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26 Elizabeth Street, Liverpool – Development Application Acoustic Report

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Report prepared for:

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Report Title: 26 Elizabeth Street, Liverpool – Development Application Acoustic Report

Please note that this correspondence has only addressed the acoustical issues discussed. Other aspects of building design, such as fire-rating, structural and waterproofing considerations must be referred to others. All Figures are intended as Sketches showing intent for Acoustic purposes.

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1 INTRODUCTION

The proposed development is a mixed-used residential, commercial and hotel building. It consists of the following:

- Basement and above-ground car parking
- Podium level with commercial tenancies
- Hotel apartments and amenities
- Residential tenancies with penthouse apartments on Levels 32-34
- Restaurant on Level 35

The proposed development is located in the Central Business District of Liverpool. It is close to busy traffic routes, commercial premises, a major shopping centre (Westfield), a Church and a School. See Figure 1-1.

This Acoustic Report has been prepared for the Development Application. In general, at the DA stage, the important acoustic elements to consider are:

- What noise will the development generate that could impact on nearby and adjoining properties.
- What existing ambient noise is there that could impact on the development itself.

An noise data logger has been installed at the development site to monitor ambient noise levels. The noise logger data has been used to determine ambient noise impacting the future development, as well as background sound levels. The background sound levels will be used to set levels of allowable noise emission from the development itself.

Figure 1-1 Site Aerial Photograph © Nearmap 2018

2 EXISTING NOISE ENVIRONMENT

An NTi Audio XL2 Acoustic Analyser has been used as a noise logger for this project. This was installed at the site from August 2-8, 2018. The details of the noise monitoring are provided in the Appendix. The noise logger data is summarised here. These are free-field levels.

Table 2-1 Summary of Noise Logger Data, dBA

Time Period	LA90	LAeq,period	LAeq,1-hour
Daytime, 7am-6pm	51	62	64
Evening, 6pm-10pm	50		
Night-time, 10pm-7am	44	57	59

- The $L_{Aeq,1\text{-}hour}$ values are based on the highest 10^{th}-percentile values in each noise assessment period.

For this project, indoor noise goals for the commercial and hotel areas will be based on the highest 10^{th}-percentile $L_{Aeq,1\text{-}hour}$ in daytime and night-time periods, separately.

Based on the noise logger data, the traffic noise values for the commercial areas (free-field traffic noise values at the podium facade) are:

- $L_{Aeq,1\text{-}hour}$ daytime (7am to 10pm): 67dBA
- $L_{Aeq,1\text{-}hour}$ night-time (10pm to 7am): 62dBA

Based on the noise logger data, the traffic noise values for the Hotel apartments (free-field traffic noise values at the Hotel facade) are:

- $L_{Aeq,1\text{-}hour}$ daytime (7am to 10pm): 65dBA
- $L_{Aeq,1\text{-}hour}$ night-time (10pm to 7am): 60dBA

Based on the noise logger data, the traffic noise values for the residential apartments (free-field traffic noise values at the residential facade) are:

- $L_{Aeq,15\text{-}hour}$ (7am to 10pm): 63dBA
- $L_{Aeq,9\text{-}hour}$ (10pm to 7am): 58dBA

3 BUILDING FACADE

3.1 Acoustic Criteria

The building envelope construction provides sound insulation between the outside environment and the indoor acoustic environment. The following guidelines establish the desirable indoor environment:

- Liverpool Council DCP
- Infrastructure SEPP
- NSW Department of Planning, *Development Near Rail Corridors and Busy Roads – Interim Guideline*
- AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*

Liverpool Council's DCP includes general clauses about traffic noise impacts and amenity of occupants of dwellings adjoining "classified" roads. The relevant section is in Section 9 *Amenity and Environmental Impact* of Part 3.7 of the DCP 2008. This includes a Section on *Acoustic Impact*. The DCP does not include specific noise levels. Specific noise level goals are included in the other documents referenced.

The SEPP State Environmental Planning Policy (Infrastructure) 2007, Chapter 102 (Road Corridor) and Chapter 87 (Rail Corridor) set indoor design sound levels for residential dwellings impacted by ground-borne transportation noise. These noise goals stated in simple form in the SEPP but are expanded upon in more detail in the NSW Department of Planning *Guideline* document. Also, the SEPP applies only to roads with 40,000 vehicles per day – whereas the NSW DoP document can be applied more broadly to other roads as well.

Table 3-1 Traffic Noise Criteria NSW DoP Guideline document

Room	Window Condition	Noise Goal
Bedrooms	Windows closed	35dBA $L_{Aeq,9hr}$
	Windows open	45dBA $L_{Aeq,9hr}$
Other Habitable Rooms	Windows closed	40dBA $L_{Aeq,15hr}$
	Windows open	50dBA $L_{Aeq,15hr}$

- Note that if the indoor levels for the "windows open" condition cannot be met then habitable rooms are required to be provided with a form of alternative outside air ventilation.

Australian Standard AS2107 provides the following guidelines for commercial premises and Hotels. The NSW Department of Planning Guideline stipulates traffic noise goals over 15-hour and 9-hour, respectively. AS2107 nominates a "representative period", which for traffic noise is usually taken as 1 hour.

Table 3-2 AS2107 Noise Criteria, dBA over representative time period

Type of occupancy/activity	Design sound level LAeq
Hotels and motels	
• Conference areas with sound reinforcement	35 to 45dBA
• Dining rooms	40 to 45dBA
• Sleeping areas; in inner city areas or near major roads	35 to 40dBA
• Sleeping areas; in suburbs	30 to 35dBA
• Maintenance areas	<55dBA
Office buildings:	
• Board and conference rooms	30 to 40dBA
• Small meeting rooms	40 to 45dBA
• Executive office	35 to 40dBA
• General office areas	40 to 45dBA
• Reception areas	40 to 45dBA
Car parks	<65dBA

Note that the stated design sound levels in AS2107 include a contribution of noise from the traffic as well as from the indoor air-conditioning equipment. Therefore, it is usual practice to allow a noise contribution from each and so the individual component noise goal is 3dBA lower.

For this project, the noise goal for the commercial areas, including dining, restaurant, and so on is 40dBA $L_{Aeq,1\text{-}hour}$. This means that the traffic noise goal is 37dBA.

The noise goal for the Hotel apartments is 40dBA during daytime hours and 35dBA during night-time hours. This means that the traffic noise goal is 32dBA for these rooms.

The presentation of the acoustic assessment included in this Acoustic report is considered suitable for the Development Application stage of the project. At the detailed design-stage of the project, the Hotel Operator Acoustic Specification document would also have to be consulted.

3.2 Recommended Construction

The noise logger was located at a distance of 21m from the centreline of Elizabeth Street. The future building façade will be closer to the road than the noise logger. Acoustic calculation has been used to determine the façade noise levels. Acoustic calculation has also been used to determine the sound insulation requirements of the façade.

Commercial Tenancies Including Restaurant

Glazing must have sound insulation at least Rw+Ctr 32. Therefore, the recommended minimum construction is:

- 10.38mm laminated glass.
- If double-glazed IGUs are used, then glass configuration is likely to need to be similar: 10mm glass – 12mm gap – 6mm glass.

In the acoustic calculations, it has been assumed that commercial tenancies have commercial-grade carpet and acoustic ceiling tiles.

Hotel Apartments

For corner apartments, glazing sound insulation must be at least Rw+Ctr 36. Therefore, the recommended minimum construction is:

- 12.5mm Viridian VLam Hush proprietary acoustic laminated glass.
- If double-glazed IGUs are used, then glass configuration is likely to need to be: 8mm glass – 16mm gap – 10.5mm Viridian VLam Hush.

For non-corner apartments, glazing sound insulation must be at least Rw+Ctr 30. Therefore, the recommended minimum construction is:

- 6.38mm laminated glass.
- If double-glazed IGUs are used, then glass configuration is likely to need to be: 8mm glass – 12mm gap – 6mm glass.

In the acoustic calculations, it has been assumed that the Hotel apartments have carpeted floors (except in wet areas).

Residential Apartments

Glazing sound insulation must be at least Rw+Ctr 30. Therefore, the recommended minimum construction is:

- 6.38mm laminated glass.
- If double-glazed IGUs are used, then glass configuration is likely to need to be: 8mm glass – 12mm gap – 6mm glass.

It has been assumed that most of the residential apartments have carpeted floors in habitable rooms, except for the penthouse apartments (Level 32-34), which will likely have hard floor finishes. The acoustic calculations showed the same glazing requirements as for the other apartments.

External Walls

If masonry walling is used, then this must comply with a minimum sound insulation rating of Rw+Ctr 45.

If lightweight external walling is used – for example, a curtain wall with opaque panels – the same minimum sound insulation rating applies as for glazing.

All facades must have the same minimum sound insulation properties.

3.3 Alternative Ventilation

When glazing is required to be kept closed to meet indoor acoustic goals, then alternative ventilation must be provided to satisfy ventilation codes. This may take the form of ducted air-conditioning incorporating outside air. Other forms of alternative ventilation are also possible. The details of the system(s) to be used for this project will be established at detailed Design Stage and/or CC Stage.

4 NOISE EMISSION FROM THE DEVELOPMENT

It is considered appropriate to apply the following documents to assess noise emission from this development:

- NSW EPA *Noise Policy for Industry* (NPfI) guideline document. This document has replaced the previous EPA document, *Industrial Noise Policy*, from October 2017.
- Protection of the Environment Operations (Noise Control) Regulation 2008.

The EPA *Noise Policy for Industry* (NPfI) has two sets of noise trigger levels which should be complied with; the *intrusiveness level* and the *amenity level*. These are assessed in each noise assessment period; being daytime, evening and night-time. The more stringent noise goal in each time period is the applicable one in that time period.

In addition to the above, NSW legislation, *Protection of the Environment Operations (Noise Control) Regulation 2008* (POEO Regulation), places additional restrictions on operation of residential air-conditioning condensers and hot-water heat-pumps.

The intrusiveness level is "background + 5dBA".

The site is considered an "urban" area, as it has proximity to relatively busy roads, shopping district and commercial premises on adjoining boundaries. The amenity level for residential boundaries in urban areas is:

- Daytime, 7am to 6pm: 60dBA
- Evening, 6pm to 10pm: 50dBA
- Night-time, 10pm to 7am: 45dBA

Note that under the NPfI, the actual amenity level for a given development is 5dBA lower than these levels.

The POEO Regulation for operation of residential air-conditioning equipment after 10pm is effectively "background – 10dBA".

Note that noise from car park fans and other fans is assessed using the EPA *intrusiveness* and *amenity* noise levels. Noise emission from residential air-conditioning is assessed the same way up until 10pm. After 10pm it is assessed differently, in accordance with the POEO Regulation.

The Rating Background Level (RBL, L_{90}) background sound levels are as follows:

- Daytime, 7am to 6pm: 51dBA
- Evening, 6pm to 10pm: 50dBA
- Night-time, 10pm to 7am: 44dBA

By comparing the intrusiveness level ("background + 5dBA") with the amenity levels in each time period, and choosing the lower noise level in each case, the noise emission goals for this project have been determined to be:

- Daytime, 7am to 6pm: 55dBA (based on amenity level – 5dBA)
- Evening, 6pm to 10pm: 45dBA (based on amenity level – 5dBA)
- Night-time, 10pm to 7am: 40dBA (based on amenity level – 5dBA)
- Night-time, 10pm to 7am: 35dBA for resi A/C condensers and H/W heat pumps

It is note that the allowable noise emission at commercial boundaries is higher than the above noise goals. However, the noise goals listed above are considered the most appropriate ones because (a) they apply at the balconies and facades of apartments within the same development, and (b) there is potential for other sites adjoining this site to be redeveloped in the future.

All of the plant and equipment at the site must comply with these noise goals – note that noise emission is assessed cumulatively so noise from all plant operating must be considered at design stage. It is usual for car park ventilation fans to include 2D acoustic duct silencers and/or acoustically lined duct to ensure that noise levels at the external grilles comply with EPA goals. These are straightforward design practices and should be reviewed at design/CC stage.

Residential Air-Conditioning and Hot-Water Heat Pump Units

Noise emission from commercial plant and equipment must comply with the noise goals stated above. The same also applies to residential air-conditioning equipment up until 10pm. After 10-pm, a different regime applies. This is covered in the Protection of the Environment Operations (Noise Control) Regulation 2008. See below.

Protection of the Environment Operations (Noise Control) Regulation 2008

The relevant clause in the *POEO (Noise Control) Regulation* is contained in Part 4 > Division 2 > Subdivision 1 > Clause 52, viz:

52 Air conditioners and heat pump water heaters

1. A person must not cause or permit an air conditioner or heat pump water heater to be used on residential premises in such a manner that it emits noise that can be heard within a habitable room in any other residential premises (regardless of whether any door or window to that room is open):
   (a) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or
   (b) before 7 am or after 10 pm on any other day.

Maximum penalty: 100 penalty units in the case of a corporation, 50 penalty units in the case of an individual.

2. A person is not guilty of an offence under subclause (1) in relation to a heat pump water heater if the conduct alleged to give rise to the offence occurs within 6 months after the commencement of this Regulation.

3. A person is not guilty of an offence under subclause (1) unless:
   (a) the person has, within 7 days after causing or permitting an air conditioner or heat pump water heater to be used in such a manner, been warned by an authorised officer or enforcement officer not to cause or permit the air conditioner or heat pump water heater to be used in that manner, and
   (b) the person causes or permits an air conditioner or heat pump water heater to be used in that manner within 28 days after the warning has been given.

4. In this clause:

heat pump water heater means a device that heats water using the energy generated from the compression of a gas.

The question about "audibility" is not clearly defined in any published statute, however, in practice, a noise level that is 10-15dBA below the L90 background sound level can be considered to be inaudible. In this case, that would mean noise emission of 34dBA or lower at the residential boundary, including at the boundary of other residential apartments within the same development. This will be addressed at detailed design stage.

5 OTHER ACOUSTIC ITEMS

The following acoustic items should also be considered at Design Stage and/or CC Stage:

- Detailed design for mechanical services noise emission from the building.
- Vibration-isolation of the indoor swimming pool.
- Part F5 of the BCA or Building Code of Australia (now part of the National Construction Code) sets out minimum sound insulation requirements for residential and hotel occupancies in a building. It is noted that the Hotel Operator may have specific Acoustic requirements as well.

6 CONCLUSION

This Report has considered the acoustic implications of the proposed development. Sound-rated façade construction has been recommended for all facades. Noise goals have been set for design purposes for noise emission from mechanical plant at the proposed development.

It is concluded that the project can comply with established acoustic criteria for both noise emission as well as noise impacts on the development itself.

7 APPENDIX A – GLOSSARY OF TERMS

Most locations where ambient noise is studied are affected by environmental noise which varies continuously, largely as a result of variations in road traffic. To describe the overall noise environment, a number of noise descriptors are used. These involve sampling the varying sound level for a defined time period (e.g. 15 minutes, or for the 9-hours from 10pm to 7am). Statistical and other analysis of the varying sound level are carried out. These descriptors are described below.

Maximum Noise Level (L_{Amax})	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
L_{A1}	The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.
L_{A10}	The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} has in the past been used as descriptor for environmental noise and road traffic noise.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. (In simple terms it is the average sound level). This descriptor is usually used to measure environmental noise and road traffic noise.
L_{A50}	The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.
L_{A90}	The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the **background noise level**.
ABL	The Assessment Background Level is the single figure background level representing each assessment period (day, evening and night) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period, day, evening and night.
SEL	Single Event noise Level. This is a shorthand means to describe the acoustic energy of a noise event. Technically it is the same acoustic energy compressed to fit into 1 second; i.e. L_{Aeq} + 10 x Log (duration in seconds of the noise event).

8 APPENDIX B

8.1 Noise Logger

A noise logger was installed at the front of the property in order to monitor traffic noise levels. See the photograph below.

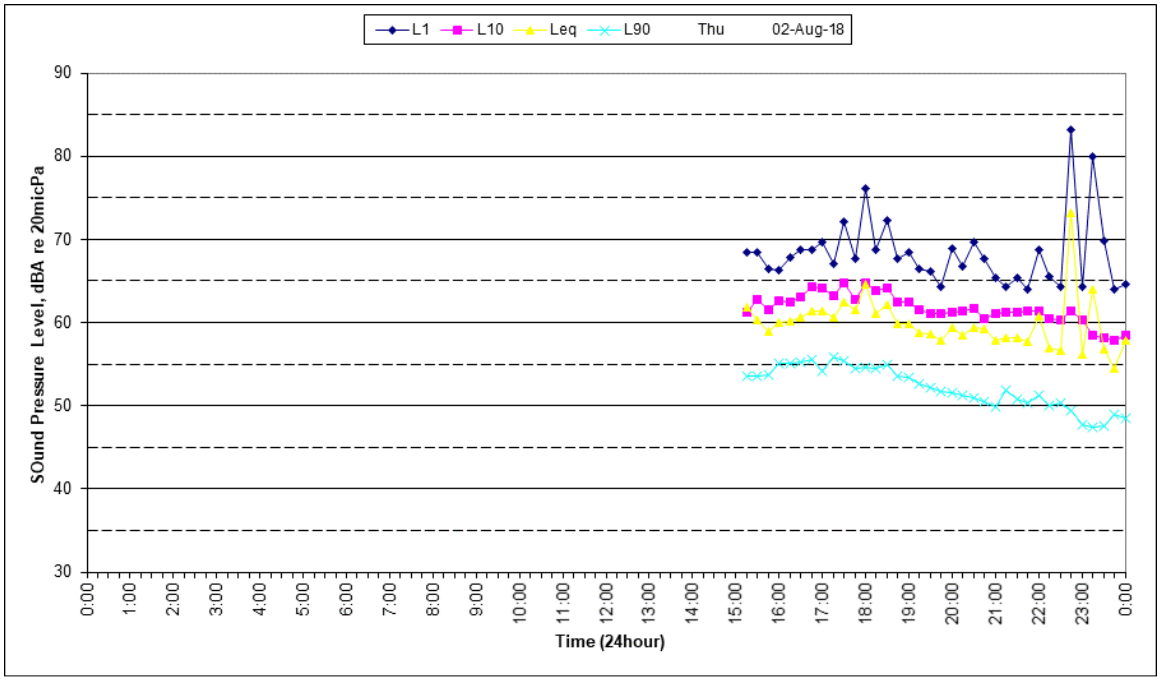
Figure 8-1 Noise logger installed near the front of the site

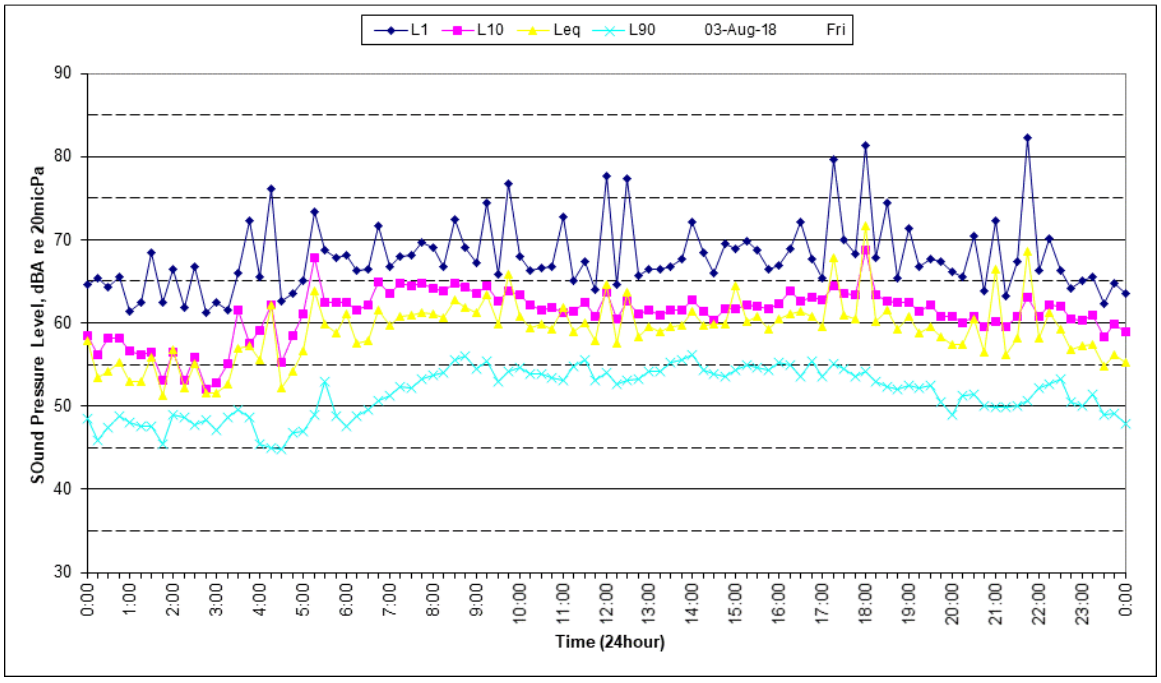
An NTi Audio XL2 Acoustic Analyser with Class 1 Microphone was used for this project. The device was set to 15-minute sampling periods, A-weighted and fast response. This equipment continuously monitors noise levels and stores statistical noise level descriptors for each sampling period. The equipment calibration was checked before and after the survey with a Pulsar Model 105 Calibrator and no significant drift was noted.

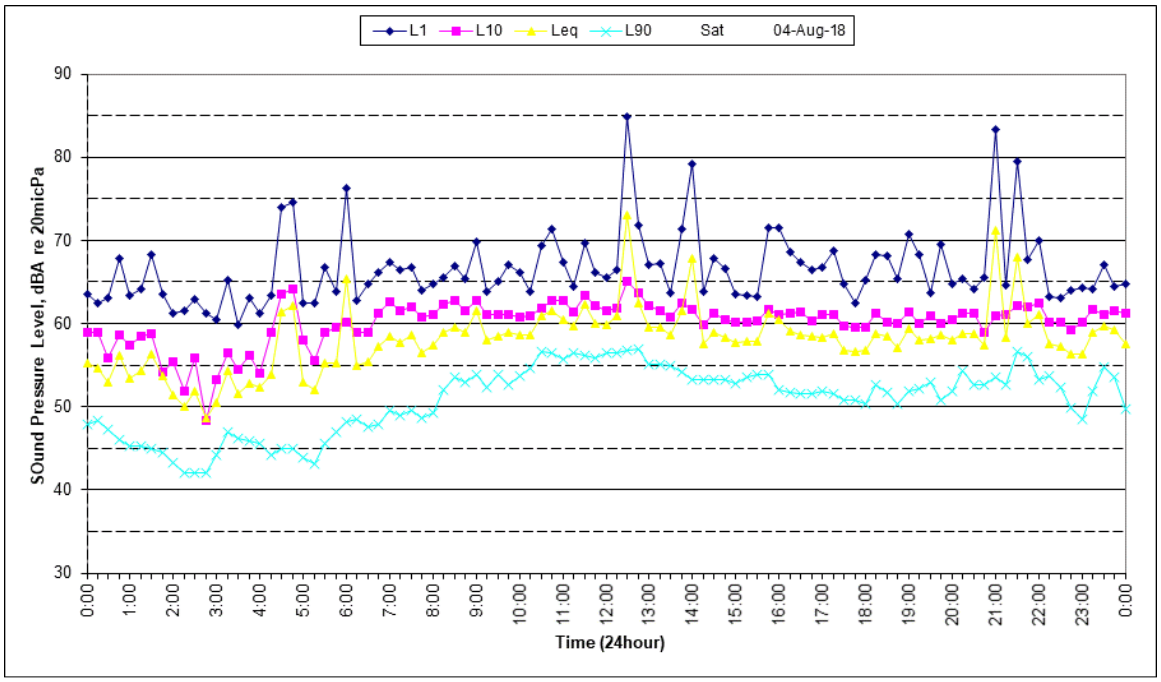
The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time, respectively. The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle or aircraft. The L_{A90} level is normally taken as the background noise level during the relevant period. L_{Aeq} is the energy-average sound level during the measurement; in simple terms it can be thought of as the average sound level.

The graphical results of the noise logging are shown on the following pages.

Noise Logger Graphs



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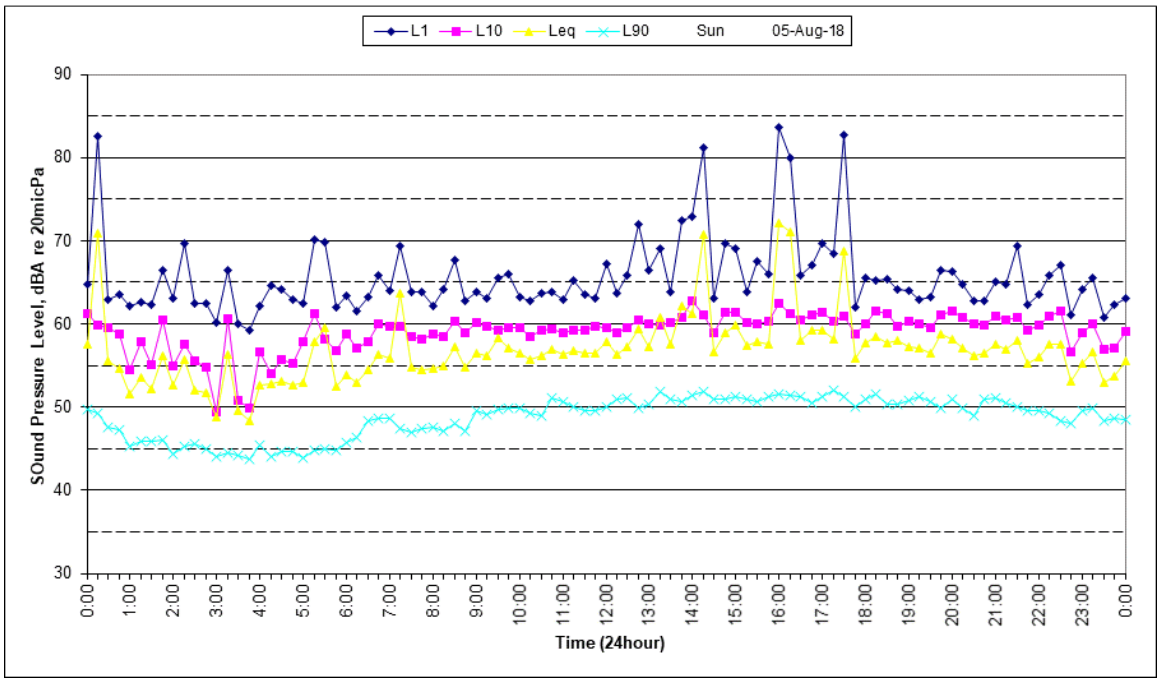
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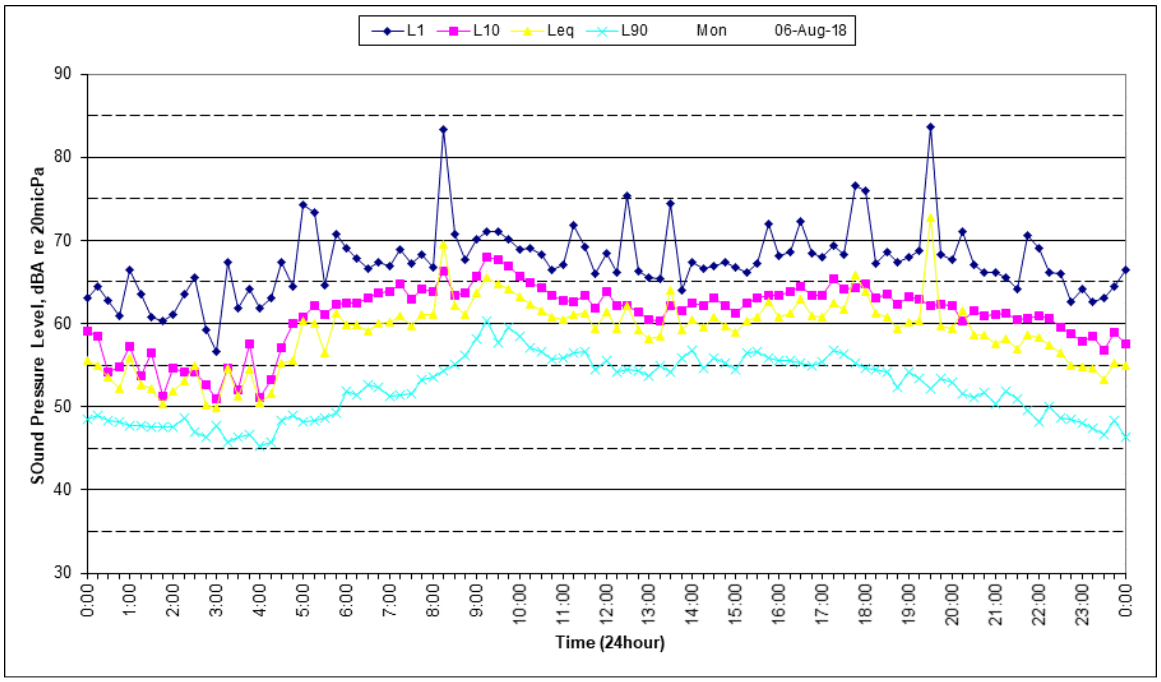
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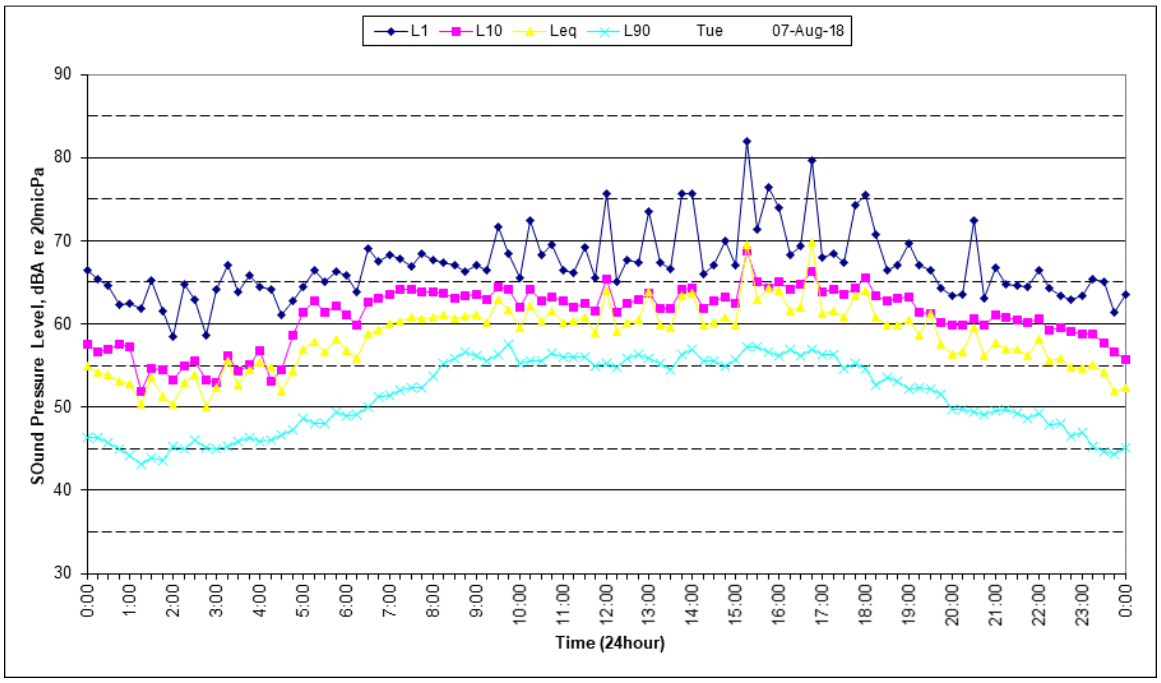
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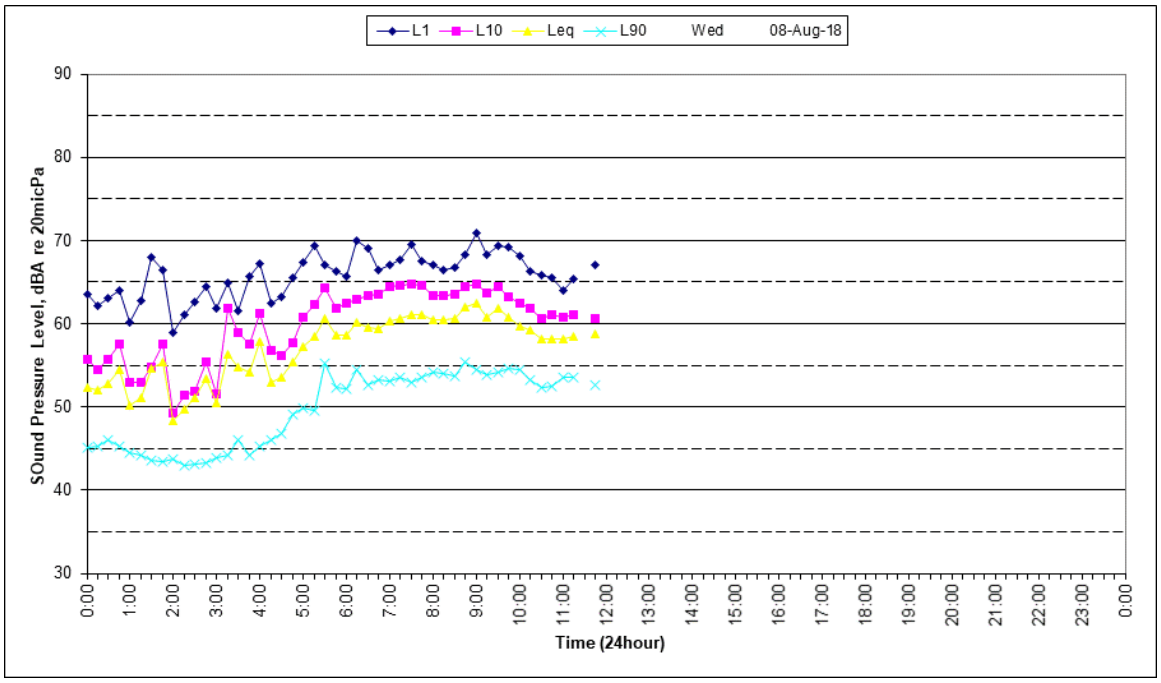
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