

THE STAR SYDNEY, PYRMONT

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The Star Sydney

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1 Introduction

Renzo Tonin & Associates was engaged by The Star Sydney to undertake an operational noise assessment to support the State Significant Development (SSD) Modification (MOD) 16 of MP08_0098 for the proposed Level 17 Outdoor Balconies at The Star Sydney, Pyrmont.

The MOD seeks to upgrade the existing outdoor balconies on Level 17 and facade simplification. The proposed facade simplification works is not deemed to have any acoustic impact and therefore, will not be further discussed in this report.

The proposal includes 7 outdoor balconies on Level 17 as follows:

- Balcony 1
- Balcony 2
- Balcony 3
- PIT80 Balcony with airlock
- Balcony 4
- Balcony 5
- Balcony 6

The expansion of the balconies will provide better experiences and improved outdoor amenity for the guests. Patrons are not expected to stay for a long period of time. No entertainment will be provided, ie. no background music played through speakers. The main sources of noise will be outdoor patrons talking on the outdoor balconies. There is no mechanical services plant and equipment associated with the works.

This report quantifies noise emission from activities associated with the proposal and assesses operational noise on nearby sensitive receivers in accordance with the noise requirements of the Modification of Minister's Approval No. MP 08_0098 MOD 14 Part F.

For the determination of the project noise goals, Renzo Tonin & Associates relies on the measurement results and assessment outcomes of the recently submitted Acoustic Compliance Assessment for The Star Sydney - MP 08_0098 MOD 14 report [ref: 4792R001.RH.210517, dated 21 June 2021] prepared by Acoustic Dynamics (Acoustic Compliance Assessment Report).

APPENDIX A contains a glossary of acoustic terms used in this report.

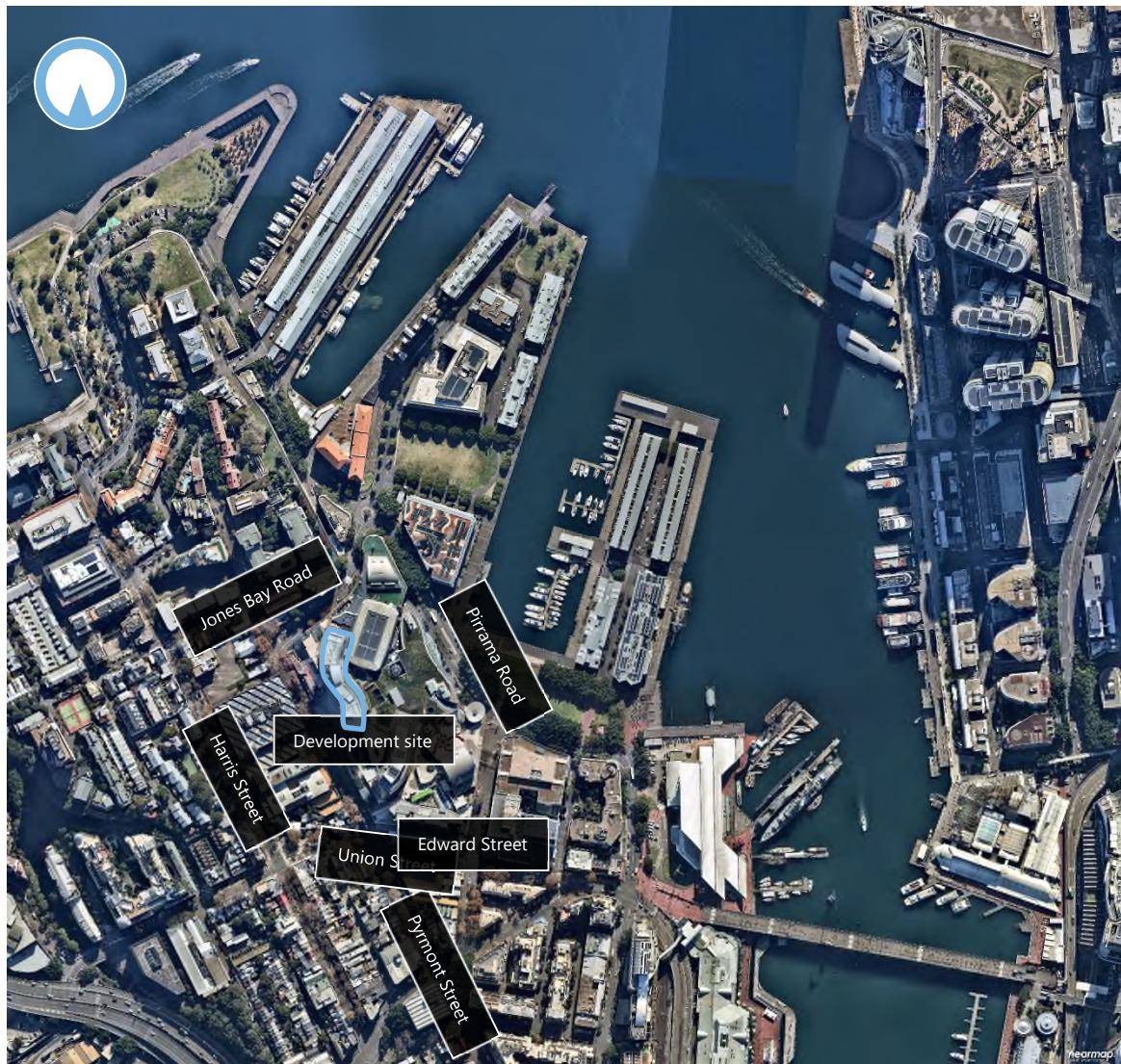
2 Project description

2.1 Site description and development overview

The Star Sydney is bound by Pyrmont Street to the west, Union Street to the south, Edward Street and Pirrama Road to the east, and Jones Bay Road to the north.

The nearest residential receivers are identified to the east along Pirrama Road (Sydney Wharf Apartments), to the north along Jones Bay Road (2 Jones Bay Road), to the west along Harris Street (84 Harris Streets) and to the south along Pyrmont Street (91 Pyrmont Street) with predominately commercial premises in the vicinity.

Figure 1: Aerial view of the existing site



2.2 Acoustic aspect

Based on the proposed design and operational parameters, patrons on the Level 17 Outdoor Balconies are deemed to require an acoustic assessment.

2.3 Acoustic assessment methodology

In order to assess the potential noise impact from subject proposal the following methodology was used:

- Identify nearest most potentially affected receiver locations to the subject site
- Determine existing background noise levels at the nearest most potentially affected receiver locations
- Use measured background noise levels to establish noise goals in accordance with the relevant noise criteria
- Using predictive noise modelling, determine the extent of noise impact from the proposal at nearby residential premises
- Identify if noise emission from the area under investigation may exceed the relevant criteria, and
- Where noise emission from the area under investigation may exceed the relevant criteria, provide recommendations to reduce noise impacts from the site.

2.4 Reference material

The following documentation has been referenced for this report:

- Architectural drawing set prepared by Design Worldwide Partnership (DWP) [ref: 2200557_The Star Modification 16_Architectural Drawings_17082021, dated 29 July 2021]

3 Project noise goals

3.1 Modification of Minister's Approval No. MP 08_0098 MOD 14 Part F

Condition F5 of the Modification of Minister's Approval is as follows:

F5 Noise

Cumulative noise caused by the approved use including music and other activities must comply with the following criteria:

1. The use must not result in the transmission of "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy **outside the boundary**;
2. The L10 noise level emitted from the use must not exceed 5dB above the background (L90) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 7.00am and 12.00 midnight when assessed at the boundary of the nearest affected property. The background noise level must be measured in the absence of noise emitted from the use.
3. The L10 noise level emitted from the use must not exceed the background (L90) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 12.00 midnight and 7.00am when assessed at the boundary of the nearest affected property. The background noise level must be measured in the absence of noise emitted from the use.
4. Notwithstanding compliance with (1) and (2) above, the noise from the use must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00am.
5. The L10 noise level emitted from the use must not exceed the background noise level (L90) in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) by more than 3dB when assessed indoors at any affected commercial premises.

3.2 Assessment locations

The identified assessment locations are outlined in Table 1 below and shown in Figure 2.

Table 1: Assessment locations

ID	Address	Description
R1	Sydney Wharf Apartments, 56-56A Pirrama Road, Pyrmont	Multi-storey residential buildings located to the north-east of the subject site on the opposite side of Pirrama Road
R2	2 Jones Bay Road, Pyrmont	A multi-storey residential building located to the north of the subject site on the opposite side of Jones Bay Road
R3	84 Harris Street	A multi-storey residential building located to the west of the subject site with the rear of the property facing towards the subject site
R4	91 Pyrmont Street	A double-storey residential building located to the south of the subject site on the opposite side of Pyrmont Street

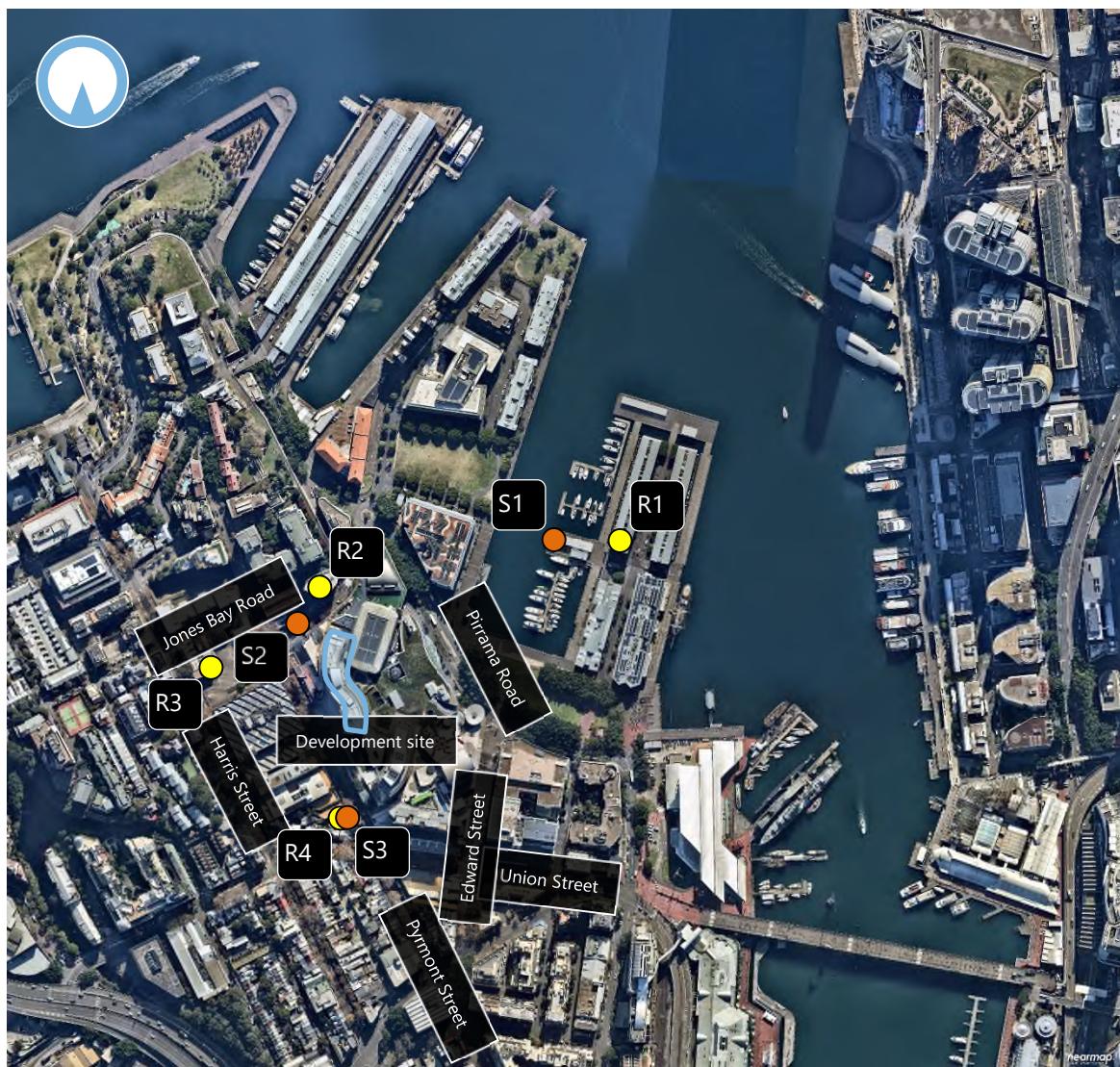
3.2.1 Noise measurement locations

The locations at which short-term measurements were undertaken by Acoustic Dynamics (Table 3.2 *External Measurement Locations* of Acoustic Compliance Assessment Report) is outlined in Table 2 and shown in Figure 2.

Table 2: Noise monitoring location

ID	Address	Description
Short-term noise monitoring		
S1	Sydney Wharf 9 Residences	Loc ID 2 is around 7m from the north-western corner of the jetty. The measured background noise levels are deemed representative for Receiver Location R1.
S2	18 Pyrmont Street	Loc ID 4 is around 2m from the facade, in line with the rear facade of the dwelling. The measured background noise levels are deemed representative for Receiver Locations R2 and R3.
S3	93 Pyrmont Street	Loc ID 6 is around 2m from the facade, near the front door of the dwelling. The measured background noise levels are deemed representative for Receiver Location R4.

Figure 2: Assessment and noise monitoring locations



3.2.2 Short term noise measurement results

A summary of the short-term measurement results (Table 5.8 *Predicted Maximum Octave Band Noise Emission Levels [dB] & Compliance Assessment of Acoustic Compliance Assessment Report*) is presented in Table 3.

Table 3: Short-term noise monitoring results

Location	Date/time	Overall dB(A)	Octave band centre frequency - Hz (dBZ)								
			31.5	63	125	250	500	1k	2k	4k	8k
S1 - Loc ID 2	Mon 7/12/20 00:40-00:55	44	53	49	47	45	42	39	33	22	13
S2 - Loc ID 4	Mon 7/12/20 01:25-01:40	52	58	57	54	50	50	48	42	37	28
S3 - Loc ID 6	Mon 7/12/20 02:15-02:30	51	55	55	52	49	45	45	45	40	31

3.3 Project noise goals

3.3.1 Operational noise

The octave band noise goals for operational noise at the identified receivers set out in Table 4 below have been established from measured noise levels set out in Section 3.2.2. For the determination of inaudibility, Renzo Tonin & Associates consider a design criterion of 10dB below the background noise level in each octave band for intermittent noise sources. It is assumed that if inaudibility goal is achieved externally, the internal inaudibility criterion will also be achieved.

Table 4: Project noise goals between the hours of 12:00am midnight and 7:00am - Condition F5, L₁₀

Location	Octave band centre frequency - Hz (dBZ)								
	31.5	63	125	250	500	1k	2k	4k	8k
R1 - Level 4, Sydney Wharf Apartments (inaudibility)	48*	39	37	35	32	29	23	12	7*
R2 - Level 8, 2 Jones Bay Road (inaudibility)	48	47	44	40	40	38	32	27	18
R3 - Level 3, rear of 84 Harris Street (inaudibility)	48	47	44	40	40	38	32	27	18
R4 - Level 1, 91 Pyrmont Street (inaudibility)	48*	45	42	39	35	35	35	30	21

Note: * Threshold of hearing in accordance with AS3657.1. Lowest third octave level for the respective octave band.

4 Level 17 Outdoor Balconies noise emission assessment

4.1 Noise sources

The expansion of the balconies will provide better experiences and improved outdoor amenity for the guests. Patrons are not expected to stay for a long period of time and therefore, talking is likely to be very limited.

Noise emission from the patrons on the Level 17 Outdoor Balconies (conservatively assumed to be half talking at any one time), as is assessable against the established noise goals, includes:

- Balcony 1 - 18 pax, 9 talking
- Balcony 2 - 3-4 pax, 2 talking
- Balcony 3 - 18 pax, 9 talking
- PIT80 Balcony with airlock - 24 pax, 12 talking
- Balcony 4 - 3-4 pax, 2 talking
- Balcony 5 - 3-4 pax, 2 talking
- Balcony 6 - 3-4 pax, 2 talking

The source noise levels used for the predictions, presented in Table 5, were referenced from the Handbook of Acoustical Measurements and Noise Control by Cyril M. Harris.

Table 5: Source noise levels for assessment

Area	Applicable noise source	Overall dB(A)	Octave band centre frequency - Hz (dBZ)								
			31.5	63	125	250	500	1k	2k	4k	8k
Level 17 Outdoor Balconies	Male raised voice (L _w L ₁₀ per person)*	75	-	-	65	70	75	69	65	60	54

Note:

* Source reference - Handbook of Acoustical Measurements and Noise Control, Third Edition, Cyril M. Harris.

4.2 Prediction methodology

The noise predictions were based upon the architectural drawings set out in Section 2.4, and carried out in accordance with ISO9613 as implemented by CadnaA computer modelling program. The software considers sound radiation patterns, acoustic shielding and potential reflections from intervening building elements, and noise attenuation due to distance.

4.3 Noise prediction results & assessment

Table 6 summarises the results of the noise assessment, presenting the predicted noise emission levels at the identified assessment locations against the established noise goals. All doors leading out to the balconies are to be kept closed at all times except for egress/ingress of patrons.

Table 6: Predicted noise level assessment between the hours of 12:00am midnight and 7:00am, L₁₀

Assessment ID	Description	Octave band centre frequency - Hz (dBZ)								
		31.5	63	125	250	500	1k	2k	4k	8k
R1 - Level 4, Sydney Wharf Apartments	Predicted noise levels	L17 Outdoor Balconies	0	0	15	20	24	18	12	0
	<i>Noise goals (inaudibility)</i>		48	39	37	35	32	29	23	12
R2 - Level 8, 2 Jones Bay Road	Predicted noise levels	L17 Outdoor Balconies	0	0	27	32	37	31	27	21
	<i>Noise goals (inaudibility)</i>		48	47	44	40	40	38	32	27
R3 - Level 3, rear of 84 Harris Street	Predicted noise levels	L17 Outdoor Balconies	0	0	25	31	35	29	24	16
	<i>Noise goals (inaudibility)</i>		48	47	44	40	40	38	32	27
R4 - Level 1, 91 Pyrmont Street	Predicted noise levels	L17 Outdoor Balconies	0	0	19	25	31	25	20	12
	<i>Noise goals (inaudibility)</i>		48	45	42	39	35	35	30	21

The noise predicted results above indicated that patrons on the Level 17 Outdoor Balconies can comply with the established noise goals (inaudibility).

Provided that the recommendations described in Section 5.1 are effectively implemented, noise contribution levels from patrons on the Level 17 Outdoor Balconies are predicted to comply with Condition F5 of Modification of Minister's Approval No. MP 08_0098 MOD 14.

5 Recommendations

5.1 Operational management

All doors leading out to the balconies are to be kept closed at all times except for egress/ingress of patrons.

5.2 Patronage

The patronage numbers as set out in Section 4.1 are not to be exceeded.

6 Acoustic risk assessment

Risk management is an integral part of good management practice. Australian/New Zealand Standard AS/NZS 4360:2004 "Risk management" has become part of our company's culture and as a consequence it permeates all aspects of the company's work and is actively promoted to our clients.

The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Our clients need to know about possible outcomes and the steps that can be taken to control any adverse impact.

There is an opportunity in the design process for the client to actively participate in risk management by providing input into risk reduction strategy. For example, the client may need to know that some aspects of risk reduction could involve passing those risks on to other entities in a better position to treat those risks. Some aspects of risk reduction may involve additional cost or time consequences. On the other hand, there may also be opportunities to avoid or avert risk at no cost to the client by rescheduling processes so that key information becomes available at a critical time.

When the client is properly informed, this supports better decision making by contributing a greater insight into risks and their impacts. It is recommended that the client seek to understand the potential risk during the detailed design phase of the development.

7 Conclusion

Renzo Tonin & Associates has completed an assessment of operational noise for the proposed Level 17 Outdoor Balconies at The Star Sydney, Pyrmont. The expansion of the balconies will provide better experiences and improved outdoor amenity for the guests. Patrons are not expected to stay for a long period of time. No entertainment will be provided, ie. no background music played through speakers. The main sources of noise will be outdoor patrons talking on the outdoor balconies.

The proposed works have been assessed against all relevant noise criteria with project specific noise goals established from the measurements, results and assessment outcomes of the Acoustic Compliance Assessment for The Star Sydney - MP 08_0098 MOD 14 report [ref: 4792R001.RH.210517, dated 21 June 2021] prepared by Acoustic Dynamics. With the adoption of the assumed parameters and recommended measures set out in Section 5, the design satisfies the relevant noise requirements.

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]	<p>The units that sound is measured in. The following are examples of the decibel readings of everyday sounds:</p> <p>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</p>
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 L ₉₀ 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 L _{eq} 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.