Lee Cunningham Partnership

Acoustic Consultancy Report

70648/3/1/4

External Plant Assessment

Report Prepared For

Sowga Ltd
Wetherspoon - High Holborn
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Report Author

Robert Martin

Checked By

M Balsom MSc MIOA (D) (E)

Telephone
0118 918 6460
Facsimile
0118 918 6480

enquiries@lcpacoustics.co.uk
www.lcpacoustics.co.uk

LCP
Riverside House
3 Winnersh Fields
Gazelle Close
Winnersh
Wokingham
RG41 5QS

A division of CAICE
Acoustic Air Movement Ltd.

Company Registration Number
2790667
VAT Registration Number
GB614683632

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i) Executive Summary

New mechanical plant is to be installed at Wetherspoon High Holborn, in London.

LCP has been commissioned by Sowga Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The design criterion is as follows:

Residential Night:	40 dB $L_{Aeq, T}$ at 9m, New Penderel House;
Commercial Day:	55 dB $L_{Aeq, T}$ at 9m, nearest commercial.

The design as proposed and assessed will achieve the required criteria provided the mitigation detailed in section 5 of this report is implemented; the emissions have been calculated as follows:

Residential Night:	40 dB $L_{Aeq, T}$ at 9m, New Penderel House;
Commercial Day:	40 dB $L_{Aeq, T}$ at 9m, nearest commercial.

This report concludes that the design criteria can be achieved.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	04/02/2015	Initial Issue	RM	MB

1 Introduction

New mechanical plant is to be installed at Wetherspoon High Holborn, in London.

LCP has been commissioned by Sowga Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The report details recommendations for necessary noise mitigation where necessary.

The guidance contained in this report is given on the basis that the operational period of the plant may potentially be continuous between 07:30 and 00:00.

2 Survey

2.1 Site Description

The site layout together with the measurement position is shown in the drawing contained within Appendix A.

2.2 Receiver Location

The site was surveyed to determine the location of the most affected receiver.

The nearest residential receiver with direct line of sight to the plant area is New Penderel House, approximately 9m to the west of the site. The nearest commercial receiver with direct line of sight to the plant area is approximately 9m to the north. This is shown in the site plan in Appendix A.

2.3 Local Noise Climate

The predominant local noise sources was existing plant noise and members of the public in Weatherspoon's garden.

2.4 Measurements

The noise monitoring took place from the 26th January to the 27th January 2015. The measurement period was considered sufficient to establish the lowest background noise levels corresponding to the operational period of the plant.

The weather conditions during the survey were predominantly calm and dry.

2.5 Measurement Results

The measured statistical broad-band sound pressure levels are shown within Appendix B. The lowest representative background noise level(s) obtained being as follows:

Table 1: Lowest measured background noise levels, dB re $2x10^{-5}$ Pa

Measurement Position	$L_{A90,\ 15\ mins}$ Day*	$L_{A90,\ 15\ mins}$ Night*
MP1	57	45

* Operation hours are 07:30 – 00:00.

3 Evaluation of Design Criteria

3.1 Residential Design Criterion

3.1.1 BS4142:1997

BS4142:1997 states that the 'likelihood of complaints' are to be assessed by subtracting the measured background noise level from the calculated rating level. The following table demonstrates the resultant assessments based upon the calculated rating level.

Table 2: BS4142 assessment based upon rating level

Difference between background noise and rating levels	Assessment
+ 10 dB	Complaints are likely
+ 5 dB	Marginal significance
- 10 dB	Complaints are unlikely

In acoustic terms, a calculated rating level 10 dB below the measured background noise level means that the measured background noise level is not increased.

An explanation of the effects of changes in the difference between the rating level and the background noise level can be found in the glossary in Appendix E. The corresponding subjective change in loudness is described.

A 5 dB correction shall be applied in the case of intermittent or tonal plant noise emissions.

BS4142:1997 also states that background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low.

3.1.2 World Health Organisation Night Noise Guidelines for Europe (2009)

The WHO's document 'Night Noise Guidelines for Europe (NNG) states the following:

"…*it is recommended that the population should not be exposed to night noise levels greater than 40 dB of* $L_{night,\ outside}$ *during the part of the night when most people are in bed*."

It then goes on to say:

"*An interim target (IT) if 55 dB* $L_{night,\ outside}$ *is recommended in the situations where the achievement of NNG is not feasible in the short run for various reasons*."

As the above guideline values consider the combined level of noise external to a façade (i.e. vehicular traffic, air traffic, building services noise etc, it is recommended that a criterion of 10 dB below these given levels is applied, depending on the particulars of the site in question.

3.1.3 World Health Organisation (WHO) Guidelines for Community Noise (1999)

The WHO's 'Guidelines for Community Noise' gives the following relevant noise criteria:

Table 3: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq, T}$ dB	Time Base (hours)	L_{Amax}, fast dB
Outdoor living area (serious annoyance, daytime and evening)	55	16	-
Outdoor living area (moderate annoyance, daytime and evening)	50	16	-
Dwelling, indoors	35	16	-
Inside bedrooms	30	8	45
Outside bedrooms	45	8	60
Outdoors in parkland and conservation areas*	-	-	-

* Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low

3.1.4 BS8233:2014

The criteria offered in BS8233 for residential buildings are largely based on the recommendations made in the Guidelines for Community Noise.

Using the general guidance from above, on the expected sound insulation performance of a façade with a partly open window, the criteria shown in the table below have been adapted from the criteria offered in table 4 of BS8233 in order to obtain acceptable external noise levels.

The noise levels shown should be treated as overall noise levels, i.e., the combination of all existing noise levels at the site, and noise levels from any proposed plant or activity.

Table 4: External ambient noise levels for dwellings, based on BS8233, dB re $2x10^{-5}$ Pa

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living Room	50 $L_{Aeq,16\ hour}$	-
Dining	Dining Room/area	55 $L_{Aeq,\ 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	50 $L_{Aeq,\ 16\ hour}$	45 $L_{Aeq,\ 8\ hour}$

In addition to the above criteria, BS8233 goes on to say:

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 $L_{Aeq,\ T}$, with an upper guideline value of 55 dB $L_{Aeq,\ T}$ which would be acceptable in nosier environments*."

The above criteria are in line with the recommendations made in WHO's 'Guidelines for Community Noise'.

3.1.5 Local Authority Requirements

The London Borough of Camden published "*Camden Development Policies 2010 – 2025: Local Development Framework*". Table E in section DP28 – Noise and Vibration, provides noise criteria for plant, which is shown below.

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB$L_{Aeq'}$

3.1.6 Design Rating Level

On the basis of the above the design rating level shall therefore be:

Design Rating Level
Existing lowest $L_{A90,\ 15\ mins}$ - 5 dB

3.2 Commercial Design Criterion (BS8233:1999)

Design criteria for non-residential buildings have been derived from BS8233:1999.

For typical office environments, the rating level is $L_{Aeq,\ T}$ 55 dB at 1m from the façade of the receiver premises.

Design Rating level
$L_{Aeq,\ T}$ 55 dB

3.3 Design Rating Levels

The design levels to be adopted for this project are set out in the table below.

Table 5: Design rating levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 12\ hr}$	Design Level (Night) $L_{Aeq, 8\ hr}$
New Penderel House	9	50	40
Nearest commercial	9	55	-

4 Review of Current Design

4.1 Current Design

The proposed plant shall be located on the roof of the Wetherspoon's above the smoking area, a screen encloses the plant area, and it is assumed that this is constructed of 75mm acoustic panelling which typical performance is shown in the table below.

	Octave Band Centre Frequency (Hz)								R_w
	63	125	250	500	1k	2k	4k	8k	
Acoustic Panel	15	22	26	34	39	47	49	48	37

The plant includes 3 Trane air conditioning units, 1 x YSH120 and 2 x DKH200. These units will run from 07:30 - 00:00.

4.2 Calculated Results

Calculations of the predicted noise levels have been carried out with the appropriate corrections for geometric attenuation, barrier effect, reflective surfaces and multiple source addition.

The design rating levels to be adopted for this project, together with the predicted noise levels, are set out in the table below.

Table 6: Predicted and design noise levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 12\ hr}$	Design Level (Night) $L_{Aeq, 8\ hr}$	Predicted Level $L_{Aeq,T}$
New Penderel House	9	50	40	63
Nearest commercial	9	55	-	63

Plant noise level data used in this assessment are contained within Appendix D. Calculations are shown within Appendix E.

5 Noise Mitigation Options

As the plant installation has been assessed to be over the required criteria at the surrounding noise sensitive receptors, the following option shall be applied in order that noise emissions are reduced to acceptable levels.

Should the plant installation be redesigned after consideration of the mitigation options, the installation shall be re-assessed to ensure compliance to the specification has been achieved.

5.1 Noise Mitigation Scheme

The suggested mitigation measure is the introduction of a suitable noise mitigation scheme by means of an acoustic louvre roof to the enclosure, required performance of an acoustic louvre roof is shown in the table below.

Table 7: Required Acoustic Mitigation performance, dB

	Octave Band Centre Frequency (Hz)								R_w
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Acoustic louvre roof	-	10	15	20	18	12	6	-	16

Should this option be implemented, the design of the mitigation will need the services of a noise control company specialising in bespoke solutions to non-standard situations.

Such a company would visit the site, and attempt to arrive at an economic solution, taking into account all the parameters of this particular situation.

The problems of air flow, pressure drop etc, applicable to this equipment will all need to be taken into account.

Such a company is:

Company	Address	Telephone	Email/Web
Caice	Riverside House 3 Winnersh Fields Winnersh Wokingham RG41 5QS	0118 918 6470	enquiries@caice.co.uk www.caice.co.uk

5.2 Mitigated Results

The design rating levels to be adopted for this project, together with the predicted noise levels inclusive of the mitigation detailed in Section 5, are set out in the table below.

Table 8: Predicted and design noise levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq,\ 12\ hr}$	Design Level (Night) $L_{Aeq,\ 8\ hr}$	Predicted Level $L_{Aeq,T}$
New Penderel House	9	50	40	40
Nearest commercial	9	55	-	40

Plant noise level data used in this assessment are contained within Appendix D.

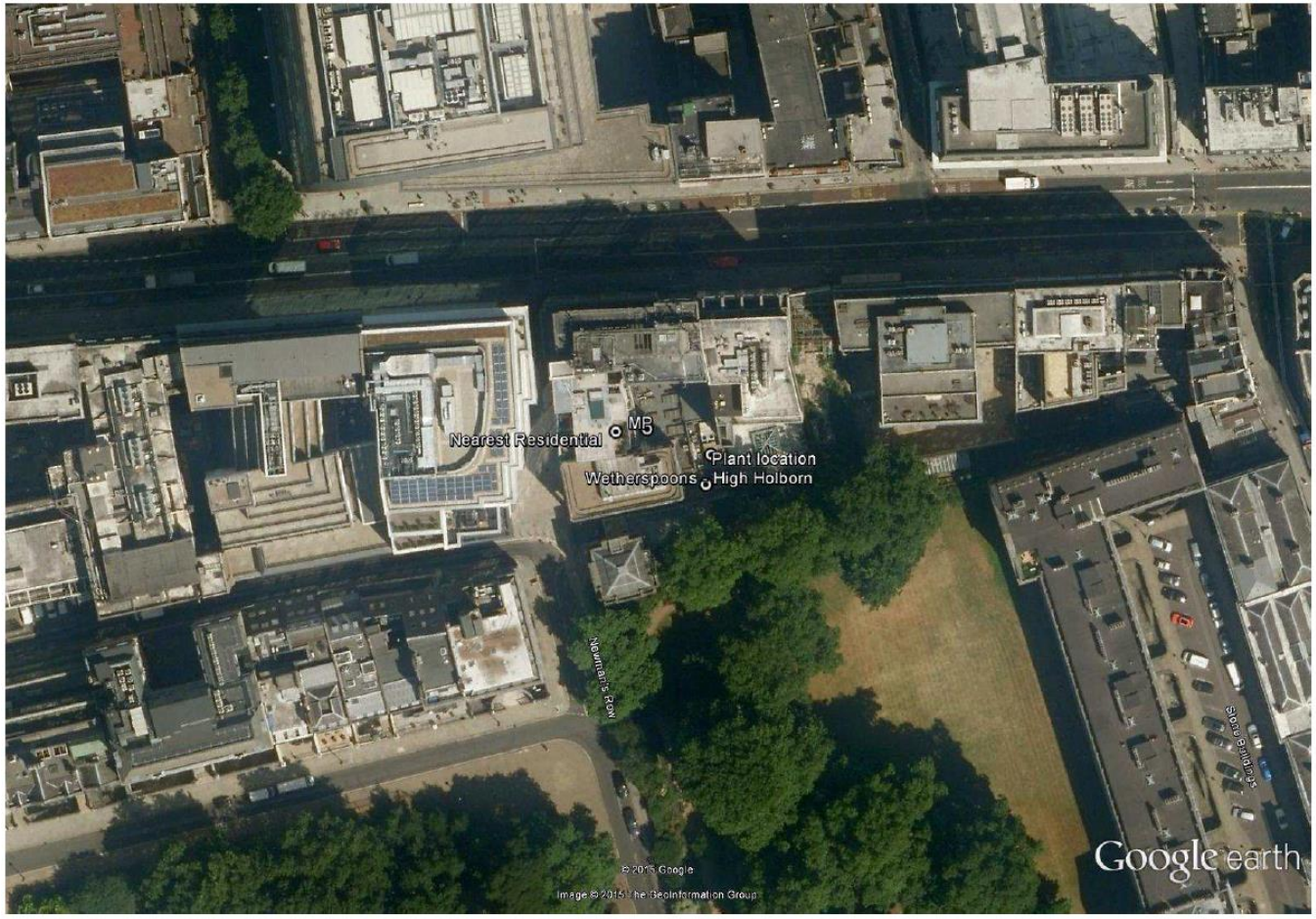
Calculations are shown within Appendix E.

6 Conclusion

An environmental noise survey has been undertaken in order to establish the existing background noise levels local to the site generally in accordance with the method contained within BS4142.

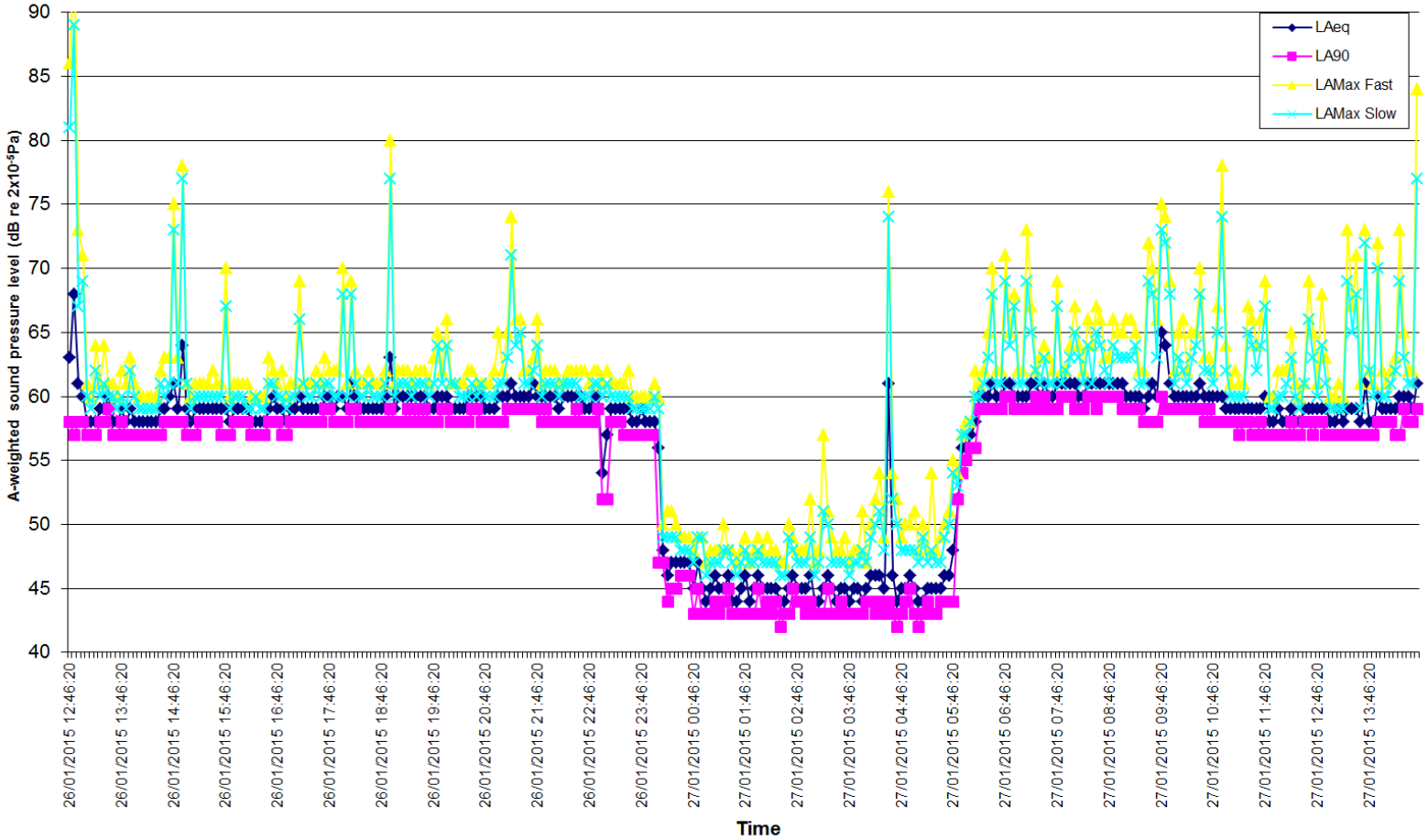
Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations show that with the implementation the noise mitigation measures detailed in section 5 of this report the design criteria will be met.

Appendix A: Site Plan



Approximate measurement position (Latitude & Longitude) 51°31'4.03"N, 0° 6'55.57"W.

Appendix B: Measurement Data



Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11207
- Svantek pre-amplifier SV12L S/N: 13260 with GRAS microphone capsule 40AE S/N: 75182

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10893 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix C: Plant Data

Plant noise data used in the preceding assessment follow.

Table 9: Manufacturer's plant sound power data, dB re 10^{-12} W

Plant	Octave Band Centre Frequency (Hz)								L_{WA}
	63	125	250	500	1k	2k	4k	8k	
YSH120	80	80	78	78	74	68	62	55	79
DKH200	87	87	85	85	81	75	69	62	86

* The sound power spectrum for this unit has been estimated based upon the manufacturer's single figure broadband value.

Appendix D: Calculations

Ref.	plant	Dimensions		Ref.dist.	Sound Level (Lp/Lw)									Lw	Reciever Distance (m)	dB(A)	Lp	No. off	dB	Angular Directionality	63	125	250	500	1k	2k	4k	8k	Reflections	dB
		D1 (m)	D2 (m)		63	125	250	500	1k	2k	4k	8k	dB(A)	dB(A)																
1	DKH200	2.20	1.70		87	87	85	85	81	75	69	62	86	86	9.0	-27	59	2	3	None	0	0	0	0	0	0	0	0	1	3
2	YSH120	2.25	1.19		80	80	78	78	74	68	62	55	79	79	9.0	-27	52	1	0	None	0	0	0	0	0	0	0	0	1	3

Ref.	plant	Receiver Lp								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	DKH200	65	65	63	63	59	53	47	40	64
2	YSH120	55	55	53	53	49	43	37	30	54
Total		66	66	64	64	60	54	48	41	65

Barrier Path Difference Loss:														
Source height	Receiver height	Barrier height	Source to barrier distance	Barrier to receiver distance	Calculated path difference	63	125	250	500	1000	2000	4000	8000	
1.7	4.2	2.4	1.0	8.0	0.08	-6	-6	-7	-9	-11	-13	-16	-19	
1.2	4.2	2.4	1.0	8.0	0.28	-7	-9	-11	-13	-16	-18	-21	-24	

Criteria										
NR	63	125	250	500	1k	2k	4k	8k	dB(A)	
31	60	49	41	35	31	28	26	24	40	

Barrier SRI																
						63	125	250	500	1k	2k	4k	8k	Rw		
					Manual	15	22	26	34	39	47	49	48	37		
					Manual	15	22	26	34	39	47	49	48	37		

Ref.	Plant	Excess								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	DKH200	5	16	23	28	28	25	22	16	24
2	YSH120	-5	6	13	18	18	15	12	6	14
Total		6	17	23	29	29	26	22	17	25

Barrier Deration									
					DKH200	0	0	0	0	0	0	0	0
					YSH120	1	0	0	0	0	0	0	0

Ref.	Plant	Mitigated Receiver Lp								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	DKH200	60	59	56	55	48	40	31	21	55
2	YSH120	49	47	43	41	34	25	16	6	41
Total		60	59	56	55	49	40	31	22	55

Net barrier loss									
					DKH200	-6	-6	-7	-9	-11	-13	-16	-19
					YSH120	-6	-9	-11	-13	-16	-18	-21	-24

	63	125	250	500	1k	2k	4k	8k	dB(A)
Criteria	60	49	41	35	31	28	26	24	40
Excess	0	10	15	20	18	12	6	-2	15

Appendix E: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting
Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).
Airborne Noise
Noise transmitted through air.
Ambient Noise
The total noise level including all 'normally experienced' noise sources.
dB or Decibel
Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB

$D_{nTw}+C_{tr}$	
The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.	
D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.

C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The ‘A’ weighted noise level exceeded for 90% of the time period T, described or measured. The ‘90’ can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The ‘A’ weighted ‘equivalent’ noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The ‘A’ weighted maximum measured noise level. Can be measured with a ‘slow’ (1 sec) or ‘fast’ (0.125 sec) time weighting.

L_{Amin}

The ‘A’ weighted minimum measured noise level.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.