ACOUSTIC REPORT FOR DEVELOPMENT APPLICATION

LINDFIELD VILLAGE LIVING PROJECT, LINDFIELD

JHA

CONSULTING ENGINEERS

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1 INTRODUCTION

JHA Consulting Engineers has been engaged by Ku-ring-gai Council to provide an acoustic assessment for the proposed residential development located at 259 & 265-271 Pacific Highway, Lindfield, NSW.

The proposal involves demolition of existing buildings and construction of a residential building with a common area. An acoustic assessment has been undertaken and it is detailed in this report along with the findings and recommendations. It has been prepared as part of the Development Application to be submitted to the Ku-ring-gai Council.

The objectives of this acoustic assessment are:

- Identify the external noise and vibration sources that will potentially affect the proposed development.
- Carry out noise surveys to determine existing ambient and background noise levels on site plus external noise sources that will potentially affect the proposed development.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation for the following issues:
- Carry out a preliminary acoustic assessment to determine whether the relevant criteria can be achieved and, where applicable, comment on noise control measures required to achieve compliance with the relevant noise level criteria.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.
- Recommendations for vibration level criteria during construction phase.

This document and related work has been prepared following JHA Consulting Engineers Quality Management System, which is based on AS/NZS ISO 9001 and ISO 14001 Environmental Management Systems.

2 PROJECT OVERVIEW

The proposed development site is located at 259 & 265-271 Pacific Highway, Lindfield, NSW. The proposed development is bordered by the Pacific Highway to the west, private residential development to the south; the northern rail corridor to the east and commercial (B2 Zone) to the north.

The existing buildings and facilities on site are the Lindfield Council Library, self-contained residential units, Lindfield Community Centre, Lindfield Resource Centre, Ku-ring-gai Youth Development Services, Lindfield Community Centre Tennis Courts, Carpark and access road.

Surrounding buildings are a mix of commercial and residential buildings. A car workshop is adjacent to the proposed development at the North of the site. Residential receivers are at the east of the rail corridor and to the west in the Pacific Highway, which is a combination of commercial and residential receivers. At the south of the site is located a commercial receiver. Figure 1 shows the proposed site location and surroundings.

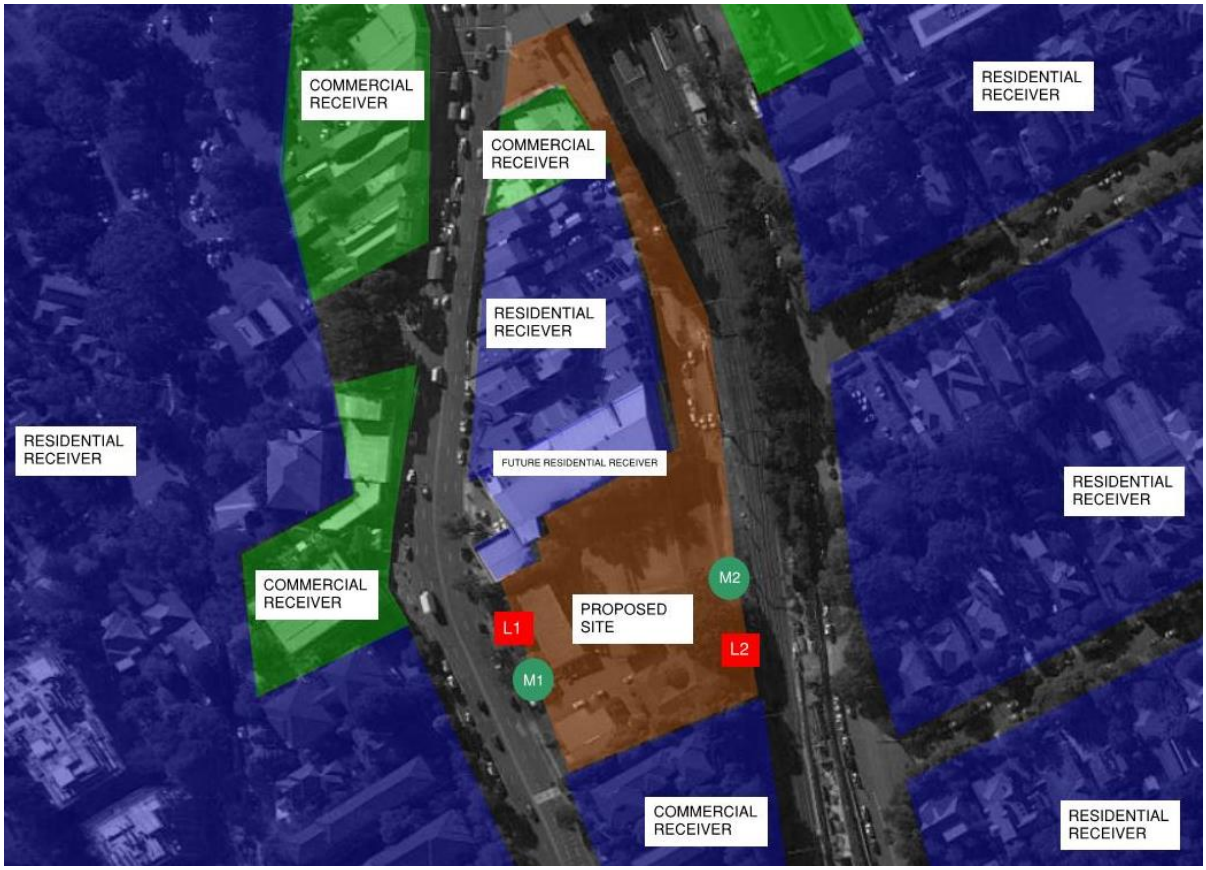


Figure 1: Aerial view of site showing the location of the proposed development and measurements.

There is a continuous traffic flow along the Pacific Highway and regular train movements on the T1 Rail Line. It is noted that noise impacts associated with the road and rail traffic will drive the minimum sound insulation requirements for façade elements and the natural ventilation strategy.

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys were conducted in the locations shown in Figure 1 in order to establish the ambient and background noise levels of the site and surrounds.

Long Term noise monitoring was carried out from Wednesday 4th April to Monday 9th April 2018 with two Rion NL-52 noise loggers (Serial Number 175549 and Serial Number 553892). The noise loggers recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise loggers was checked before and after use and no deviations were recorded.

On Thursday 26th March, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with a NTI XL-2 hand-held Sound Level Meter (SLM) (Serial Number A2A-13742-E0). The calibration of the SLM was checked before and after each use and no deviations were recorded.

JHA Consulting Engineers carried out the surveys, in accordance with the method described in the *'AS/NZ 1055:1997 Description and measurement of environmental noise, parts 1 and 2'*.

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site plus noise emissions from road and rail traffic. Two short-term noise monitoring locations were chosen as representative as follows:

- Location M1: Pacific Highway at the proposed site boundary.
- Location M2: At the rear of the property, at the railway line boundary.

From observations during the site visit, it is noted that at location M1 ambient and background noise levels were dominated by traffic noise from Pacific Highway. At location M2, ambient and background noise levels were dominated by distant traffic noise from Pacific Highway plus rail traffic pass-byes. A summary of the results of the short-term noise monitoring are shown in Table 1.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB re 20μPa*								
			Overall dB(A)	*Octave Band Centre Frequency, Hz*							
				31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	26/03/2018 1:16pm – 1:31pm	$L_{90,15min}$	**58**	60	60	55	53	52	54	49	40	30
		$L_{eq,15min}$	**66**	69	72	67	66	62	62	57	50	44
		$L_{10,15min}$	**69**	71	75	69	66	64	65	61	53	46
M2	26/03/2018 12.46pm – 1:01pm	$L_{90,15min}$	**45**	58	56	48	42	41	41	36	29	21
		$L_{eq,15min}$	**56**	63	65	62	56	52	50	46	46	46
		$L_{10,15min}$	**53**	66	67	61	53	50	46	41	37	30

Table 1: Results of short-term noise monitoring.

3.3 LONG-TERM NOISE MONITORING

The noise loggers were located on the boundary of the proposed development site as shown in Figure 1. These locations were secured and are considered to be representative of the typical ambient and background noise levels. The long-term noise monitoring locations were chosen as follows:

- Location L1: Located on the Pacific Highway to the West of Lindfield Public Library.
- Location L2: To the rear of the site located on the boundary boarded by the T1 rail line.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. Weather conditions were monitored during the duration of the noise survey and were typically calm and dry. As stated in the NSW EPA Noise Policy for Industry (NPI) 2017, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs). The background noise levels are shown in Table 2, together with the L_{Aeq} ambient noise levels measured for each period.

Location	*L_{Aeq} Ambient Noise Levels, dB(A)*			*L_{A90} Background Noise Levels, dB(A)*		
	Day 7am-6pm	*Evening 6pm-10pm*	*Night 10pm-7am*	*Day 7am-6pm*	*Evening 6pm-10pm*	*Night 10pm-7am*
Location L1	65	65	63	54	50	37
Location L2	60	61	57	45	43	34

Table 2: Results of long-term noise monitoring.

3.4 TRAFFIC NOISE MONITORING

The traffic noise levels from the Pacific Highway were measured at location L1. The measurement results are summarised in Table 3.

Location	*Measured Noise Levels, dB(A)*	
	Day (7am-10pm)	*Night (10pm-7am)*
Location L1	$L_{Aeq,15hour}$ 65	$L_{Aeq,9hour}$ 63

Table 3: Day time and night time traffic noise levels.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Noise Emissions and Intrusive Noise
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - Kur-ring-gai Council Local Environmental Plan (K-LEP) 2012.
  - Kur-ring-gai Council Development Control Plan (K-DCP) 2016.
  - NSW EPA Noise Policy for Industry (NPI) 2017.
- Traffic and Rail Noise
  - Infrastructure State Environmental Planning Policy (ISEPP) 2007.
  - NSW Department of Planning (DoP) 'Development Near Rail Corridors or Busy Roads – Interim Guideline' 2008.
  - DECCW NSW Road Noise Policy (RNP) 2011.
  - Australian Standard AS 3671:1989 'Road Traffic Noise Intrusion – Building siting and construction'.
  - UK Department of the Environment – Calculation of Road Traffic Noise (CoRTN).
  - Nord 2000: New Nordic Prediction Method for Rail Traffic Noise.
- Rail Vibration
  - NSW Department of Planning (DoP) 'Development Near Rail Corridors or Busy Roads – Interim Guideline' 2008.
  - NSW Department of Environment and Conservation 'Assessing Vibration: a technical guideline' 2006.

4.1 NOISE EMISSIONS AND INTRUSIVE NOISE

4.1.1 KU-RING-GAI COUNCIL DEVELOPMENT CONTROL PLAN

Relevant Planning Documents of Ku-ring-gai Council Legislation have been reviewed for any noise requirement or criteria. Section C Part 23.8 of the Ku-ring-gai Council Local Centres Development Control Plan (K-DCP 2016) specifies the following controls for general acoustic privacy:

1 *Development is to be designed to minimise the impact of external noise sources (eg busy roads, railways, swimming pools, heavy vehicle entries) on the internal and external spaces used by occupants.*

2. *Balconies and other external building elements are to be designed and located to minimise infiltration and reflection of noise onto the façade.*

3 *Building must be designed to minimise noise transmission by, but not limited to:*

i. *careful siting and orientation of the building;*
ii. *locating bedrooms away from both internal and external noise generators of a development, eg by using storage or circulation areas as a buffer or grouping room uses according to the noise level generated.*

Note: Internal noise generators include, but are not limited to – kitchens, laundries and living areas

4 *Measures such as mounding or high solid fencing will only be permitted where they are compatible with the streetscape.*

5 *When designing and siting active open spaces (eg BBQ areas, swimming pools, communal areas etc) regard must be paid to potential noise impacts on adjacent rooms and buildings, such as bedrooms.*

6 *The noise level from air conditioning systems is not to exceed $L_{aeq\ 15\ minute}$ by 5dBA measured at any bedroom window.*

For developments near roads and rail corridors, K-DCP Part B Section 20.1 requires that developments are designed in accordance with:

- NSW Department of Planning (DoP) *'Development Near Rail Corridors or Busy Roads – Interim Guideline'* 2008.
- AS3671:1989 Acoustics – Road traffic noise intrusion – Building siting and construction.
- AS2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors.

Along with the following controls:

4 *Where dwellings are located on busy roads incorporate the following into the design of the development to reduce traffic noise within the dwelling:*

i. *cavity brick walls;*
ii. *double glazing;*
iii. *solid core doors;*
iv. *concrete floors;*
v. *recessed balconies;*
vi. *located habitable rooms (bedroom, living rooms) away from the road / noise source;*
vii. *use of landscaping mounds and vegetation as noise buffers.*

4.1.2 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI. The use of the noise monitoring procedures and background noise assessment methodology are commonly recommended by other relevant guidelines.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent sets the Project Noise Level (PNL's). The intrusiveness and amenity criterions are presented in Table 4 and Table 5 respectively. The PNL's are determined in Table 6.

The NSW NPI defines the intrusiveness criteria as follows:
"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Indicative Noise Amenity Area	*Period*	*Measured Rating Background Level (L_{A90}), dB(A)*	*Intrusiveness Criterion, dB(A)*
Residential Urban (R4)	Day	45	50 $L_{Aeq,15min}$
	Evening	43	48 $L_{Aeq,15min}$
	Night	34	39 $L_{Aeq,15min}$
Commercial (B2)	When in use	45	50 $L_{Aeq,15min}$

Table 4: Determination of intrusiveness criterion.

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level (L_{Aeq}), dB(A)*	*Adjusted Amenity Criterion, dB(A)*
Residential Urban (R4)	Day	60	58 $L_{Aeq,15min}$ (60-5+3)
	Evening	50	48 $L_{Aeq,15min}$ (50-5+3)
	Night	45	43 $L_{Aeq,15min}$ (45-5+3)
Commercial	When in use	65	63 $L_{Aeq,15min}$ (65-5+3)

Table 5: Determination of amenity criterion.

Indicative Noise Amenity Area	*Period*	*$L_{Aeq,15m}$ dB(A)*	
		Intrusiveness Criterion	*Amenity Criterion*
Residential urban (R4)	Day	50	58
	Evening	48	48
	Night	39	43
Commercial	When in use	50	63

Table 6: Determination of Project Noise Level's.

4.2 TRAFFIC AND RAIL NOISE

4.2.1 DEVELOPMENT NEAR RAIL CORRIDORS OR BUSY ROADS – INTERIM GUIDELINE 2008

The Development Near Rail Corridors or Busy Roads – Interim Guideline (DNRCBR-IG) 2008 details the application of clauses 85, 86, 87, 102 and 103 of the Infrastructure State Environmental Planning Policy (ISEPP) which is required to be used when a residential development is adjacent to a rail corridor, a freeway, a toll-way, a transit-way or a road with an Annual Average Daily Traffic volume (AADT) of more than 40,000 vehicles.

The DNRCBR-IG outlines two types of noise propagation are to be taken into account when assessing new developments near rail corridors and busy roads. The first being airborne noise that propagates through air from the source to the receiver. The second being ground-borne noise that propagates through the ground as vibration.

For residential developments near road corridors carrying greater than 40,000 AADT, ISEPP clause 102 applies. The Pacific Highway has an AADT higher than 40,000 as per RMS information available. Therefore, there are requirements to assess and include mitigation against road traffic noise for the proposed residential development under clause 102 of the ISEPP. Similarly, for the proposed developments, ISEPP clause 87 applies as being near to a rail corridor.

The criteria for airborne noise as stated in ISEPP clause 87 and 102 is presented below in Table 7.

Occupancy	*Natural Ventilation*	*Design Noise Level*	
		Day, $L_{Aeq\ (15\ Hour)}$ dB(A)	*Night, $L_{Aeq\ (9Hour)}$ dB(A)*
Bedrooms	Closed Windows	-	35
	Open Windows	-	45
All other Habitable Areas	Closed Windows	40	40
	Open Windows	50	50

Table 7: Internal noise level requirements for airborne noise.

For ground-borne noise, the DNRCBR-IG states that ground-borne noise is generally associated where buildings are constructed on land that is over tunnels, but may also occur for sensitive cases adjacent or near rail corridors. The stated criteria for ground-borne noise is presented in Table 8.

Occupancy	*L_{Asmax} of 95th percentile dB(A)]*	
	Daytime (7am -10pm)	*Night-time (10pm-7am)*
Habitable Areas	40	35

Table 8: Ground-borne noise internal noise level requirements.

4.3 RAIL VIBRATION

The DNRCBR-IG requires vibration to be assessed for vibration sensitive buildings within 60 metres of the nearest operation track of a rail corridor.

Further to the above, the proposed development also resides within the assessable zone for rail vibration. A summary of the assessable zones for vibration based on proximity are shown below in Figure 2.

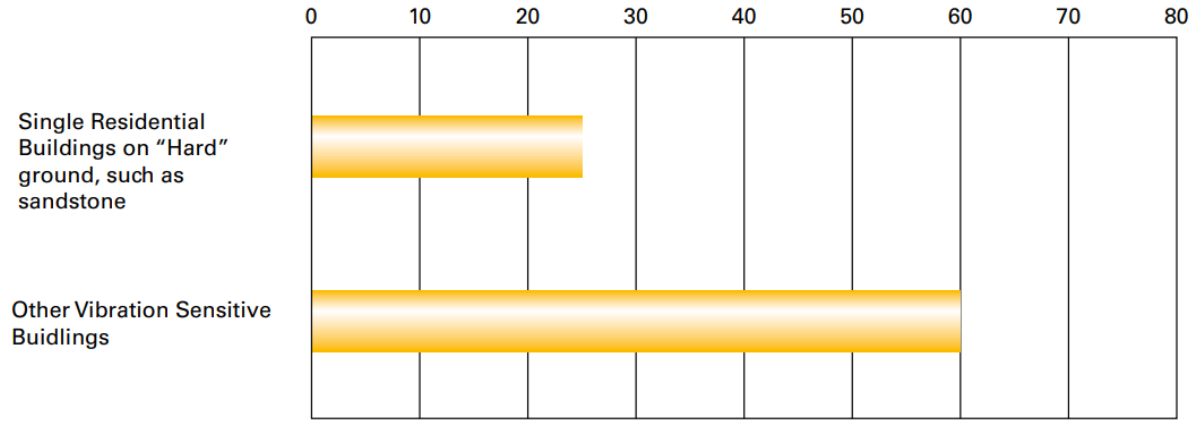


Figure 2: Assessment Zones for Rail Vibration

The acceptable vibration dose values are based on the 'Assessing Vibration: a technical guideline' 2006 and establish the vibration criteria from rail traffic that is not be exceeded within the habitable spaces of the proposed development. These values are shown below in Table 9.

Location	*Daytime (7:00am to 10:00pm)*		*Night-time (10:00pm to 7:00am)*	
	Preferred Value	*Maximum Value*	*Preferred Value*	*Maximum Value*
Residences	0.20	0.40	0.13	0.26

Table 9: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$).

4.3.1 NSW ROAD NOISE POLICY

The NSW DECC Road Noise Policy (RNP) establishes criteria for traffic noise from:

- *Existing roads*
- *New road projects*
- *Road development projects*
- *New traffic generated* other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above the existing noise levels. An increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.*by developments*

For existing residences and

5 NOISE IMPACT ASSESSMENT AND RECOMMENDATIONS

5.1 RAIL & TRAFFIC NOISE

3D acoustic modeling for external noise intrusion from the surrounding roads and rail was conducted using the simulation software SoundPlan (Version 8). The acoustic modeling was undertaken considering no specific meteorological characteristics such as dominant wind direction and speed or temperature, therefore it was considered under neutral conditions.

Noise levels from the road were predicted in accordance with the Calculation of Road Traffic Noise (CoRTN) methodology. This method is recognized by regulatory authorities around Australia and is endorsed by the NSW OEH for use in projects of this scale. Noise levels from rail development have been predicted using the 'Nord 2000: New Nordic Prediction Method for Rail Traffic Noise', which is a recognised methodology by authorities around Australia and endorsed by Transport for New South Wales. The Nord 2000 method uses L_{max} levels; the model was validated against Waratah passenger train pass-by measurements taken at the site.

The Western façades overlook the Pacific Highway which is a source of continuous traffic noise with an AADT of 46,600 as per NSW RMS data. The Eastern façade overlooks the T1 rail corridor which is also a source of noise and vibration impacting on the development. The acoustic analysis has been based on the following:

- Detailed noise survey as shown in Section 3
- Receivers within the residential apartments have been located at 1.5m above ground level.
- Shielding provided by the balconies to each apartment where relevant.
- Apartment areas based on architectural drawings provided by Fox Johnston Architects
- Solid sections of the façade with a sound reduction index of R_W50
- No specific meteorological characteristics such as dominant wind direction and speed or temperature

Based on the analysis, the sound insulation performance requirements to achieve the nominated noise criteria are shown in Appendix A. Further to the analysis, recommended glazing systems and their corresponding sound insulation performances are presented below in Table 10.

Weighted Sound Reduction Index R_w	*Fixed Single Glazing System*	*Fixed Double Glazing System*	*Sliding Door System*
32	6.38mm laminated	6mm/12mm air gap/6mm	6.38mm laminated
35	10.38mm laminated	6mm/12mm air gap/10mm	10.38mm laminated
37	12.38mm laminated	6mm/12mm air gap/10.38mm	6mm/12mm air gap/10.38mm
39	12.5 Vlam Hush	6mm/16mm air gap/10.38mm	AWS SoundOut Sliding Door

Table 10: Recommended glazing

5.1.1 NATURAL VENTILATION

Further to the above, an open windows assessment has been conducted in order to assess whether the habitable spaces can meet the internal noise level requirements with windows open for natural ventilation (open in accordance with the natural ventilation requirements of the NCC). If there is an exceedance of the internal noise level criteria with the windows open by more than 10 dB(A), alternative means of ventilation is required in accordance with the requirements of the NCC and K-DCP (i.e. alternative ventilation system complying with AS 1668.2:2012 'Mechanical ventilation in buildings'.

The results of the assessment indicate that a number of apartments exposed to noise from the Pacific Highway and the Rail Corridor will require an acoustically treated alternative means of ventilation in order to meet the aforementioned requirements. The apartments requiring alternative means of ventilation have been identified in drawing number A-800-002 provided by Fox Johnston Architects.

Based on our detailed assessment, a combination of passive/natural ventilation solutions have been incorporated into the design to ensure apartments can achieve both natural ventilation and the relevant acoustic criteria set out in Section 4 of this Acoustic Report. These design solutions are detailed below and are illustrated on the Architectural Sections provided by Fox Johnston in drawing number A-800-001 and shown below in Figure 3 & Figure 4.

The acoustic recommendations include the following:

Typical Highway Balcony –

- Acoustic Louvre with Transmission loss equal or greater than shown in Table 11.
- Acoustic plenum to be lined with perforated timber with a Noise Reduction Coefficient (NRC) ≥ 0.5.
- Operable glazed louvres or equivalent with an acoustic performance ≥R_W32.

Item	*Transmission Loss (dB)*					
	125	*250*	*500*	*1000*	*2000*	*4000*
Acoustic Louvre	8	7	11	21	24	16

Table 11: Transmission loss of acoustic louvre

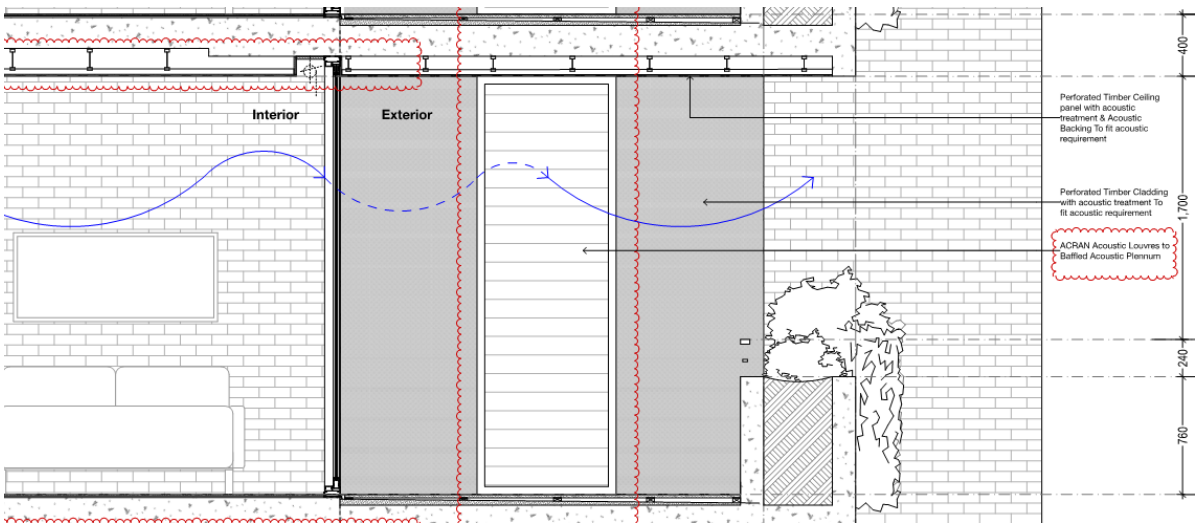
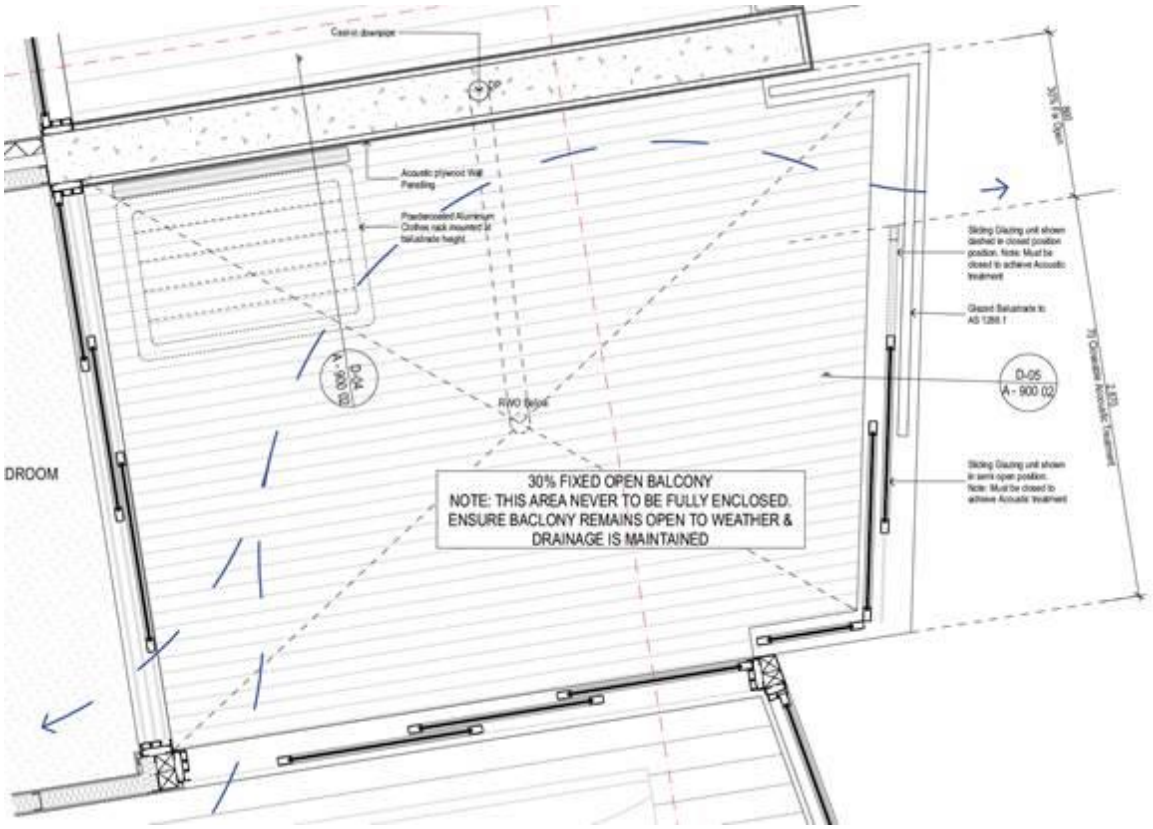


Figure 3: Typical Highway Balcony

Typical Railway Balcony –

- Fixed glass to 70% of Façade opening with minimum Sound Reduction Index R_W32
- Balcony walls and ceiling to be lined with perforated timber cladding with Noise Reduction Coefficient (NRC) ≥ 0.5
- Glazing with an acoustic performance equal or greater than shown in Appendix B

The typical arrangement for the Railway side acoustic treatment is shown below in Figure 4.



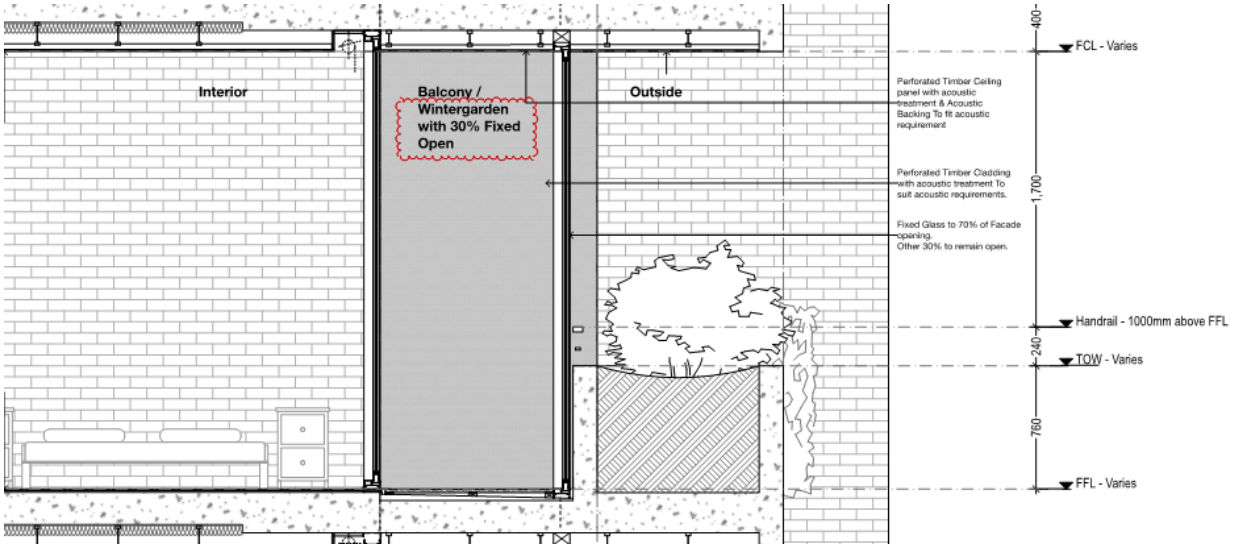


Figure 4: Typical Railway Balcony

5.1.2 INTERNAL NOISE ASSESSEMNT

Further to the above, an internal noise assessment has been carried out for the most affected apartments in order to demonstrate compliance with the aforementioned noise criteria. The acoustic assessment has been based on the following:

- Acoustic amelioration measures as shown in Section 5.1.1
- Modelled noise levels on the façade as calibrated with noise measurements shown in Section 3.

The worst-case predicted noise levels are summarised below in Table 12.

Façade	*Location*	*Period*	*Internal Noise Criteria* $L_{Aeq, period}$ *dB(A)*		*Predicted Noise Levels* $L_{Aeq, period}$ *dB(A)*	
			Windows Open	*Windows Closed*	*Windows Open*	*Windows Closed*
Pacific Highway	Bedrooms	Daytime	-	-	-	-
		Night-time	45	35	43	32
	Living Areas	Daytime	55	45	43	35
		Night-time	55	45	37	33
Railway Corridor	Bedrooms	Daytime	-	-	-	-
		Night-time	45	35	39	33
	Living Areas	Daytime	55	45	39	36
		Night-time	55	45	42	34

Table 12: Internal Noise Assessment

Based on the predicted internal noise levels shown in Table 12, it is our opinion that the recommended design solutions will ensure that all apartments can achieve both natural ventilation and meet the relevant acoustic criteria as set out in in Section 4 of this Acoustic Report.

5.2 MECHANICAL SERVICES NOISE

Noise from the proposed development's plant rooms should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

At this stage, final mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions. A preliminary review has been undertaken for the building services / plant rooms.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest sensitive receivers meets the noise level criteria.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation
  - Noise enclosures as required
  - Sound absorptive panels
  - Acoustic louvres as required
  - Noise barriers as required

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures. It shall be noted that the noise level emissions from the mechanical plant room cannot exceed the established PNL's in Table 6.

5.3 TRAFFIC GENERATION NOISE

The proposed development sits adjacent to the Pacific Highway with an AADT volume of 46,600. The potential noise sources associated with the underground car park will be the noise generated by vehicle movements.

As a worst-case scenario, it has been assumed that the car park is fully utilised. Based on this assumption, an increase of less than 1 dB is expected and therefore the increase in traffic movements due to the car park is considered to be negligible and will not increase the traffic noise levels.

6 CONCLUSION

A noise and vibration impact assessment has been carried out for the proposed development at 259 & 265-271 Pacific Highway, Lindfield, NSW. This report forms part of the documentation package to be submitted to local authorities as part of the Development Application.

Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact.

An acoustic assessment of the road and rail noise has been carried out. Based on the assessment, recommendations have been provided for the sound insulation performance of the façade in order to meet the required internal noise levels.

A natural ventilation assessment has been conducted in accordance with the requirements of DNRCBR-IG and has determined that a number of apartments exposed to noise from both the Pacific Highway and adjacent rail corridor will require alternative means of ventilation. In our opinion, the recommended design solutions will ensure that all apartments can achieve both natural ventilation and meet the relevant acoustic criteria as set out in in Section 4 of this Acoustic Report.

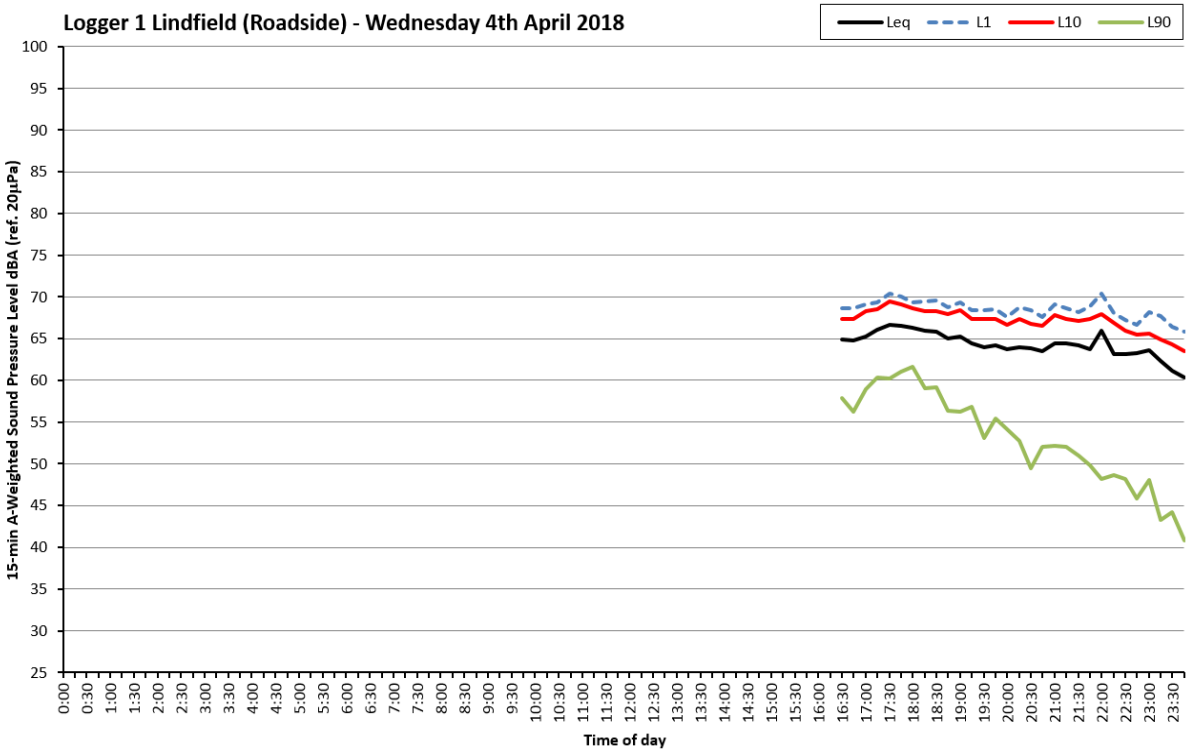
At this stage, mechanical plant selections have not been made. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

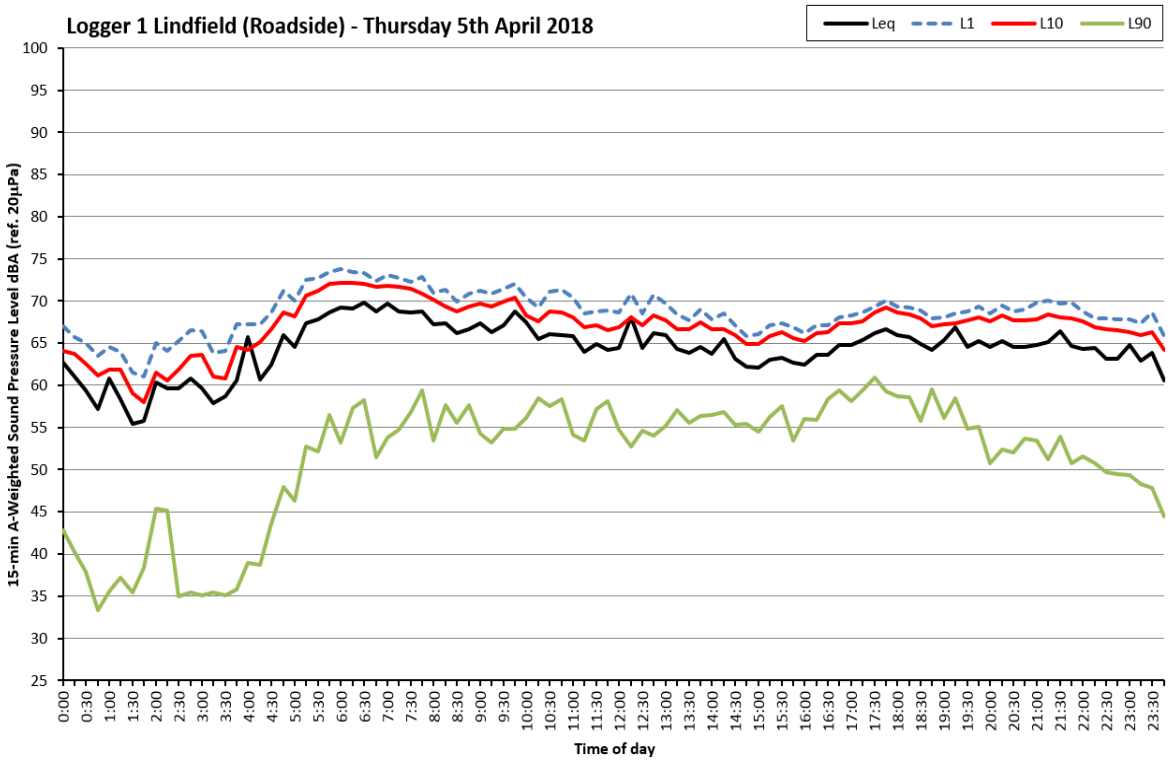
The traffic noise impact due to the number of predicted trips from the proposed development – based on the information provided by the RMS' AADT– is anticipated to be insignificant, as the noise levels will not increase more than 1 dB(A) at the sensitive noise receivers.

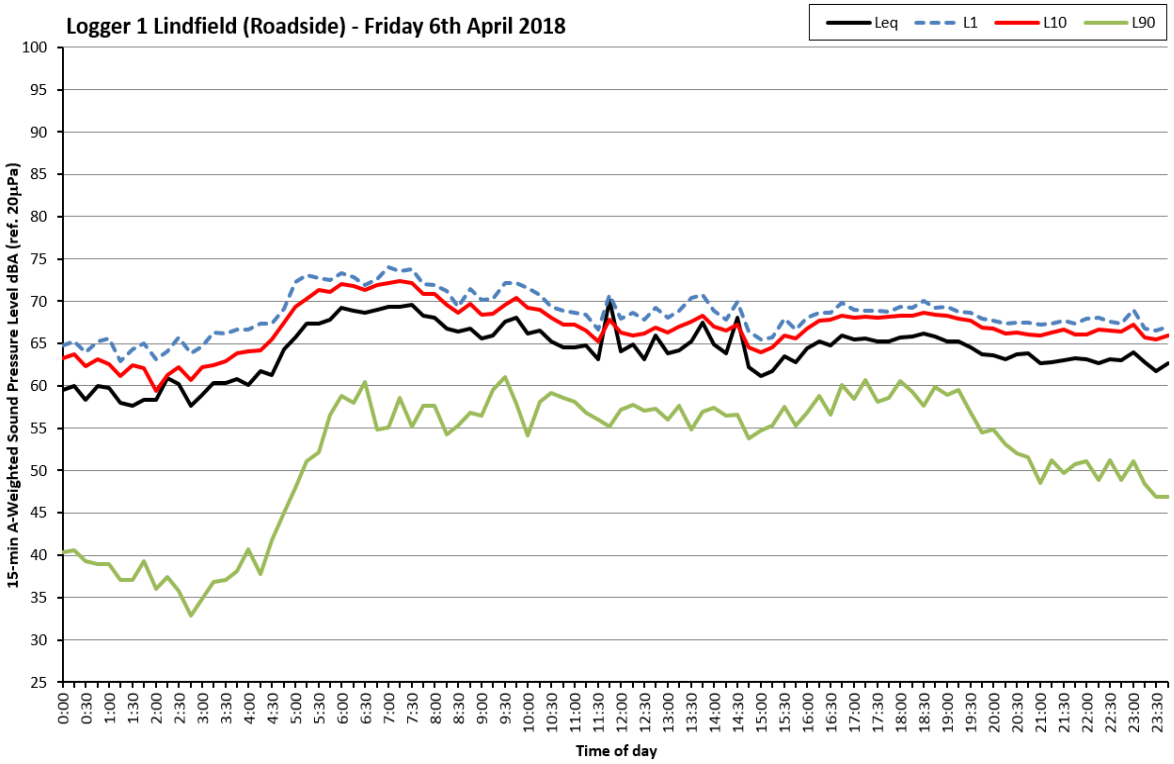
Having given regard to the above listed conclusions, it is the finding of this assessment that the Development Application should not be refused on the grounds of excessive noise and vibration generation.

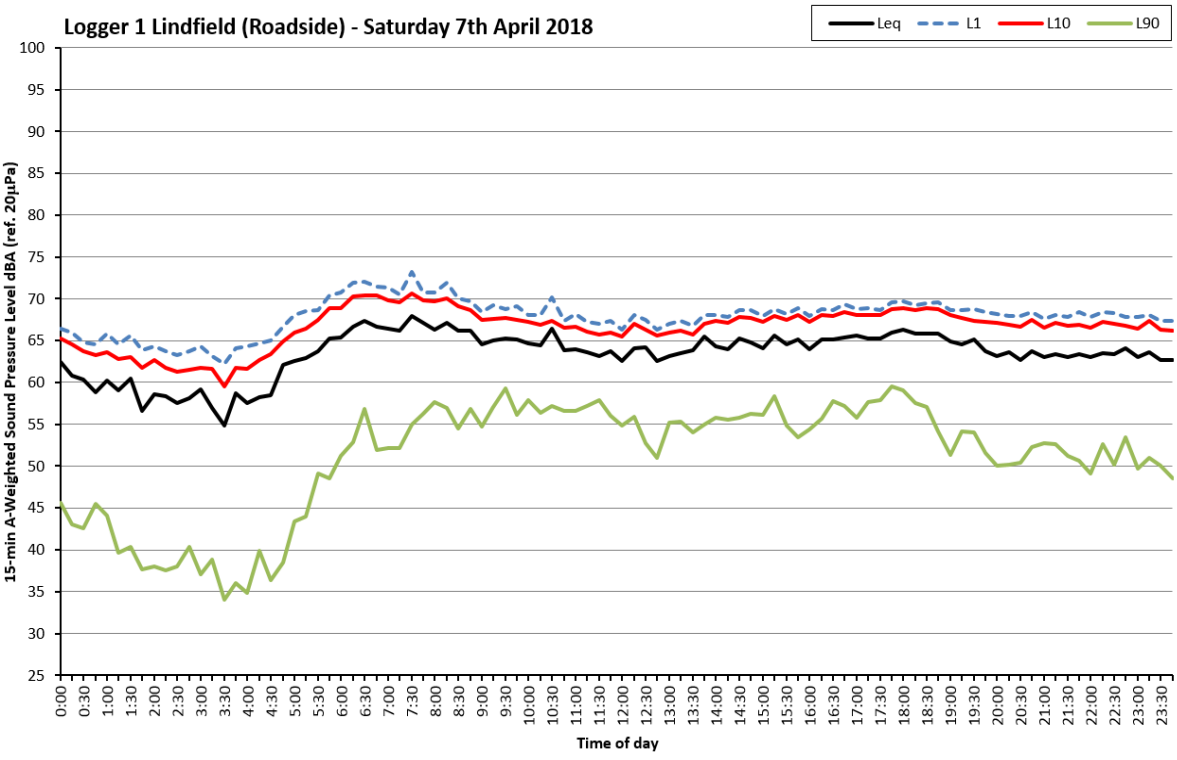
The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modification to the building and the introduction of any noise sources.

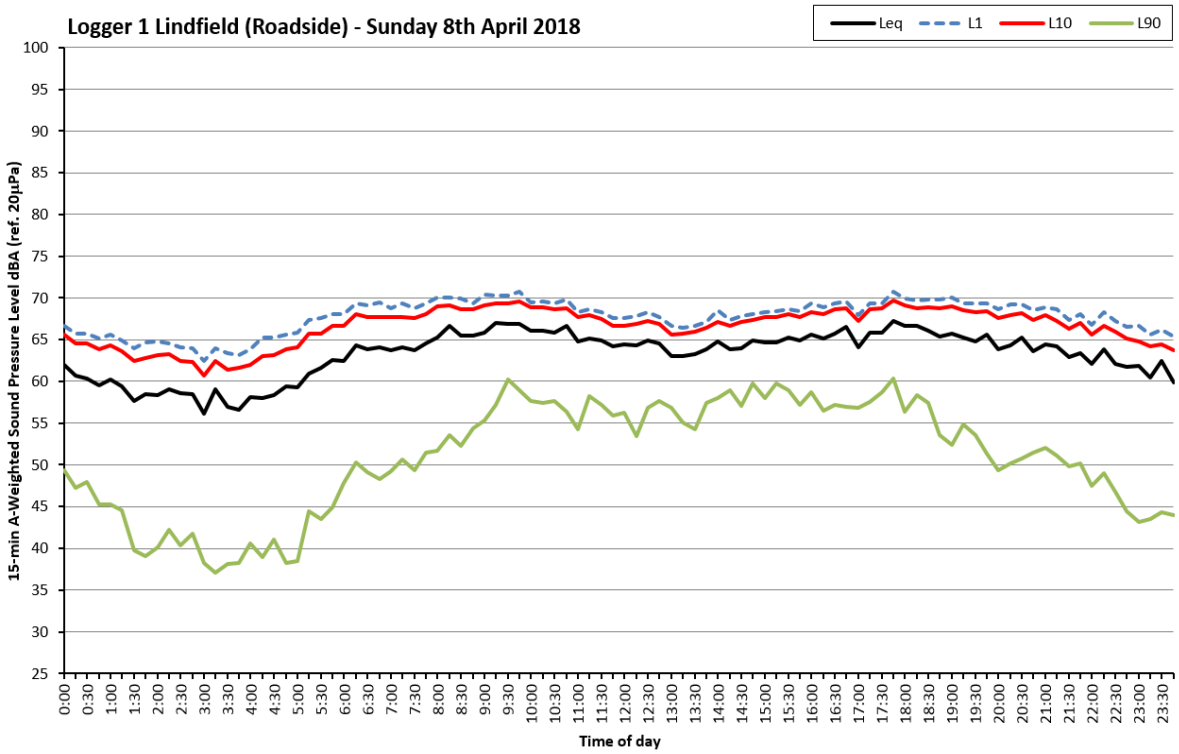
APPENDIX A: LONG-TERM NOISE MONITORING RESULTS

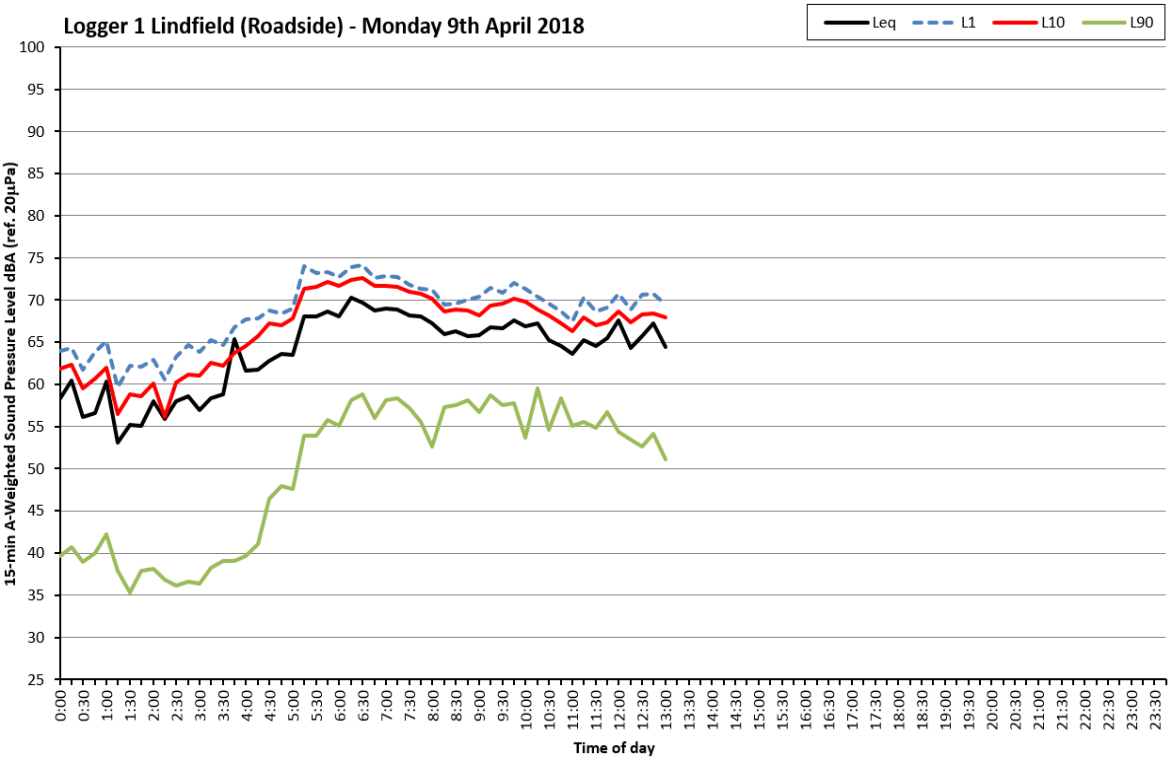


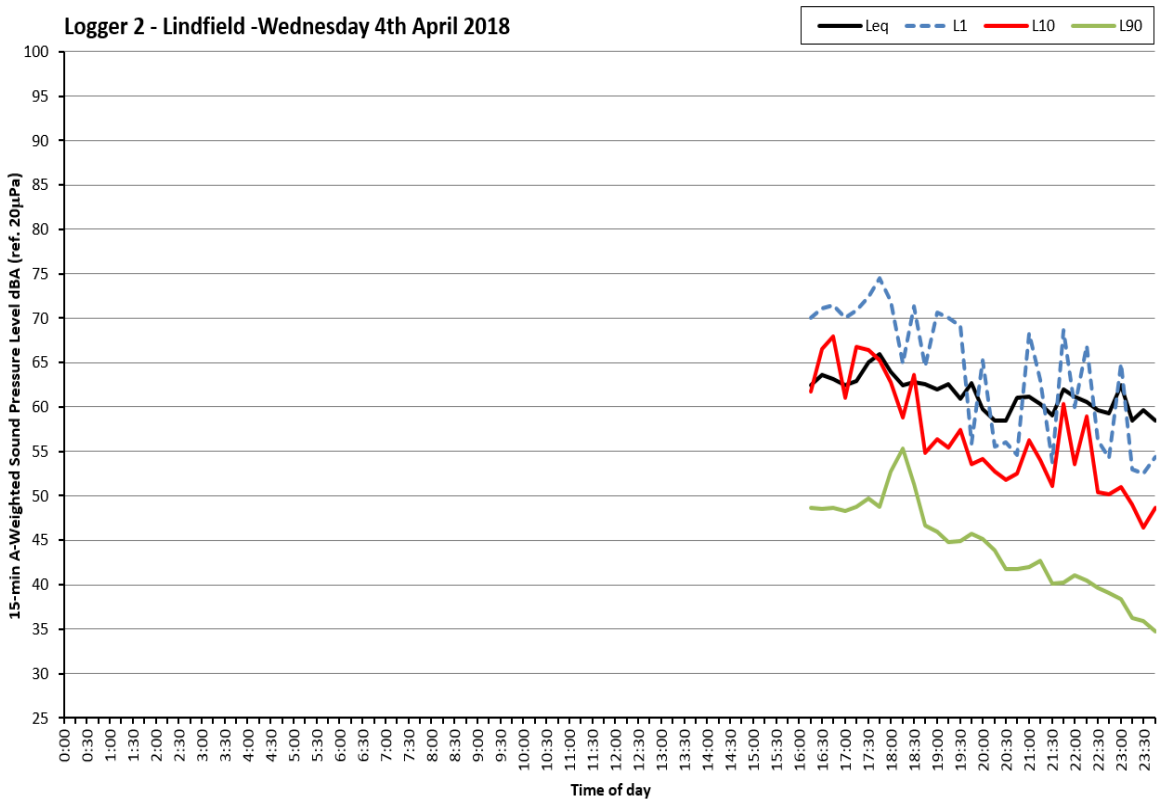


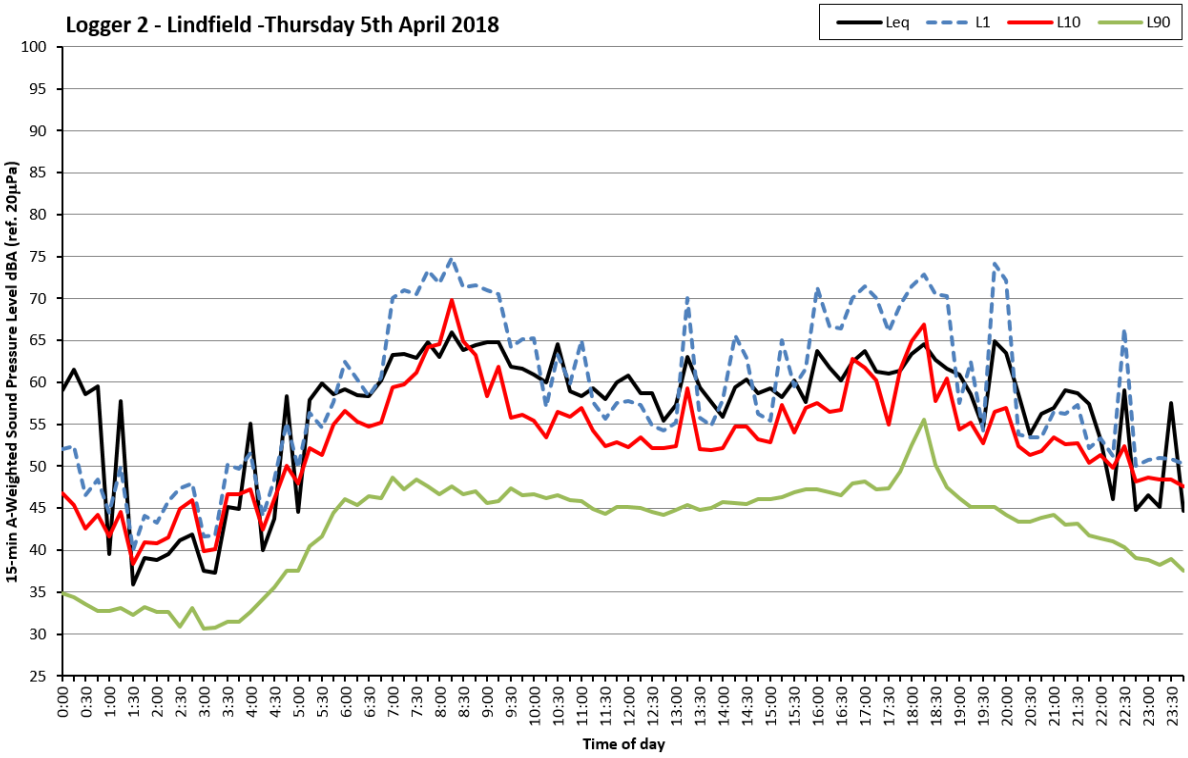

Logger 1 Lindfield (Roadside) - Friday 6th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

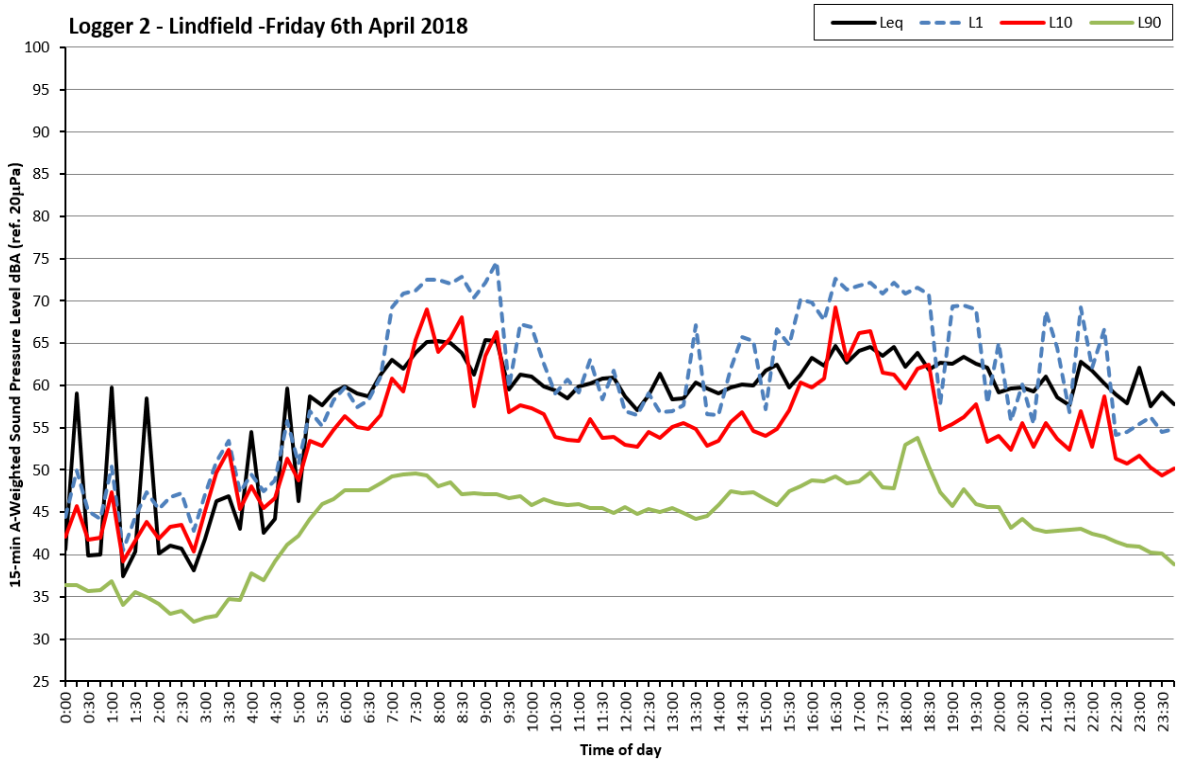

Logger 1 Lindfield (Roadside) - Saturday 7th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

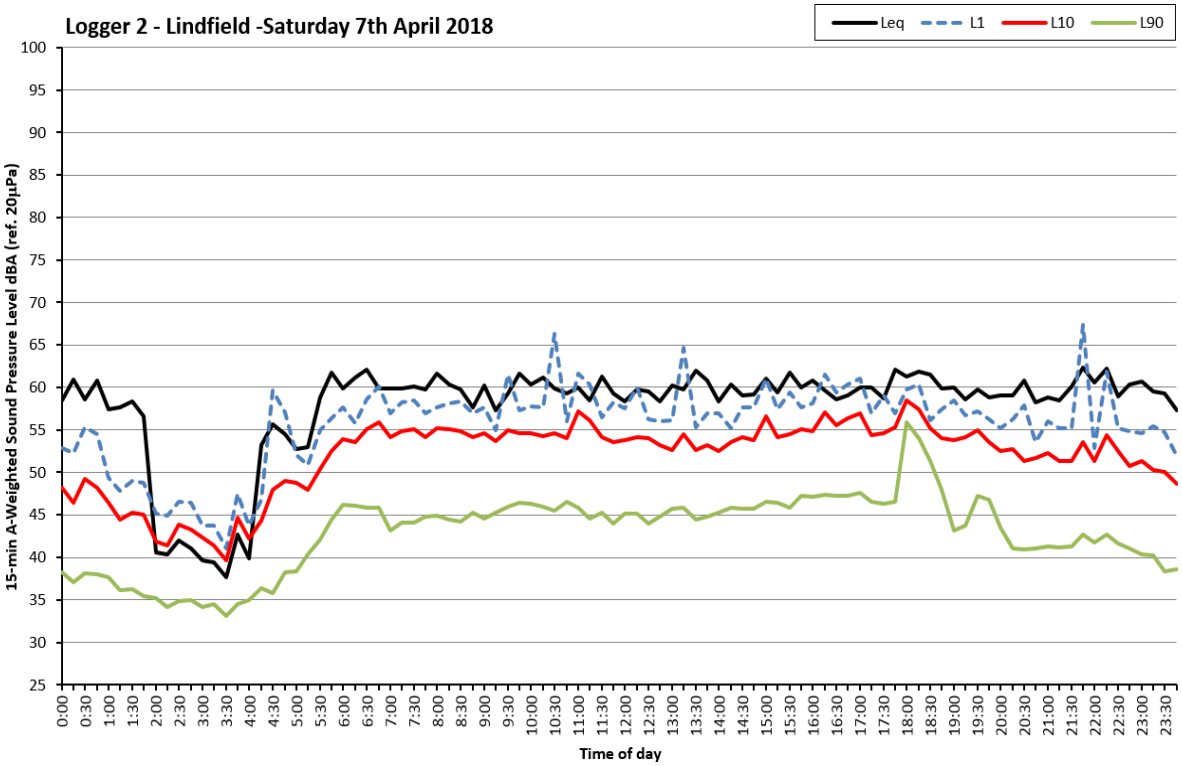

Logger 1 Lindfield (Roadside) - Sunday 8th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

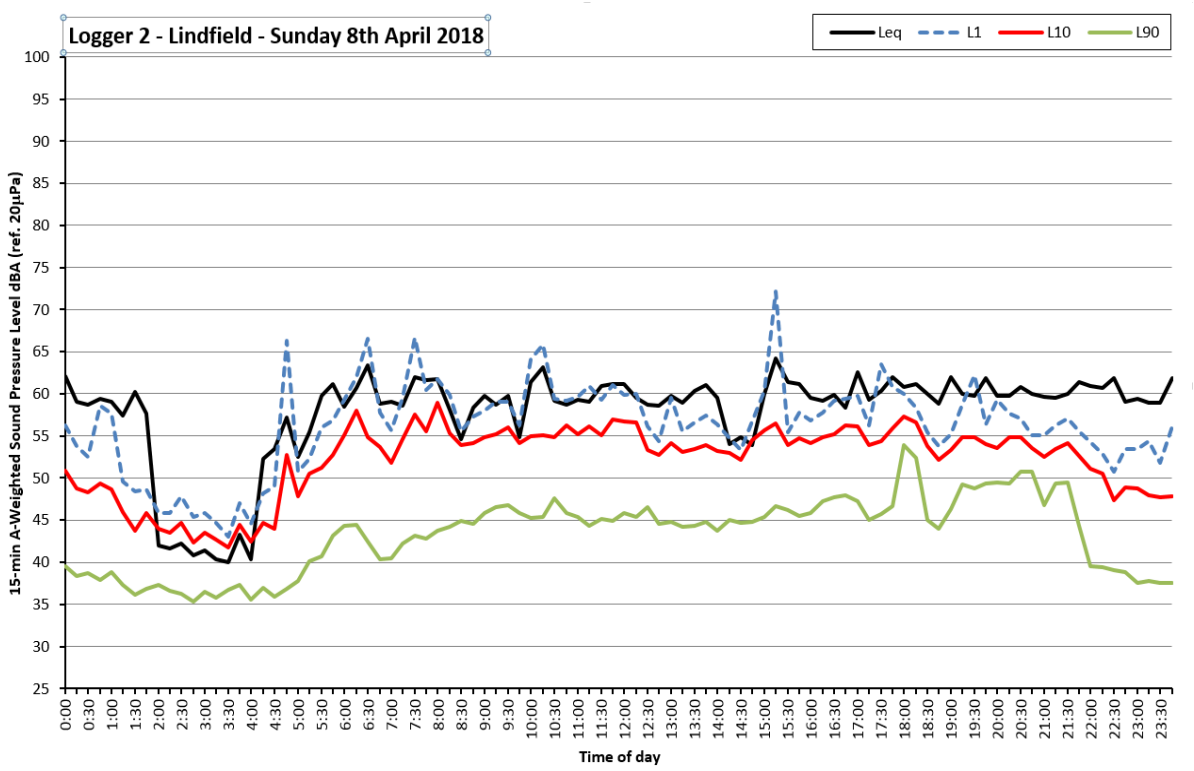

Logger 1 Lindfield (Roadside) - Monday 9th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

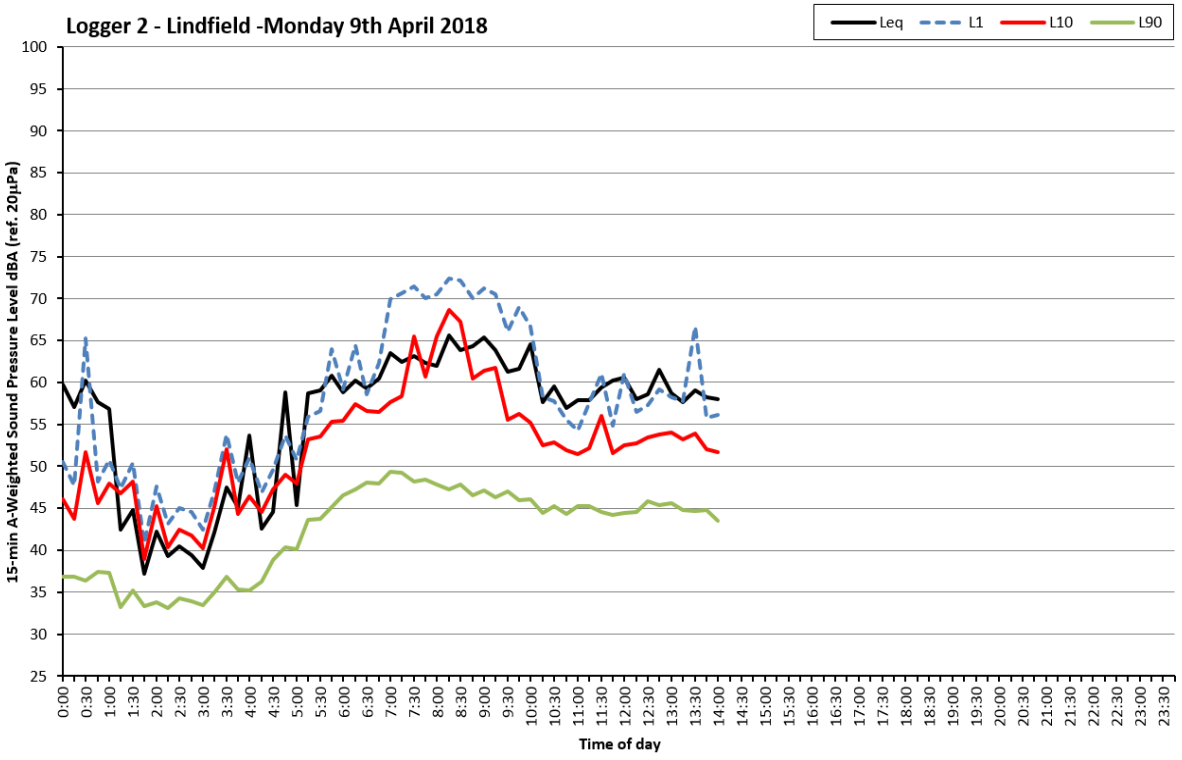

Logger 2 - Lindfield -Wednesday 4th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day


Logger 2 - Lindfield -Thursday 5th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day


Logger 2 - Lindfield -Friday 6th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

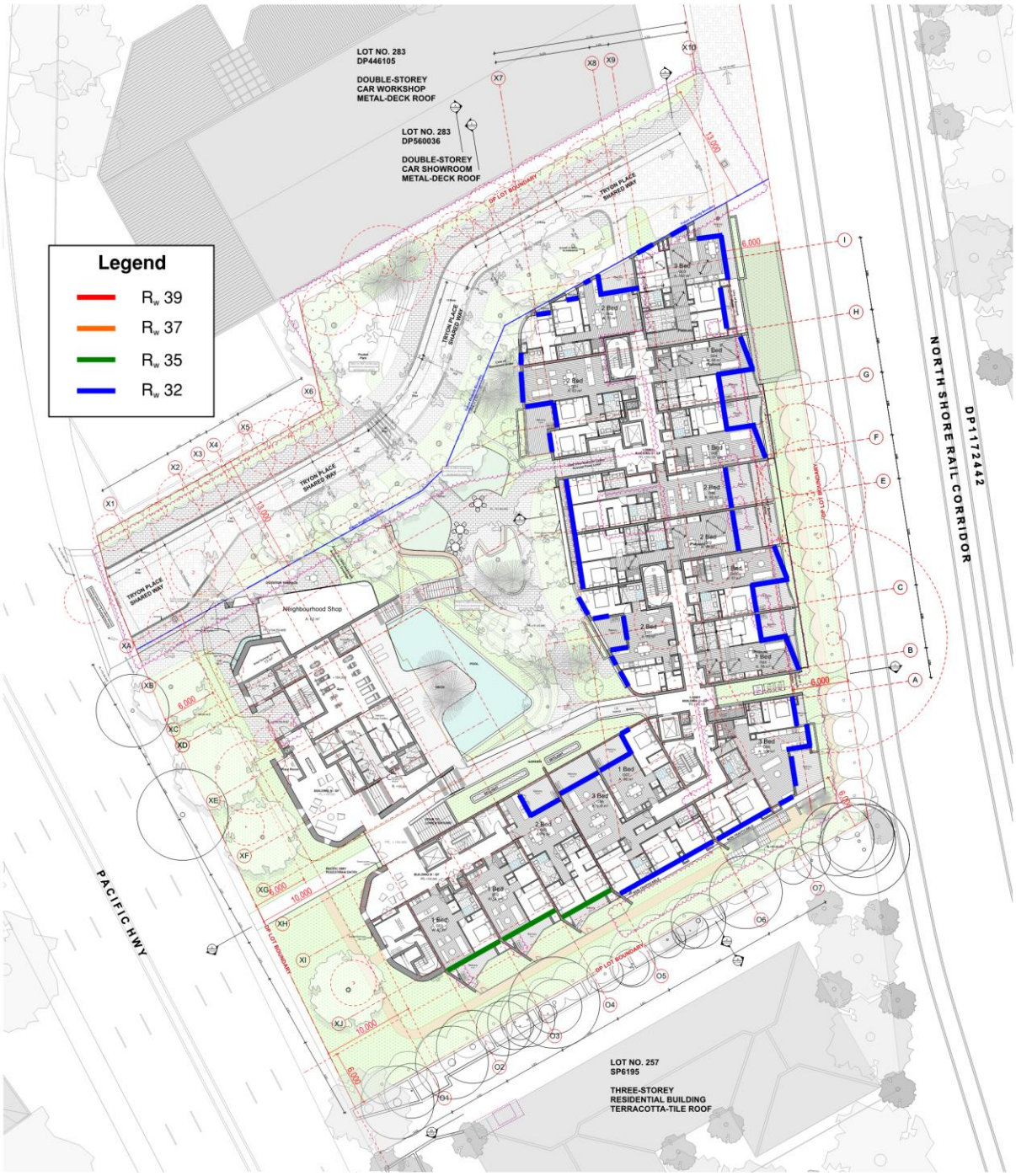

Logger 2 - Lindfield -Saturday 7th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day


Logger 2 - Lindfield - Sunday 8th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

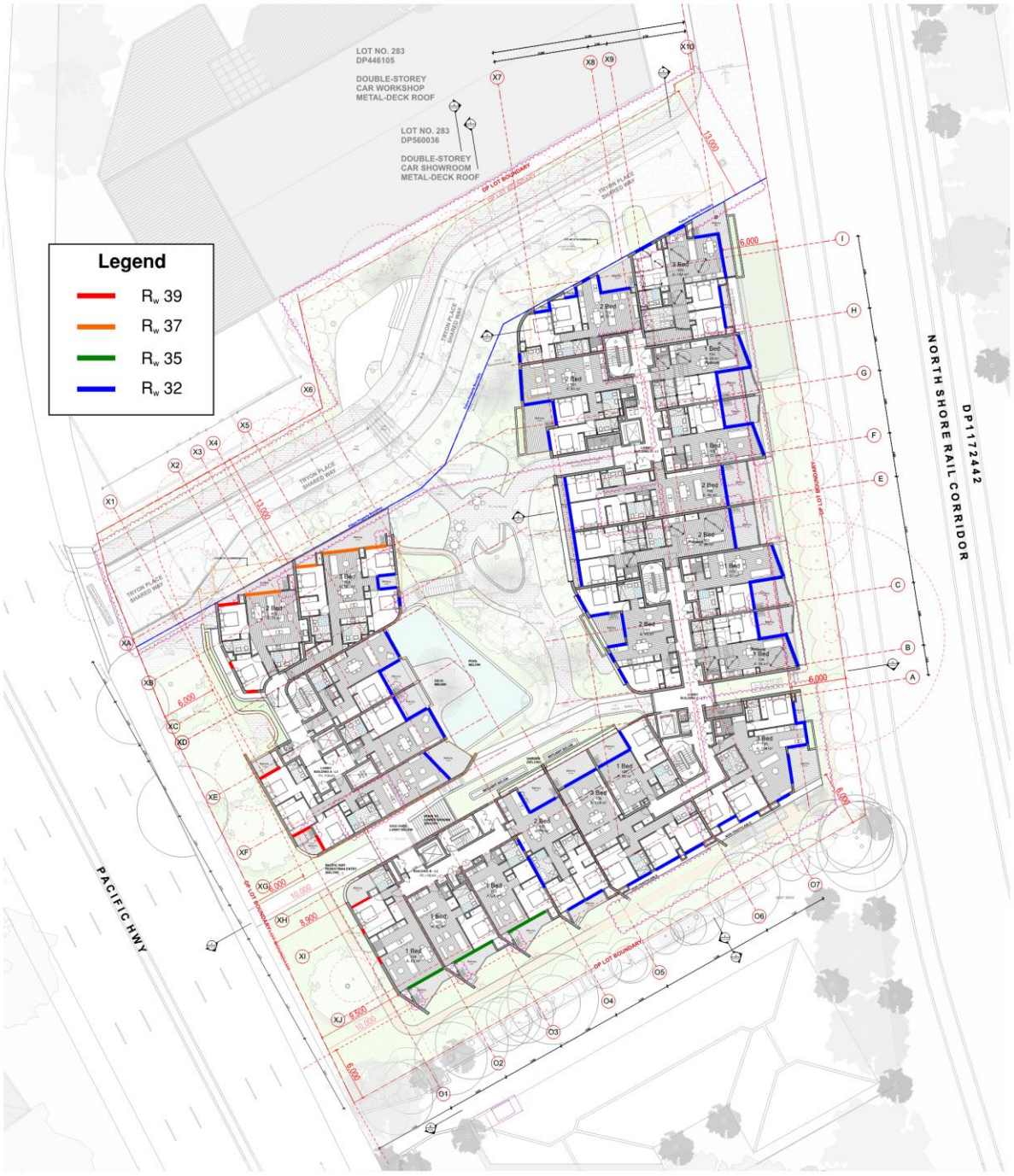

Logger 2 - Lindfield -Monday 9th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of day

APPENDIX B: SOUND INSULATION RECOMMENDATIONS FOR EXTERNAL GLAZING

GROUND LEVEL



LEVEL 01


Legend
R_w 39
R_w 37
R_w 35
R_w 32
LOT NO. 283
DP446105
DOUBLE-STOREY
CAR WORKSHOP
METAL-DECK ROOF
LOT NO. 283
DP560036
DOUBLE-STOREY
CAR SHOWROOM
METAL-DECK ROOF
NORTH SHORE RAIL CORRIDOR
DP1172442
PACIFIC HWY

LEVEL 02


Legend
R_w 39
R_w 37
R_w 35
R_w 32
PACIFIC HWY
NORTH SHORE RAIL CORRIDOR
DP1172442
TRYON PLACE (BELOW)
DP LOT BOUNDARY

LEVEL 03


Legend
R_w 39
R_w 37
R_w 35
R_w 32
TRYON PLACE (BELOW)
DP LOT BOUNDARY
PACIFIC HWY
NORTH SHORE RAIL CORRIDOR
DP1172442
18.663
13.000
6.000
10.000
8.000
9.450

LEVEL 04


Legend
Rw 39
Rw 37
Rw 35
Rw 32
TRYON PLACE (BELOW)
DP LOT BOUNDARY
PACIFIC HWY
NORTH SHORE RAIL CORRIDOR
DP1172442
18.663
13.000
6.000
10.000
9.450
8.000

LEVEL 05


Legend
R_w 39
R_w 37
R_w 35
R_w 32
PACIFIC HWY
NORTH SHORE RAIL CORRIDOR
DP1172442

LEVEL 06


Legend
R_w 39
R_w 37
R_w 35
R_w 32
PACIFIC HWY
NORTH SHORE RAIL CORRIDOR
DP1172442
DP LOT BOUNDARY
18.663
10.000
6.000
8.000
9.450