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Acoustic Report
- Traffic Noise -

For proposed development at

No. 129-131 Memorial Ave, Liverpool

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Date	*Revision History*	*Prepared By:*	*Reviewed and Authorised by:*
25/07/2016	Initial Report	Domeniki Tsagaris	Moussa Zaioor
12/08/2016	Final Report	Domeniki Tsagaris	Moussa Zaioor

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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. 129-131 Memorial Ave, Liverpool is built to achieve acceptable internal noise levels.

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 Council Conditions/Requirements, such that all habitable rooms in the proposed development shall be designed to limit internal noise levels.

The site is located on Memorial Ave in the suburb of Liverpool (Figure 1 – Site Location). The architectural plans by Ghazi Al Ali Architects dated the 29th September, 2016 are for the proposed construction of a five (5) storey residential building including one (1) level of basement parking.

2.0 Noise Survey and Instrumentation

On the 2nd August, 2016, Acoustic Solutions went to the above address to carry out acoustic measurements at the proposed front building line facing Memorial Ave (Figure 2 – Noise Reading Location). Unattended environment noise monitoring was conducted for seven (7) days from Tuesday 2nd August to Tuesday 9th August, 2016.

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 $\mathbf{L_{(Aeq,\ 15\ minutes)}}$, $\mathbf{L_{(A90,\ 15\ minutes)}}$, $\mathbf{L_{(A10,\ 15\ minutes)}}$, $\mathbf{L_{(A1,\ 15\ minutes)}}$ 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 2nd August – 9th August, 2016

At Point A	$\mathbf{L_{(Aeq,\ 15\ minutes)}}$	$\mathbf{L_{(A90,\ 15\ minutes)}}$
Day & Evening Time – 7:00am-10:00pm	66 dB(A)	59 dB(A)
Night & Early Morning Time – 10:00pm-7:00am	60 dB(A)	47 dB(A)

3.0 Acoustical Study (AS/NZS 2107:2000)

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 Leq noise level descriptor is used when assessing this type of noise source. The Leq 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 2107:2000 "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 2107:2000 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 2107:2000 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	55
Houses and Apartments near major roads		
Living Areas	35	45
Sleeping Areas	30	40
Work Areas	35	45
Apartment common areas (e.g. foyer, lift lobby)	45	55

4.0 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 Memorial Ave.

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} =47 dB(A) plus 15]= 62 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 MECHANICAL PLANT & EQUIPMENT

The one (1) level of basement parking for the proposed development 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.

The noise from proposed mechanical plant is governed under Section 2.1 of the NSW Industrial Noise policy. Noise intrusion from the mechanical plant & equipment is generally considered acceptable if the weighted level of noise from the source measured over a 15 minutes interval does not exceed the rating background noise level (RBL) by more than 5dB at the boundary of the nearest residential receiver.

- $L_{Aeq,15\ minutes}$ < rating background level + 5

Section 3.1 of the above policy defines the background level as $L_{A90,15\ minutes}$ which 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.

Background noise levels in the area are governed by rail noise from the adjacent railway corridor, traffic noise from Memorial Ave and the surrounding commercial/residential activities.

We recommend that acoustic assessment of mechanical plant and equipment is carried out at CC stage when mechanical services plans have become available.

7.0 RECOMMENDATIONS (Windows, External Walls & Roof)

Building Component	Rw Rating to be Achieved
Sliding Windows & Sliding Doors in Bedrooms of Units *facing Memorial Ave* are to be 10mm laminated awning type with full perimeter acoustic seals. (1)	36-38
Sliding Windows & Sliding Doors in Living/Dining/Kitchen Areas of Units *facing Memorial Ave* are to be 10mm laminated awning type with full perimeter acoustic seals. (1)	33-36
All other Sliding Windows & Sliding Doors in Living/Dining/Kitchen & Bedroom Areas of all other 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 dwellings are to be unrestricted and to be in accordance with AS 2047 (Windows in Buildings). (1)	-
External Walls are to be Double skin cavity brick walls, brick veneer minimum 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 dwellings is to be Minimum 150mm Concrete Roof AND/OR Galvanised Steel Trough Roofing (0.5mm), on 10mm gypsum plaster board ceiling with 100mm gaps & 50mm thick, 15kg/m³ mineral wool batts in cavity (2).	45-50

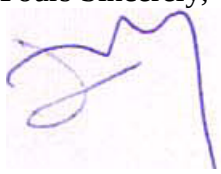
NB: This report is to be read in conjunction with the BASIX certificate and any other related building specification. (1). No weep holes in windows/sliders. All gaps between window & door frames and the masonry alls are to be sealed using acoustic foam Hilti CP620 or similar. Glass wool batts can be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

8.0 Discussion and Conclusion

The construction of the proposed development at No. 129-131 Memorial Ave, Liverpool 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 Council Conditions/Requirements.

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

Yours Sincerely,



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9.0 Appendix

Figure 1 - Site Location

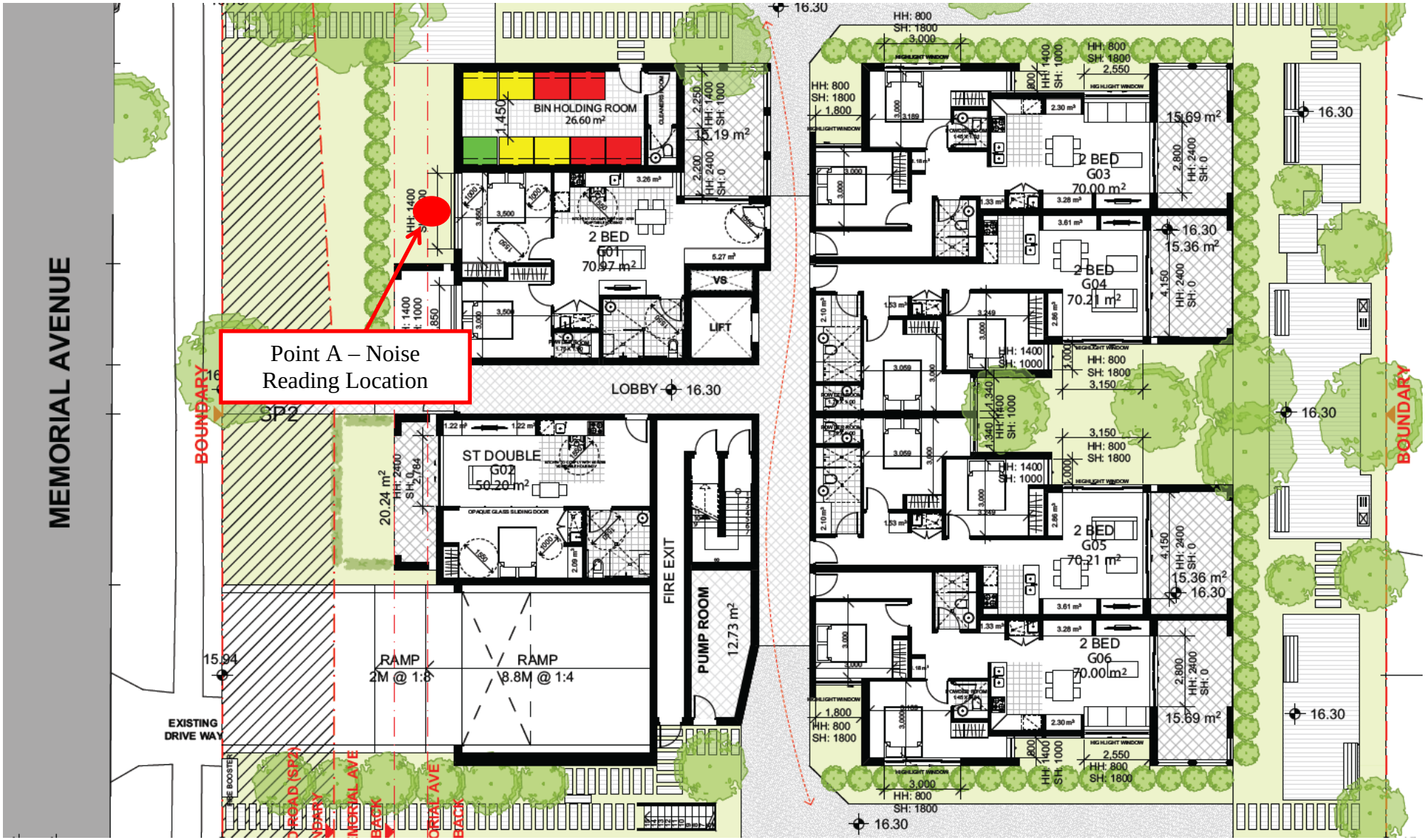

Figure 2 - Noise Reading Location

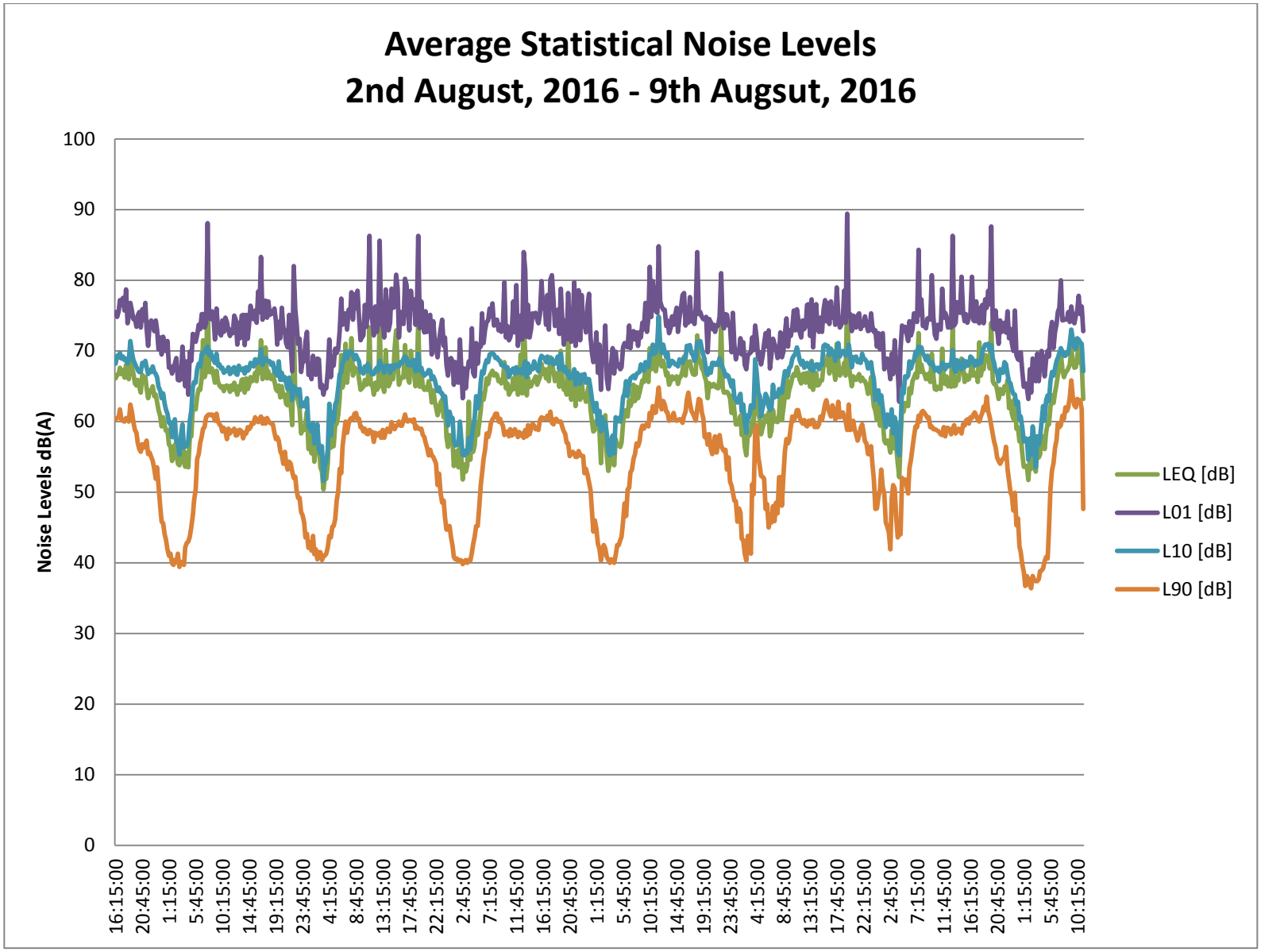

Figure 3 - Noise Survey