ACOUSTIC NOISE & VIBRATION SOLUTIONS P/L
Suite 9, No. 438 Forest Rd, Hurstville, NSW 2220 ABN: 37 169 392 456
Phone: (02) 9793 1393 Email: info@acousticsolutions.com.au

Acoustic Report

Part 1 - AS 2107:2016 Internal Amenity Noise Assessment

Part 2 - Environmental Impact Assessment

For The Proposed Seniors Living Development

at

No. 69 Melwood Avenue, Forestville

Prepared By: Domeniki Tsagaris (M.I.E. Aust), B.E.(UNSW)
Australian Acoustical Society (Sub).
Approved By: Moussa Zaioor (M.I.E. Aust), CPENG,
Australian Acoustical Society (Member).

Date: December 05th, 2022
Reference No.: 2022-395

Document Control

Date	***Revision History***	***Prepared By:***	***Reviewed and Authorised by:***
27/10/2022	Initial Report	Domeniki Tsagaris	Moussa Zaioor
05/12/2022	Final Report	Domeniki Tsagaris	Moussa Zaioor

Table of Contents

1.0 SCOPE OF WORK & SITE DESCRIPTION

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. 69 Melwood Avenue, Forestville is built to achieve acceptable internal noise levels as per Northern Beaches Council requirements.

Noise intrusion levels from neighboring Melwood Oval and traffic noise on Melwood Ave , are to be within the limits adopted by AS/NZS 2107:2016 "Acoustics – Recommended Design Sound Levels and Reverberations times for Building Interiors" and the Northern Beaches Council requirements.

Noise breakout from the use of the proposed building, including all proposed mechanical plants and equipment is to comply with the NSW Noise Policy for Industry (2017) and Northern Beaches Council requirements.

The subject site is located on Melwood Ave in the suburb of Forestville (Figure 1 – Site Location) (Figure 2 - Surrounding Environment). The architectural plans by CD Architects dated September, 2022 are for the proposed construction of Seven (7) seniors living units comprising of five (5) three-bedroom units and two (2) two-bedroom units with a total of 13 car spaces provided on Level 1.

2.0 ACOUSTIC DESCRIPTORS

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} is a common noise 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. This measure is also a common measure of environmental noise and road traffic noise.

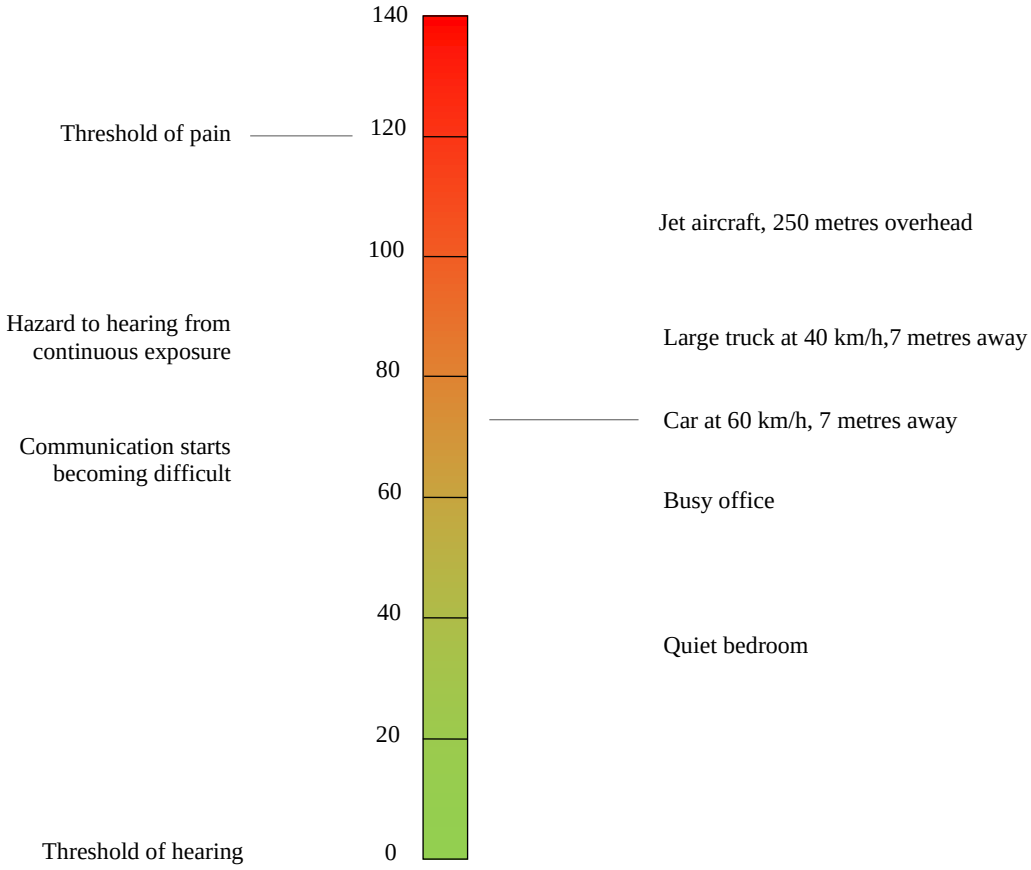
L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

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 (daytime, evening and nighttime) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and nighttime.

The level of common sounds on the dB(A) scale as the figure below:



3.0 NOISE SURVEY, INSTRUMENTATION & RESULTS

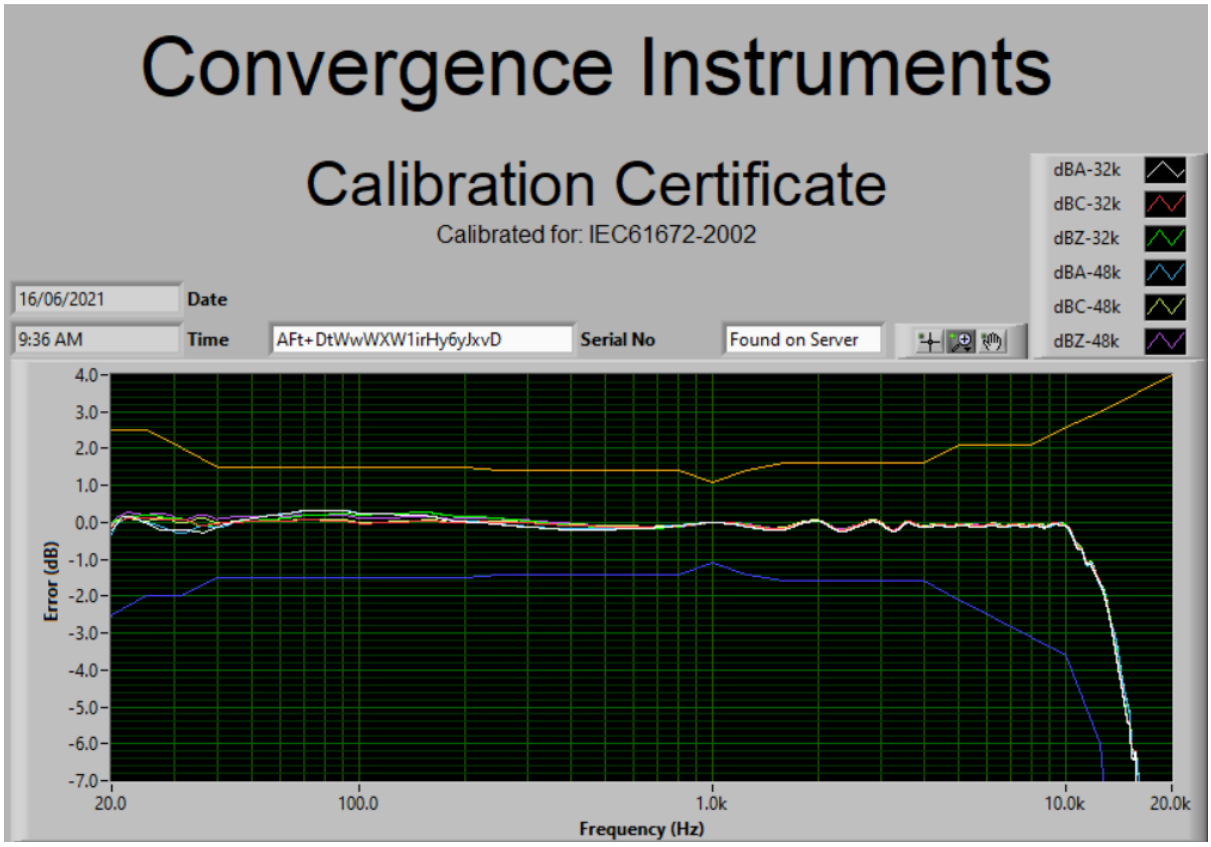
On the 7th of November,2022 an engineer from this office went to the above address to carry out acoustic measurements at the northern boundary of the proposed development in order to determine existing noise levels (Figure 3 – Noise Reading Location Point A).

Unattended noise measurements at point A were carried out for a period of seven (7) days between the 7th of November 2022 and the 14th November, 2022. The noise survey was conducted to determine the $L_{(A90,\ 15\ minutes)}$ and $L_{(Aeq,\ 15\ minutes)}$ of the existing background and ambient noise levels during the Day (7:00-18:00), Evening (18:00-22:00) and Night (22:00-7:00).

All unattended sound level measurements and analysis performed throughout this project are carried out with a NSRTW_MK3 wireless sound level data logger (Serial No. AFt+DtWwWXW1irHy6yJxvD- Office Tag- machine 3). The sound logger specifications are as follows:

- Type 1 digital MEMS microphone
- Non-volatile 128 Mb recording memory
- Records L-max, L-min and Leq levels
- Log interval adjustable from 125 ms (8 points per second) up to hours
- A, C and Z weighting curves
- Oscilloscope and spectrum analyser features
- Observes and records 100% of the acoustic signal
- Software calculates global Leq according to ISO and OSHA methods
- WIFI connectivity to report measured levels remotely
- Weatherproof casing designed for indoor/outdoor applications
- Activity detection and logging.
- Long-term measurement and recording of acoustic levels for environmental impact studies.

The loggers are factory calibrated and front logger manufacturer's calibration certificate dated 16/06/2021 is presented below:



Calibration Certificate

The microphone was positioned 1.5m from ground level. The machines were calibrated prior and after reading using our Svantek SV 33A S/N: 90200 class 1 Calibrator with No significant drift recorded. Any readings affected by strong wind or rain have been disregarded. A Summary of those readings are presented in the tables below:

Table 3.0 – Summary of Unattended Noise Measurements at Point A
(7th November, 2022 – 14th November, 2022)

Location	***Time of Day***	***Leq 15 Minute dB(A)***	***L90 15 Minute dB(A)***	***RBL ****
Point A – Northern Boundary of Site	Day 7:00-18:00	49	44	40
	Evening 18:00-22:00	46	43	37
	Night 22:00-7:00	44	38	32

* RBL- Rated background noise levels as determined in accordance with Fact Sheet B as per the Noise Policy for Industry 2017.

PART 1 – INTERNAL AMENITY NOISE ASSESSMENT

4.0 AUSTRALIAN STANDARD 2107:2016

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".

Noise intrusion levels from neighboring Melwood Oval and traffic noise on Melwood Ave , are to be within the limits adopted by AS/NZS 2107:2016.

AS/NZS 2107:2016 sets out design internal noise levels and reverberation times for different buildings depending on the use of these structures. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply that to the sound level measured within the space unoccupied although ready for occupancy. In Table 1, Page 13, the standard recommends the following noise levels for residential buildings.

Type of occupancy/activity	Design sound level ($L_{Aeq,t}$) range	Design reverberation time (T) range, s
RESIDENTIAL BUILDINGS (see Note 5 and Clause 5.2)		
Houses and apartments in inner city areas or entertainment districts or near major roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	35 to 45	—
Sleeping areas (night time)	35 to 40	—
Work areas	35 to 45	—
Houses and apartments in suburban areas or near minor roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	30 to 40	
Sleeping areas (night time)	30 to 35	
Work areas	35 to 40	—

5.0 BUILDING COMPONENT RECOMMENDATIONS

The façade specification can be conservatively estimated using the following formula:

$R_w = L_{(ext)} - L_{(int)} + 10 \log (S/A) + ADJ$ where

$R_{w=}$ Transmission loss of room façade.
$L_{(ext)=}$ External Noise level L eq $_{x\ hrs}$.= dB(A).
$L_{(int)=}$ Internal Noise level L eq $_{x\ hrs}$.= dB(A).
S = Total exterior surface area of the room.
A = Total sabins of absorption of the room.
ADJ = 3 + F+ G where F = 2 for Rail noise, F= 4 for Traffic noise with negligible trucks [percentage < 10%], and F= 6 for Traffic Noise with more than 10% trucks.

G allows for Primary angles of sound per the table below;

Angle of Incidence, deg.	Adjustment (G), dB
0-30	-3
30-60	-1
Random	0
60-80	+2

As the façade is made up of individual elements with different transmission coefficients. The total transmission loss of the façade is calculated using the following equation where n represents each material components of the façade :

$$R_{Total} = -10log_{10}\left(\frac{1}{\sum_{n=1}^{N} S_n}\sum_{n=1}^{N} S_n \tau_n\right)$$

.

6.0 FAÇADE & ROOF BUILDING COMPONENTS

The most practical building façade and roof components and material specifications to suit the required noise reduction indices for the above project are provided in Table 6.1 below:

Table 6.1 Windows/Sliders, Doors, Walls & Roof Specifications

Building Component	Rw Rating to be Achieved
Windows & Sliding Doors in all Habitable Areas of all Units are to be 6.38mm laminated type with full perimeter Fin Mohair Woven Brush Seals (1)(2)(3).	**32**
Windows in non-habitable areas (Bathrooms/Laundries/Storage Areas etc) are unrestricted and in accordance with AS 2047 (Windows in Buildings) (1)(2)(3).	**-**
Units Entry Doors are to be solid core 42mm thick, soft plastic gasket around sides, top and drop seal at base or any other combination having an STC of minimum 30 (2)(3)	**30-33**
External Walls are to be 270/250 mm double brick, brick veneer, hebel, dincel construction or any other method of wall construction with Rw of 50. (2)(3)	**50**
Roof of all Units is to be Minimum 150mm Concrete.	50

NB: This report is to be read in conjunction with the BASIX certificate and any other related building specification. (1). No through weep holes in windows/sliders. (2) All gaps between window & door frames and the masonry walls are to be sealed using acoustic foam Hilti CP620 or similar. Glass wool batts should be applied prior to the application of the foam to seal larger gaps. (3) All gaps are to be acoustically sealed.

*****Glazing Notes -Leaks & Glazing Attenuation-**

- The Acoustic performance of a glazing system highly depends on the leaks around and within the glazing frame and façade. A double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 30 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, a double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.
- A 10.38mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 29 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, 10.38m mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.
- A double-glazing system with Rw of 40, a 10.38m mm laminated glazing system with Rw of 35, and a 6.38 mm laminated glazing system with Rw of 32 will all attain almost the same Rw of around 20 (less than that of 3.0 mm float glass) at a leak of 1 % in the façade or a within/around the glazing system.

The graph below shows the actual transmission loss achieved inside a room with different glazing thicknesses relative to small leaks occurring along the window frame and façade.

- A test report is to be provided from a recognized acoustic laboratory, verifying that the glazing system (glass, frame and seals) will meet the nominated sound rating required.

PART 2 – ENVIRONMENTAL IMPACT ASSESSMENT

7.0 ACCEPTABLE NOISE LEVEL FROM PROPOSED DEVELOPMENT– Noise Break out -

7.1 NSW NOISE POLICY FOR INDUSTRY (2017)

The above policy seeks to promote environmental well-being through preventing and minimizing noise by providing a framework 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.

7.1.1 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.

The recommended amenity noise levels for the proposed development No. 69 Melwood Avenue, Forestville are presented in Table 7.1.1.1 below.

Table 7.1.1.1- Recommended Amenity Noise levels

Type of Receiver	***Area***	***Time Period***	***Recommended Leq Noise Level, dB(A)***
Residence	Suburban	Day	55
		Evening	45
		Night	40

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

Factor	***Correction***
Tonal Noise	+ 5 dB [1,2]
Low-Frequency Noise	+ 2 or 5 dB [1]
Intermittent Noise	+ 5 dB
Duration	+ 0 to 2 dB(A)
Maximum Adjustment	Maximum correction of 10 dB(A)[1](excluding duration correction)

1. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
2. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Correction for duration is to be applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aequ,15min}$ equivalent noise criterion is depicted in Table 7.1.1.3 for the duration of the event. This adjustment accounts for unusual and one-off events and does not apply to regular and/or routine high-noise level events.

Table 7.1.1.3 – Adjustment for Duration as per Fact Sheet C (Noise Policy for Industry 2017)

Allowable duration of noise (one event in any 24-hour period)	***Allowable exceedance of LAeq,15min equivalent project noise trigger level at receptor for the period of the noise event, dB(A)***	
	Daytime & evening (7 am–10 pm)	***Night-time (10 pm–7 am)***
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

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. 69 Melwood Avenue, Forestville is as follows:

- Day period: **55** – 5 + 3 = 53 dB(A)
- Evening period: **45** – 5 + 3 = 43 dB(A)

- Night period: **40** – 5 + 3 = 38 dB(A)

7.1.2 INTRUSIVENESS NOISE CRITERIA

Section 2.3 of the NSW Noise Policy for Industry summarizes the intrusive criteria as below:

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

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),

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 the daily/evening/night lowest tenth percentile of L_{90} background noise levels and calculated in accordance with Fact Sheet B of the NPfI 2017.

The predicted noise from the source $L_{Aeq,15\ min}$ is measured as at the most affected point within the most affected residential at the point where the most impact occurs. Therefore, the acceptable L_{eq} noise intrusiveness criterion for the proposal during the day, evening and night is as follows:

- **Day period:** **40 + 5 = 45 dB(A)**
- **Evening period:** **37 + 5 = 42 dB(A)**
- **Night period:** **32 + 5 = 37 dB(A)**

7.1.3 PROJECT NOISE TRIGGER LEVEL

A summary of intrusiveness and amenity noise levels as determined in sections 7.1.1 & 7.1.2 are shown in Table 7.1.3 below:

Table 7.1.3- Summary of Intrusiveness and project amenity noise levels

Period	***Intrusiveness Noise Level dB(A)***	***Project Amenity Noise level dB(A)***
Day Time (7:00am-6:00pm)	45	53
Evening Time (6:00pm-10:00pm)	43	43
Night & Early Morning (10:00pm – 7:00am)	37	38

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:

- **Day period $L_{Aeq,15\ min}$: 45 dB(A)**
- **Evening period $L_{Aeq,15\ min}$: 43 dB(A)**
- **Night period $L_{Aeq,15\ min}$: 37 dB(A)**

The proposed developments and its activities including all mechanical plant will not exceed the project noise trigger level at the most sensitive location, provided all noise control recommendations in Section 8.0 are adhered to.

8.0 MECHANICAL PLANT

A range of mechanical plant and equipment will be included in the proposed development at No. 69 Melwood Ave, Forestville. Noise emitted by the use of the proposed mechanical plant is assessed in accordance with the trigger noise level as determined in section 7.1.3 of this report.

The proposed basement levels might require a mechanical ventilation system which needs to be designed in accordance with Australian Standard AS 1668.2:2012 *"The use of ventilation and air-conditioning in buildings -Mechanical ventilation in buildings"* for smoke clearance.

Air-conditioning will also be installed in the proposed development. Typical sound power noise levels for car park exhaust fans, condensing units, and security roller doors levels are presented in the table below:

Table 9.1.1 – Typical Mechanical Plant Leq Sound Power Levels

FREQUENCY [Hz]	63	125	250	500	1k \	2k	4k	8k	dBA
Typical Car park Exhaust fan	80	82	84	87	86	83	78	71	**90**
Typical Condensing Unit- air condition	71	69	67	61	58	54	47	44	**64**
Typical Condensing Unit- Refrigeration	76	74	72	66	63	57	52	49	**69**
Leq, 15 mins Car-Park security roller door.	69	63	65	65	77	78	80	79	**85**

Regarding the above-mentioned noise sources, the following is noted:

- Noise from mechanical plant and equipment is based on file data of pervious similar projects.
- The data calculated by our office ranged widely and is dependent on whether quieter and well-maintained equipment is used or not.
- The refrigeration mechanical plant will always operate, irrespective of whether the commercial units are operating or not. However, when the commercial units are closed,

the ambient temperature is lower, thus the refrigeration condensers will operate on low speed.

- The air-condition equipment for commercial/retail properties will only operate during operating hours.

As the proposed development is still in the initial application stage, we recommend that further acoustic assessment is carried out when the development has been approved and Mechanical Services plans have been prepared for our review.

9.0 RECOMMENDATIONS

The recommendations listed in table 9.1 below are essential for the Noise break-out from the proposed development to comply with section 7.0 of this report.

Table 9.1 – Noise Break Out Mitigation

Item	RECOMMENDATIONS
Basement Roller Door	• 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.
AC Condenser Units	• We recommend that all outdoor air-conditioning units to be acoustically enclosed or set away by more than 3.0m from any boundary with a sound power level of each unit no more than 65 dB(A). We recommend acoustic assessment at CC stage of all proposed A/C units position and specifications.
General Mechanical Plant	• We recommend acoustic assessment at CC stage of all proposed mechanical plants and equipment once the development has been approved and full Mechanical Services Plans have been prepared. In the meantime, we recommend the following: • Procurement of quiet plant (when required) and the maintenance of existing plant. • Strategic positioning of plant away from potential sensitive receivers. • Commercially available silencers or acoustic attenuators for air discharge and air intakes of plant. • Acoustically lined and lagged ductwork.

	• Acoustic screens and barriers between plant and sensitive neighbouring premises; and/or, • Partially enclosed or fully enclosed acoustic enclosures around plant.
Sound Barrier Fencing	• We recommend a 1.8 High Gap free fence along the perimeter of the site. Fence can be of lapped & capped timber, colourbond or masonry construction.

As the proposed development is still in the initial application stage, we recommend that further acoustic assessment is carried out when the development has been approved and Mechanical Services plans have been prepared for our review.

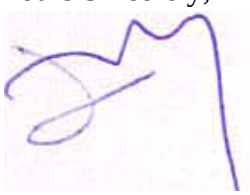
10.0 DISCUSSION & CONCLUSION

The proposed development at No. 69 Melwood Ave, Forestville if carried out as recommended in plans and specifications and including the acoustic recommendations in this report, will meet the Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended Design Sound Levels and Reverberations times for Building Interiors" and North Beach Council requirements.

Noise Break Out from the proposed development will comply with the requirements of the NSW Noise Policy for Industry (2017) and North Beach Council, provided recommendations in Section 9 of this report are adhered to.

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

Yours Sincerely,



M. Zaioor
M.S. Eng'g Sci. (UNSW).
M.I.E.(Aust), CPEng
Australian Acoustical Society (Member).

11.0APPENDIX

Figure 1 - Site Plan

Figure 2 - Noise Reading Location Point A

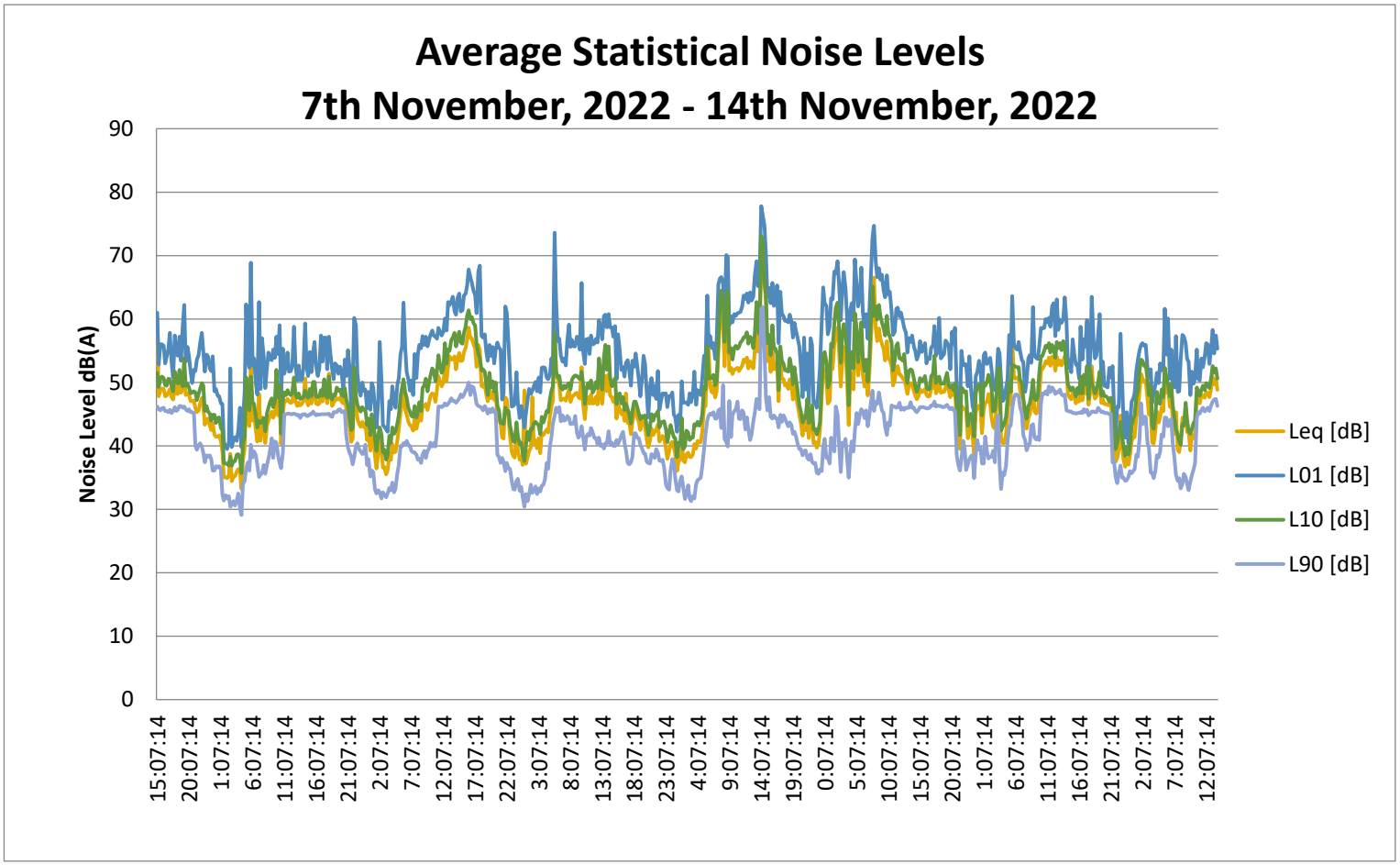


Figure 3 - Noise Survey Point A