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SITE 2, SYDNEY OLYMPIC PARK

Acoustic Assessment for Development Application

14 August 2019

Ecove Site 2 Pty Ltd

TK563-01F02 Acoustic Report for DA (r1)

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1 Introduction

Renzo Tonin & Associates was engaged to assess noise and vibration impacts onto and from the proposed mixed-use development at Site 2A and 2B Australia Avenue, Sydney Olympic Park.

This study examines the effects of external noise intrusion onto the proposed development from road traffic, major events and rail noise and vibration. Long-term noise measurements were carried out by Renzo Tonin & Associates from 1st November 2018 to 16th November 2018 to establish the existing levels of external noise affecting the development. Attended vibration measurements from underground rail pass-bys were undertaken on 2nd July 2019.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

1.1 Acoustic assessment requirements

The Department of Planning and Environment issued Secretary's Environmental Assessment Requirements ('SEARs') for the site. The SEARs application SSD 9383 stipulate the following specific requirements regarding the assessment of noise and vibration for the project:

11. Noise, Odour and Vibration

The EIS shall:

- *Assess the noise impacts on the proposed development from all surrounding land uses, including from the Olympic Park Rail Line and Sydney Olympic Park events (including impact from fireworks and low frequency noise from amplified music), operations at the Homebush Liquid Waste Treatment Plant and other surrounding commercial and industrial activity.*
- *Identify appropriate noise mitigation measures and management practices to be adopted*
- *Identify the main noise and vibration generating sources and activities at all stages of construction, and any noise sources during operation, outlining measures to minimise and mitigate potential noise and vibration impacts on surrounding occupiers of land.*

13. Construction

The EIS shall include a Construction Pedestrian and Traffic Management Plan addressing:

- *Potential impacts of the construction on surrounding areas including the adjoining rail corridor and the public realm with respect to noise and vibration, air quality and odour impacts, dust and particle emissions, water quality, storm water runoff, groundwater seepage, soil pollution and construction waste*

14. Major Events

The EIS shall:

- *Address the impact of major events in the precinct as they relate to the proposed development within the Town Centre (SOP Major Event Impact Assessment Guidelines)*
- *Demonstrate that the proposed development and future operation can provide acceptable amenity in major event mode, including any management or mitigation measure to address potential impacts.*

The SEARs above do not refer to any specific documents for the assessment of noise and vibration. As such, guidance has been sought from the following documents in determining the relevant criteria used in this report:

1. Sydney Olympic Park Master Plan 2030;
2. State Environment Planning Policy (Infrastructure) 2007;
3. Department of Planning (DoP) publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008;
4. Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended design sound pressure levels and reverberation times for building interiors";
5. Department of Environment and Conservation publication "Assessing Vibration: A technical guideline";
6. German Standard DIN 4150, Part 3 1999 "Structural vibration – Effects of vibration on structures";
7. British Standard BS 7385 Part 2 1993 "Evaluation and measurement for vibration in buildings"; and
8. Australian Standard AS ISO 2631.2-2014 "Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration".

2 Site description

2.1 Site location

Site 2 has frontages to Australia Avenue to the west, Murray Rose Avenue to the north and Parkview Drive to the south. The Olympic Park Train Station is located approximately 120m west of site with the underground rail tunnel, servicing the T7 Olympic Park Line, running directly under the site. The site is surrounded by commercial properties with residential properties to the south. The worst-affected residential receiver is located on the opposite side of Parkview Drive, to the south, at 11 Australia Avenue.

An aerial photograph showing the site and surrounds is shown in Figure 1 below.

2.2 Overview of proposed development

The proposed development consists of two building towers, divided as Site 2A and Site 2B, with a common 4-level basement for car parking and back of house services.

The tower on Site 2A, located on the northern side of the site and consists of 33 levels with the following uses:

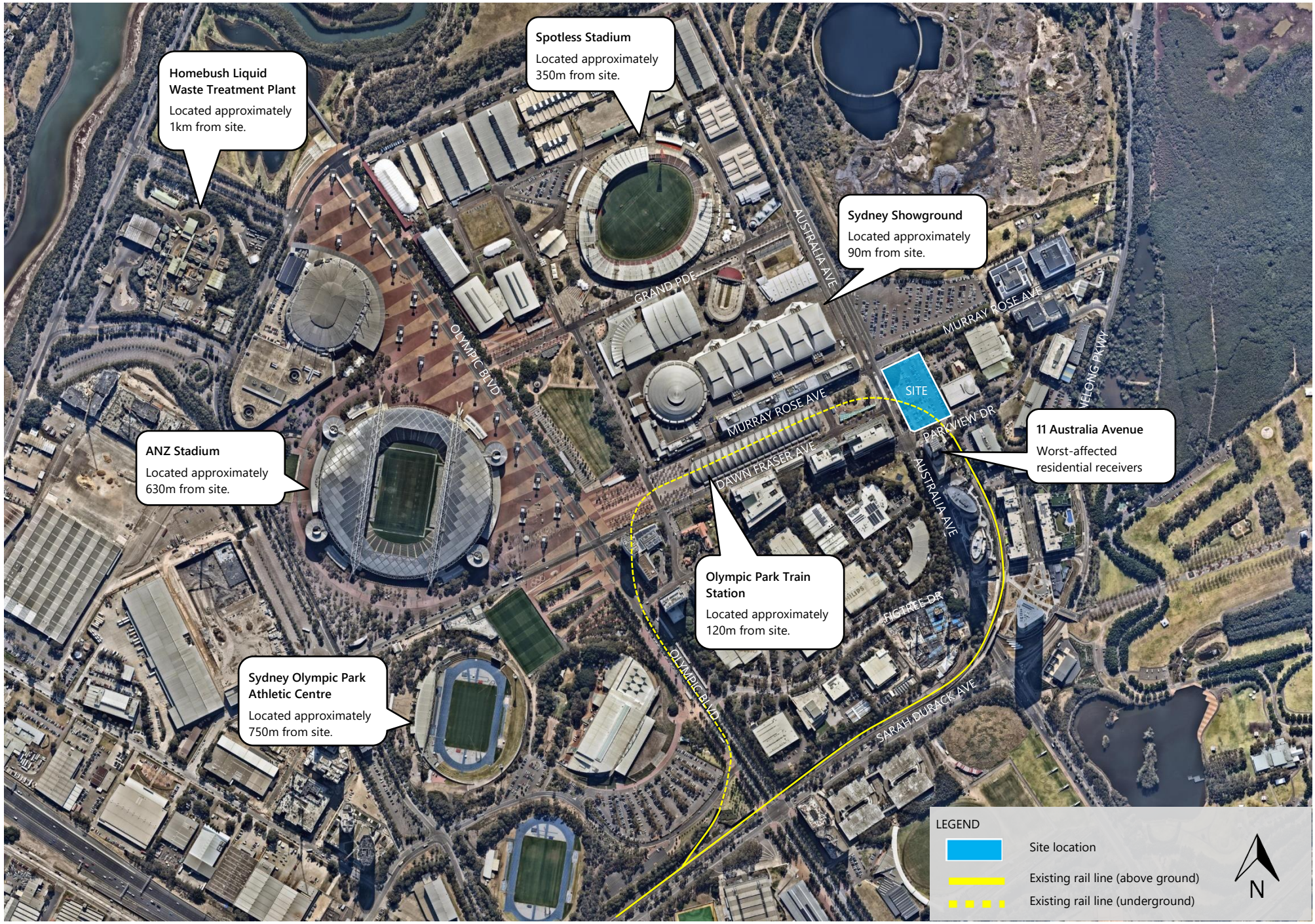
- Ground Level – Lobby;
- Level 1 – Function rooms;
- Level 2 to Level 13 Upper – Offices;
- Level 14 to Level 29 – Hotel rooms; and
- Level 30 – Pool, gym and bar.

The tower on Site 2B consists of 15 levels with the following uses:

- Ground Level – Retail and lobby; and
- Level 1 to Level 15 – Offices.

Two loading docks, one for each building, are proposed for the development. The maximum vehicle size the loading docks can accommodate is a medium rigid vehicle.

Figure 1: Aerial photograph showing the site and surrounds



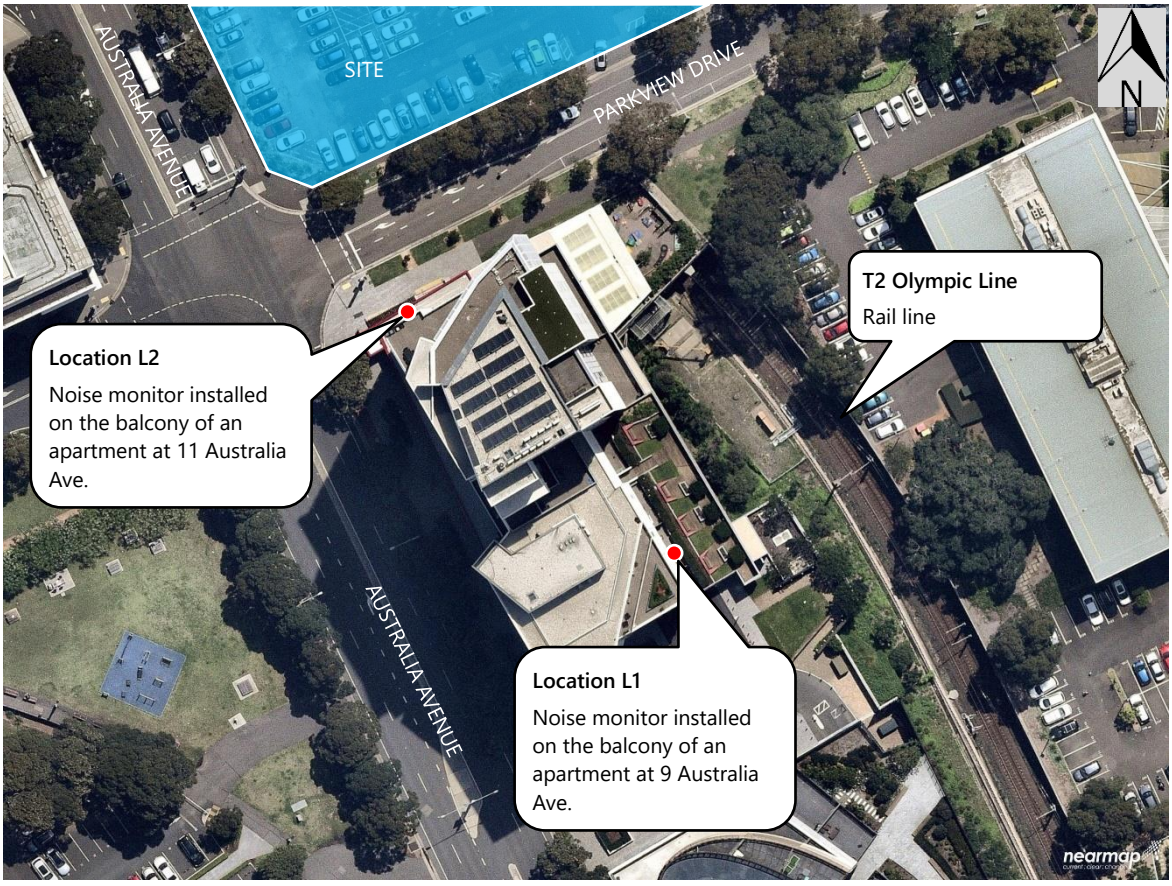
3 Ambient and background noise surveys

Two unattended long-term noise monitors were installed from 1st November 2018 to 16th November 2018 to determine the existing level of ambient and background noise levels pertinent to the site. One noise monitor (Location L1) was installed on the balcony of a residential apartment at 9 Australia Avenue, facing the rail line, from 1st November to 10th November 2018. The second monitor (Location L2) was installed on the balcony of a residential apartment at 11 Australia Avenue, facing the intersection of Australia Avenue and Parkview Drive, from 9th November to 16th November 2018. Locations of the noise monitors are shown in Figure 2 below. Background noise levels measured at Location L2 represent the worst-affected residential receiver.

The noise monitors recorded noise levels on a continuous basis and stored data every fifteen minutes. The monitors were calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment comply with Australian Standard 1259.2-1990 "Acoustics – Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

Detailed results of the background and ambient noise monitoring undertaken are presented in Appendix D.

Figure 2: Locations of unattended long-term noise monitors



3.1 Results of long-term noise monitoring

3.1.1 Rail and road traffic noise

The design rail and road traffic noise levels are taken from the representative L_{Aeq} for the week for both day time (7am to 10pm) and night time (10pm to 7am) periods. The design external rail and road traffic noise levels are presented in Table 1 below.

Table 1: Representative day and night road/rail noise levels from long-term noise monitoring

Monitoring Location (refer to Figure 2)	Survey Period	Measured Road/Rail Noise Level $L_{Aeq,\,T}$[1,2], dB(A)	Predicted Road/Rail Noise Level at the Worst-Affected Facade $L_{Aeq,\,T}$[1,2], dB(A)
Location L1 – Balcony of an apartment at 9 Australia Avenue, facing T2 Olympic Rail Line.	Day time (7am to 10pm) 1 November 2018 to 10 November 2018	64	64
	Night time (10pm to 7am) 1 November 2018 to 10 November 2018	59	59
Location L2 – Balcony of an apartment at 11 Australia Avenue, facing the road intersection between Australia Avenue and Parkview Drive.	Day time (7am to 10pm) 9 November 2018 to 16 November 2018	63	63
	Night time (10pm to 7am) 9 November 2018 to 16 November 2018	57	57

Notes:

1. Noise levels presented are facade corrected values.
2. Representative external noise levels in measured L_{Aeq} over 15 hour and 9 hour day and night period respectively.

3.1.2 Background noise

Table 2 below presents the results of the long-term unattended noise monitoring for background noise.

Table 2: Background noise levels from long-term noise monitoring

Noise Monitoring		Representative Background Noise Levels in dB(A)	Day[1]	Evening[2]	Night[3]
Location (refer to Figure 2)	Duration				
Location L1 – Balcony of an apartment at 9 Australia Avenue, facing T2 Olympic Rail Line.	1 November 2018 to 10 November 2018	L_{A90}	51	49	45
		L_{Aeq}	62	62	58
Location L2 – Balcony of an apartment at 11 Australia Avenue, facing the road intersection between Australia Avenue and Parkview Drive.	9 November 2018 to 16 November 2018	L_{A90}	53	49	43
		L_{Aeq}	61	60	56

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's Noise Policy for Industry as follows.

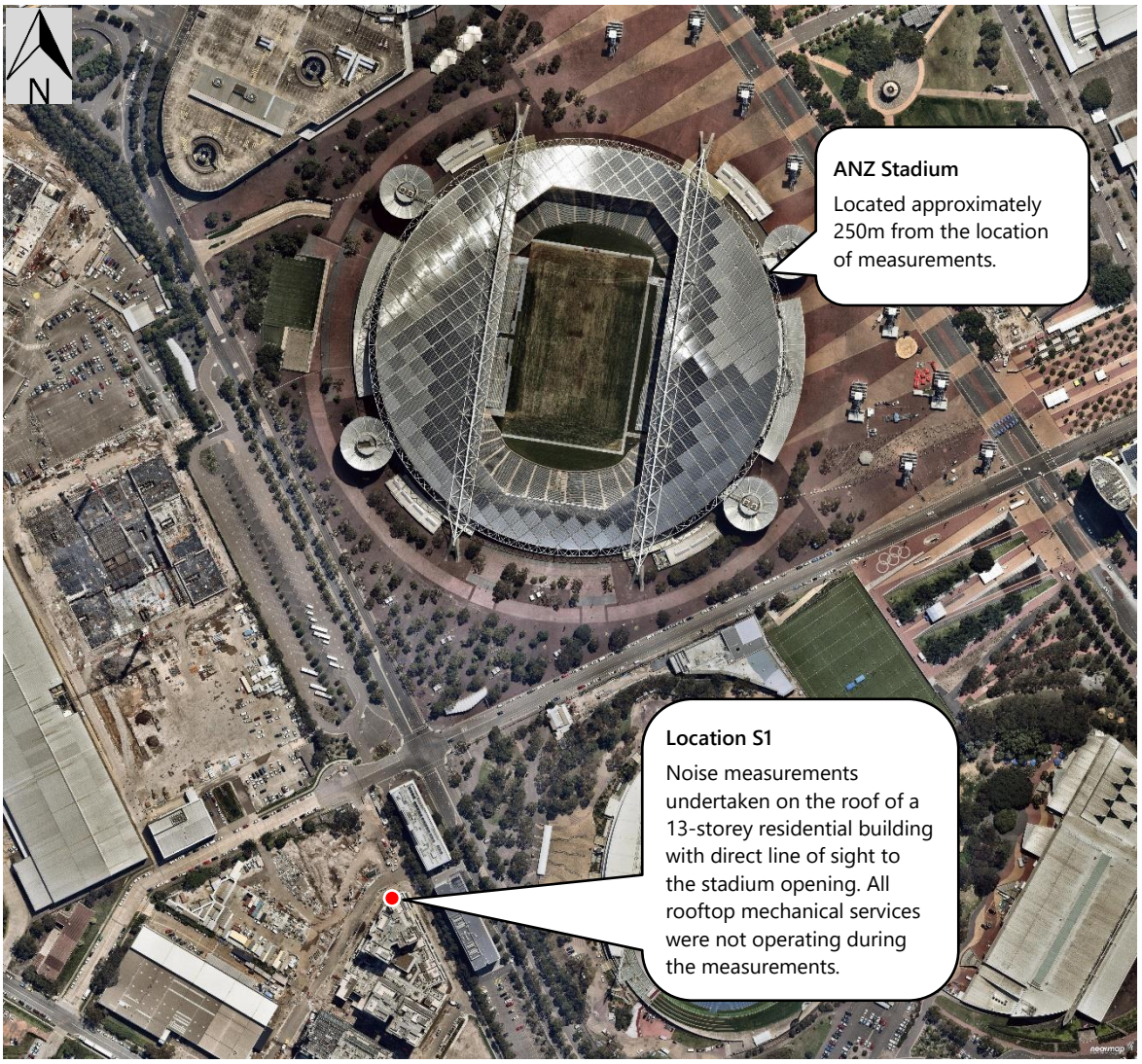
1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

3.2 Noise from major events

Short-term noise measurements were undertaken, at Location S1 shown in Figure 3 below, during a major concert event (*Taylor Swift Reputation Stadium Tour* with approximately 72,805 crowd count) held at the ANZ Stadium on the 2nd November 2018.

The concert was clearly audible from the measurement location, Location S1. Dominant noise sources included amplified low-frequency music and crowd noise.

Figure 3: Location of noise measurements for a major event (Taylor Swift Reputation Stadium Tour)



The equipment used for noise measurements was a Brüel & Kjær Type 2250 precision sound level analyser which is a Class 1 instrument having accuracy suitable for field and laboratory use. The instrument was calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

The loudest 15-minute period from the measurement is shown in Table 3 below. Noise from the major event in this period consisted of amplified music from the live concert and crowd cheer.

Table 3: Major event noise measurement results

Measurement Location	Survey Period	Measured Maximum $L_{Aeq,15\ min}$, dB(A)	Predicted maximum $L_{Aeq,\ 15\ min}$, dB(A) at the worst-affected facade of site
Location S1	2nd November 2018 6:30pm to 7:50pm	69	65

Notes:

1. The loudest L_{eq} 15-minute period from the measurement is shown in this table.

4 External noise intrusion assessment

4.1 Criteria

4.1.1 Road and rail traffic

The relevant documents applicable to this development are as follows:

1. Sydney Olympic Park Master Plan 2030 ('SOP Master Plan 2030');
2. State Environment Planning Policy (Infrastructure) 2007 ('ISEPP');
3. Department of Planning (DoP) publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008 ('DoP Guideline'); and
4. Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended design sound pressure levels and reverberation times for building interiors" ('AS2107').

It is noted that the ISEPP stipulates internal noise criteria for residential developments. A hotel development is considered commercial and does not trigger the requirements of the ISEPP. However, as the use of a hotel development is relatable to that of a residential development, guidance has been sought in accordance with the ISEPP. Internal noise criteria for occupancies that are not covered in the ISEPP are selected based on AS2107.

The noise criteria outlined in the documents above were considered. Table 4 below provides a summary of the relevant acoustic criteria for this development.

Table 4: Recommended internal noise criteria for rail and road traffic noise

Type of Occupancy	Windows Condition	Design Noise Level	
		Day, $L_{eq\ (15hour)}$, dB(A)	Night, $L_{Aeq\ (9hour)}$, dB(A)
Hotel Spaces			
Ballroom and Function Room	Closed	45	-
Bars, Lounges and Gyms	Closed	50	-
Hotel Entry Lobby	Closed	50	-
Hotel rooms	Closed	40	35
Residential Spaces			
Living rooms and working areas	Closed	40	40
Sleeping rooms	Closed	-	35
Commercial Spaces			
Retail	Closed	50	-
Restaurants	Closed	50	-
Office suites	Closed	45	-

Notes:

1. Internal noise criteria not covered by the ISEPP have been determined in accordance with AS2107.

Relevant sections from the above documents are presented in Appendix B of this report. Results of the background and ambient noise monitoring conducted on site are presented in Appendix D.

4.1.2 Noise from major events

The SOP Master Plan 2030 has set internal noise criteria for noise associated with major events, intruding into new developments within the Sydney Olympic Park. The criteria relevant for this project are outlined in Table 5 below. Relevant sections from the SOP Master Plan 2030 are presented in Appendix B.

Table 5: SOP Master Plan 2030 maximum internal noise criteria for noise intrusion from major events

Internal Space	Noise Criterion	Period	Noise Measure
Living rooms	45dB(A)	Day & Evening	$L_{Aeq, 15min}$
Working areas			
Sleeping rooms	40dB(A)	Night Time	

4.2 Calculated internal noise levels

Results from the noise surveys were used to calculate internal noise levels within the proposed development. Noise calculations were conducted using the OutsideIn Glazing Spreadsheet developed in this office which take into account external noise levels, facade transmission loss and room sound absorption characteristics. Noise levels were calculated for each building facade to account for any variation in the external noise levels affecting different parts of the building.

Glazing constructions required to comply with the nominated noise criteria are presented in Section 4.3.

4.3 Glazing requirements

Table 6 below presents recommended glazing performance for the building facades to achieve compliance with the maximum noise levels nominated in Table 4 and Table 5 above.

Table 6: Recommended glazing performance

Facade	Level	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness, Type and Configuration	Laboratory Test Reference
Building 2A (northern building)					
All	Ground	Lobby and Sports Bar	R_w 25	4mm standard float glass	ESTIMATE
	Level 2 to 13 Upper	Office	R_w 29	6.38mm laminated glass Or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE

Facade	Level	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness, Type and Configuration	Laboratory Test Reference
	Level 14 to 29	Hotel Rooms	R_w 35	10.38mm laminated glass Or IGU consisting of 10mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
Building 2B (southern building)					
All	Ground	Lobby	R_w 25	4mm laminated glass	ESTIMATE
All	Ground Upper to Level 14	Office	R_w 29	6.38mm laminated glass Or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

LEGEND where no appropriate test certificate exists:

1. ESTIMATE: The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
2. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the Rw rating as soon as practicable. In the case of impact rating for floor systems, no particular impact rating is guaranteed to comply with either the Building Code of Australia or Strata Scheme Management Act and hence carpet runners may still be required.
3. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The STC/Rw of the form of construction exceeds the project requirements.
4. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

5. The information in this table is provided for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
6. The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
7. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.
8. The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.
9. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.
10. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

11. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
12. Check design of all junction details with acoustic consultant prior to construction.
13. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
14. The information provided in this table is subject to modification and review without notice.
15. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

5 Rail vibration assessment

5.1 Criteria

Vibration criteria have been determined in accordance with the following documents:

1. State Environment Planning Policy (Infrastructure) 2007 ('ISEPP');
2. Department of Planning (DoP) publication "Development Near Rail Corridors & Busy Roads - Interim Guideline" 2008 ('DoP Guideline 2008'); and
3. Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended design sound pressure levels and reverberation times for building interiors" ('AS2107').

It is noted that the ISEPP only stipulates criteria for residential developments. Hotel and office developments are considered as commercial and do not trigger the requirements of the ISEPP. However, as hotel use is relatable to that of a residential development (i.e. sleeping), guidance has been sought in accordance with the ISEPP. Criteria for office spaces have been determined with guidance from AS2107.

5.1.1 Ground-borne noise

The DoP Guideline 2008 provides recommended criteria for ground-borne or regenerated rail noise for residential developments.

Table 7 below provides a summary of the recommended noise limits for this project.

Table 7: Recommended internal noise criteria for regenerated rail noise

Occupancy	Period	Recommended Maximum Design Noise Level, $L_{Amax\ (slow)}$
Hotel Rooms	Day Time (7am to 10pm)	40
	Night Time (10pm to 7am)	35
Offices	When in used	45
Ballroom and Function Room	When in used	45
Bars, Lounges and Gyms	When in used	50

Notes:

1. $L_{Amax\ (slow)}$ is A-weighted maximum sound pressure level measures using "Slow" response time for 95% of rail pass-by events.
2. Internal noise criteria not covered by the ISEPP have been determined in accordance with AS2107.

5.1.2 Rail tactile vibration

In addition to regenerated rail noise, Section 3.6.3 of the DoP Guideline 2008 provides recommended vibration criteria based on the following documents:

1. Department of Environment and Conservation's Assessing Vibration: A technical guideline 2006 ('DEC Guideline 2006');
2. German Standard DIN4150, Part 3 1999;
3. British Standard BS7385 Part 2 1993; and
4. Australian Standard AS2670.2 1990 ('AS2670.2').

The above documents have been reviewed and the criteria for assessment of tactile vibration from train pass-bys affecting the proposed development are quantified from the following:

- Department of Environment and Conservation's Assessing Vibration: A technical guideline 2006; and
- British Standard BS6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)" ('BS6472')

The criteria curves presented in BS6472 are identical to those presented in AS2670.2 and the International Standard ISO2631-2.1989.

Criteria for continuous vibration from the British Standard BS6472 for residential spaces, offices and commercial workshop environments are shown in Figure 4 below.

Figure 4: Tactile vibration criteria for residential buildings

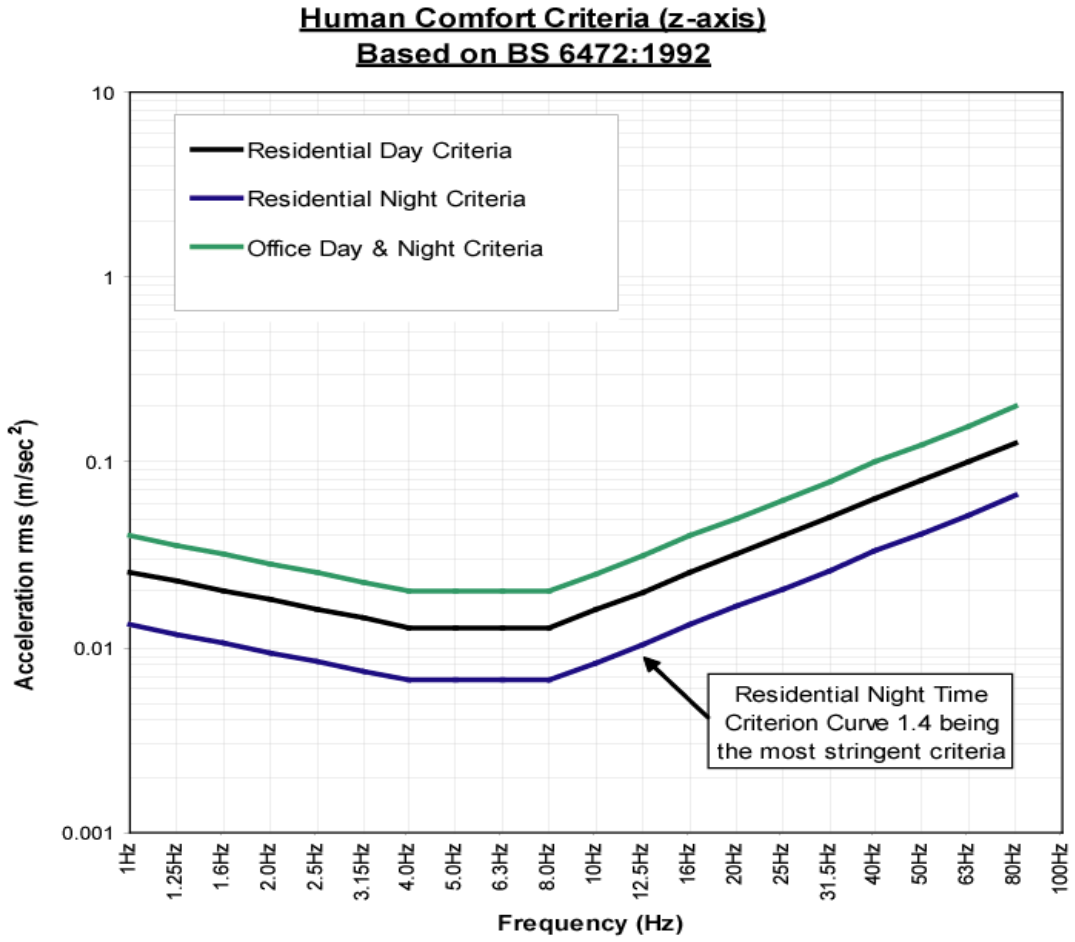


Table 2.4 of the DEC Guideline 2006 presents acceptable vibration dose values for intermittent vibration. Table 8 below outlines DEC's requirements.

Table 8: Acceptable VDVs for intermittent vibration in residential buildings m/s$^{1.75}$

Location	Period	Preferred VDV m/s$^{1.75}$	Maximum VDV m/s$^{1.75}$
Hotel Rooms	Day time (7am – 10pm)	0.20	0.40
	Night time (10pm – 7am)	0.13	0.26
Offices	Day time (7am – 10pm)	0.40	0.80
	Night time (10pm – 7am)	0.40	0.80

5.2 Rail vibration monitoring locations

Attended rail vibration survey was conducted on site at Location V1, V2, V3 and V4 as shown in Figure 5 on Tuesday 2nd July 2019. The measurement locations were representative of the nearest proposed basement foundation shoring adjacent to the rail tunnel.

Figure 5: Attended rail vibration measurement locations on site

5.3 Instrumentation

Short-term vibration measurements were undertaken using the Sinus SoundBook multi-channel analyser with PCB accelerometers. At Locations V1 and V3, three accelerometers (x-axis, y-axis & z-axis) were magnetically fixed to a right angle steel bracket that was adhered to the existing bitumen on site. At Locations V2 and V4, one accelerometer (z-axis) was fixed to a metal washer that was adhered to the existing bitumen on site. The recorded ground vibration levels of train pass-bys are shown in Section 5.4 below together with the vibration criteria from British Standard BS6472 and DEC Guideline 2006 intermittent vibration dosage criterion.

5.4 Measurement results

Results of the train vibration survey were plotted against night and day criterion of British Standard BS6472 as show in Figure 6 to Figure 13 below. In addition, the measured train vibration levels were used to calculate the vibration dosage values ('VDV') and then compared to the acceptable levels from the Table 2.4 of DEC Guideline 2006.

Results from the measurements demonstrate that the floor induced vibration within the proposed building from each of the measured train pass-bys were compliant with the BS6472 and DEC Guideline 2006 for human comfort in a residential environment during the day and night.

5.4.1 Ground-borne rail noise inside proposed development

Regenerated or ground-borne rail noise is the low rumble heard inside buildings with vicinity of railway or tunnels or railway tracks due to ground vibration generated by passing trains which propagate through soil and rock up into building elements such as foundation, wall and floors which re-radiates as audible sound. Train vibration levels measured on site were used to predict the regenerated rail noise inside the proposed building nearest to the rail corridor. The calculated noise levels inside the development spaces are summarised in Table 9 (Building 2A) and Table 10 (Building 2B) below.

Table 9: Calculated regenerated rail noise levels - Building 2A

Floor Level	Proposed Occupancy/Space	Calculated[1] Ground-borne Rail Noise inside development, dB(A)	Project Internal Criteria for Ground-borne Rail Noise, dB(A)	Comply? (Yes/No)
Ground	Lobby and Bar	45	50	Yes
Ground Upper	Restaurant	46	50	Yes
Level 1	Function	43	45	Yes
Level 1 Mezzanine	Plant	41	-	Yes
Level 2 to 13 Upper	Office	11-38	45	Yes
Level 14 and above	Hotel	<9	35	Yes

Notes:

1. Ground-borne noise calculations were based upon the measured $L_{Amax\ (slow)}$ of 95% of train pass-events as per DoP Guideline 2008.

Table 10: Calculated regenerated rail noise levels - Building 2B

Floor Level	Proposed Occupancy/Space	Calculated[1] Ground-borne Rail Noise inside development, dB(A)	Project Internal Criteria for Ground-borne Rail Noise, dB(A)	Comply? (Yes/No)
Ground	Lobby and Retail	51	50	No
Ground Upper	Office	52	45	No
Level 1	Office	49	45	No
Level 1 Mezzanine	Office	47	45	No
Level 2	Office	44	45	Yes
Level 3 and above	Office	42	45	Yes

Notes:

1. Ground-borne noise calculations were based upon the measured $L_{Amax\ (slow)}$ of 95% of train pass-events as per DoP Guideline 2008.

On the basis of rail vibration measurements on site, ground-borne rail noise levels inside the proposed office spaces of Building 2B are predicted to exceed the project criteria by 1-7dB.

A full and detailed assessment of the isolation treatment is required during the detailed design stage to ensure that regenerated noise within the development spaces from underground train pass-bys comply with the project criteria shown in Table 7 above. Vibration isolation treatment may include, but not limited to, decoupling of the basement foundation using resilient elements such as rubber bearing pads.

Figure 6: Vibration assessment for human annoyance (BS6472) in z-axis - Location V1

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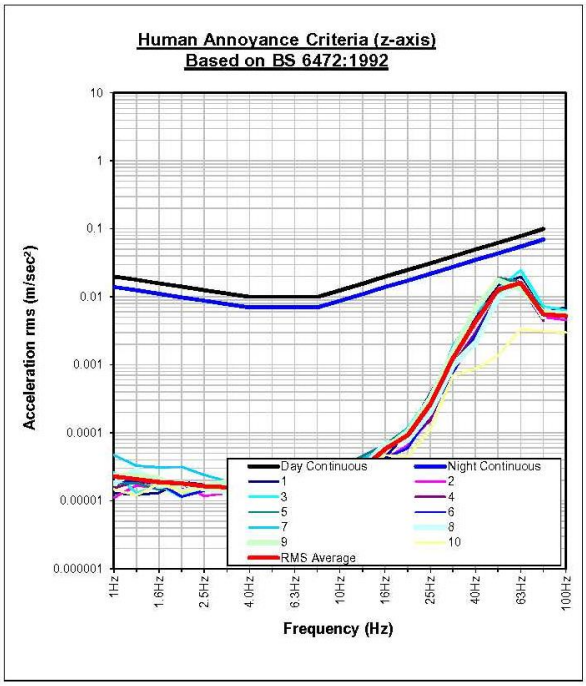
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V1 (Z-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	12.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	16Hz	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001		
	20Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001		
	25Hz	0.0004	0.0002	0.0004	0.0002	0.0003	0.0002	0.0003	0.0002	0.0003	0.0001	0.0003		
	31.5Hz	0.0015	0.0010	0.0012	0.0010	0.0014	0.0008	0.0019	0.0010	0.0016	0.0007	0.0013		
	40Hz	0.0048	0.0030	0.0041	0.0030	0.0064	0.0027	0.0058	0.0021	0.0066	0.0009	0.0044		
	50Hz	0.0149	0.0102	0.0130	0.0107	0.0191	0.0104	0.0113	0.0098	0.0177	0.0014	0.0127		
	63Hz	0.0197	0.0149	0.0249	0.0142	0.0168	0.0154	0.0140	0.0165	0.0129	0.0033	0.0161		
	80Hz	0.0058	0.0051	0.0073	0.0045	0.0064	0.0052	0.0059	0.0051	0.0060	0.0031	0.0055		
	100Hz	0.0071	0.0046	0.0064	0.0048	0.0055	0.0047	0.0056	0.0038	0.0057	0.0030	0.0052		
Weighted rms	Day	0.0037	0.0026	0.0040	0.0026	0.0040	0.0027	0.0029	0.0027	0.0036	0.0006	0.0031	0.0100	0.0200
	Night	0.0037	0.0026	0.0040	0.0026	0.0040	0.0027	0.0029	0.0027	0.0036	0.0006	0.0031	0.0070	0.0140
eVDV	Day	0.0359	0.0258	0.0388	0.0256	0.0394	0.0264	0.0284	0.0266	0.0354	0.0062	0.0303	0.20	0.40
	Night	0.0237	0.0170	0.0256	0.0169	0.0260	0.0174	0.0187	0.0175	0.0233	0.0041	0.0200	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 7: Vibration assessment for human annoyance (BS6472) in x-axis - Location V1

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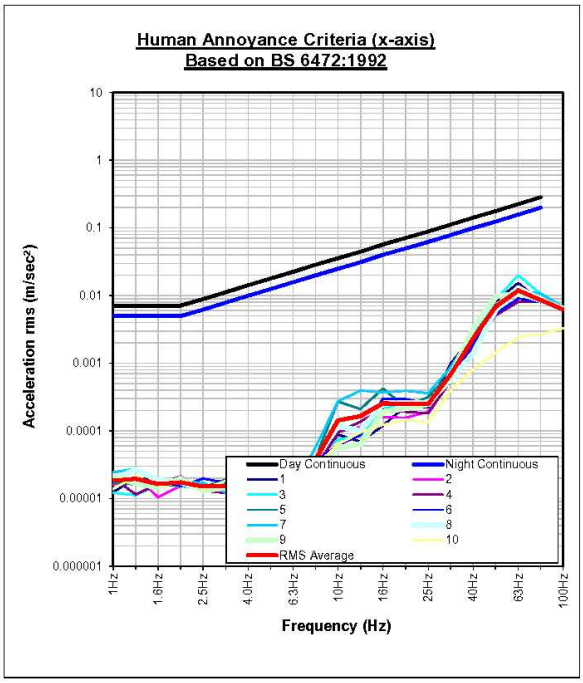
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V1 (X-direction)
Source:	Trains

Assessment Location:	Residential	Axis	X	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0001	0.0001	0.0001	0.0001	0.0003	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0004	0.0001	0.0001	0.0001	0.0002		
	16Hz	0.0001	0.0002	0.0002	0.0002	0.0004	0.0003	0.0004	0.0002	0.0002	0.0001	0.0003		
	20Hz	0.0002	0.0002	0.0003	0.0002	0.0002	0.0003	0.0004	0.0003	0.0002	0.0001	0.0002		
	25Hz	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0004	0.0003	0.0002	0.0001	0.0002		
	31.5Hz	0.0010	0.0006	0.0007	0.0006	0.0007	0.0006	0.0009	0.0006	0.0007	0.0004	0.0007		
	40Hz	0.0025	0.0018	0.0025	0.0019	0.0031	0.0020	0.0029	0.0014	0.0032	0.0008	0.0023		
	50Hz	0.0083	0.0051	0.0086	0.0052	0.0091	0.0054	0.0061	0.0061	0.0096	0.0014	0.0069		
	63Hz	0.0155	0.0081	0.0200	0.0081	0.0121	0.0091	0.0119	0.0131	0.0109	0.0025	0.0120		
	80Hz	0.0084	0.0081	0.0106	0.0083	0.0095	0.0080	0.0108	0.0088	0.0086	0.0027	0.0086		
	100Hz	0.0072	0.0063	0.0069	0.0062	0.0070	0.0061	0.0069	0.0055	0.0064	0.0033	0.0063		
Weighted rms	Day	0.0006	0.0004	0.0008	0.0004	0.0006	0.0004	0.0006	0.0005	0.0006	0.0001	0.0005	0.0071	0.0140
	Night	0.0006	0.0004	0.0008	0.0004	0.0006	0.0004	0.0006	0.0005	0.0006	0.0001	0.0005	0.0050	0.0100
eVDV	Day	0.0064	0.0040	0.0077	0.0040	0.0060	0.0042	0.0055	0.0053	0.0058	0.0013	0.0053	0.20	0.40
	Night	0.0042	0.0026	0.0051	0.0026	0.0040	0.0028	0.0036	0.0035	0.0038	0.0009	0.0035	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 8: Vibration assessment for human annoyance (BS6472) in y-axis - Location V1

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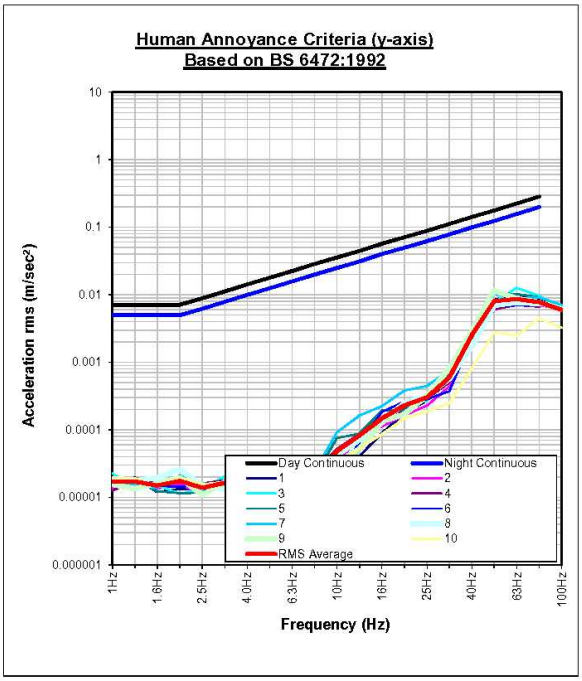
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V1 (Y-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Y	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000		
	12.5Hz	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001		
	20Hz	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0004	0.0003	0.0002	0.0001	0.0002		
	25Hz	0.0003	0.0002	0.0003	0.0003	0.0003	0.0003	0.0004	0.0003	0.0003	0.0002	0.0003		
	31.5Hz	0.0006	0.0004	0.0007	0.0005	0.0007	0.0004	0.0008	0.0006	0.0008	0.0002	0.0006		
	40Hz	0.0031	0.0021	0.0030	0.0021	0.0031	0.0023	0.0030	0.0018	0.0029	0.0008	0.0025		
	50Hz	0.0084	0.0060	0.0078	0.0062	0.0106	0.0067	0.0102	0.0070	0.0116	0.0028	0.0081		
	63Hz	0.0103	0.0074	0.0127	0.0071	0.0103	0.0070	0.0089	0.0078	0.0088	0.0025	0.0087		
	80Hz	0.0084	0.0069	0.0097	0.0067	0.0092	0.0070	0.0092	0.0074	0.0078	0.0045	0.0078		
	100Hz	0.0062	0.0065	0.0063	0.0063	0.0065	0.0060	0.0071	0.0052	0.0062	0.0033	0.0060		
Weighted rms	Day	0.0005	0.0004	0.0006	0.0004	0.0006	0.0004	0.0006	0.0004	0.0006	0.0002	0.0005	0.0071	0.0140
	Night	0.0005	0.0004	0.0006	0.0004	0.0006	0.0004	0.0006	0.0004	0.0006	0.0002	0.0005	0.0050	0.0100
eVDV	Day	0.0053	0.0039	0.0058	0.0039	0.0060	0.0041	0.0057	0.0042	0.0059	0.0019	0.0048	0.20	0.40
	Night	0.0035	0.0026	0.0038	0.0025	0.0039	0.0027	0.0037	0.0028	0.0039	0.0012	0.0032	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 9: Vibration assessment for human annoyance (BS6472) in z-axis - Location V2

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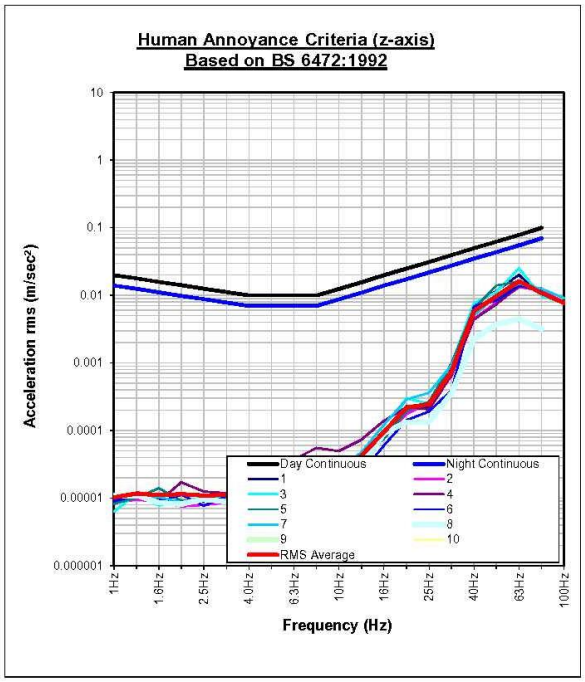
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V2 (Z-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000			0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000		
	12.5Hz	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000			0.0000		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001			0.0001		
	20Hz	0.0002	0.0002	0.0003	0.0002	0.0002	0.0001	0.0003	0.0001			0.0002		
	25Hz	0.0002	0.0003	0.0002	0.0002	0.0003	0.0002	0.0004	0.0001			0.0002		
	31.5Hz	0.0008	0.0006	0.0010	0.0007	0.0010	0.0004	0.0009	0.0004			0.0008		
	40Hz	0.0075	0.0045	0.0076	0.0044	0.0064	0.0070	0.0051	0.0023			0.0059		
	50Hz	0.0117	0.0079	0.0113	0.0075	0.0140	0.0084	0.0099	0.0038			0.0098		
	63Hz	0.0202	0.0133	0.0251	0.0138	0.0160	0.0141	0.0150	0.0045			0.0162		
	80Hz	0.0099	0.0118	0.0098	0.0127	0.0124	0.0117	0.0125	0.0032			0.0109		
	100Hz	0.0076	0.0081	0.0077	0.0084	0.0089	0.0075	0.0091	0.0029			0.0078		
Weighted rms	Day	0.0037	0.0026	0.0041	0.0026	0.0035	0.0029	0.0030	0.0010			0.0031	0.0100	0.0200
	Night	0.0037	0.0026	0.0041	0.0026	0.0035	0.0029	0.0030	0.0010			0.0031	0.0070	0.0140
eVDV	Day	0.0359	0.0254	0.0403	0.0259	0.0346	0.0283	0.0292	0.0099			0.0299	0.20	0.40
	Night	0.0237	0.0167	0.0265	0.0170	0.0228	0.0187	0.0192	0.0065			0.0197	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 10: Vibration assessment for human annoyance (BS6472) in z-axis - Location V3

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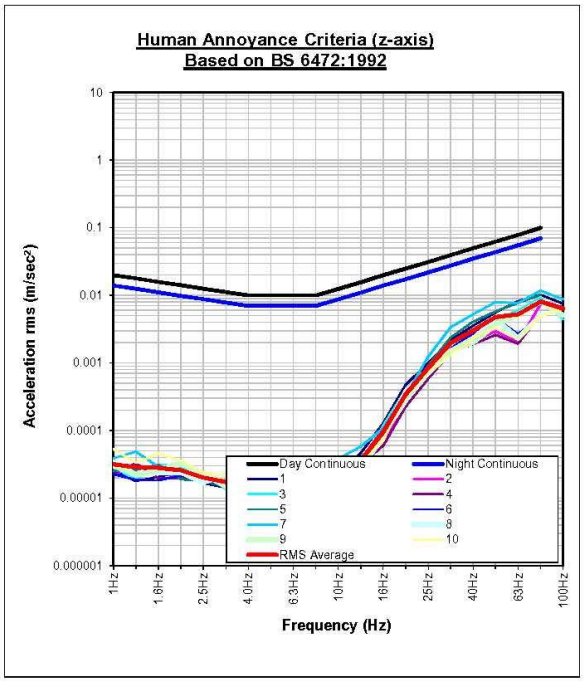
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V3 (Z-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	12.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	20Hz	0.0005	0.0002	0.0004	0.0002	0.0003	0.0004	0.0003	0.0004	0.0003	0.0004	0.0003		
	25Hz	0.0010	0.0007	0.0009	0.0006	0.0009	0.0008	0.0012	0.0007	0.0007	0.0007	0.0008		
	31.5Hz	0.0022	0.0015	0.0020	0.0015	0.0024	0.0017	0.0034	0.0015	0.0015	0.0013	0.0020		
	40Hz	0.0036	0.0021	0.0023	0.0019	0.0041	0.0027	0.0053	0.0023	0.0020	0.0024	0.0031		
	50Hz	0.0056	0.0029	0.0044	0.0026	0.0058	0.0046	0.0080	0.0044	0.0037	0.0034	0.0048		
	63Hz	0.0082	0.0020	0.0061	0.0019	0.0078	0.0027	0.0077	0.0023	0.0052	0.0022	0.0053		
	80Hz	0.0103	0.0074	0.0092	0.0053	0.0103	0.0049	0.0118	0.0051	0.0081	0.0049	0.0081		
	100Hz	0.0075	0.0063	0.0044	0.0048	0.0088	0.0051	0.0088	0.0054	0.0051	0.0065	0.0064		
Weighted rms	Day	0.0020	0.0011	0.0016	0.0009	0.0020	0.0012	0.0025	0.0011	0.0014	0.0010	0.0016	0.0100	0.0200
	Night	0.0020	0.0011	0.0016	0.0009	0.0020	0.0012	0.0025	0.0011	0.0014	0.0010	0.0016	0.0070	0.0140
eVDV	Day	0.0194	0.0109	0.0155	0.0090	0.0197	0.0119	0.0241	0.0111	0.0133	0.0100	0.0152	0.20	0.40
	Night	0.0128	0.0072	0.0102	0.0059	0.0130	0.0078	0.0159	0.0073	0.0087	0.0066	0.0100	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 11: Vibration assessment for human annoyance (BS6472) in x-axis - Location V3

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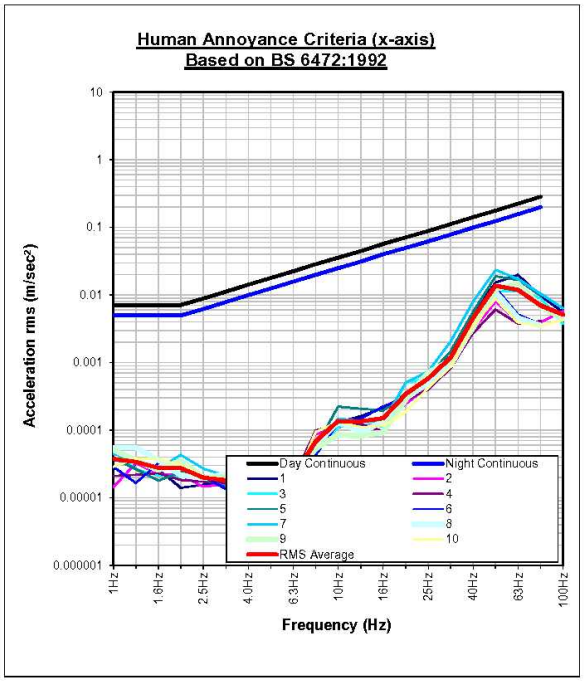
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V3 (X-direction)
Source:	Trains

Assessment Location:	Residential	Axis	X	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001		
	10Hz	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	12.5Hz	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	16Hz	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002		
	20Hz	0.0003	0.0002	0.0005	0.0003	0.0003	0.0003	0.0005	0.0003	0.0003	0.0002	0.0003		
	25Hz	0.0007	0.0004	0.0006	0.0004	0.0006	0.0006	0.0007	0.0005	0.0007	0.0004	0.0006		
	31.5Hz	0.0013	0.0009	0.0011	0.0008	0.0015	0.0009	0.0021	0.0009	0.0011	0.0009	0.0012		
	40Hz	0.0056	0.0031	0.0033	0.0028	0.0057	0.0043	0.0080	0.0035	0.0033	0.0036	0.0046		
	50Hz	0.0153	0.0080	0.0114	0.0061	0.0191	0.0128	0.0236	0.0111	0.0123	0.0088	0.0138		
	63Hz	0.0200	0.0041	0.0116	0.0038	0.0167	0.0051	0.0173	0.0046	0.0148	0.0039	0.0119		
	80Hz	0.0098	0.0039	0.0089	0.0041	0.0098	0.0037	0.0105	0.0036	0.0068	0.0035	0.0071		
	100Hz	0.0056	0.0058	0.0037	0.0048	0.0067	0.0045	0.0064	0.0040	0.0045	0.0043	0.0051		
Weighted rms	Day	0.0010	0.0004	0.0007	0.0003	0.0010	0.0006	0.0012	0.0005	0.0007	0.0004	0.0007	0.0071	0.0140
	Night	0.0010	0.0004	0.0007	0.0003	0.0010	0.0006	0.0012	0.0005	0.0007	0.0004	0.0007	0.0050	0.0100
eVDV	Day	0.0095	0.0040	0.0065	0.0033	0.0099	0.0059	0.0119	0.0051	0.0072	0.0043	0.0073	0.20	0.40
	Night	0.0063	0.0026	0.0043	0.0022	0.0066	0.0039	0.0078	0.0034	0.0047	0.0028	0.0048	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 12: Vibration assessment for human annoyance (BS6472) in y-axis - Location V3

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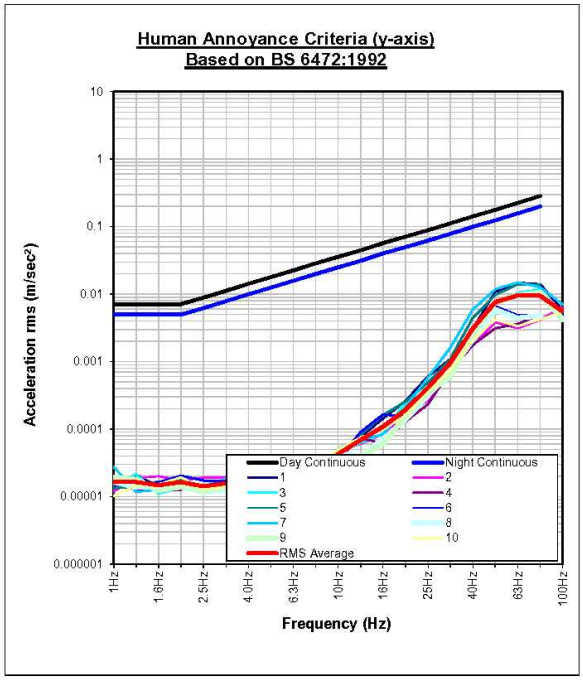
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V3 (Y-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Y	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001		
	20Hz	0.0003	0.0002	0.0003	0.0001	0.0003	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002		
	25Hz	0.0006	0.0003	0.0004	0.0002	0.0005	0.0004	0.0006	0.0003	0.0004	0.0004	0.0004		
	31.5Hz	0.0011	0.0008	0.0008	0.0007	0.0011	0.0009	0.0016	0.0008	0.0006	0.0008	0.0010		
	40Hz	0.0031	0.0017	0.0022	0.0018	0.0044	0.0025	0.0059	0.0021	0.0026	0.0021	0.0031		
	50Hz	0.0109	0.0039	0.0074	0.0032	0.0098	0.0066	0.0119	0.0059	0.0076	0.0042	0.0077		
	63Hz	0.0149	0.0032	0.0106	0.0036	0.0141	0.0049	0.0150	0.0044	0.0097	0.0034	0.0096		
	80Hz	0.0140	0.0042	0.0118	0.0050	0.0137	0.0049	0.0128	0.0048	0.0107	0.0042	0.0095		
	100Hz	0.0058	0.0064	0.0046	0.0055	0.0064	0.0050	0.0071	0.0045	0.0042	0.0055	0.0056		
Weighted rms	Day	0.0008	0.0002	0.0006	0.0002	0.0007	0.0004	0.0008	0.0003	0.0005	0.0003	0.0005	0.0071	0.0140
	Night	0.0008	0.0002	0.0006	0.0002	0.0007	0.0004	0.0008	0.0003	0.0005	0.0003	0.0005	0.0050	0.0100
eVDV	Day	0.0074	0.0024	0.0054	0.0023	0.0072	0.0036	0.0080	0.0032	0.0052	0.0025	0.0052	0.20	0.40
	Night	0.0049	0.0016	0.0036	0.0015	0.0047	0.0023	0.0053	0.0021	0.0034	0.0017	0.0034	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 13: Vibration assessment for human annoyance (BS6472) in z-axis - Location V4

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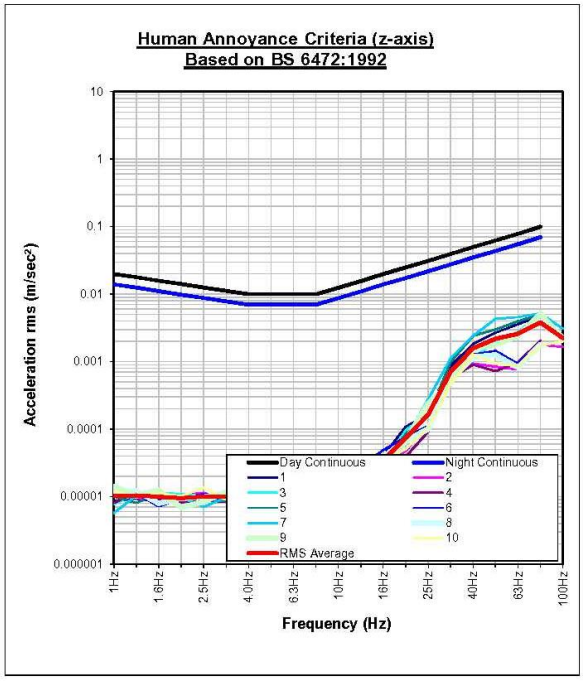
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	TK563
Location:	Site 2A + 2B, Sydney Olympic Park, NSW 2127 - vibration measurement location V4 (Z-direction)
Source:	Trains

Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	2,411
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	455



Legend														
Measurement		1	2	3	4	5	6	7	8	9	10	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	12.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	16Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	20Hz	0.0001	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	25Hz	0.0002	0.0001	0.0002	0.0001	0.0002	0.0001	0.0003	0.0001	0.0002	0.0001	0.0002		
	31.5Hz	0.0009	0.0006	0.0006	0.0006	0.0010	0.0005	0.0011	0.0005	0.0005	0.0005	0.0007		
	40Hz	0.0018	0.0009	0.0011	0.0009	0.0024	0.0013	0.0024	0.0012	0.0015	0.0013	0.0016		
	50Hz	0.0027	0.0008	0.0019	0.0007	0.0030	0.0015	0.0043	0.0013	0.0018	0.0009	0.0022		
	63Hz	0.0036	0.0008	0.0028	0.0010	0.0040	0.0009	0.0046	0.0008	0.0024	0.0009	0.0026		
	80Hz	0.0048	0.0018	0.0050	0.0021	0.0050	0.0019	0.0052	0.0018	0.0051	0.0017	0.0038		
	100Hz	0.0023	0.0017	0.0024	0.0018	0.0026	0.0021	0.0031	0.0018	0.0022	0.0020	0.0022		
Weighted rms	Day	0.0009	0.0003	0.0007	0.0004	0.0010	0.0004	0.0012	0.0004	0.0007	0.0004	0.0007	0.0100	0.0200
	Night	0.0009	0.0003	0.0007	0.0004	0.0010	0.0004	0.0012	0.0004	0.0007	0.0004	0.0007	0.0070	0.0140
eVDV	Day	0.0088	0.0034	0.0073	0.0035	0.0100	0.0043	0.0117	0.0039	0.0073	0.0038	0.0070	0.20	0.40
	Night	0.0058	0.0023	0.0048	0.0023	0.0066	0.0028	0.0077	0.0026	0.0048	0.0025	0.0046	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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6 Operational noise assessment

6.1 Criteria

6.1.1 EPA requirements

The NSW Environment Protection Authority ('EPA') sets out noise criteria in its Noise Policy for Industry ('NPfI') to control the noise emission from industrial sources impacting on the amenity of residential receivers. The project noise trigger level is set as the lower value of the following two assessment components:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

Noise intrusiveness ensures that industrial noise does not exceed the background noise level by an excessive margin, preventing significant changes in the noise characteristic pertinent to the development site and surrounds. This is commonly referred to as the 'background plus 5' criterion. That is, the noise level from new industrial development, assessed in periods of 15 minutes, should not exceed the existing background noise level (measured in the absence of that development) by more than 5dB(A).

Noise amenity ensures that industrial noise levels do not increase without limit, for if a number of industrial noise sources are permitted to increase the background noise level by 5dB(A), in turn there would be a point where the ultimate noise level is unacceptable. A limit on the ultimate acceptable noise level is therefore included in the NPfI as a way of ensuring that cumulative noise impact from industrial growth is curtailed. This limit is referred to as the project amenity noise level. The appropriate limit in any circumstance relates to the land use category, for example, there are different limits for rural, suburban and urban areas.

Table 11 below presents the recommended amenity noise level relevant to the receivers surrounding the proposed development site. The project amenity noise level is defined as the recommended amenity noise level minus 5dB(A).

Table 11: NPfI Amenity Noise Levels - Recommended L_{Aeq} Amenity Noise Levels from Industrial Noise Sources [EPA NPfI Table 2.1]

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
			Recommended amenity noise level
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A) Recommended amenity noise level
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See Column 4	5dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70

Notes:

- Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
- On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
- The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

In accordance with Section 2.4 of the NPfI, the following **exceptions** to the above method to derive the project amenity noise level apply:

1. In areas with high traffic noise levels (see Section 2.4.1 of the NPfI).
2. In proposed developments in major industrial clusters (see Section 2.4.2 of the NPfI).
3. Where the resultant project amenity noise level is 10dB, or more, lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
4. Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

Table 12 present the site-specific noise production criteria from industrial noise sources, namely mechanical plant.

Table 12: Project noise trigger level for noise emission from industrial noise sources (EPA NPfI)

Time of Day	Column 1	Column 2	Column 3	Column 4
	Rating Background Level (RBL) $L_{A90\ dB}$	Intrusiveness Criterion (RBL+5) $L_{Aeq,\ (15min)}$ dB	Project Amenity Noise Level (PANL) $L_{Aeq,\ (15min)\ dB}$	Project Noise Trigger Level $L_{Aeq,\ (15min)}$ dB
Day (7am to 6pm)	53	58	53	53
Evening (6pm to 10pm)	49	54	43	43
Night (10pm to 7am)	43	48	38	38

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in Table 2 above

Column 3 – Project Amenity Noise Level determined based on 'Residential - suburban' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB, plus 3dB to convert from period to 15 minute value

Column 4 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level

6.1.2 Maximum noise level event assessment

The potential for sleep disturbance from maximum noise level events, from the proposed development, needs to be considered. Section 2.5 of the NPfI provides sleep disturbance trigger levels, summarised as shown in Table 13 below.

Table 13: Sleep disturbance noise trigger levels - Canterbury Road receivers

Receiver	Sleep Disturbance Trigger Levels, 10:00pm to 7:00am	
	$L_{Aeq,\ 15\ minute}$	L_{AFmax}
All residential	Greater than 40dB(A) or RBL plus 5dB, whichever is the greater = 48dB(A)	52dB(A) or RBL plus 15dB, whichever is the greater = 58dB(A)

Where noise from the proposed development is predicted to exceed the sleep disturbance trigger levels above in Table 13, during the night time, a detailed noise level assessment is required. The detailed assessment is required to cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the frequency of events occurring during the night time.

6.2 Recommended noise control measures

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the recommended EPA's NPfI noise emission criteria noted in Section 6.1 above.

6.2.1 Mechanical plant

As details of mechanical plant at this stage have not been finalised, the following in-principal recommendations are provided:

- Acoustic assessment of mechanical services equipment will need to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in EPA's NPfI (Table 13);

- As noise control treatment can affect the performance of the mechanical services system, it is recommended that consultation with an acoustic consultant be made during the initial phase of mechanical services system design in order to reduce the need for revision of mechanical plant and noise control treatment;

- Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following:

    - Procurement of 'quiet' plant;

    - Strategic positioning of plant away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises;

    - 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 over plant.

- Mechanical plant shall have their noise specifications and their proposed locations checked prior to their installation on site;

- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625. "Rotating and Reciprocating Machinery - Mechanical Vibration"; and

- Swimming pool on Level 32 and associated pumps and pipework shall be vibration isolated from the building structure.

6.2.2 Loading dock

Noise from the operation of the loading docks has the potential to impact the amenity of the residences located opposite Parkview Drive at 11 Australia Avenue. Noise generating activities from the operation of the loading docks include trucks reversing into the loading dock, idling of the trucks within the dock and unloading activities.

Noise impact from the loading dock has been assessed with the findings as follows:

- Maximum vehicle size the loading dock can accommodate is a Medium Rigid Vehicle (MRV);

- Sound Power Level of a truck idling with refrigeration plant running is $L_{eq,\ T}$ 97dB(A);
- Sound Power Level of a truck reversing with reversing beeper alarm is $L_{eq,\ 15\ min}$ 74dB(A); and
- Truck is to be turned off whilst unloading.

Based on the above findings, the predicted noise emission from the use of both loading docks (Building 2A and Building 2B) is $L_{eq,\ 15\ min}$ 50dB(A) which is compliant with the day period project noise emission goals. As such, the loading docks are to be used only during the day period between 7am and 6pm.

7 Internal sound insulation

Internal walls and floors shall comply with the National Construction Code of Australia 2019 (formally Building Code of Australia). All services and doors shall comply with the requirements of the NCC 2019. Appendix C presents a summary of acoustic provisions outlined in Part F5 of the NCC 2019.

8 Conclusion

Renzo Tonin & Associates has completed an acoustic assessment of the proposed hotel and office development at Site 2, Sydney Olympic Park including noise and vibration impacts onto the site from road, rail and major events as well as potential noise impacts from the operation of the development.

The study of external noise and vibration intrusion into the subject development has found that appropriate controls can be incorporated into the building design to achieve a satisfactory accommodation environment, consistent with the intended quality of the development and the SEARs for the project.

Noise emission goals for the project operation have been set in accordance with the EPA's Noise Policy for Industry. It is feasible that noise emissions from the subject site can comply with these criteria, subject to detailed design for Construction Certificate.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Criteria and design methodology

B.1 Sydney Olympic Park Master Plan 2030

Relevant sections from the Sydney Olympic Park Master Plan 2030 are presented below.

4.6.15 Noise Controls

The Sydney Olympic Park Authority will continue to use 'Public Positive Covenants' to ensure landowners and lessees acknowledge the environmental and operational conditions that arise from the sporting, events and entertainment business – a prominent feature of life at Sydney Olympic Park that may affect their use and enjoyment of their properties.

To acknowledge and minimise the current potential noise impacts of sporting and entertainment venues and control transport and industrial noise to confirm with NSW guidelines:

> *New development is to acknowledge that it will be located within a major sport and entertainment events precinct that may be subject to high noise events from time to time. This will be achieved by creating a 'Section 88D' instrument (on Sydney Olympic Park land) or a 'Section 88E' instrument (on non-Sydney Olympic Park land) on title advising of likely noise levels in the precinct.*
>
> *Applicants for a new development must prepare a report by a suitably qualified acoustic consultant assessing the possibility of land use conflicts as a result of the development. The land use conflict could be, for example, from an entertainment venue on the closest residential receiver or it could be the result of a new residential development possibly restricting the use of an existing entertainment venue. The suitability of the development for the site is the responsibility of the applicant who is required to assess the noise impact and to incorporate appropriate measures into the development.*
>
> *All noise impact assessments require ambient noise levels measured at the noise sensitive premises during representative periods to ensure all major intermittent noises are measured and quantified. This particularly applies to outdoor concerts, sporting events and latenight parties. The results of the noise measurements should be used to design noise mitigation measures relevant to the proposed development.*
>
> *All plant rooms shall be designed to meet the requirements of the NSW Industrial Noise Policy.*

Commercial Development

> *Design commercial development to comply with the maximum internal noise criteria set out in Table 4.5 Maximum Noise Criteria – Office Development below:*

Table 4.5 Maximum Noise Criteria – Office Development

Internal Space	*Noise Criterion*	*Time Period*	*Noise Measure*
Offices	*45dBA*	*Day & Evening*	*LAeq, 15 min*

Hotels and Serviced Apartments Development

Wherever practicable, hotels and serviced apartment developments shall be sited, oriented and treated to maximise natural ventilation and avoid the use of air conditioning.

Where residential development is located in the area marked 'Substantial Noise Mitigation Required', air conditioning and double glazed windows and doors are required to reduce noise impact at certain times by closing all doors and windows.

Design hotels and serviced apartment developments to comply with the residential internal noise criteria set out in Table 4.8 Maximum Noise Criteria – Hotels and Serviced Apartments below:

Table 4.8 Maximum Noise Criteria – Hotels and Serviced Apartments

Internal Space	*Noise Criterion*	*Time Period*	*Noise Measure*
Living Rooms	*45dBA*	*Day & Evening*	*LAeq, 15min*
Working Areas			
Sleeping Rooms	*40dBA*	*Night Time*	

B.2 State Environmental Planning Policy (Infrastructure) 2007

The NSW State Environmental Planning Policy (Infrastructure) 2007 (known as 'ISEPP') came into force in NSW on 1 January 2008 to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the ISEPP includes the following clauses:

Clauses: Rail corridors

Clause 85: any development on land that is in or immediately adjacent to a rail corridor, if the development is:

a) likely to have an adverse effect on rail safety;

b) involves the placing of a metal finish on a structure and the rail corridor concerned is used by electric trains, or;

c) involves the use of a crane in air space above any rail corridor.

Clause 86: any development (other than development to which clause 88 of the Infrastructure SEPP applies) that involves the penetration of the ground to a depth of at least 2m below ground level (existing) on land that is:

a) within or above a rail corridor; or

b) within 25m (measured horizontally) of a rail corridor; or

c) within 25m (measured horizontally) of the ground directly above an underground rail corridor

Note: the consent authority must not grant consent without consulting with the rail authority and obtaining concurrence consistent with clauses 86(2)-(5)

Clause 87: development for any of the following purposes that is on land that is in or immediately adjacent to a rail corridor and the consent authority considers development is likely to be adversely affected by rail noise or vibration:

- *building for residential use*
- *a place of public worship*
- *a hospital*
- *an educational establishment or childcare centre*

Clauses: Road corridors

Clause 102: development for any of the following purposes that is on land in or adjacent to a road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data available on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

- *building for residential use*
- *a place of public worship*
- *a hospital*
- *an educational establishment or childcare centre*

Clause 103: any development which involves penetration of the ground to a depth of at least 3m below ground level (existing) on land that is the road corridor of roads or road projects as specified in schedule 2 of the SEPP.

**For Clauses 87 (Rail) and 102 (Road): if the development is for the purpose of a building for residential use, the consent authority must be 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 10pm-7am*
- *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.*

B.2.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

B.2.2 Clarification of ISEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the ISEPP apply to internal noise levels with windows and doors closed. However as the preliminary noise assessment is based on measurements/predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the ISEPP. The equivalent external goals have been determined on the following basis:

- The ISEPP states: "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*." The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the ISEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 14 presents the ISEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 14: ISEPP noise criteria for new residential development

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35

Room	Location	$L_{Aeq, 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

B.3 Australian/New Zealand Standard AS/NZS 2107:2016

As traffic noise levels are not constant, an L_{eq} noise level descriptor is used when assessing this type of noise source. The L_{eq} is the mean energy level of the noise being measured.

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

This standard recommends the following noise levels for residential buildings.

Table 15: Recommended design sound levels for different areas of occupancy in buildings

Type of occupancy/ activity	Recommended design sound level, L_{Aeq}, dB(A)	Recommended reverberation time (T),s
5 OFFICE BUILDINGS		
General office areas	40 to 45	0.4 to 0.6
Private offices	35 to 40	0.6 to 0.8
Public spaces	40 to 50	0.5 to 1.0
Reception areas	40 to 45	0.6 to 0.8
Rest rooms and break-out spaces	40 to 45	0.4 to 0.6
Toilets	45 to 55	-
Undercover carparks	<65	-
7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2)		
Hotels and motels-		
Bars and lounges	<50	0.6 to 1.0
Conference areas-		
Without sound reinforcement-		
Up to 50 persons	35 to 40	Curve 1 of AS2107 Appendix A
From 50 to 250 persons	30 to 35	Curve 1 of AS2107 Appendix A
With sound reinforcement	35 to 45	Curve 1 of AS2107 Appendix A
Dining rooms	40 to 45	See Note 1

Type of occupancy/ activity	Recommended design sound level, L_{Aeq}, dB(A)	Recommended reverberation time (T),s
Enclosed carparks	<65	-
Foyers and recreation areas	45 to 50	See Note 1
Kitchen, laundry and maintenance areas	<55	-
Sleeping areas (night time)-		
AFTHotels and motels in inner city areas or entertainment districts or near major roads	35 to 40	-
Hotels and motels in suburbs or near minor roads	30 to 35	-
Washrooms and toilets	45 to 55	-
8 SHOP BUILDINGS		
Enclosed carparks	<65	-
Show rooms	<50	See Note 3
Small retails stores (general)	<50	See Note 3
Specialty Shops (where detailed discussion is necessary in transactions)	<45	See Note 3

NOTES:

1. The recommended design sound levels are for a fully fitted out and completed building. Attention is drawn to the additive noise effect of many machines within the same area and adjacent areas. Allowance for the total number and type of noise sources should therefore be made in the selection of equipment and in the design of building spaces. A building owner or developer may consider an allowance of 3-5 dB(A) to be appropriate.
2. Recommended reverberation time is 10 percent to 20 percent higher than Curve 1 of Appendix A.
3. Reverberation time should be minimized as far as practicable for noise control.
4. Certain teaching spaces, including those intended for students with learning difficulties and students with English as a second language, should have reverberation times at the lower end of the specified range.
5. Specialist advice should be sought for these spaces.
6. A very wide range of noise levels can occur in the occupied state in spaces housing manufacturing processes, and the levels are primarily subject to control as part of a noise management program (see AS/NZS 1269.2). The possibilities for segregating very noisy processes from quieter ones by partitioning vary between particular industries and plants. For reasons such as these, it is difficult to make generalized recommendations for desirable, or even maximum, design levels for the unoccupied state, but one guiding principle may still be observed - when the activity in one area of a manufacturing plant is halted, it is desirable that the local level should if possible drop to 70 dB(A) or lower to permit speech communication without undue effort.
7. In situations where traffic noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time and for an appropriate measurement period according to the area of occupancy or activity in the building. Where traffic noise fluctuates rapidly with the passage of individual vehicles, the community reaction may not correlate well with the equivalent continuous noise level as measured.
8. The overall sound pressure level in dB(A) should conform to the recommended design sound level given in Table 1. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C.
9. In spaces in which high quality sound recordings are to be made, the levels set for low frequency octave bands should not be exceeded (see Appendix C). Subsequent replay of the recordings may cause an amplification of the ambient sound resulting in an overemphasis of its low-frequency components. Specialist advice should always be sought when these spaces are being designed. In some circumstances, for purposes of very high quality recording, lower levels than those specified in Table 1 may be required.

APPENDIX C Internal sound insulation

C.1 National Construction Code 2019

The National Construction Code of Australia (NCC) outlines minimum requirements for inter-tenancy (party) walls and ceiling/ floors to maintain privacy. This includes the incorporation of penetration of a service through a floor or through more than one sole-occupancy unit.

NCC nominates required Weighted Sound Reduction Indexes (R_w) and spectrum adaptation factor (C_{tr}) for partition constructions, of different space/ activity types in adjoining units. The R_w and $R_w + C_{tr}$ are single number descriptors for quantifying the attenuating performance of partitions for typical intrusive noises produced inside residences. The higher the rating, the greater the isolation provided by the partition.

Spectrum adaptation factors are commonly used to compensate for the fact that certain kinds of sounds are more readily transmitted through insulating materials than others insulate.

The adaptation factor C_{tr} has now been introduced for most building elements which require an airborne sound insulation rating. The only exception is a wall which separates a dwelling from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification. Therefore, both the C_{tr} factor and the R_w of the building element will need to be considered in most cases.

The C_{tr} factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and music reproduction equipment.

The Deemed-to-Satisfy Provisions also have impact sound insulation requirements for floors. The terms to describe the impact sound insulation of the floor is the weighted normalised impact sound pressure level ($L_{n,w}$). The lower the $L_{n,w}$ of the floor, the better the performance of the floor in terms of impact sound insulation.

The following section represents a summary of acoustic provisions outlined in the Part F5 of the NCC.

C.2 Sound Insultion Provision of NCC of Australia 2019

The acoustic provisions for inter-tenancy walls and floors in Class 2 and 3 buildings are outlined in the National Construction Code of Australia and the following is an extract from the NCC:

"F5.2 Determination of airborne sound insulation ratings

A form of construction required to have an airborne sound insulation rating must –

a. have the required value for weighted sound reduction index (R_w) or weighted sound reduction index with spectrum adaptation term ($R_w + C_{tr}$) determined in accordance with AS/NZS 1276.1 or ISO 717.1 using results from laboratory measurements; or

b. comply with Specification F5.2.

F5.3 Determination of impact sound insulation ratings

a. A floor in a building required to have an impact sound insulation rating must –

i. have the required value for weighted normalised impact sound pressure level with spectrum adaptation term ($L_{n,w}$) determined in accordance with AS/ISO 717.2 using results from laboratory measurements; or

ii. comply with Specification F5.2.

b. A wall in a building required to have an impact sound insulation rating must –

i. for a Class 2 or 3 building be of discontinuous construction;

c. For the purposes of this part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

i. for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

ii. for other than masonry, there is no mechanical linkage between leaves except at the periphery.

F5.4 Sound insulation rating of floors

a. A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an $L_{n,w}$ (impact) not more than 62 if it separates –

i. sole-occupancy units; or

ii. a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

F5.5 Sound insulation rating of walls

a. A wall in a Class 2 or 3 building must –

i. have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates sole-occupancy units; and

ii. have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

iii. comply with F5.3(b) if it separates:

(A) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

(B) a sole-occupancy unit from a plant room or lift shaft.

b. A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an R_w not less than 30.

c. Where a wall required to have sound insulation has a floor above, the wall must continue to –

i. the underside of the floor above; or

ii. a ceiling that provides the sound insulation required for the wall.

F5.6 Sound insulation rating of services

a. If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an $R_w + C_{tr}$ (airborne) not less than –

i. 40 if the adjacent room is a habitable room (other than a kitchen); or

ii. 25 if the adjacent room is a kitchen or non-habitable room.

b. If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (a)(i) and (ii).

F5.7 Sound insulation of pumps

A flexible coupling must be used at the point of connection between the services pipes in a building and any circulating or other pumps."

APPENDIX D Locations and results of noise and vibration surveys

D.1 Long-term noise monitoring locations

Location L1: Balcony of an apartment at 9 Australia Avenue, facing T2 Olympic Rail Line

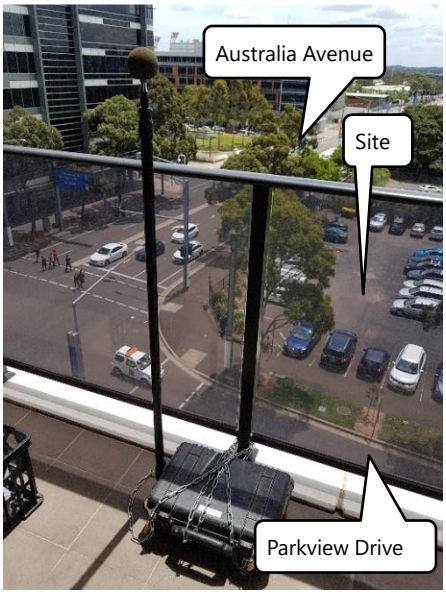
Survey Period: 1st November to 10th November 2018

Figure 14: Photograph of Location L1

Location L2: Balcony of an apartment at 11 Australia Avenue, facing the road intersection between Australia Avenue and Parkview Drive

Survey Period: 9th November to 16th November 2018

Figure 15: Photograph of Location L2

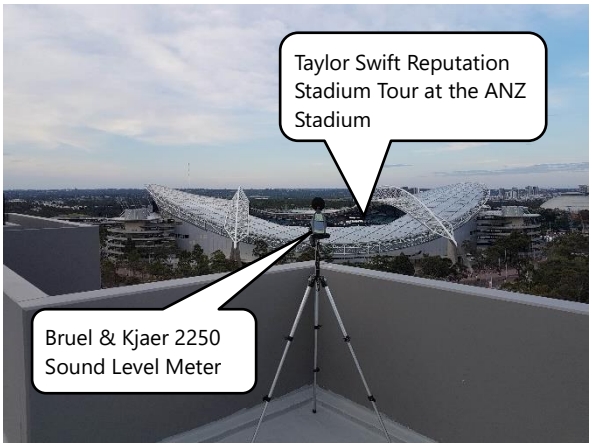


D.2 Attended noise measurements

Location S1: Rooftop of a residential building at 7-9 Carter Street

Survey Period: 2nd November 2018 between 5:00pm and 8:00pm

Figure 16: Photograph of Location S1

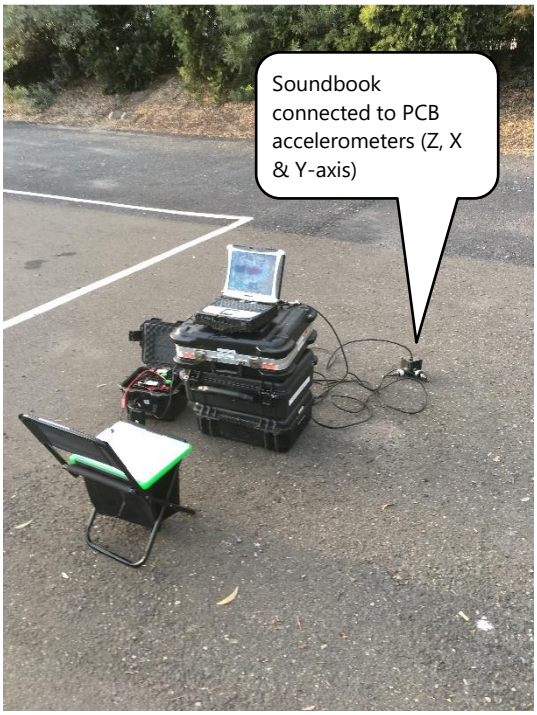


D.3 Attended vibration measurements

Location V1: On site – refer to Figure 5 on Page 15

Survey Period: 2nd July 2019 between 7:40am and 9:13am

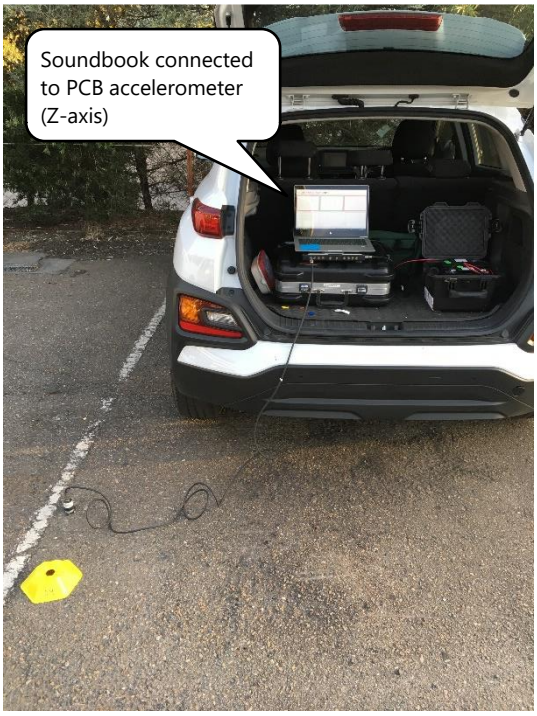
Figure 17: Photograph of Location V1



Location V2: On site – refer to Figure 5 on Page 15

Survey Period: 2nd July 2019 between 7:34am and 9:15am

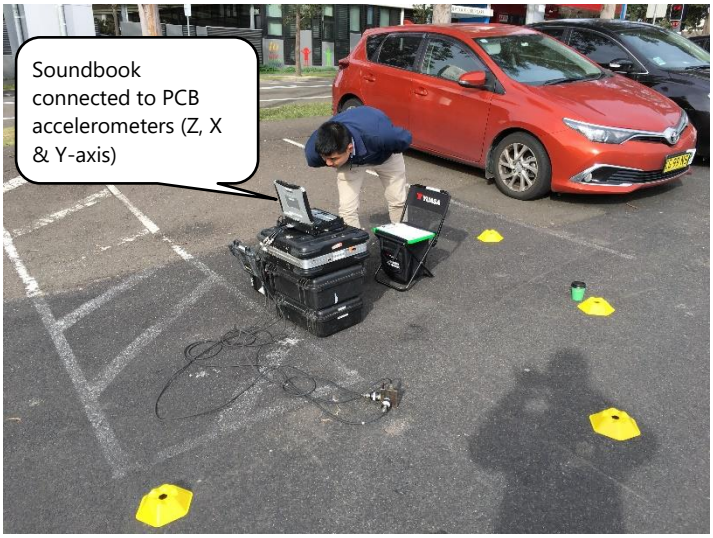
Figure 18: Photograph of Location V2



Location V3: On site – refer to Figure 5 on Page 15

Survey Period: 2nd July 2019 between 9:51am and 11:34am

Figure 19: Photograph of Location V3



Location V4: On site – refer to Figure 5 on Page 15

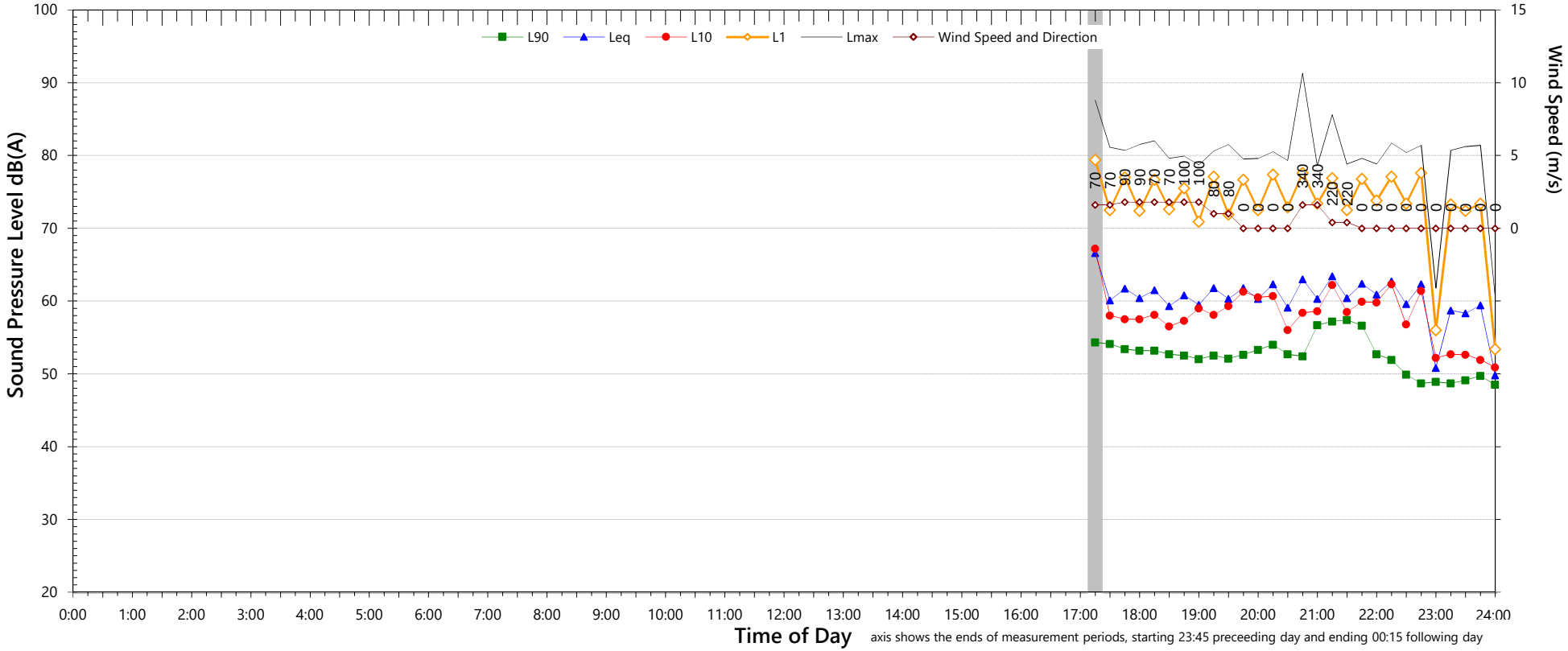
Survey Period: 2nd July 2019 between 9:46am and 11:40am

Figure 20: Photograph of Location V4

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Thursday, 1 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	53	52	48
LAeq (see note 6)	58	59	55

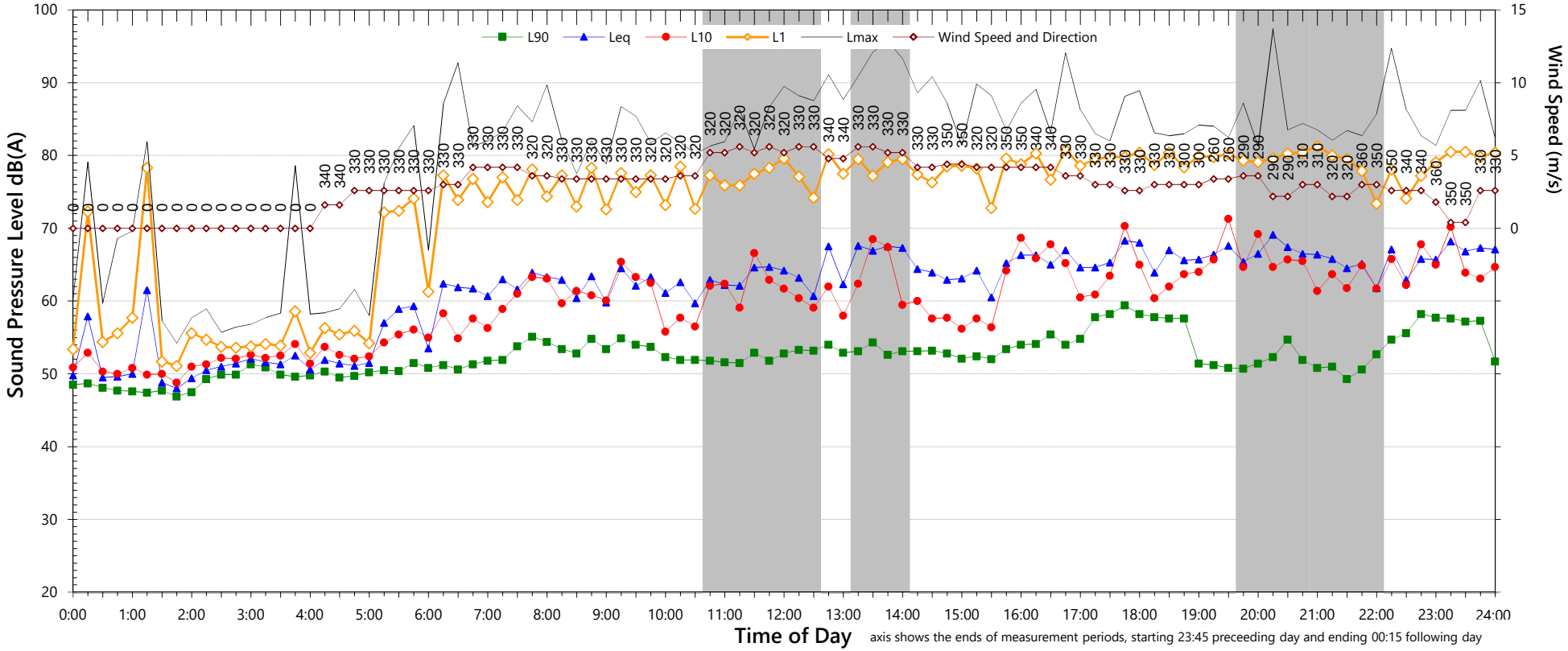
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Friday, 2 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	52	51	42
LAeq (see note 6)	62	64	59

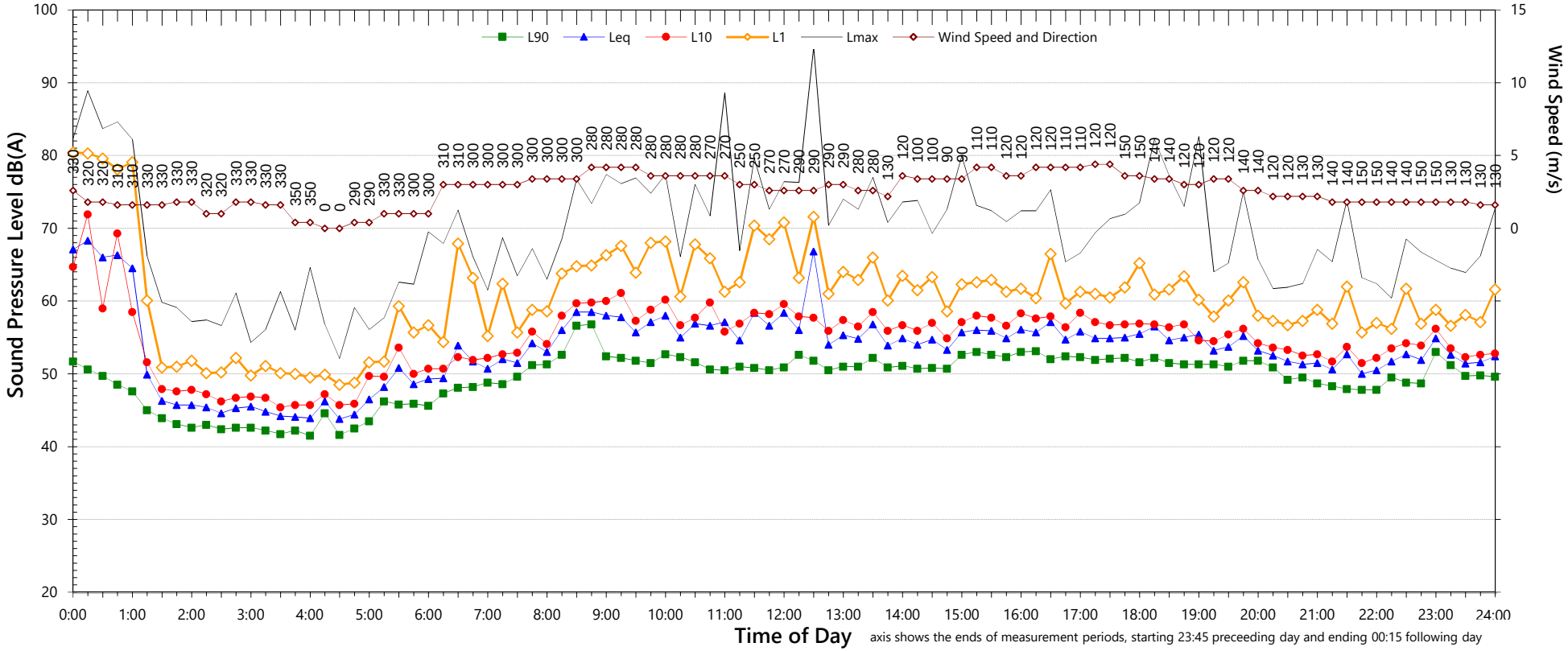
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Saturday, 3 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	51	48	49
LAeq (see note 6)	54	51	49

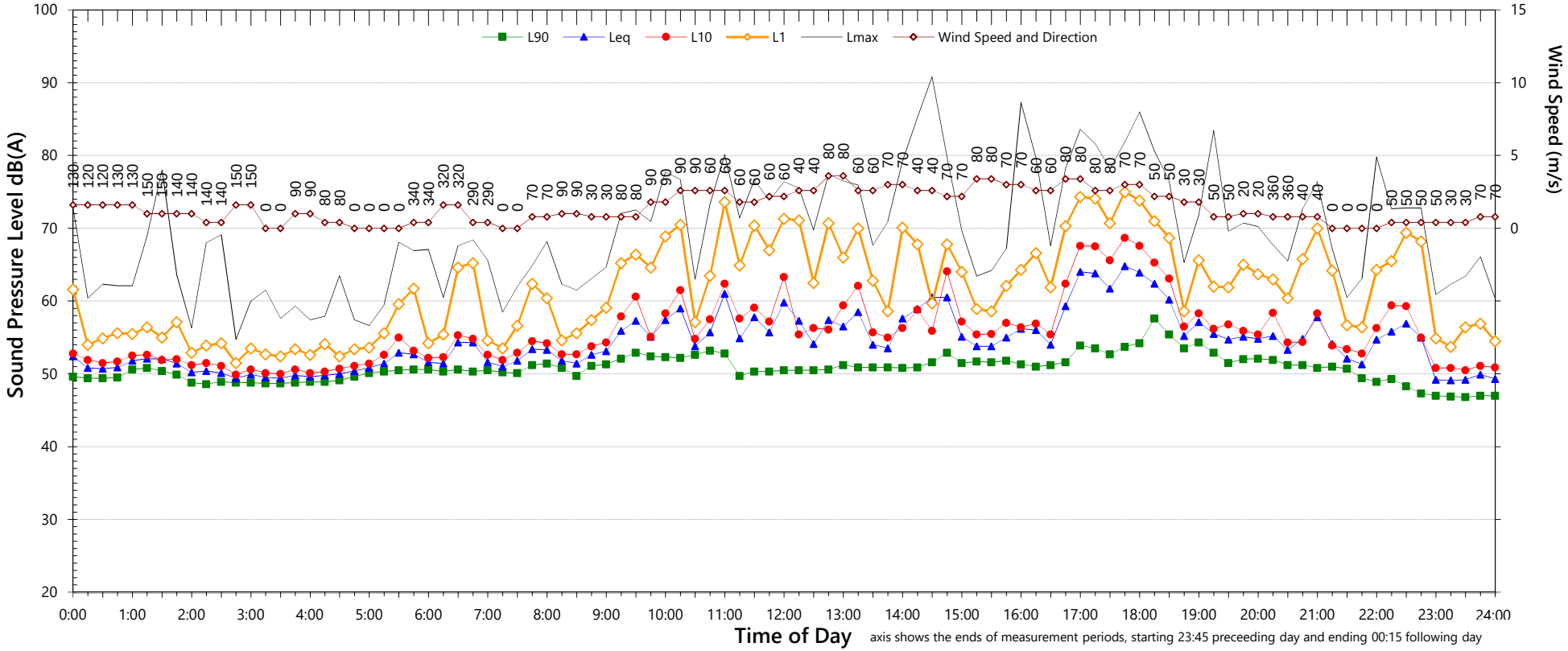
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Sunday, 4 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	50	50	43
LAeq (see note 6)	56	54	53

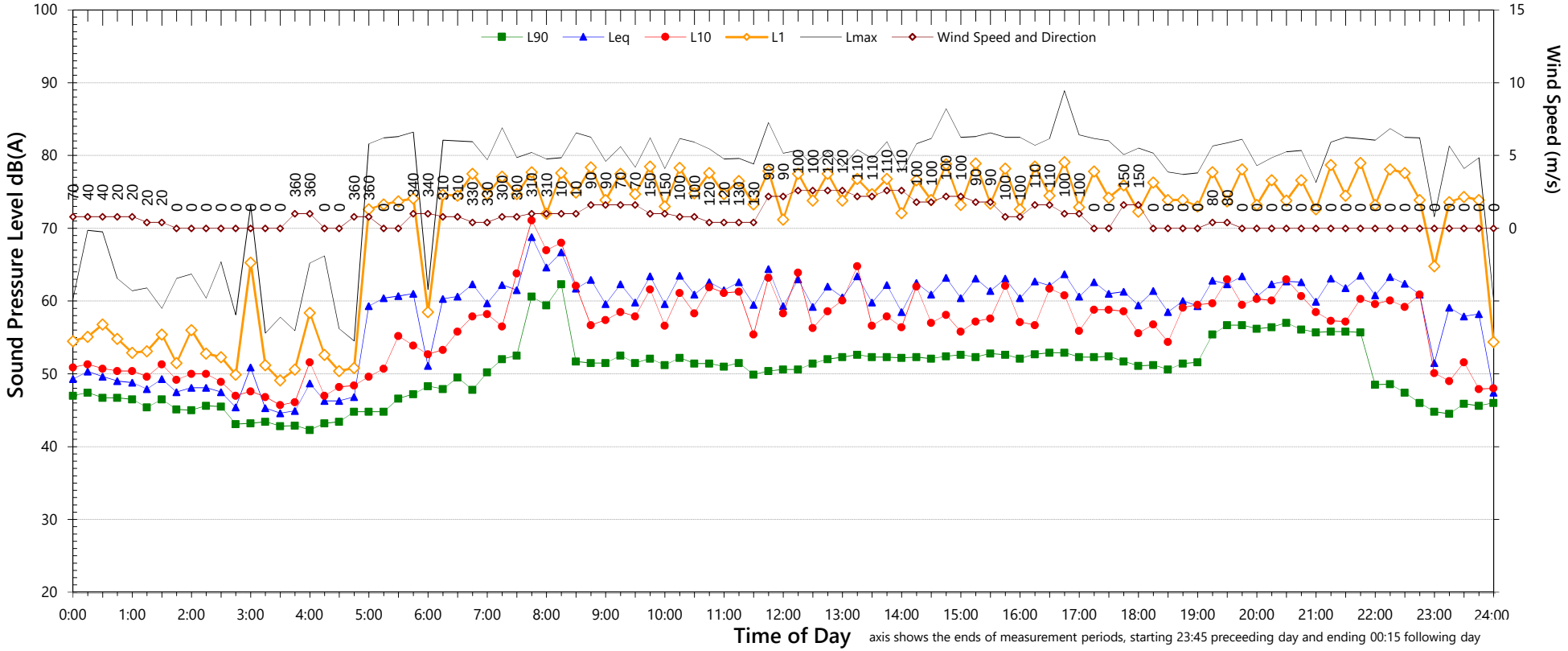
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Monday, 5 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	51	51	46
LAeq (see note 6)	60	59	54

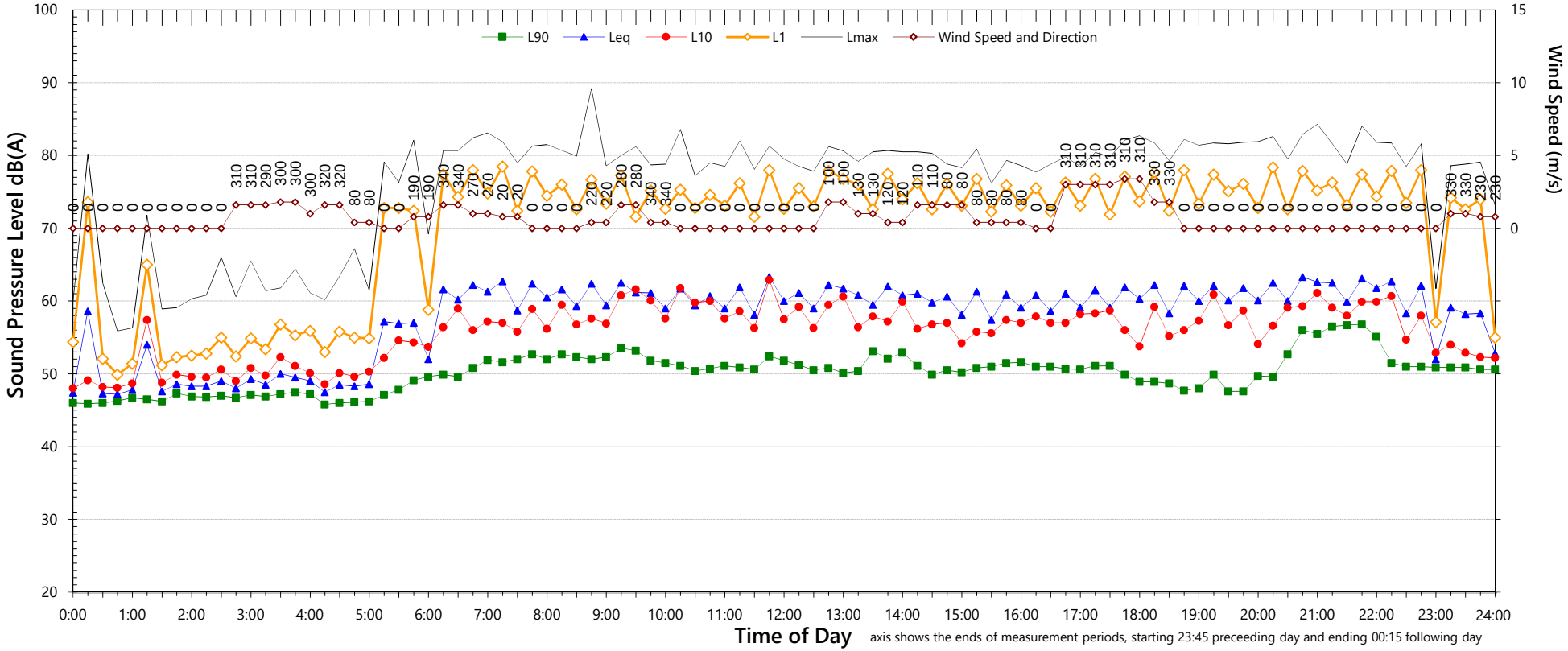
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Tuesday, 6 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	50	48	49
LAeq (see note 6)	58	59	54

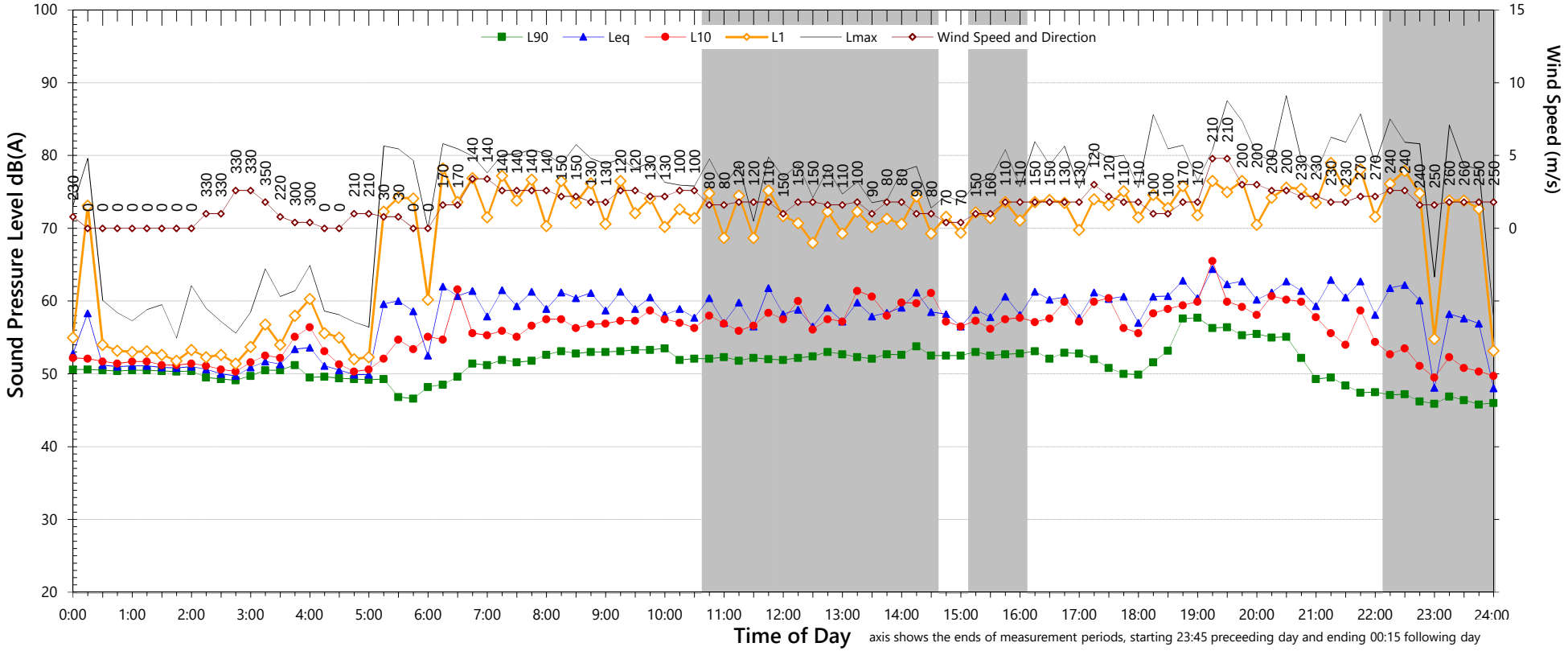
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Wednesday, 7 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	51	48	45
LAeq (see note 6)	57	59	54

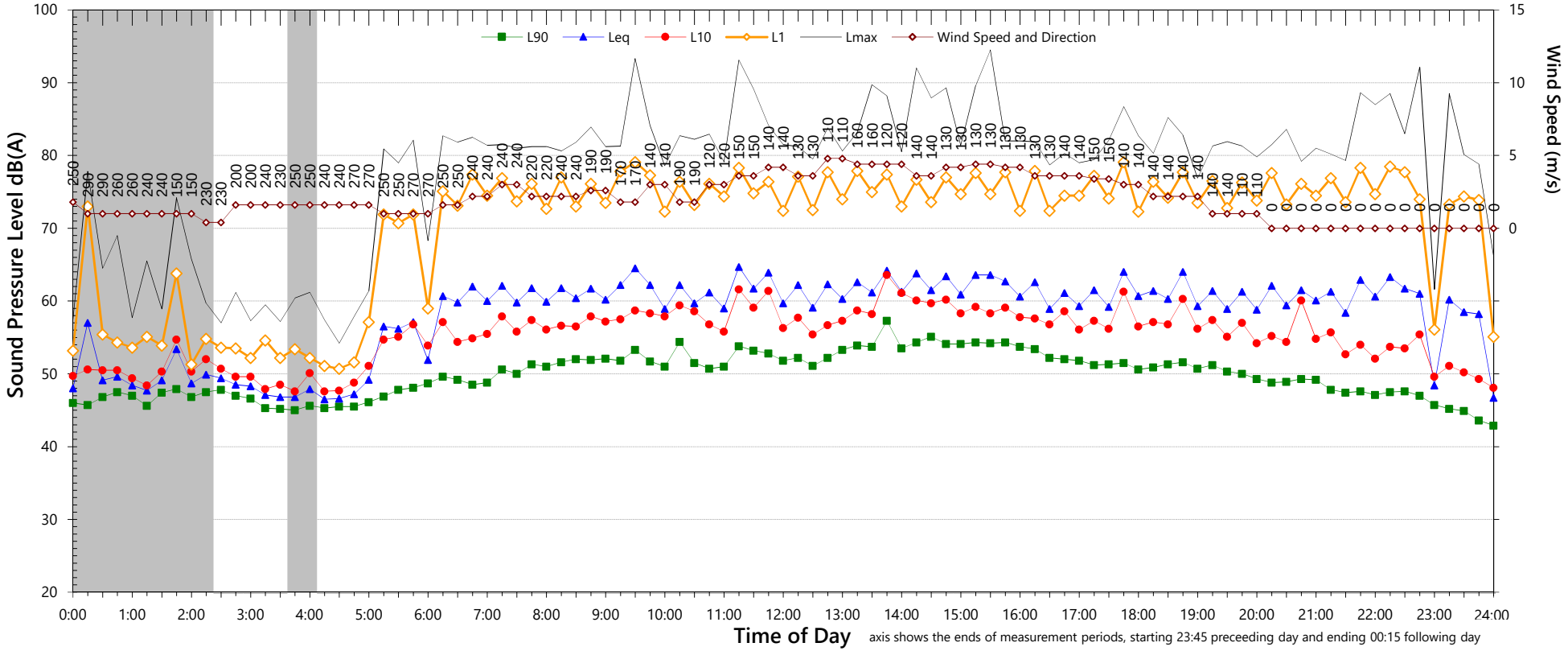
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Thursday, 8 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	51	48	40
LAeq (see note 6)	59	59	56

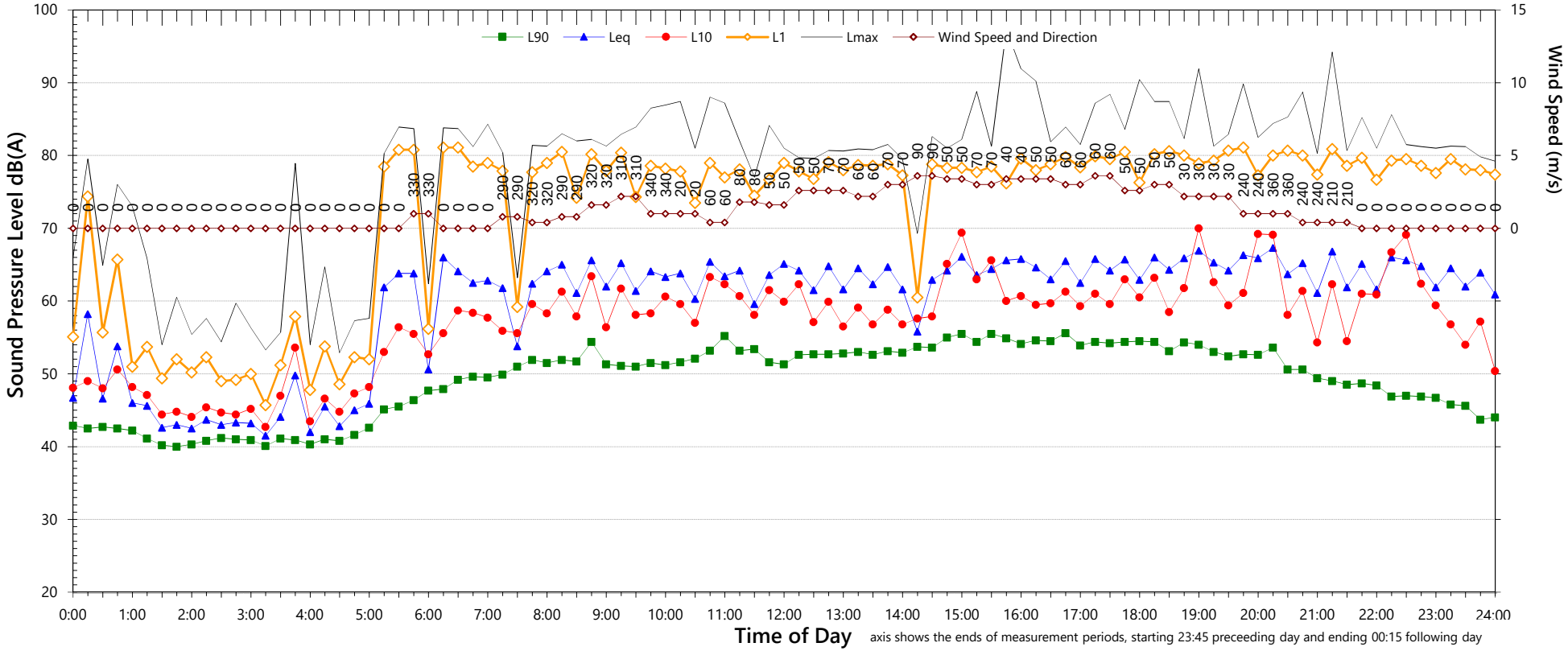
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Friday, 9 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	51	49	41
LAeq (see note 6)	61	63	58

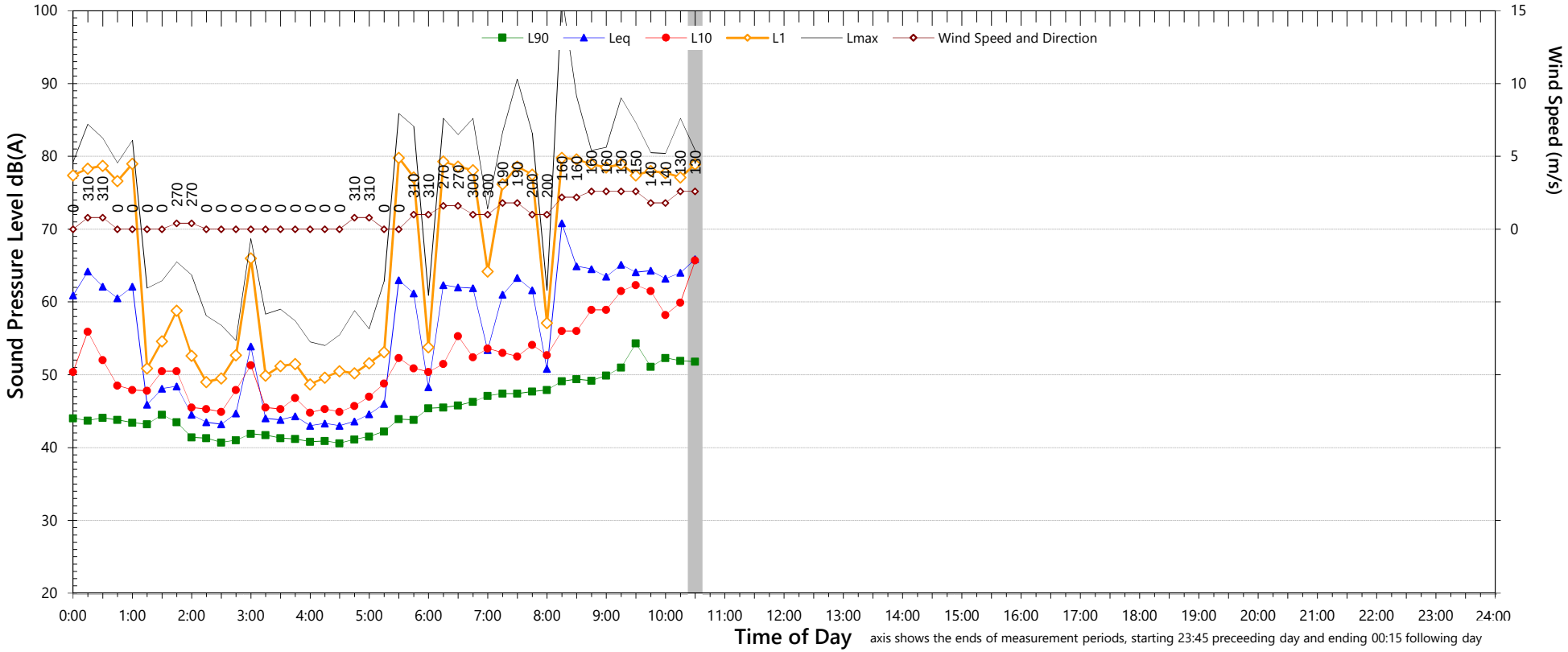
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L01 - Balcony of 305/9 Australia Ave

Saturday, 10 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	47	-	-
LAeq (see note 6)	62	-	-

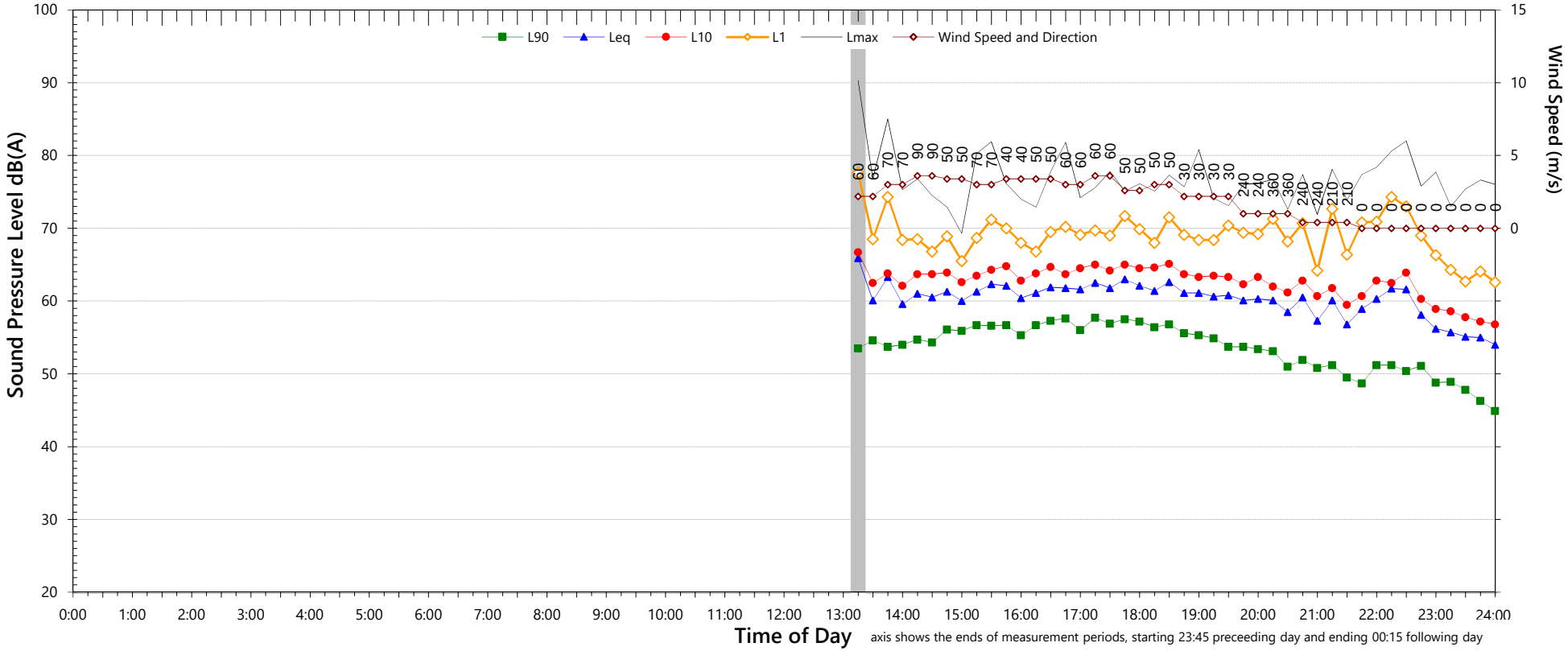
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Friday, 9 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	54	50	44
LAeq (see note 6)	59	58	52

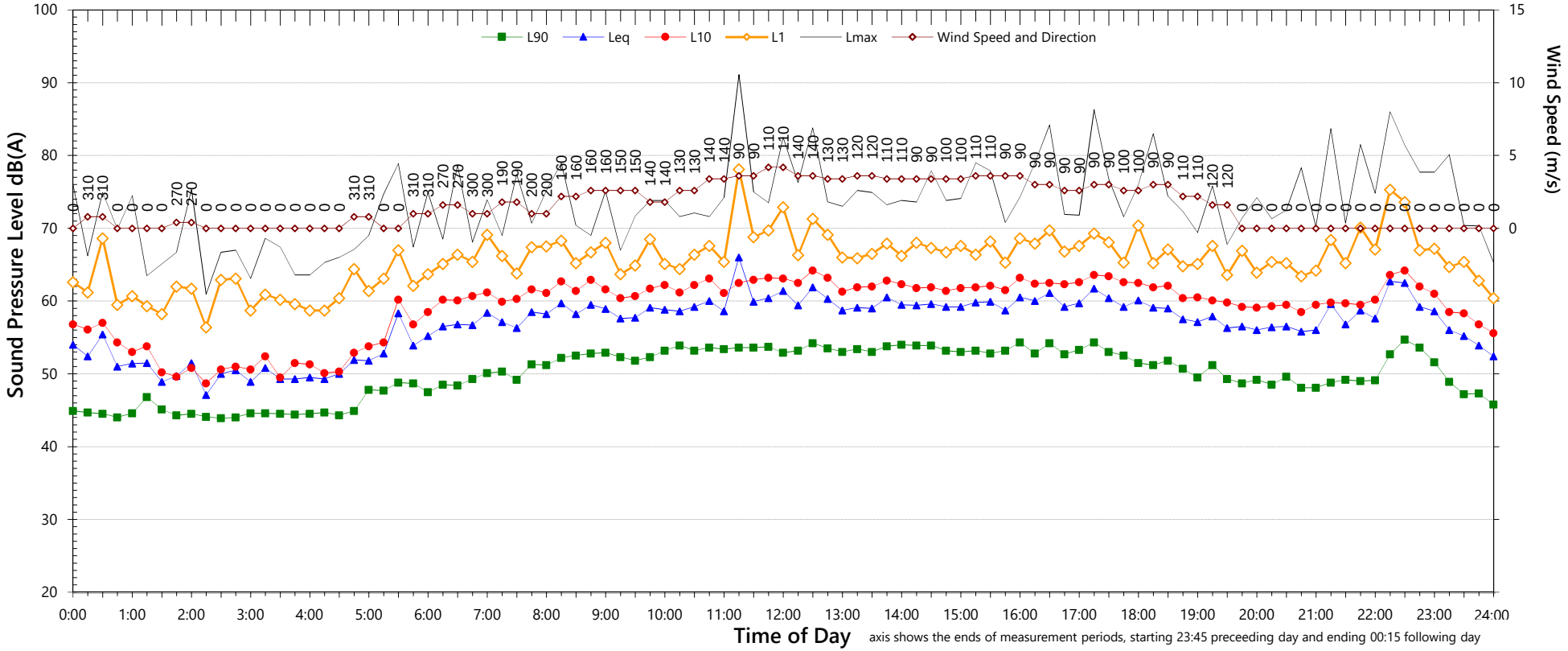
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Saturday, 10 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	52	48	44
LAeq (see note 6)	57	55	52

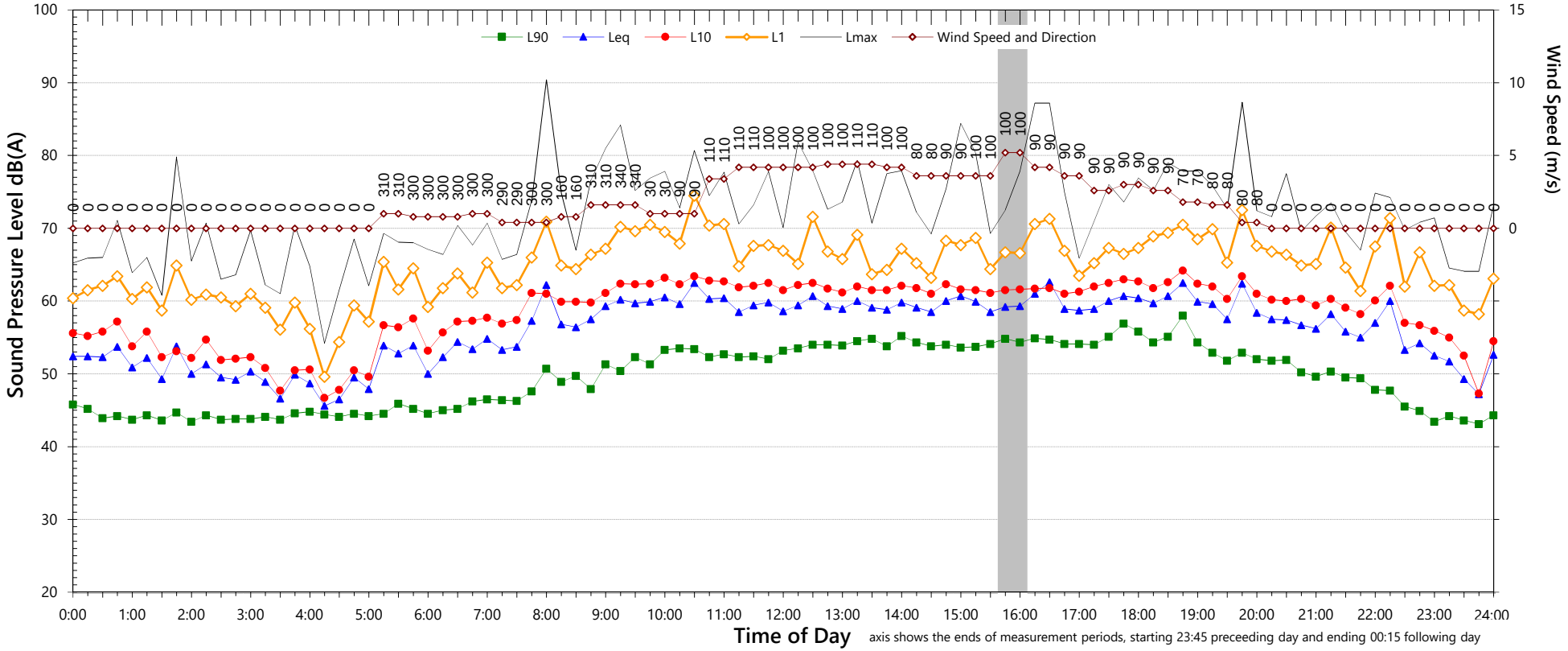
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Sunday, 11 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	49	49	42
LAeq (see note 6)	57	56	53

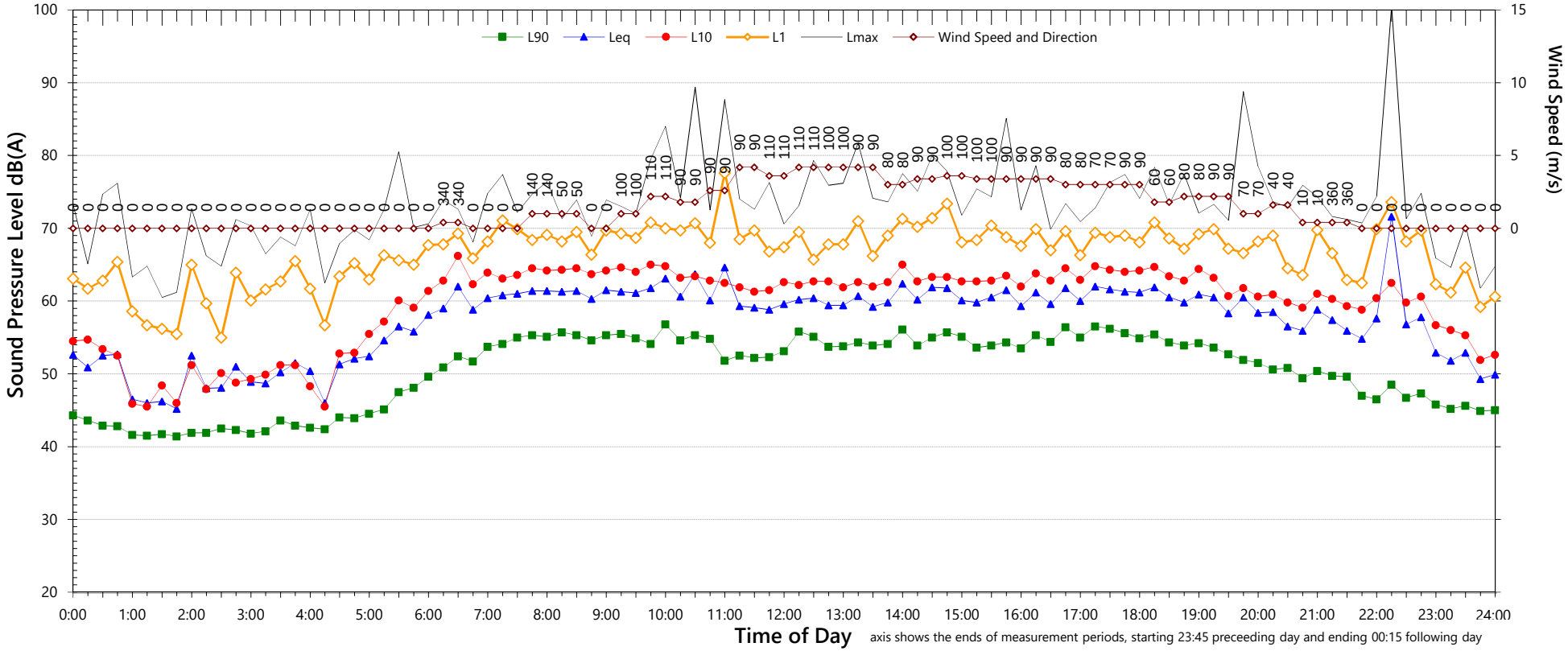
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Monday, 12 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	53	48	42
LAeq (see note 6)	59	56	57

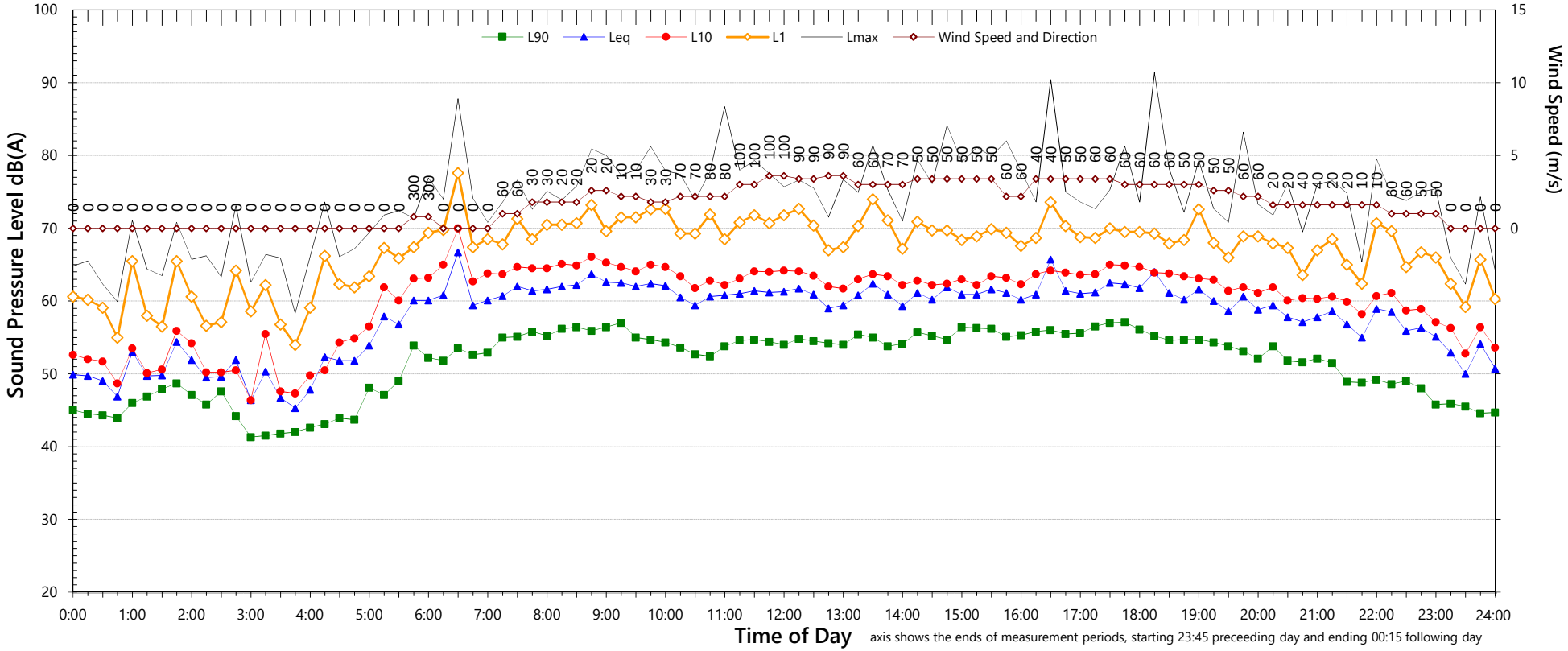
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Tuesday, 13 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	54	49	43
LAeq (see note 6)	59	57	54

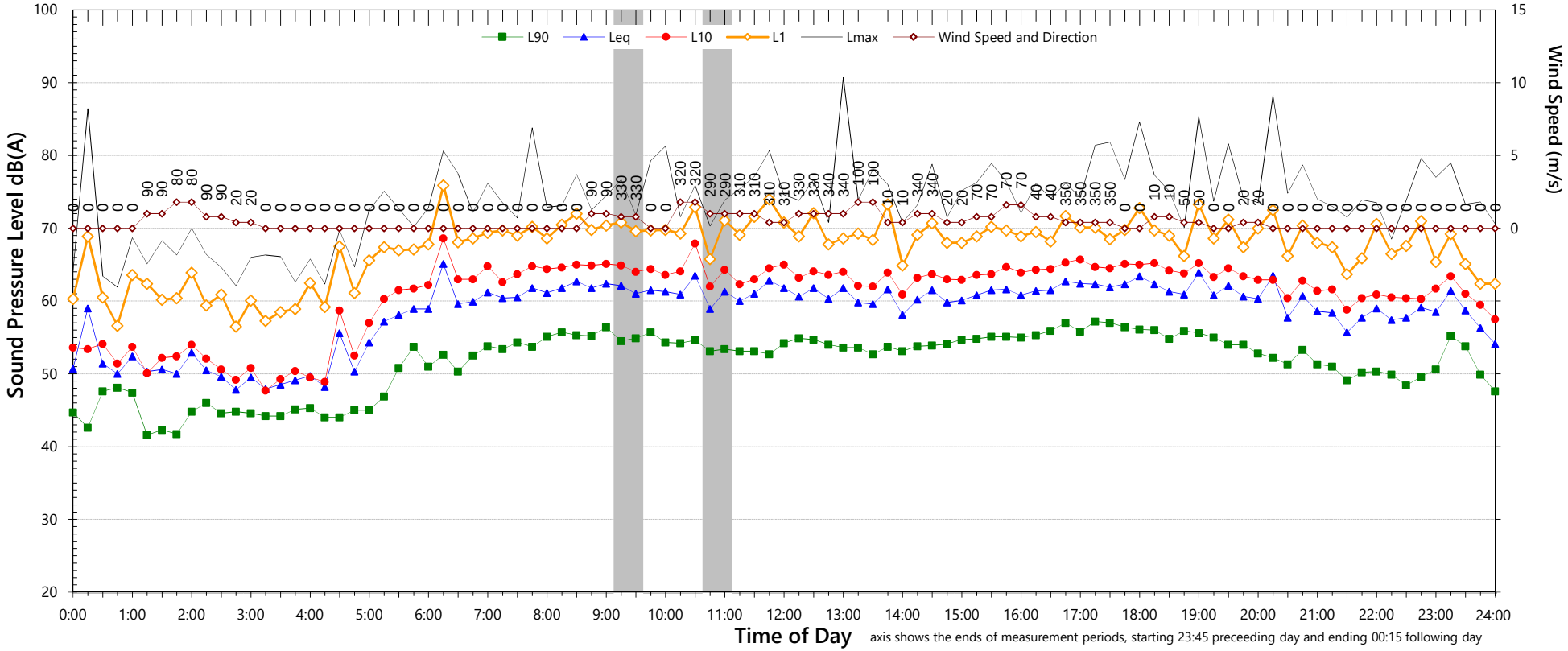
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Wednesday, 14 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	53	50	43
LAeq (see note 6)	59	58	55

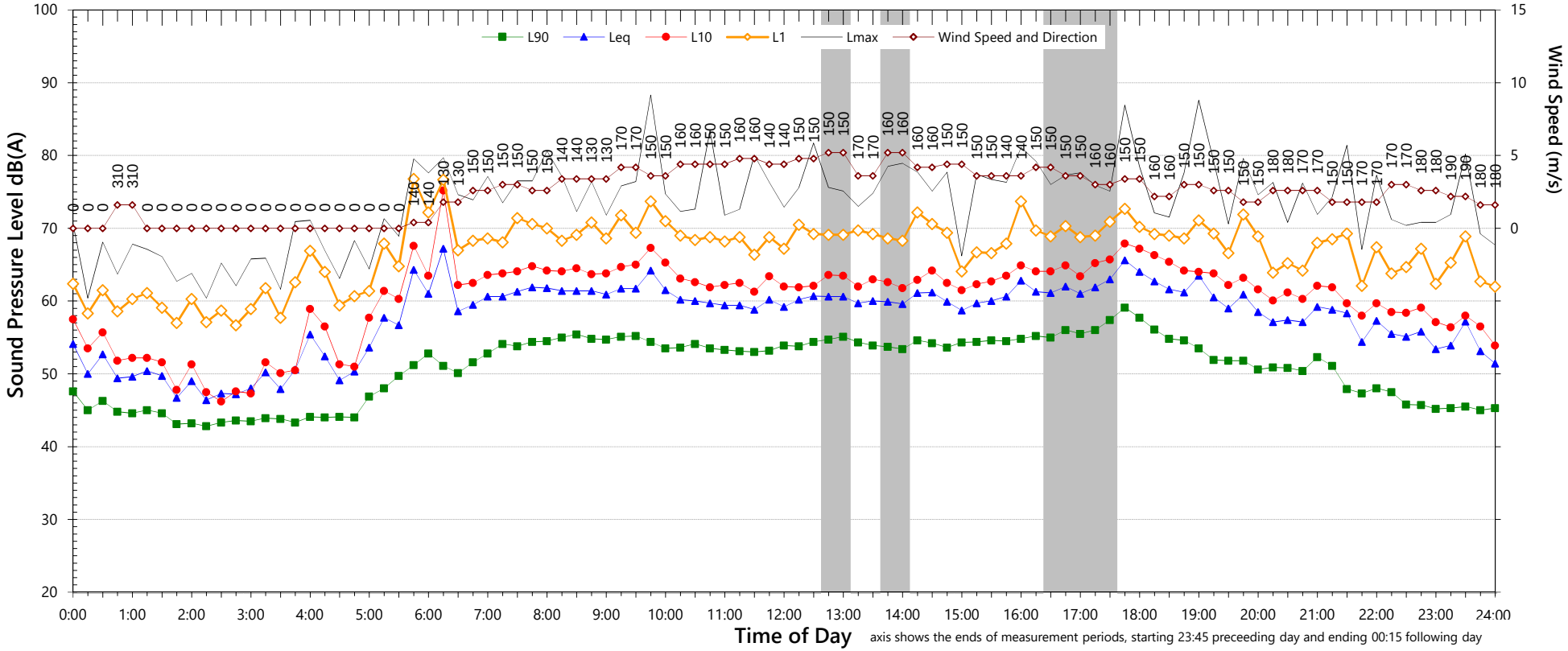
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Thursday, 15 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	53	48	43
LAeq (see note 6)	59	57	52

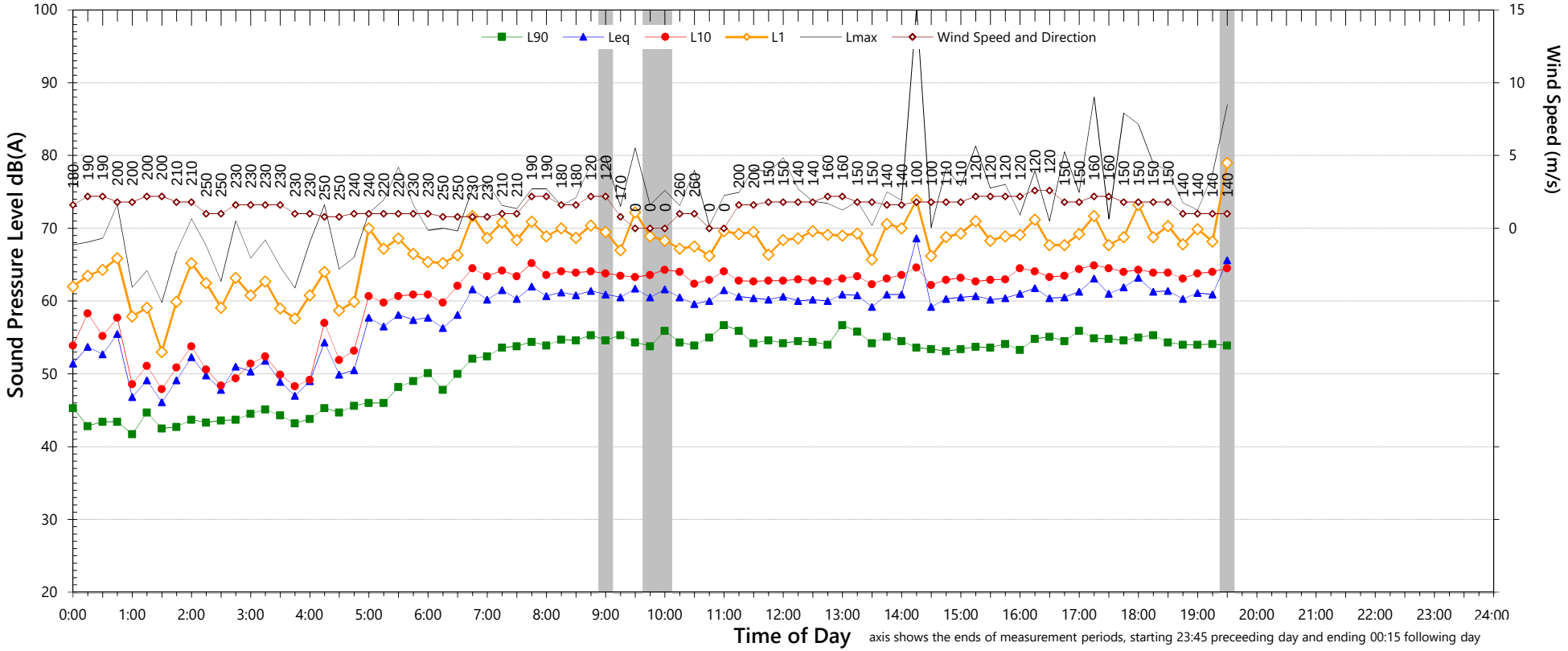
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

Location L02 - Balcony of 502/11 Australia Ave

Friday, 16 November 2018



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day**[2]	**Evening**[3]	**Night**[4 5]
L_{90}	54	54	-
LAeq (see note 6)	59	59	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured 1m from facade; tabulated results free-field corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)