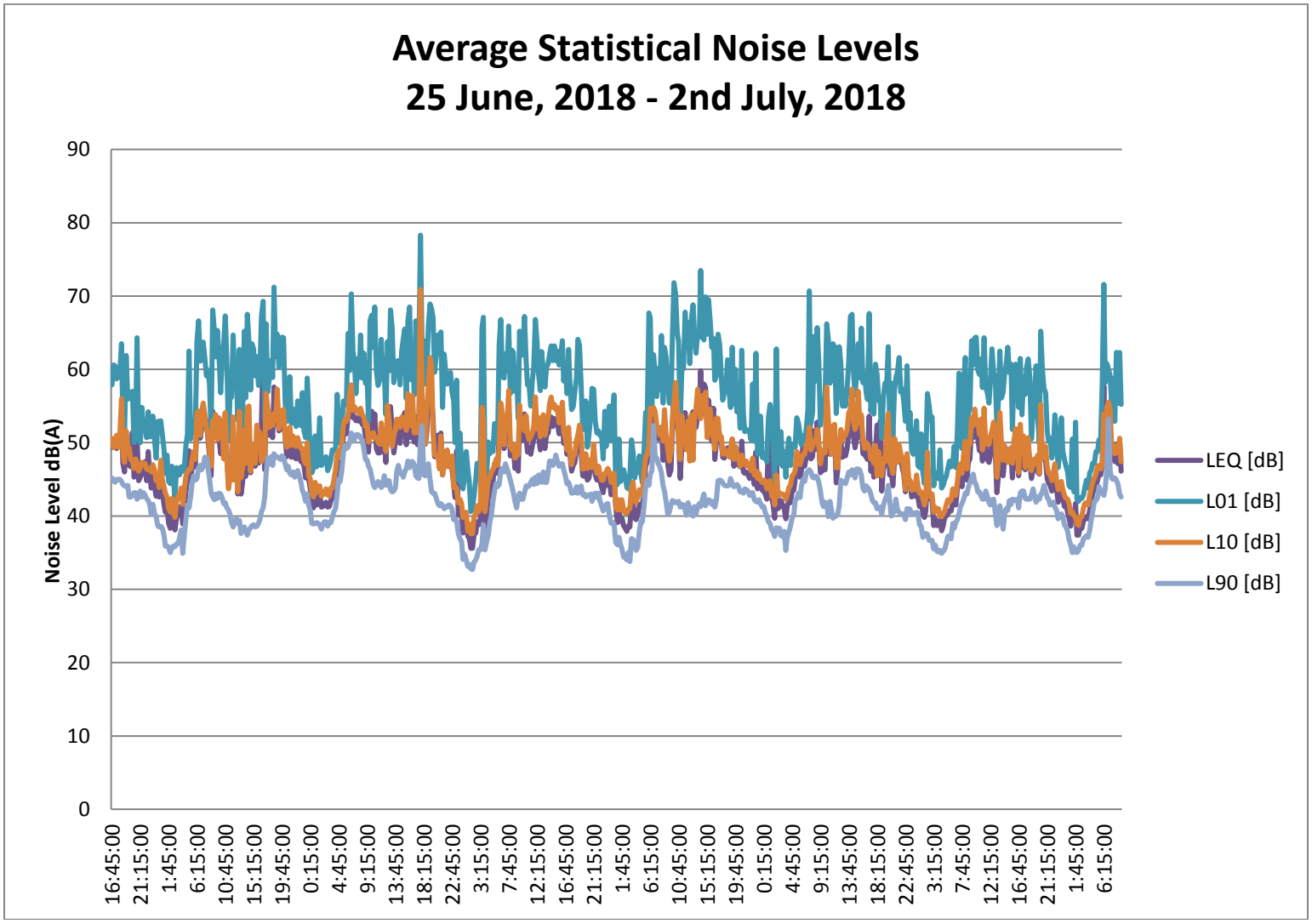

Figure 3 - Noise Survey