NOISE & VIBRATION IMPACT ASSESSMENT (SSD 8800)

PARRAMATTA LEAGUES CLUB HOTEL, PARRAMATTA

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

Project Number	180374
Project Name	Parramatta Leagues Club Hotel
Description	Noise & Vibration Assessment for SSDA
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Revision History

Issued To	Revision and Date						
Laura Vallentine - Hassell Architects	REV	A	B				
	DATE	01/11/2018	28/11/2018				
Jason Perica	REV	A	B				
	DATE	01/11/2018	28/11/2018				
	REV						
	DATE						

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1 INTRODUCTION

JHA Engineers has been engaged by Parramatta Leagues Club (PLC) to provide a Noise and Vibration Impact Assessment for the State Significant Development (SSD) Application for the proposed new PLC Hotel in Parramatta, NSW. The site is located adjacent to the existing Parramatta Leagues Club and associated carpark in O'Connell Street with Ross Street.

Secretary's Environmental Assessment Requirements (SEARs) have been issued, requiring the preparation of an Environmental Impact Statement (EIS) for the proposed development. This report addresses the requirements established by the Department of Planning and Environment (DP&E) as part of the SSD process and has been prepared considering the following documentation:

- SEARs issued on 06/11/2018 by the DP&E in SSD 8800.
- NSW EPA Noise Policy for Industry 2017.
- NSW State Environmental Planning Policy – Infrastructure 2007.
- Parramatta Local Environmental Plan 2011 and Development Control Plan 2011.
- Traffic Report prepared by TTPP dated 22/11/2018
- Architectural drawings prepared by Hassell

This acoustic report demonstrates compliance with the aforementioned SEARs and has been prepared to accompany a SSD Application to the NSW DP&E. This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Determine existing ambient and background noise levels on site.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

This report provides:

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

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

2 DESCRIPTION OF PROPOSAL

2.1 PROPOSED DEVELOPMENT

The proposal involves the demolition of existing improvements and erection of a 17 storey hotel building (plus a single level basement for services) accommodating 209 beds and including the lower 4 levels containing a café, pool, fitness/recreational uses and a function room ancillary to the hotel

The site is bounded by O'Connell Street to the east, Parramatta River and Parramatta Park to the west, the future Western Sydney Stadium to the south and the existing PLC and associated multi-storey carpark to the north. The site is located within an urban environment characterised by normal levels of activities during day-time. Figure 1 shows the site location and noise sensitive receivers.

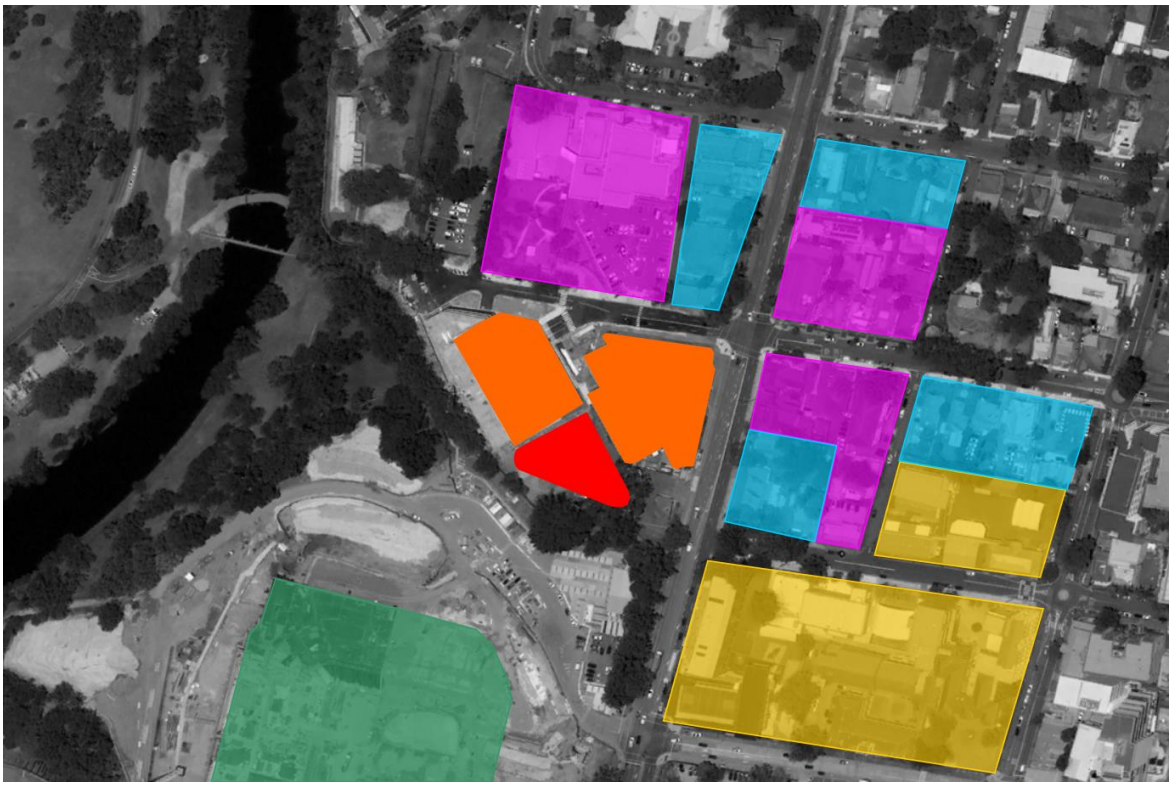


Figure 1: Site of proposed PLC Hotel – red – PLC and associated carpark – orange– future Western Sydney Stadium – green – educational receivers – yellow – residential receivers – blue – and commercial receivers – purple

Based on the proposed architectural layout and the nearest noise sensitive receivers, Table 1 shows a summary of most affected noise receivers surrounding the site along with their respective distances used within the calculations.

Sensitive Receiver	*Receiver Type*	*Distance, m*
Western Sydney Stadium	Active Recreational	75
40 O'Connell Street	Residential	45
Our Lady of Mercy College	Educational	55
46 O'Connell Street	Commercial	60

Table 1: Nearest sensitive receivers surrounding the proposed site

3 EXISTING NOISE ENVIRONMENT

3.1 GENERAL

Attended and unattended noise surveys around the proposed site were conducted in order to establish the ambient and background noise levels of the site and surrounds.

Long-term noise monitoring was carried out from Friday 19th to Monday 29th October 2018 with a Rion NL-52 noise logger (Serial Number: 1054192). The noise logger recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

The noise logger microphone was mounted 1.5 metres above the ground and windshield was used to protect the microphone. Weather conditions were generally calm and dry during the unattended noise monitoring.

On Thursday 5th April 2018, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with a NTI XL-2 hand-held Sound Level Meter (Serial Number: A2A-13742-E0). The calibration of the SLM was checked before and after each use and no deviations were recorded.

The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the each attended noise monitoring.

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

The long-term and short-term noise monitoring locations are shown in Figure 2.

Figure 2: Noise survey locations

3.2 LONG-TERM NOISE MONITORING

The noise logger was located on the boundary of the proposed development site. This location was secured and considered to be representative of the typical ambient and background noise levels. The long-term noise monitoring location was chosen as follows:

- Location L1: At the proposed site boundary.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

The background noise levels have been established in general accordance with the methodology described in the NSW NPI, i.e. the 10th percentile background noise level for each period of each day of the ambient noise survey. The median of these levels is then presented as the background noise level for each assessment period.

The octave band noise levels measured for each period for the relevant parameters are shown in Table 2.

Period	*Parameter*	*Sound Pressure Level, dB re 20μPa*									
		Overall dB(A)	*Octave Band Centre Frequency, Hz*								
			31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Day	$L_{90,15min}$	**53**	66	60	53	51	50	49	46	41	32
	$L_{eq,15min}$	**60**	70	66	60	57	56	55	52	50	43
	$L_{10,15min}$	**62**	72	68	62	59	58	57	55	53	46
Evening	$L_{90,15min}$	**49**	64	58	52	49	46	45	41	35	27
	$L_{eq,15min}$	**56**	68	64	58	54	51	52	48	42	35
	$L_{10,15min}$	**59**	70	65	60	56	54	55	51	45	37
Night	$L_{90,15min}$	**46**	62	56	49	46	43	41	37	31	21
	$L_{eq,15min}$	**53**	66	62	55	51	48	49	45	39	30
	$L_{10,15min}$	**55**	68	65	57	53	50	52	48	41	32

Table 2: Long-term noise levels measured on site.

3.3 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative octave band noise levels of the site plus to confirm long-term monitoring noise levels. Two short-term noise monitoring locations were chosen as representative as follows:

- Location M1: Noise logger location.
- Location M2: O'Connell Street.

From observations during the site visit, it is noted that at locations M1 and M2 ambient and background noise levels are dominated by construction noise during the day from the nearby stadium as well as traffic noise for the Evening and Night-time periods.

A summary of the results of the short-term noise monitoring are shown in Table 3.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB re 20µPa*									
			Overall dB(A)	*Octave Band Centre Frequency, Hz*								
				31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	19/10/2018 16.20 – 16.35	$L_{90,15min}$	**52**	59	56	53	51	47	47	44	37	29
		$L_{eq,15min}$	**56**	66	62	58	55	51	53	49	42	37
		$L_{10,15min}$	**59**	68	63	60	57	53	55	51	44	39
	30/10/2018 10.24 – 10.39	$L_{90,15min}$	**53**	57	56	51	48	48	48	47	42	32
		$L_{eq,15min}$	**61**	63	60	56	57	57	56	54	54	46
		$L_{10,15min}$	**65**	67	63	58	59	61	60	57	56	49
M2	30/10/2018 10.07 – 10.22	$L_{90,15min}$	**60**	64	61	58	56	55	57	53	47	37
		$L_{eq,15min}$	**72**	73	70	66	65	66	69	64	57	52
		$L_{10,15min}$	**76**	77	72	69	69	70	73	69	61	54

Table 3: Short-term noise levels measured on site.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

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

- Planning
  - City of Parramatta Council Local Environment Plan 2011.
  - City of Parramatta Council Development Control Plan 2011.
- Noise Emissions and Intrusive Noise
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - NSW EPA Noise Policy for Industry (NPI) 2017.
  - NSW Liquor and Gaming. Noise conditions for licensed premises.
  - Association of Australasian Acoustical Consultants *'Licensed Premises Noise Assessment Technical Guideline'* 2014.
- Traffic Noise
  - NSW Infrastructure State Environmental Planning Policy (ISEPP) 2007.
  - NSW Department of Planning (DoP) *'Development Near Rail Corridors or Busy Roads – Interim Guideline'* 2008.
  - NSW DECCW Road Noise Policy (RNP) 2011.
- Construction Noise and Vibration
  - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC Assessing Vibration: A Technical Guideline 2006.

The following sections of this report will review these relevant legislation and guidelines, and if similar criteria, procedures, and/or methodologies are found, then the most stringent will be applied.

4.1 SEARS

Based on the SEARs requirements issued on 6th November 2018, The following items have been found to be relevant and are incorporated within this Noise & Vibration Impact Assessment. These are as follows:

"...

13. Noise and Vibration

- *A Noise and Vibration Assessment is required and is to include consideration of the proposed construction and operational impact of the development in accordance with the relevant EPA guidelines.*
- *This assessment must consider any potential noise impacts on nearby noise sensitive receivers and outline proposed noise mitigation and monitoring procedures.*

..."

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulation framework for the protection of the environment in New South Wales. The Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the use of acceptable noise criteria which either may be defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

4.3 CITY OF PARRAMATTA COUNCIL

The site is located within City of Parramatta Council limits and consists of RE2 Private Recreation. Figure 3 shows the land zoning of the site as per information extracted from the City of Parramatta Council Local Environmental Plan (CPC-LEP 2011) map (6250_COM_LZN_009_010_20170822).

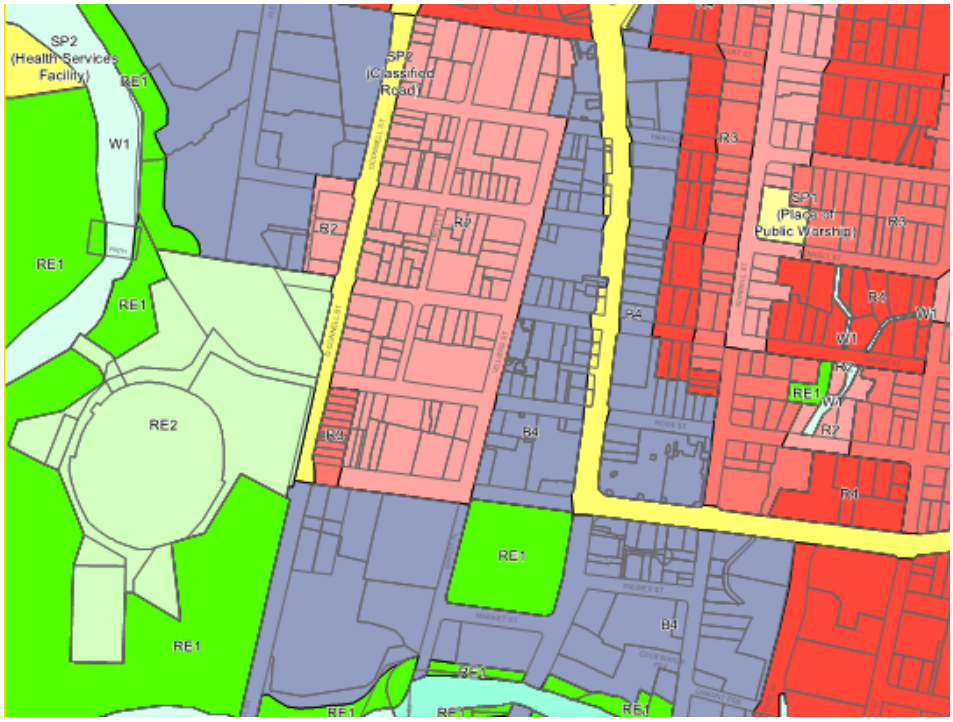


Figure 3: CPC-LEP 2011 Land Zoning Map of the site and surroundings.

4.4 NOISE EMISSIONS AND INTRUSIVE NOISE

4.4.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 (NPI) assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

NSW NPI noise assessment methodology is generally used by relevant guidelines and legislation to establish background and ambient noise levels. The assessment is generally carried out based on the existing ambient and background noise levels addressing the following:

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

These criteria are established for each assessment period (day, evening and night) and the more stringent assessment result sets the Project Noise Trigger Level (PNTL's).

4.4.1.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criteria as follows:

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

Indicative Noise Amenity Area	*Period*	*Measured Rating Background Noise Level (L_{A90}), dB(A)*	*Intrusiveness Criterion, dB(A)*
Mixed Use (B4): Residential	Day	53	58
	Evening	49	54
	Night	46	51
Suburban Residential (R2 & R3)	Day	53	58
	Evening	49	54
	Night	46	51
Commercial	When in use	49	54
Educational	Noisiest 1 hour period when in use	53	58

Table 4: Determination of the intrusiveness noise level criteria for noise sensitive receivers.

4.4.1.2 Amenity Criteria

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

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

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level (L_{Aeq}), dB(A)*	*Amenity Criterion, dB(A)*
Mixed Use (B4): Residential	Day	60	58 $L_{Aeq,15min}$ (60-5+3)
	Evening	50	48 $L_{Aeq,15min}$ (50-5+3)
	Night	45	43 $L_{Aeq,15min}$ (45-5+3)
Suburban Residential (R2 & R3)	Day	55	53 $L_{Aeq,15min}$ (55-5+3)
	Evening	45	43 $L_{Aeq,15min}$ (45-5+3)
	Night	40	38 $L_{Aeq,15min}$ (40-5+3)
Commercial	When in use	65	63 $L_{Aeq,15min}$ (65-5+3)
Educational	Noisiest 1 hour period when in use	35*	58 $L_{Aeq,15min}$ (60-5+3)

Table 5: Determination of the amenity noise level criteria for noise sensitive receivers. *Internal noise levels. Amenity Criteria has been adjusted considering a minimum sound transmission loss of 25 dB for fixed windows.

4.4.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 6 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion*	*Amenity Criterion*
Mixed Use (B4): Residential	Day	58	58
	Evening	54	48
	Night	51	43
Suburban Residential (R2 & R3)	Day	58	53
	Evening	54	43
	Night	51	38
Commercial	When in use	54	63
Educational	Noisiest 1 hour period when in use	58	58

Table 6: Determination of PNTL's for the proposed development.

4.4.2 NSW LIQUOR AND GAMING

The current noise conditions for licensed premises by the NSW Liquor and Gaming Authority are shown below.

- The L_{A10}* noise level emitted from the licensed premises shall not exceed the background noise level (L_{A90}) in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) by more than 5dB between 7:00 am and 12:00 midnight at the boundary of any affected residence.
- The L_{A10}* noise level emitted from the licensed premises shall not exceed the background noise level (L_{A90}) in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) between 12:00 midnight and 7:00 am at the boundary of any affected residence.
- Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00 am.

* For the purpose of this condition, the L_{A10} can be taken as the average maximum deflection of the noise emission from the licensed premises.

The adapted NSW Liquor and Gaming Authority criteria for patron noise emissions are detailed in Table 7. As the proposed licensed premises will operate past mid-night, the relevant noise criteria have been established for both time periods (i.e. day-time and night-time)

Location	*Period*	*Criteria*	*Sound Pressure Level, dB re 20µPa*								
			Overall dB(A)	*Octave Band Centre Frequency, Hz*							
				31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	Midnight to 7:00am	$L_{A10,15min} \leq L_{A90,15min}$	**46**	62	56	49	46	43	41	37	31	21
	7:00am to midnight	$L_{A10,15min} \leq L_{A90,15min}$ + 5dB	**54**	69	63	57	54	51	50	46	40	32

Table 7: NSW Liquor and Gaming Authority noise criteria at nearest residential receivers – patrons noise and music.

4.5 TRAFFIC NOISE

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

The clauses 85, 86, 87, 102 and 103 of the Infrastructure SEPP refers to guidelines that must be taken into account when a development is adjacent to a rail corridor, a freeway, a toll-way, a transit-way or a road with an annual average daily traffic volume (AADT) of more than 40,000 vehicles.

At this stage, there are no rail corridors neither busy roads adjacent – O' Connell Street's AADT is lower than 40,000 vehicles as per NSW Roads & Maritime Services traffic volume data (refer to Section 5.4) – to the proposed development site or planning to develop. Therefore, we understand that this guideline does not apply for this project.

4.5.2 NSW ROAD NOISE POLICY

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

- *Existing roads*
- *New road projects*
- *Road development projects*
- *New traffic generated by developments*

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

4.6 VIBRATION CRITERIA

The Department of Environment and Climate Change (DECC) developed a document, *'Assessing Vibration: A Technical Guideline'* in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 *'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'*.

The guideline does not however address vibration induced damage to structures or structure-borne noise effects.

Vibration criteria for continuous and impulsive vibration are presented in Table 8, in terms of vibration velocity levels. When assessing intermittent vibration comprising a number of events, it is recommended that the Vibration Dose Value (VDV) is used. Table 9 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-9}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 8: Continuous and impulsive vibration criteria applicable to the site. *Note: Day-time is 07:00 to 22:00 and night-time is 22:00 to 07:00.*

Place	*Time*	*Vibration Dose Values, $m/s^{1.75}$*	
		Preferred	*Maximum*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 9: Intermittent vibration criteria applicable to the site.

4.7 CONSTRUCTION NOISE AND VIBRATION

4.7.1 NOISE CRITERIA

As per the SEARs requirements for the proposed construction activities, noise criteria are established in accordance with the NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the construction noise level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background level by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. They are as follows:

- Retail outlets: $L_{Aeq,15min}$ 70dBA (external)

Table 10 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential receivers	Noise affected / External	62	57
	Highly noise affected / External	75	N/A
Commercial	External	62	70
Educational	External	62	N/A

Table 10: ICNG construction airborne noise criteria for sensitive receivers surrounding the site.

Where reference is made to an internal noise level, an external noise level 10dB above the internal noise levels are applied which should achieve the internal noise level where a window is adequately opened to provide natural ventilation.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) (internal)
- Night: $L_{Aeq,15min}$ 35dB(A) (internal)

The internal noise levels are assessed at the centre of the most affected habitable room.

4.7.2 VIBRATION CRITERIA

For human comfort vibration criteria, please refer to the vibration velocity and vibration dose values provided in Section 4.6.

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous Section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:1993 *'Structural Vibration – Effects of Vibration on Structures'* and British Standard BS 7385.2:1993 *'Evaluation and Measurement for Vibration in Buildings'* are to be adopted. Guideline values from DIN 4150.3:1993 and BS 7385.2:1993 are presented in Table 11 and Table 12 respectively.

Structural type	*r.m.s. velocity, mm/s*			
	Foundation			*Plane of floor uppermost full storey*
	Less than 10Hz	*10 to 50Hz*	*50 to 100Hz*	*Frequency mixture*
Commercial, industrial or similar	20	20 to 40	40 to 50	40
Dwellings or similar	5	5 to 15	15 to 20	15
Particularly sensitive	3	3 to 8	8 to 10	8

Table 11: DIN 4150.3:1993 Guideline values of vibration velocity for evaluating the effects of short-term vibration.

Structural type	*Peak particle velocity, mm/s*	
	4 to 15Hz	*15Hz and above*
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s @ 4Hz increasing to 20mm/s @ 15Hz	20mm/s @ 15Hz increasing to 50mm/s @ 40Hz and above

Table 12: BS 7385.2:1993 Guideline values of vibration velocity for evaluating cosmetic damage.

5 OPERATIONAL NOISE IMPACT ASSESSMENT – NOISE EMISSIONS

Noise break-out from the proposed development has the potential to impact on future noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant from the development to the surrounding receivers.
- Noise emissions from patrons and background music in the rooftop bar.
- Noise emissions from patrons in the function terrace and music in the function room.
- Noise emissions from traffic generated by the proposed development.

Each of these noise sources has been considered in the operational noise impact assessment. The noise impact assessments assume the following:

- Noise levels are continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest measure background noise levels at the nearest noise sensitive receiver have been used to provide a worst-case scenario.

5.1 MECHANICAL SERVICES NOISE

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

At this stage, final mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions. However, a preliminary assessment has been carried out for the mechanical plant rooms from which the following is noted:

- Based on the plant room locations, the most restrictive noise level criterion during night-time is 43 dB(A) at residential receivers.
- Considering the distance from the plant rooms to the nearest noise sensitive receivers, at this stage, maximum allowable noise emissions from the plant rooms have been predicted to be limited to $L_{Aeq,15min}$ 76 dB(A) SPL at 1 metre from each plant room boundary.

Noise controls will need to be incorporated with the design of the plant rooms to ensure that the cumulative noise output from plant at the nearest noise sensitive receivers is within the allowable limits. Usual design noise controls that may need to be implemented will typically include, but are not limited to:

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

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

5.2 ROOFTOP BAR NOISE

Noise emissions from the proposed rooftop bar have been assessed at the nearest noise sensitive receivers. The noise assessment has considered the following assumptions

- Rooftop bar will operate during night-time period – worst-case scenario.
- One person per 1 m^2 for the rooftop terrace
- The vocal effort of patrons communicating are "normal" speech to provide a worst case scenario.
- Every two patrons, only one person will be speaking at any given time.
- A 1.5m high solid construction to be on the terrace perimeter.

The noise of patrons associated with the rooftop bar is highly variable as there are several factors which drive the noise emissions. For the noise assessment, sound power levels have been derived as per Hayne et al technical paper[1]. The Sound Power Levels used within the assessment are summarised below in Table 13.

Noise Source	*Sound Power Level, dB re 1pW*								
	Overall dB(A)	*Octave Band Centre Frequency, Hz*							
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
L_{10} one person "normal" vocal effort	67	53	55	57	58	65	63	59	52	48
L_{10} 115 patrons "normal" vocal effort	100	84	86	88	89	96	94	90	83	79

Table 13: Sound power levels for people talking with "normal" vocal effort.

We have assumed that typical L_{A10} music noise levels will be approximately 10 dB below the noise levels presented above. Table 14 presents the predicted noise levels from the rooftop bar in the nearest residential receiver.

Parameter	*Sound Pressure Level, dB re 20µPa*								
	Overall dB(A)	*Octave Band Centre Frequency, Hz*							
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Noise from Patrons	100	84	86	88	89	96	94	90	83	79
Screening attenuation		-5	-6	-6	-7	-10	-11	-13	-16	-16
Distance attenuation (70 m)		-37	-37	-37	-37	-37	-37	-37	-37	-37
Correction to free-field		-6	-6	-6	-6	-6	-6	-6	-6	-6
Resulting level at residential boundary	44	36	37	39	39	43	40	34	24	20
NSW Liquor and Gaming Criteria (midnight to 7am)	46	62	56	49	46	43	41	37	31	21
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 14:–Rooftop bar patrons noise break-out to nearest residential receiver during night-time period.

[1] Prediction of noise from small to medium sized crowds. M.J. Hayne et al. Proceedings of AAS 2011.

5.3 FUNCTION ROOM AND TERRACE NOISE

A Function Room and terrace are proposed in Level 3. It is anticipated that amplified music will be the key noise source for events such as music performances, weddings, etc. The character of the amplified music, such as sound pressure level and spectra, vary in accordance with the type of music / event. Noise emissions from the operational noise have been predicted for the location of the nearest noise sensitive receivers. The noise assessment assumes the following:

- Function Room will operate during night-time period – worst case scenario.
- Maximum capacity is 500 patrons for the function room and terrace area
- The vocal effort of patrons communicating will generally be "normal" speech to provide a worst case scenario.
- For every two patrons only one person will be speaking at any given time.
- The noise break-out has been assumed through the weakest building envelope construction of the Function Room and glazed terrace, i.e. glazing façade with a Sound Insulation performance of R_W32

The Sound Power Levels used within the assessment are summarised below in Table 15.

Noise Source	*Sound Power Level, dB re 1pW*									
	Overall dB(A)	*Octave Band Centre Frequency, Hz*								
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
L_{10} live band	**105**	97	99	100	102	99	101	98	92	85
L_{10} 250 patrons "normal" vocal effort	**102**	88	90	92	93	100	98	94	87	83

Table 15: Sound power levels for noise sources in the Function Room.

Based on the previously noted assumptions, the predicted noise levels are shown below in Table 16

Parameter	*Sound Pressure Level, dB re 20μPa*									
	Overall dB(A)	*Octave Band Centre Frequency, Hz*								
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Noise from Patrons and Music	**107**	98	100	101	103	103	103	99	93	87
Increase in the reverberant field		5	5	4	4	3	3	3	3	3
Correction to free-field via glazing façade		-6	-6	-6	-6	-6	-6	-6	-6	-6
Façade attenuation		-8	-15	-19	-24	-29	-33	-35	-41	-46
Distance attenuation (45 m)		-33	-33	-33	-33	-33	-33	-33	-33	-33
Resulting level at residential boundary	**40**	54	49	46	43	38	34	28	16	5
NSW Liquor and Gaming Criteria (midnight to 7am)	**46**	62	56	49	46	43	41	37	31	21
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 16: Predicted Noise Levels for Function Room & Terrace Area

5.4 TRAFFIC NOISE

Proposed primary access for the traffic generated by the development will be via O'Connell Street. There is no provision of car parking for hotel use and it is understand that hotel guests will utilise the new PLC multi-storey carpark. Therefore, the traffic generated by the proposed development will be passenger drop-off.

Traffic data have been obtained from NSW Roads and Maritime Services website plus traffic report prepared by TTPP[2]. NSW RMS's station was located in O'Connell Street during the year 2009 and recorded 27,781 AADT. Existing traffic as per TTPP's report is 29,258 AADT.

As noted in NSW NRP (Section 4.3.2), when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational), the NSW RNP states that an increase up to 2 dB in relation to existing noise levels is anticipated to be insignificant.

Expected traffic generated by the proposed development is approximately 180 vehicles during peak hours. Therefore, it is expected that traffic due to the proposed development will be less than the maximum allowable increase of 2 dB.

It can be stated that the traffic increase will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy recommendations.

5.5 INTERNAL NOISE LEVELS

Consideration for the internal noise should be given during the detailed design phase for the noise impacts related to sports and music events from the nearby stadium along with the traffic generated noise from the adjacent multi-storey car park.

The external façade should be designed such that the internal noise levels of the proposed development are within the recommendations of the relevant Australian Standards and guidelines, with further consideration for sleep disturbances.

Based on the expected noise impacts on the proposed development, an alternative means of ventilation is recommended such that fresh air can be provided within the guest rooms with the windows closed. The alternative means of ventilation is required to be in accordance with the requirements of the NCC - i.e. alternative ventilation system complying with AS 1668.2:2012 *'Mechanical ventilation in buildings'*.

[2] *Parramatta Leagues Club Hotel. 1 Eels Place, Parramatta. Transport and Accessibility Impact Assessment*. TTPP 22 November 2018

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Currently the project is at an early design stage and a detailed construction program is not yet fully defined. This section of the assessment provides general recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan.

Any noise from demolition and construction activities to be carried out on site must not result in *"offensive noise"* to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT CODES AND STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.7 of this report contains the relevant legislation, codes and standards plus construction noise and vibration criteria for this project.

6.2 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

At this stage, there is no information regarding construction plant / equipment plus work activities / duration. However, a preliminary construction noise and vibration assessment has been carried out in order to identify the likely potential impact of various generic construction plant / equipment on sensitive receivers surrounding the site. The Contractor will be responsible for preparing a Works Plan and Schedule which include all relevant noise and vibration information.

The key noise sources on site during construction stage of the proposed development will be from heavy plant / equipment such as excavators, bulldozers, hand held pneumatic tools, grinders, etc. It is anticipated that the key construction activities to occur are as follows:

- Site establishment.
- Demolition, excavation, foundation and piling.
- Structure, façade and fit-out works.
- Landscaping.

Table 17 shows the maximum allowable sound pressure level at the boundary of the construction site in order to meet the applicable construction noise level criteria at the nearest noise sensitive receivers during standard construction hours. Allowances have been made for distance attenuation, shielding and reflections.

Receiver	*Noise Criteria dB(A)*	*Distance, in m*	*Maximum Noise Level ($L_{Aeq,15min}$) at the site boundary*
Residential	63	45	96

Table 17: Maximum allowable construction noise level at the construction boundary.

A detailed noise assessment shall be carried out for the Construction Noise and Vibration Management Plan when details for the construction plant / equipment plus activities / duration will be known.

The NSW RMS *'Construction Noise and Vibration Guideline'* provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DEC's *'Assessing Vibration: A Technical Guideline'*). The recommended safe working distances for typical construction plant are provided in Table 18.

Plant Item	*Description*	*Cosmetic Damage*	*Human Response*
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Hand held	1m	Avoid Contact with Structure

Table 18: Recommended minimum working distances for vibration intensive plant from sensitive receivers

If the Contractor has concerns for the disruptions at nearest sensitive receivers due to vibration intensive plant use, it is recommended that prior to the commencement of the works, to undertake a preliminary vibration survey on each key vibration generating activity / equipment.

The preliminary vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimised as far possible.

A vibration monitoring system may be considered to assess the risk of potential structural damage to nearby buildings of concern.

6.3 CONTROL ELEMENTS

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan (CNVMP), and undertake noise and vibration monitoring for the duration of the project.

6.3.1 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort.

Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both, cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.
  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Selecting plant and equipment with low vibration generation characteristics.
  - Operate plant in a quietest and most effective manner.
  - Where appropriate, limit the operating noise of equipment.
  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
  - Where appropriate, obtain acoustic test certificates for equipment.
- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.3.2 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds either the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

7 SUMMARY AND CONCLUSIONS

A noise and vibration assessment has been carried out for the proposed development of the Parramatta Leagues Club Hotel at Parramatta. This report forms part of the documentation package to be submitted to the Department of Planning as part of the State Significant Development Application.

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

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

At this stage, mechanical plant selections have not been made. Therefore, a detailed assessment has not been able to be carried out. A preliminary review has been carried out for the plant rooms, and based on their location, distance to noise sensitive receivers and noise level criteria, noise emissions from the plant rooms shall be limited to 76 dB(A) SPL at 1 metre of the plantroom boundaries. Recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

External noise emissions associated with the operation of the rooftop bar have been assessed in accordance with the NSW Liquor and Gaming Authority criteria. The predicted noise levels demonstrate that the operations of the rooftop bar are expected to meet the noise criteria.

The external noise emissions associated with the operation of the Function Room and terrace has been assessed. Based on the assessment, the expected noise level at the nearest residential noise sensitive receiver will meet the noise level criteria provided the recommended amelioration measures are implemented.

The traffic generation noise has also been assessed based on the rates provided in the noted traffic report. Based on the assessment, the noise levels as a result of the additional traffic is anticipated to be insignificant, as the noise levels will not increase more than 1 dB at the nearest sensitive noise receivers.

Potential construction noise and vibration impacts on the surroundings have been presented in this report and recommendations based on the relevant guidelines are provided. If, during construction works, an item of equipment exceeds the stated airborne noise and / or vibration criteria at any sensitive location, the additional noise / vibration control measures presented in this report, together with construction best practices, shall be considered to minimise noise and vibration impacts on the sensitive receivers.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the SSD application should not be refused on the grounds of excessive noise and vibration generation.

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

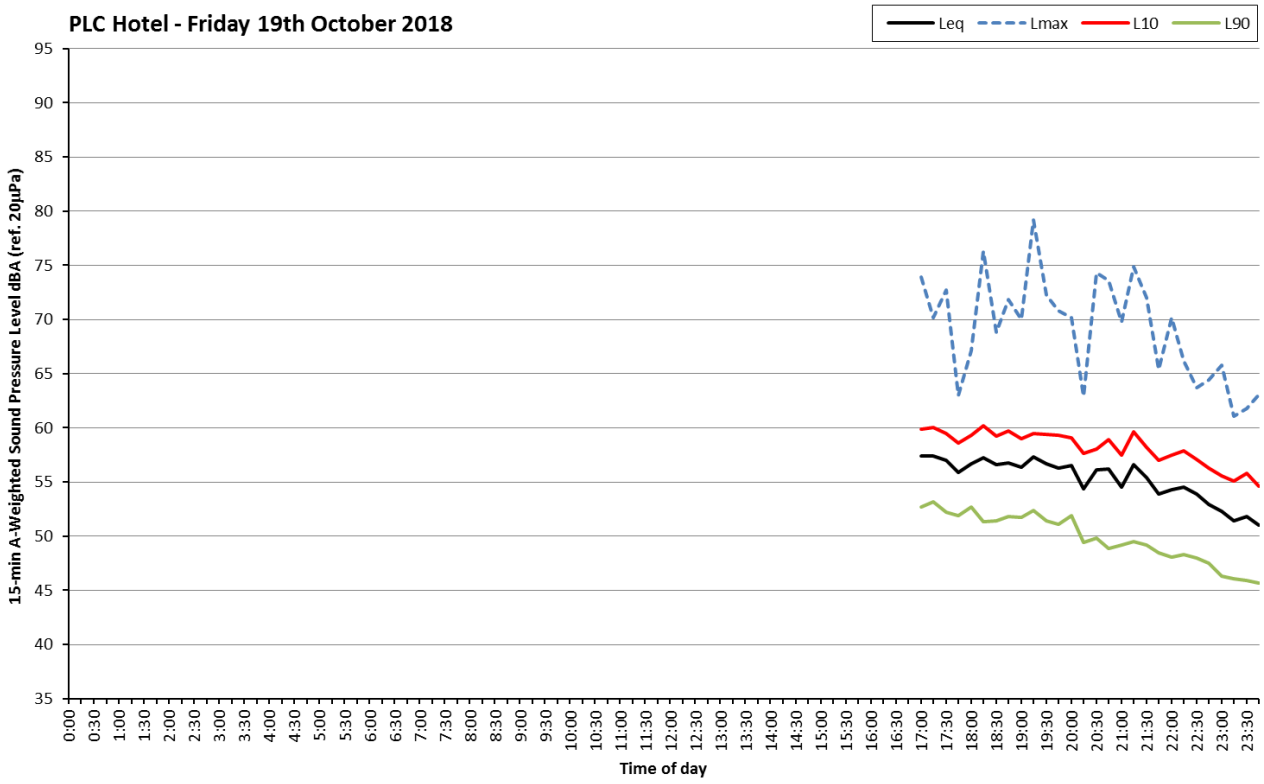
APPENDIX A: LONG-TERM MONITORING RESULTS

L_{Amax} – The L_{Amax} level is the maximum noise level during the sample period.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.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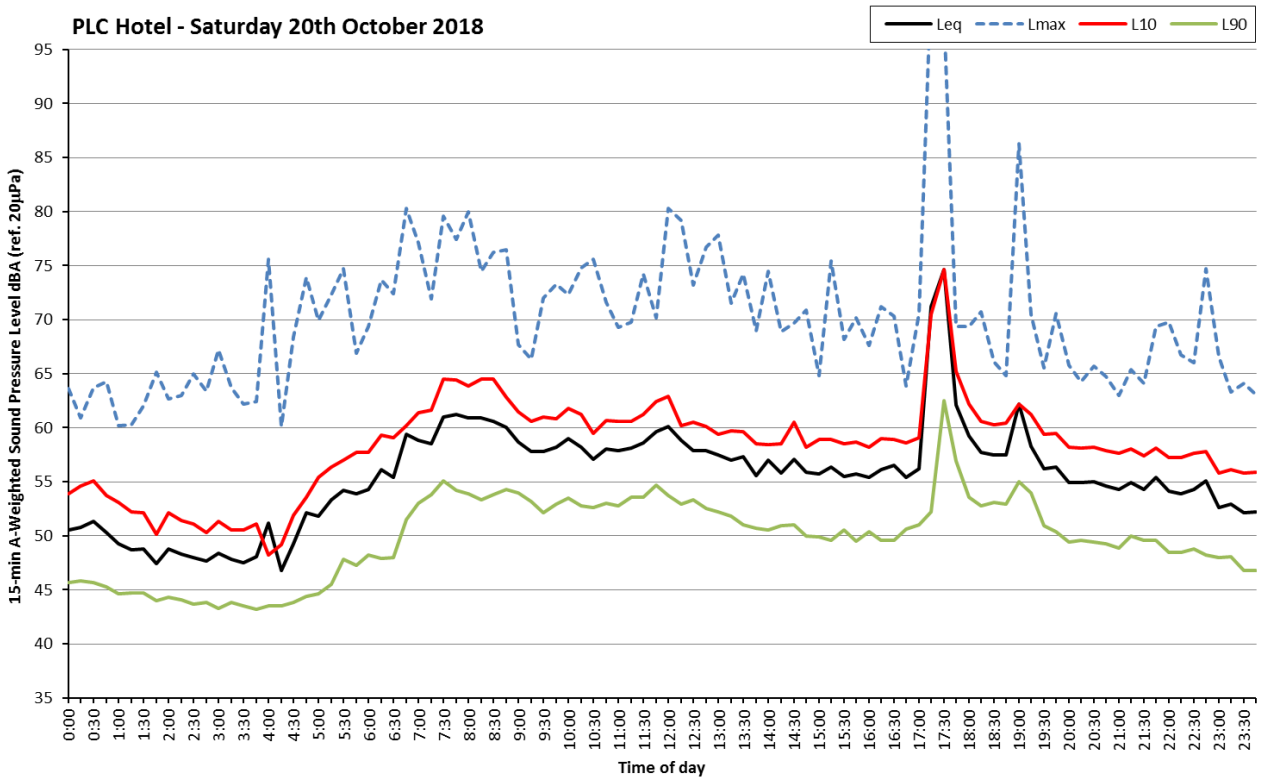
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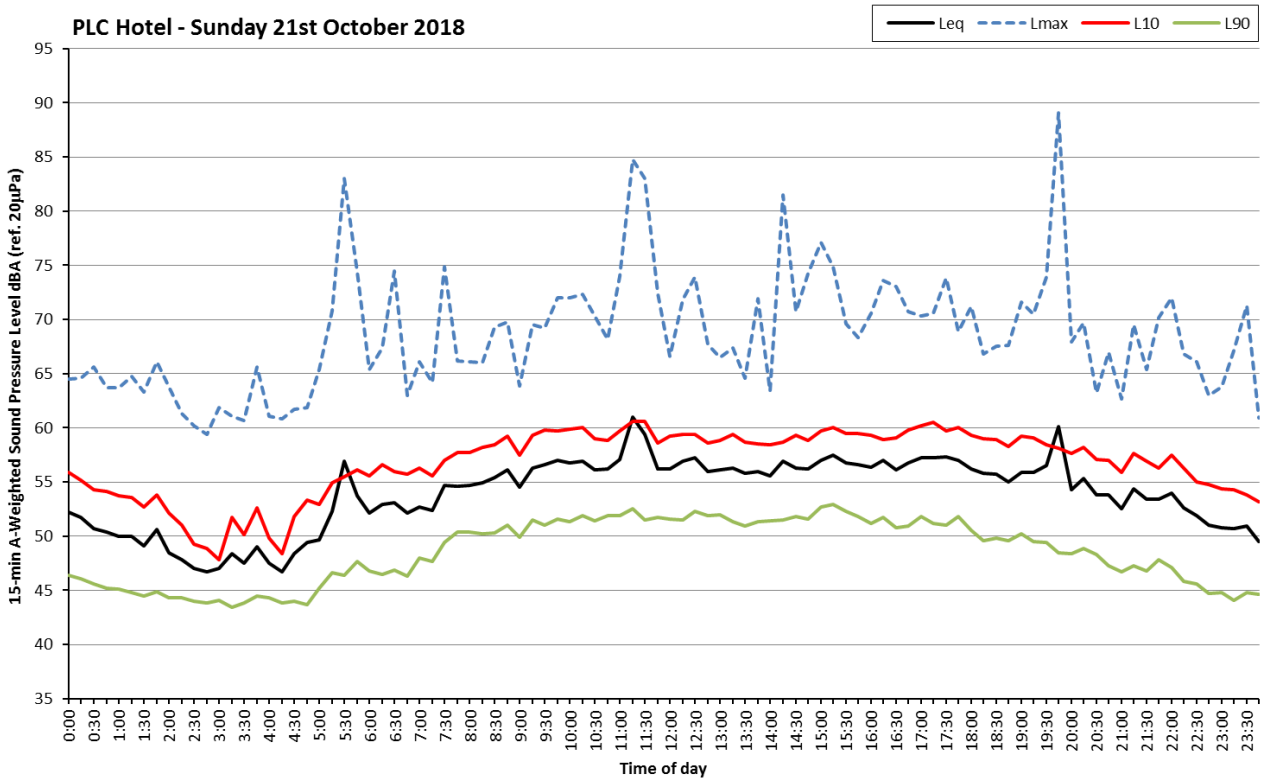
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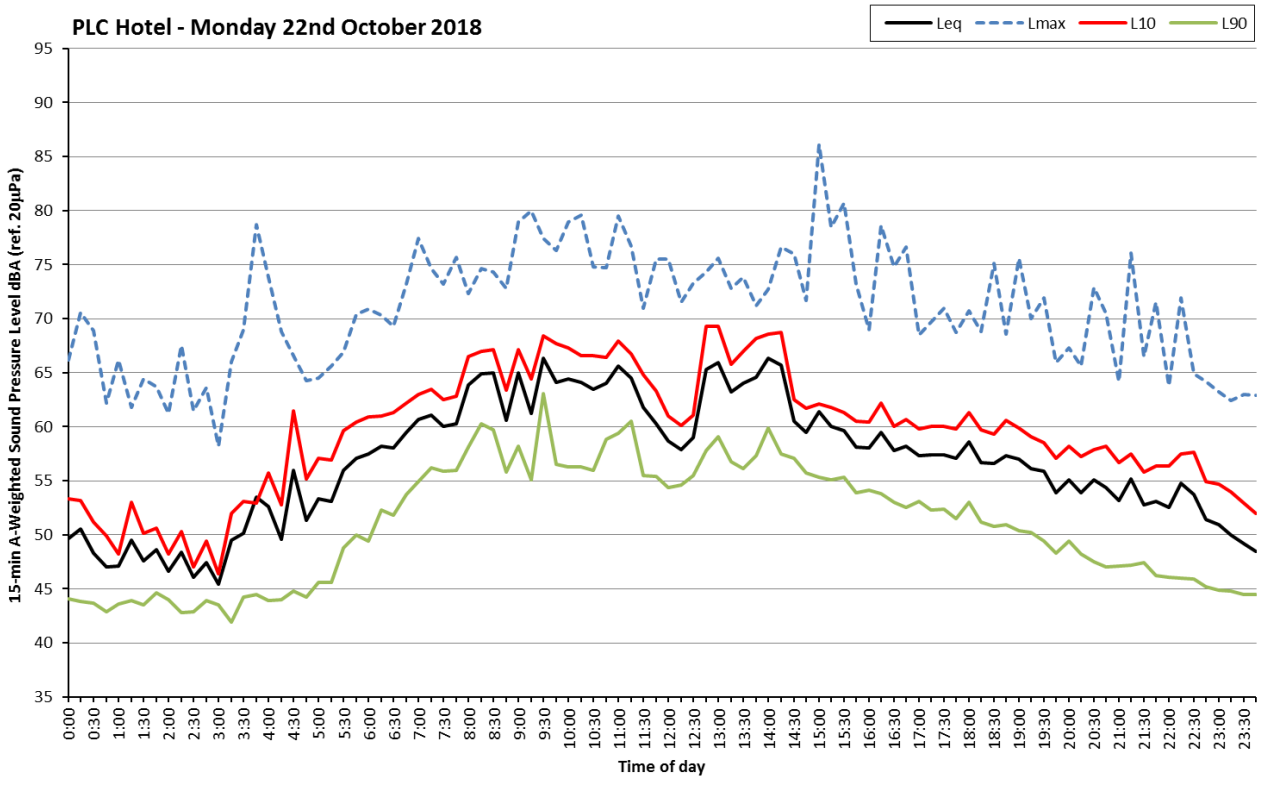
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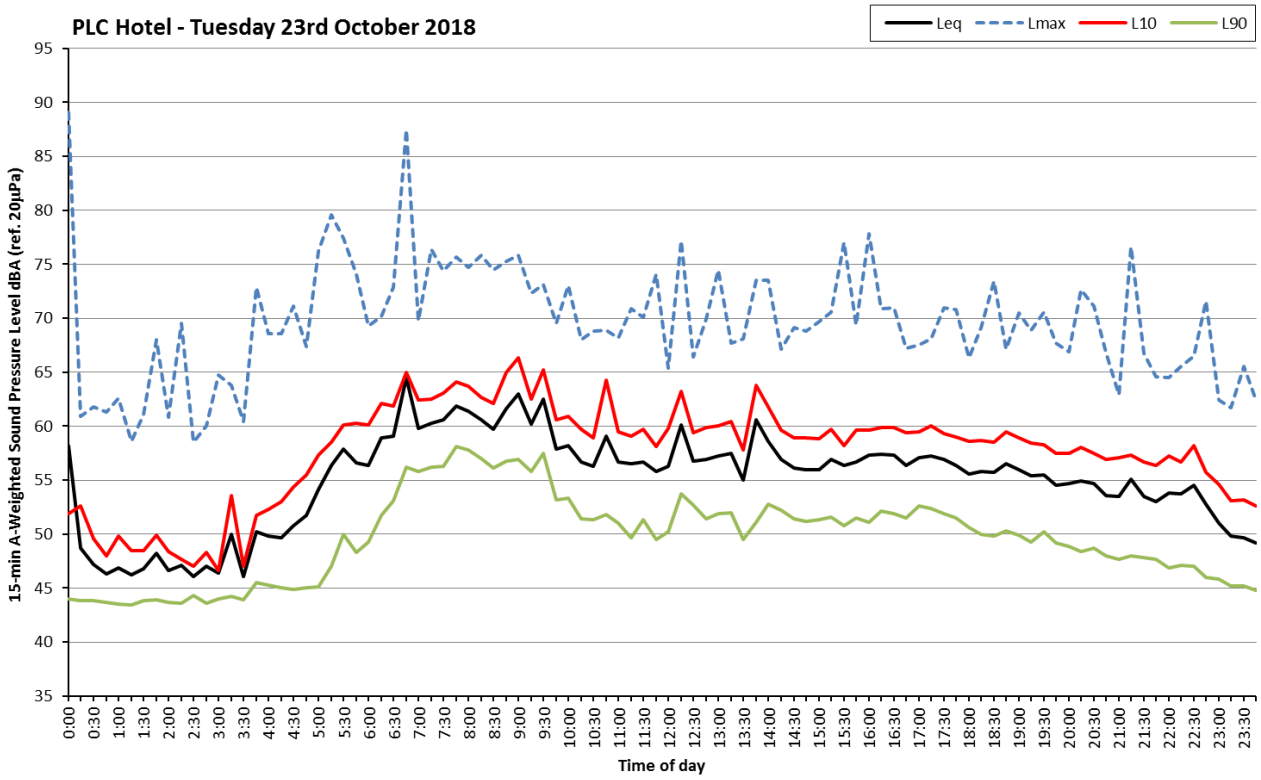
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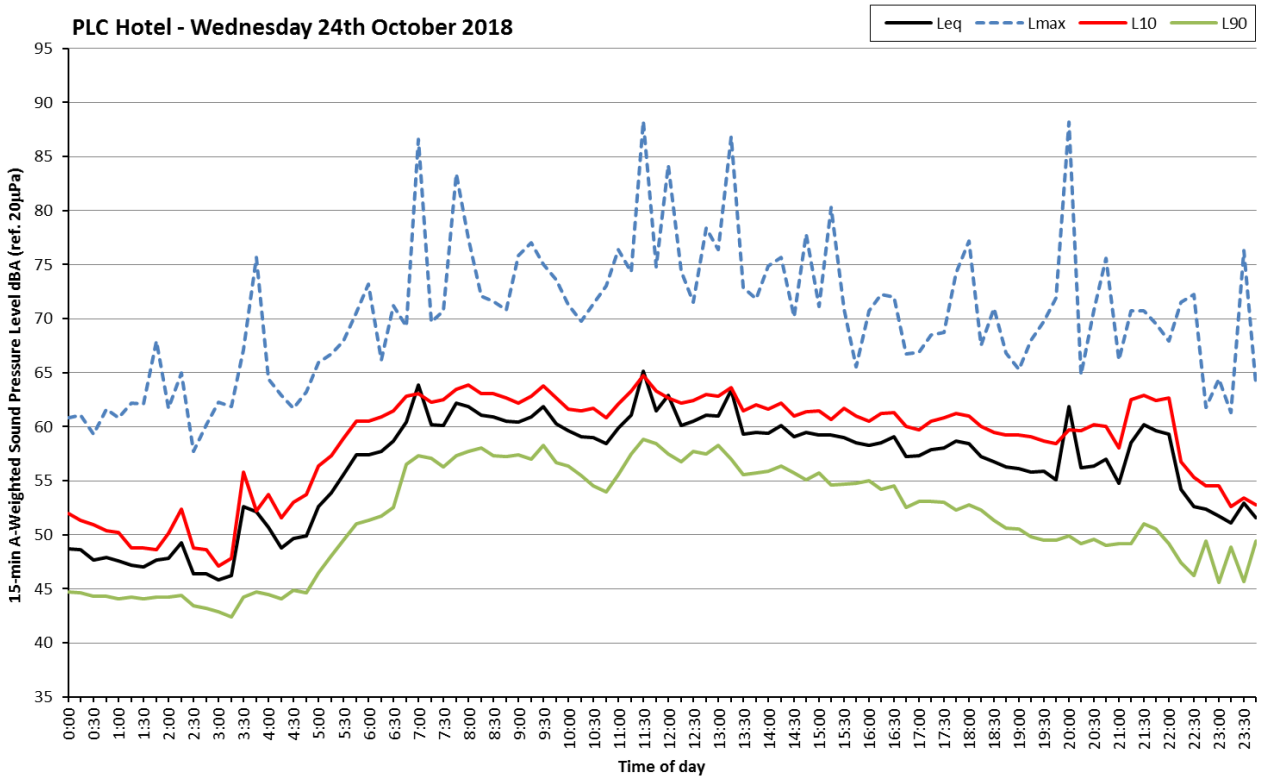
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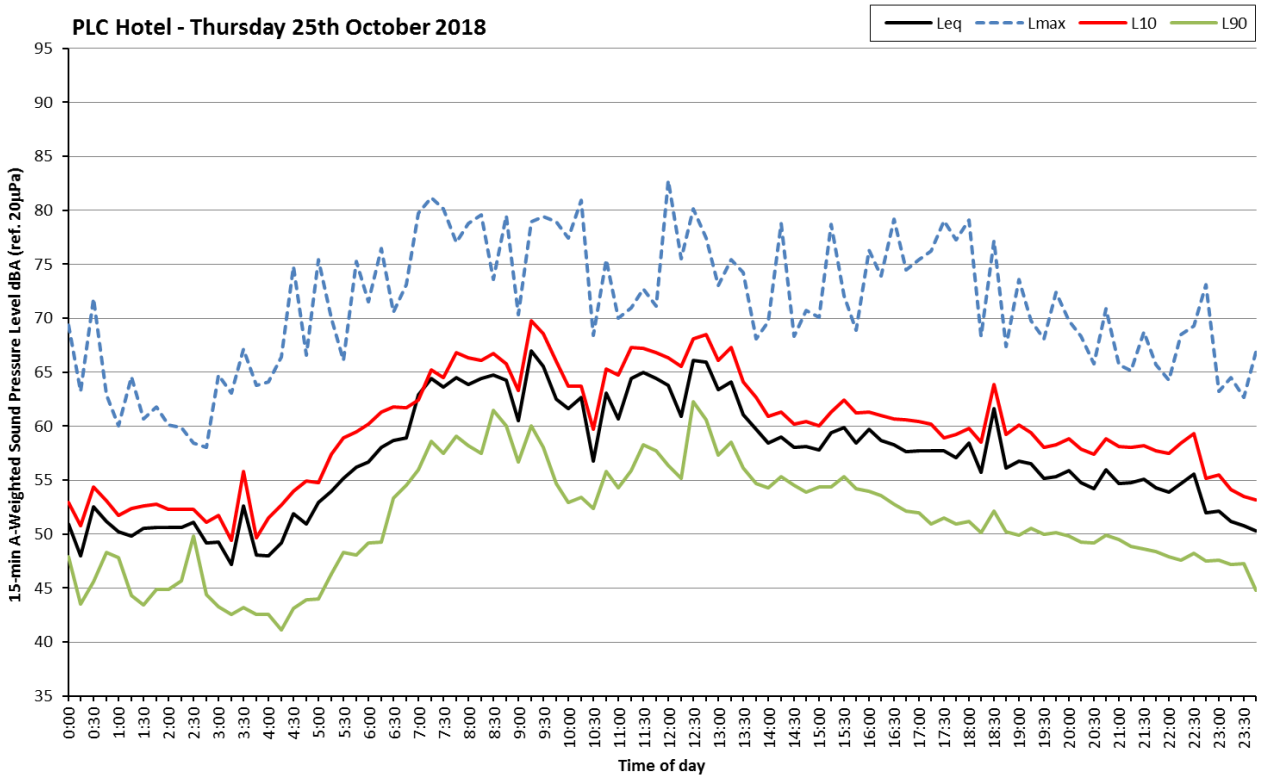
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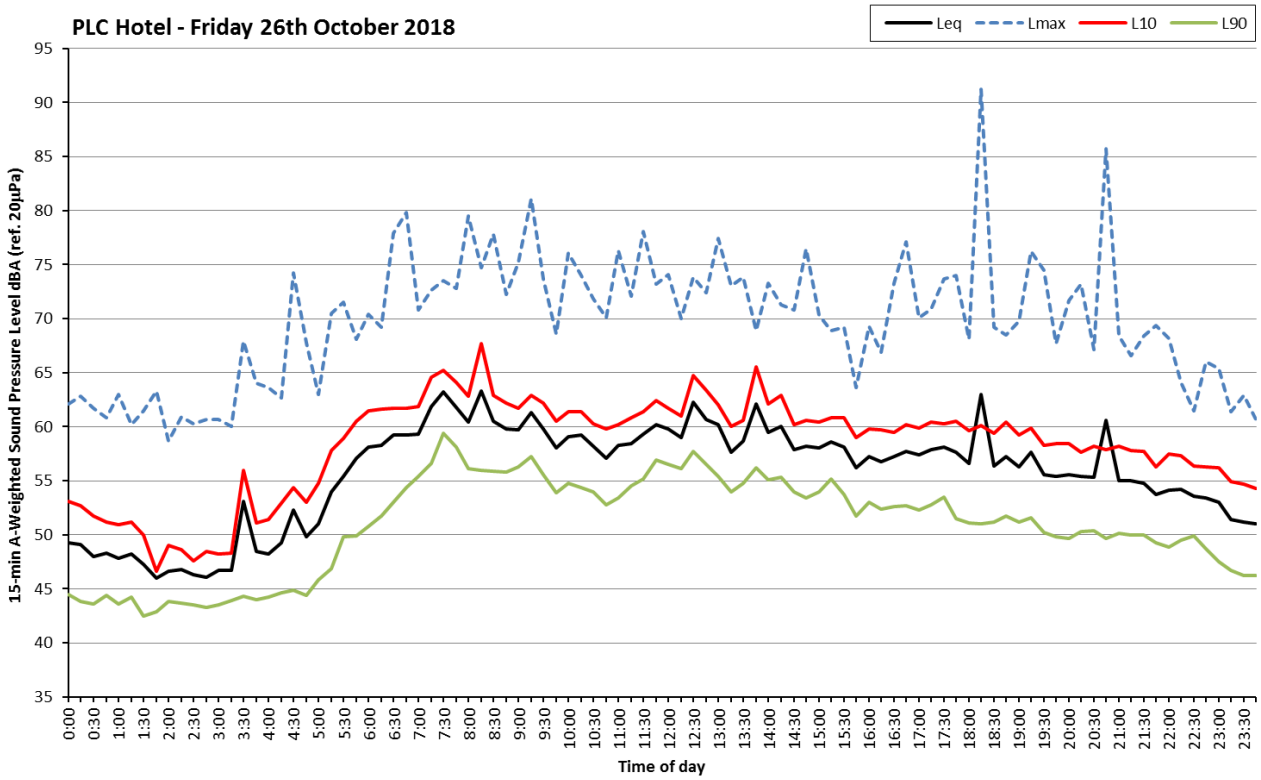
Time of day


PLC Hotel - Friday 26th October 2018
Leq
Lmax
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
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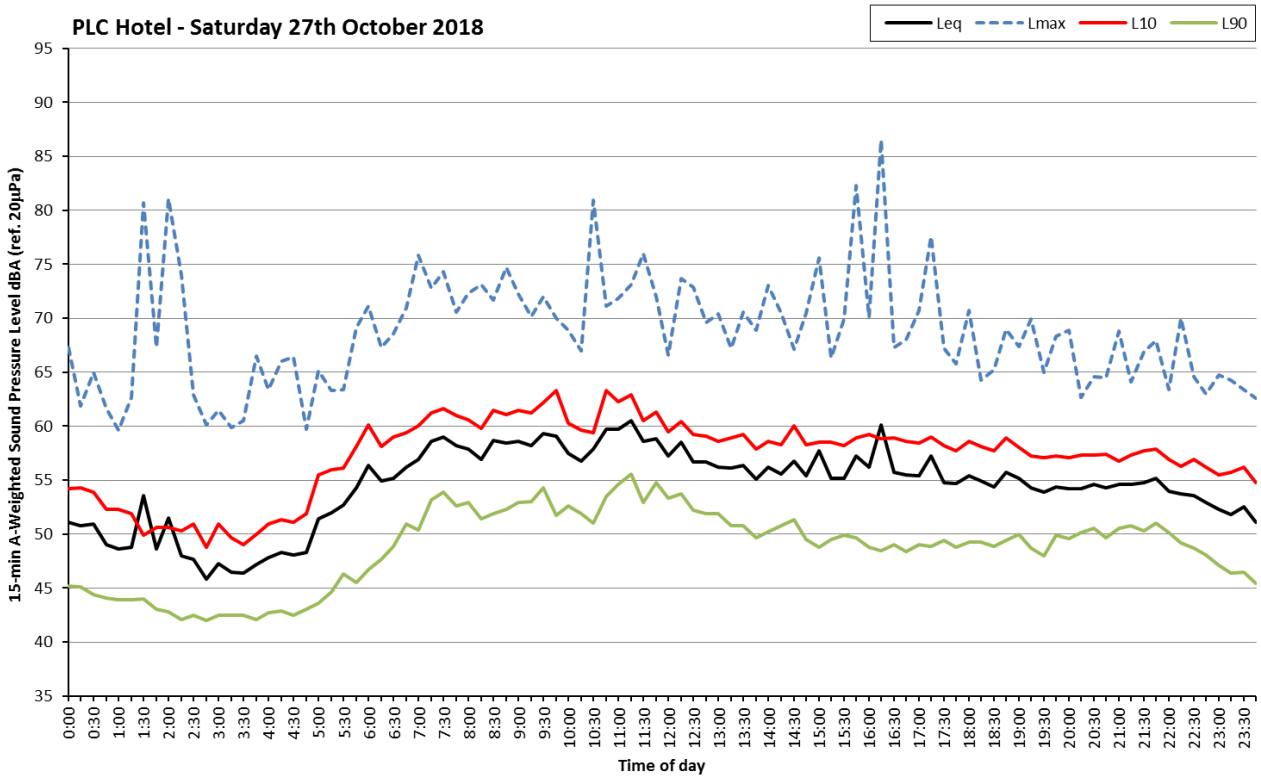
PLC Hotel - Saturday 27th October 2018
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15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
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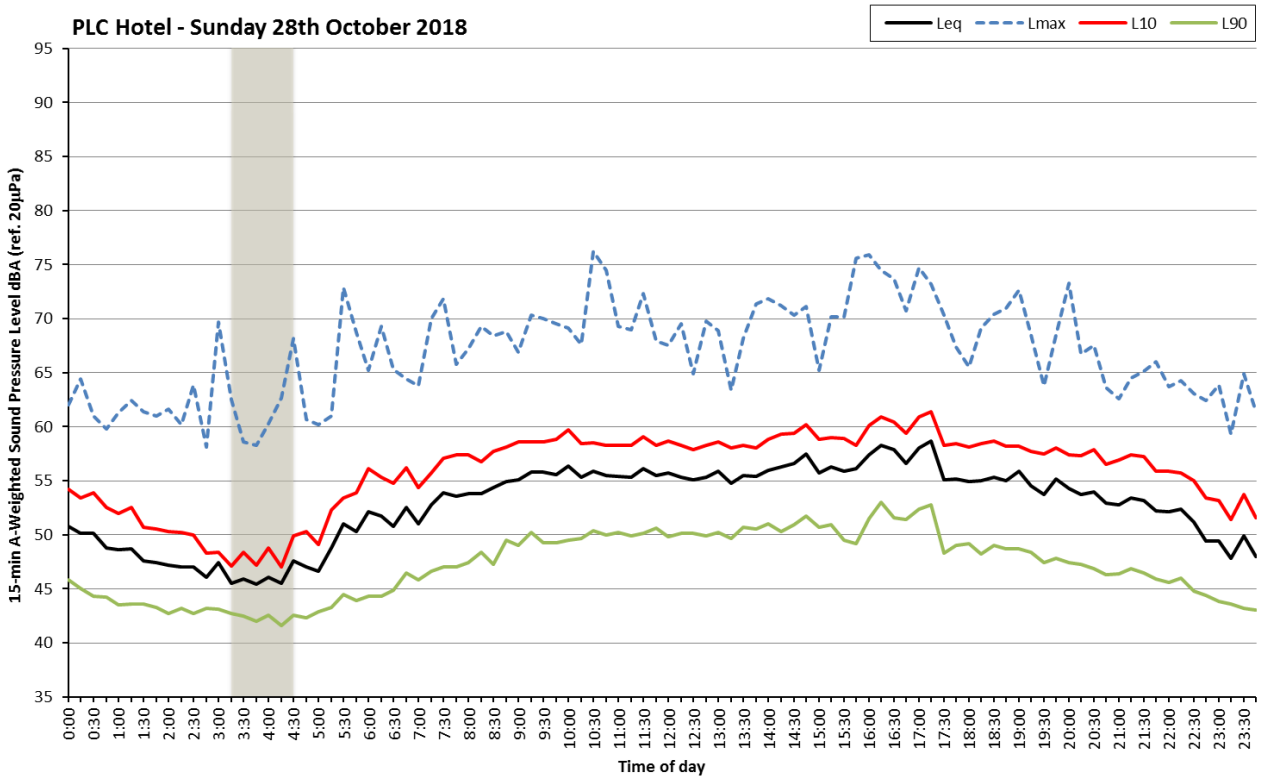
Time of day


PLC Hotel - Sunday 28th October 2018
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15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
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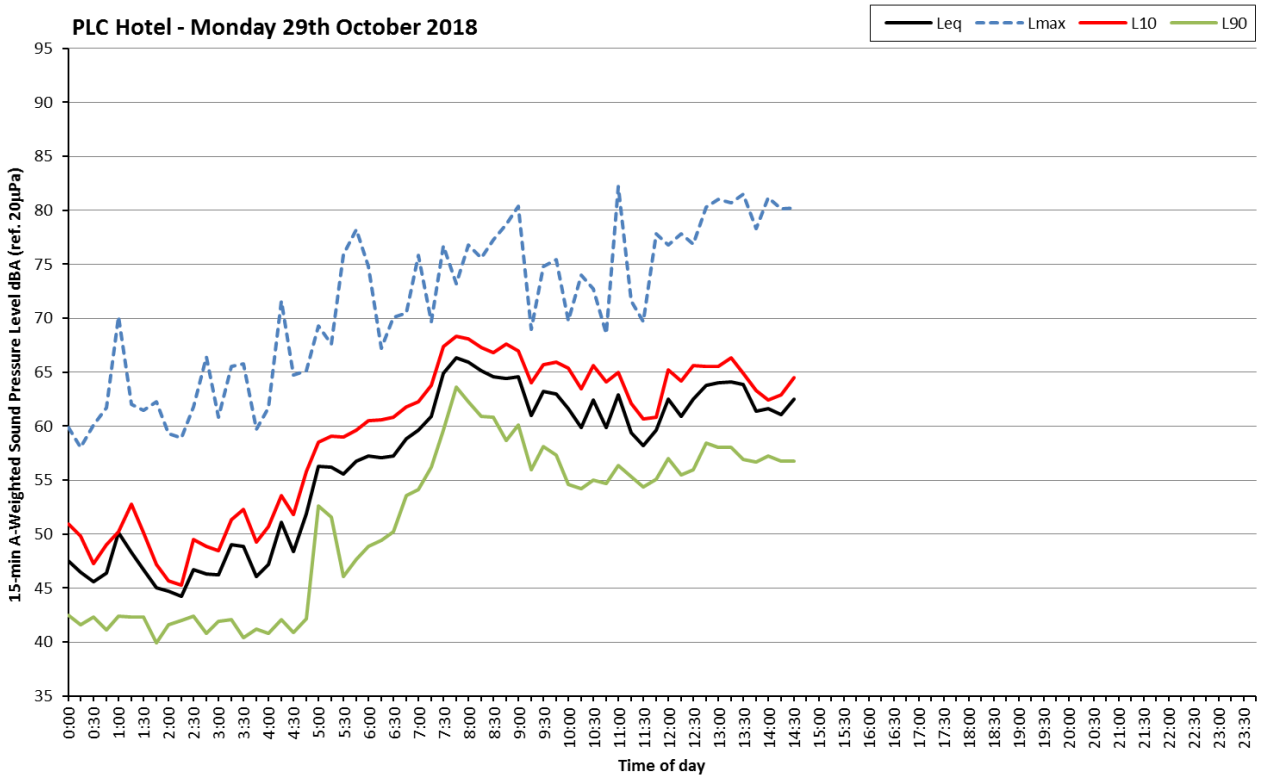
Time of day


PLC Hotel - Monday 29th October 2018
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15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
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Time of day