Acoustic Consultancy Report

03336/3/1/1

External Plant Assessment

Report Prepared For

Gsm Ltd
Iceland Oxford
22 January 2021

Report Author

[redacted]

Robert Martin 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

Contents

i) Executive Summary

New mechanical plant is to be installed at the Iceland Food store development at Unit 1, Oxford Shopping Park, Oxford.

LCP has been commissioned by Iceland Foods to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The representative background sound level was 43 dB $L_{A90,\ 15\ mins}$.

The recommended residential design criterion is as follows:

33 dB $L_{Aeq,\ T}$ at the nearest residential on Sandy Lane, approximately 205m away.

The design will achieve the recommended rating level, the report concludes that:

The calculations show an indication of low impact against BS4142:2014 criteria.

The calculated levels are acceptable according to BS8233 and WHO Guidelines for Community Noise.

ii) Document History

Issue	Date	Issue Details	Issued By
1	22nd January 2021	Initial Issue	RM

1 Introduction

New mechanical plant is to be installed at the Iceland Food store development at Unit 1, Oxford Shopping Park, Oxford.

LCP has been commissioned by Iceland Foods to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The guidance in this report is on the basis that the mechanical plant will be consistently operating over a 24 hour period.

2 Site Description

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

3 Local Noise Climate

The predominant local noise sources were vehicular noise form A4142 and existing mechanical plant noise from neighbouring units.

4 Measurements

The noise monitoring took place from the 21/01/2021 to the 22/01/2021. The measurement period was considered sufficient to establish the representative background sound levels corresponding to the operational period of the plant.

The weather conditions monitored during the survey are shown in the following table.

Table 1: Weather Conditions at Measurement Location

Weather	Value
Average Wind Speed	1m/s
Wind Direction	SW
Cloud Cover	0%
Max. Temperature	2°C
Min. Temperature	1°C
Precipitation	None

5 Results

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

Table 2: Representative background sound levels, dB re $2x10^{-5}$ Pa

Measurement Position	$L_{A90,\ 15\ mins}$ Night*
MP1	43

* Day and Night periods are defined in BS4142:2014 as between 07:00 and 23:00, and 23:00 and 07:00 respectively.

6 Evaluation of Design Criteria

6.1 BS4142:2014

BS4142:2014 states that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

Table 3: BS4142 assessment based upon rating level

Difference between background noise and rating levels	Assessment
+ 10 dB	Indication of a significant adverse impact
+ 5 dB	Indication of an adverse impact
0 dB	Indication of low impact

Certain acoustic features can increase the significance of impact. The specific sound level should be corrected if a tone, impulse or other acoustic feature is expected to be present.

Table 4: Corrections for acoustic features, subjective method

Acoustic Feature	Correction, dB		
	Just Perceptible	Clearly Perceptible	Highly Perceptible
Tonality	2	4	6
Impulsivity	3	6	9
Other Characteristics	3		
Intermittency	3		

Typically the acoustic feature correction would not be expected to exceed 10dB.

Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty.

6.2 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*."

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

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

Table 5: 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

6.4 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 6: 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'.

6.5 Recommended Rating Level

The recommended residential design rating level, inclusive of any corrections for acoustic features should therefore be:

Residential Design Rating Level
Representative $L_{A90,\ 15\ mins}$ - 10 dB

On the basis of the above the recommended rating level is shown in the following table.

Table 7: Design rating levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level $L_{A,T}$
Nearest residential on Sandy Lane	205	33

7 Review of Plant Installation

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. Plant noise levels and fan attenuators used in this assessment are contained within Appendix C. Calculations are shown within Appendix D.

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

Receiver Premises	Approx. Distance (m)	Design Level $L_{Aeq,\ 8\ hr}$*	Predicted Level $L_{Aeq,\ 8\ hr}$
Nearest residential on Sandy Lane	205	33	33

* For the purposes of this assessment, the design period is from 23:00 to 07:00

8 Conclusion

An environmental noise survey has been undertaken in order to establish the existing background sound levels local to the site generally in accordance with the method contained within BS4142: 2014.

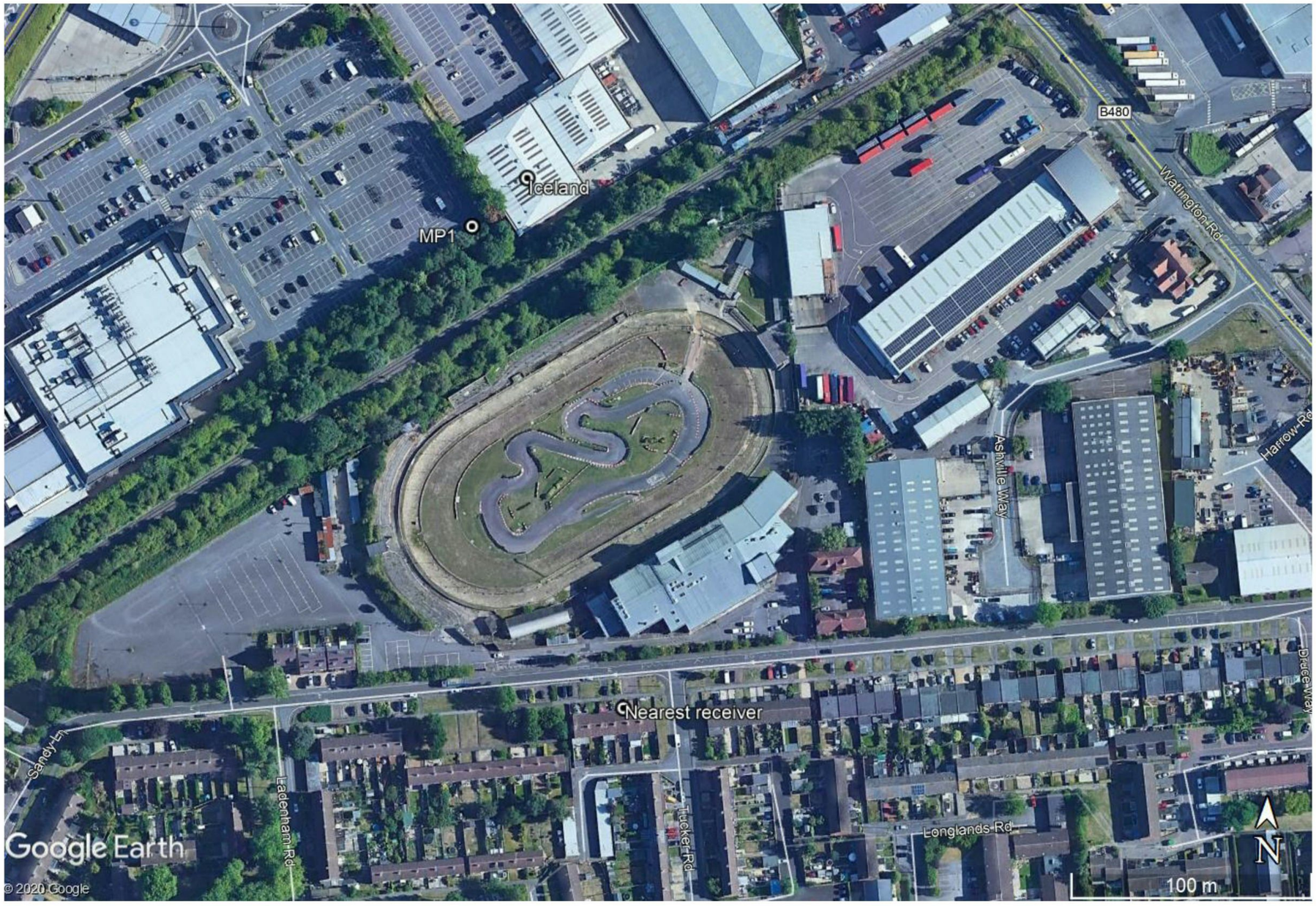
Calculations have been carried out to determine the noise levels at the nearest receiver premises.

The calculations meet the recommended rating level and show an indication of low impact against BS4142:2014 criteria.

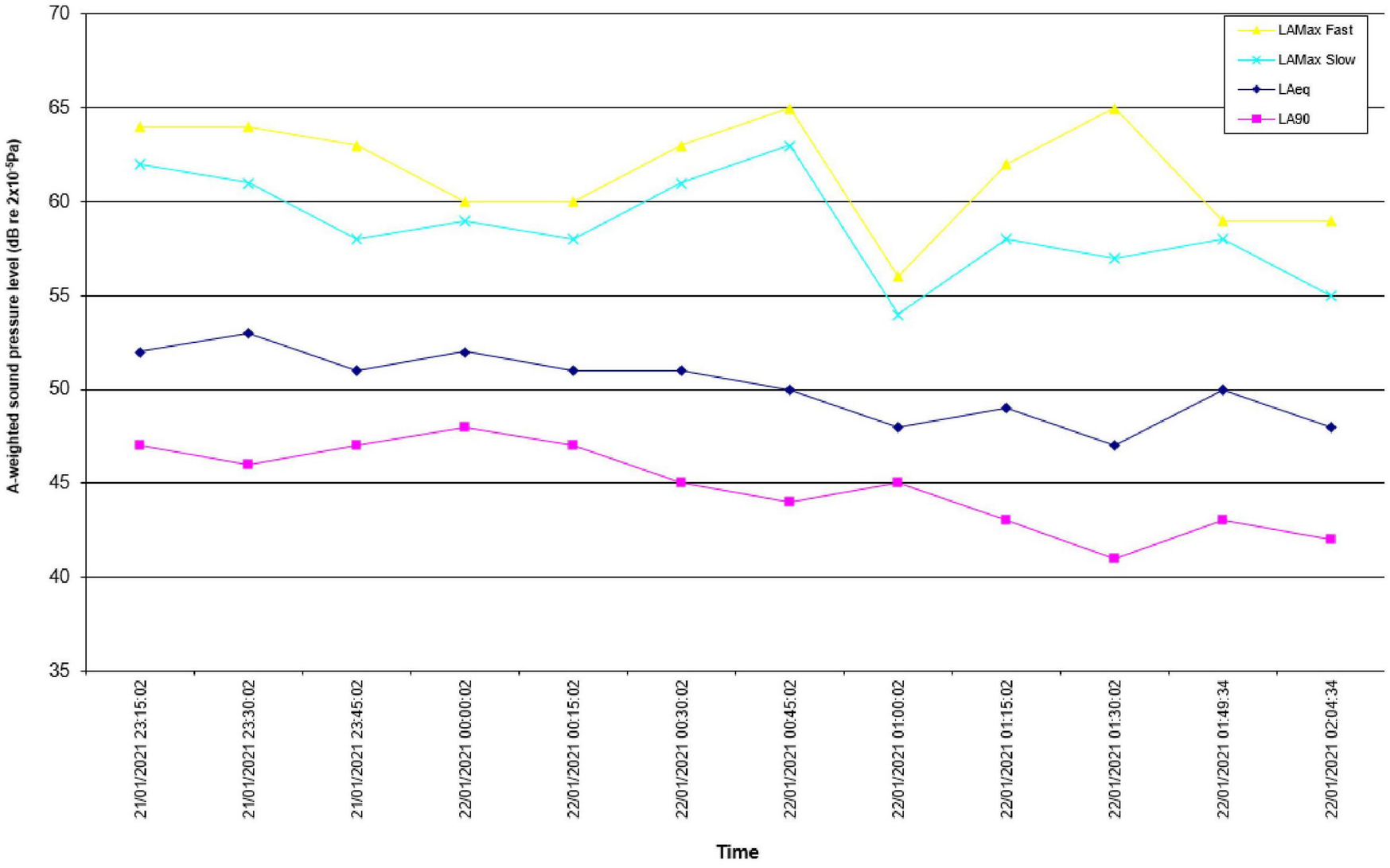
The calculated levels are acceptable according to BS8233 and WHO Guidelines for Community Noise.

It is therefore recommended that planning permission in respect of the plant installation shall be given.

Appendix A: Site Plan



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 979 Sound Level Meter S/N: 27152
- Svantek pre-amplifier SV12L S/N: 25151 with GRAS microphone capsule 40AE S/N: 158102

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 114.0 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: Manufacturers Plant Sound Data, dB

Plant	Data Type	Octave Band Centre Frequency (Hz)								L_A
		63	125	250	500	1k	2k	4k	8k	
KDS111	Lp at 10m	42	41	42	37	32	27	22	22	39
RF-SJ102L2H-63	Lp at 10m	34	35	36	36	33	29	24	24	38
MSA132	Lp at 1m	26	36	33	37	24	18	10	3	35
PUHY-P450YNW-A	Lp at 1m	75	64	67	65	60	55	50	45	66
PUZ-ZRP140YKA3	Lp at 1m	62	55	52	50	47	42	38	30	52
MUZ-AP35VG-E2	Lp at 1m	49	50	51	47	44	42	36	32	50
SDX4	Fan Lw	74	77	72	72	69	66	62	57	74

Appendix D: Calculations

Ref.	plant	Ref.dist.	Sound Level (Lp/Lw) 63	125	250	500	1k	2k	4k	8k	dB(A)	Lw dB(A)	Reciever Distance (m)	dB(A)	Lp	No. off	dB	Angular Directionality	63	125	250	500	1k	2k	4k	8k	Reflections	dB	Façade correction	dB	Additional Attenuation 63	125	250	500	1k	2k	4k	8k
1	KDS111	10.00	42	41	42	37	32	27	22	22	39	67	205.0	-54	13	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
2	RF-SJ102L2H-63	10.00	34	35	36	36	33	29	24	24	38	66	205.0	-54	12	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
3	MSA132	1.00	26	36	33	37	24	18	10	3	35	43	205.0	-54	-11	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
4	PUHY-P450YNW-A	1.00	75	64	67	65	60	55	50	45	66	74	205.0	-54	19	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
5	PUZ-ZRP140YKA3	1.00	62	55	52	50	47	42	38	30	52	60	205.0	-54	6	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
6	MUZ-AP35VG-E2	1.00	49	50	51	47	44	42	36	32	50	58	205.0	-54	4	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	3								
7	SDX4		74	77	72	72	69	66	62	57	74	74	205.0	-54	20	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	3	1	2	2	2	3	3	4	7

Ref.	plant	Receiver Lp 63	125	250	500	1k	2k	4k	8k	dB(A)
1	KDS111	24	23	24	19	14	9	4	4	21
2	RF-SJ102L2H-63	16	17	18	18	15	11	6	6	20
3	MSA132	-12	-2	-5	-1	-14	-20	-28	-35	-3
4	PUHY-P450YNW-A	37	26	29	27	22	17	12	7	28
5	PUZ-ZRP140YKA3	21	14	11	9	6	1	-3	-11	11
6	MUZ-AP35VG-E2	8	9	10	6	3	1	-5	-9	9
Total		**40**	**34**	**34**	**33**	**28**	**24**	**19**	**16**	**34**

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
1.0				205.0	-1.00	0	0	0	0	0	0	0	0
1.0				205.0	-1.00	0	0	0	0	0	0	0	0
1.0				205.0	-1.00	0	0	0	0	0	0	0	0
1.0				205.0	-1.00	0	0	0	0	0	0	0	0
1.0				205.0	-1.00	0	0	0	0	0	0	0	0
1.0				205.0	-1.00	0	0	0	0	0	0	0	0

Criteria NR	63	125	250	500	1k	2k	4k	8k	dB(A)
23	54	42	33	27	23	20	17	16	33

Barrier SRI	63	125	250	500	1k	2k	4k	8k	Rw
Manual									0
Unknown	100	100	100	100	100	100	100	100	101

Ref.	Plant	Excess 63	125	250	500	1k	2k	4k	8k	dB(A)
1	KDS111	-29	-19	-9	-8	-9	-11	-13	-11	-12
2	RF-SJ102L2H-63	-37	-25	-15	-9	-8	-9	-11	-9	-13
3	MSA132	-65	-44	-38	-28	-37	-40	-45	-50	-36
4	PUHY-P450YNW-A	-17	-16	-5	0	-1	-3	-6	-8	-5
5	PUZ-ZRP140YKA3	-32	-28	-22	-18	-17	-19	-20	-26	-22
6	MUZ-AP35VG-E2	-45	-33	-23	-21	-20	-19	-22	-24	-24
7	SDX4	-28	-14	-10	-4	-3	-3	-4	-7	-7
Total		-13	-8	1	5	5	4	2	0	1

Barrier Deration								
KDS111	0	0	0	0	0	0	0	0
RF-SJ102L2H-63	0	0	0	0	0	0	0	0
MSA132	0	0	0	0	0	0	0	0
PUHY-P450YNW-A	0	0	0	0	0	0	0	0
PUZ-ZRP140YKA3	0	0	0	0	0	0	0	0
MUZ-AP35VG-E2	0	0	0	0	0	0	0	0
SDX4	0	0	0	0	0	0	0	0

Ref.	Plant	Mitigated Receiver Lp 63	125	250	500	1k	2k	4k	8k	dB(A)
1	KDS111	24	23	24	19	14	9	4	4	21
2	RF-SJ102L2H-63	16	17	18	18	15	11	6	6	20
3	MSA132	-12	-2	-5	-1	-14	-20	-28	-35	-3
4	PUHY-P450YNW-A	37	26	29	27	22	17	12	7	28
5	PUZ-ZRP140YKA3	21	14	11	9	6	1	-3	-11	11
6	MUZ-AP35VG-E2	8	9	10	6	3	1	-5	-9	9
7	SDX4	24	26	21	21	17	14	9	1	23
Total		**40**	**34**	**34**	**32**	**27**	**23**	**18**	**14**	**33**

Net barrier loss								
KDS111	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
RF-SJ102L2H-63	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
MSA132	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PUHY-P450YNW-A	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PUZ-ZRP140YKA3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
MUZ-AP35VG-E2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
SDX4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix E: Glossary

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

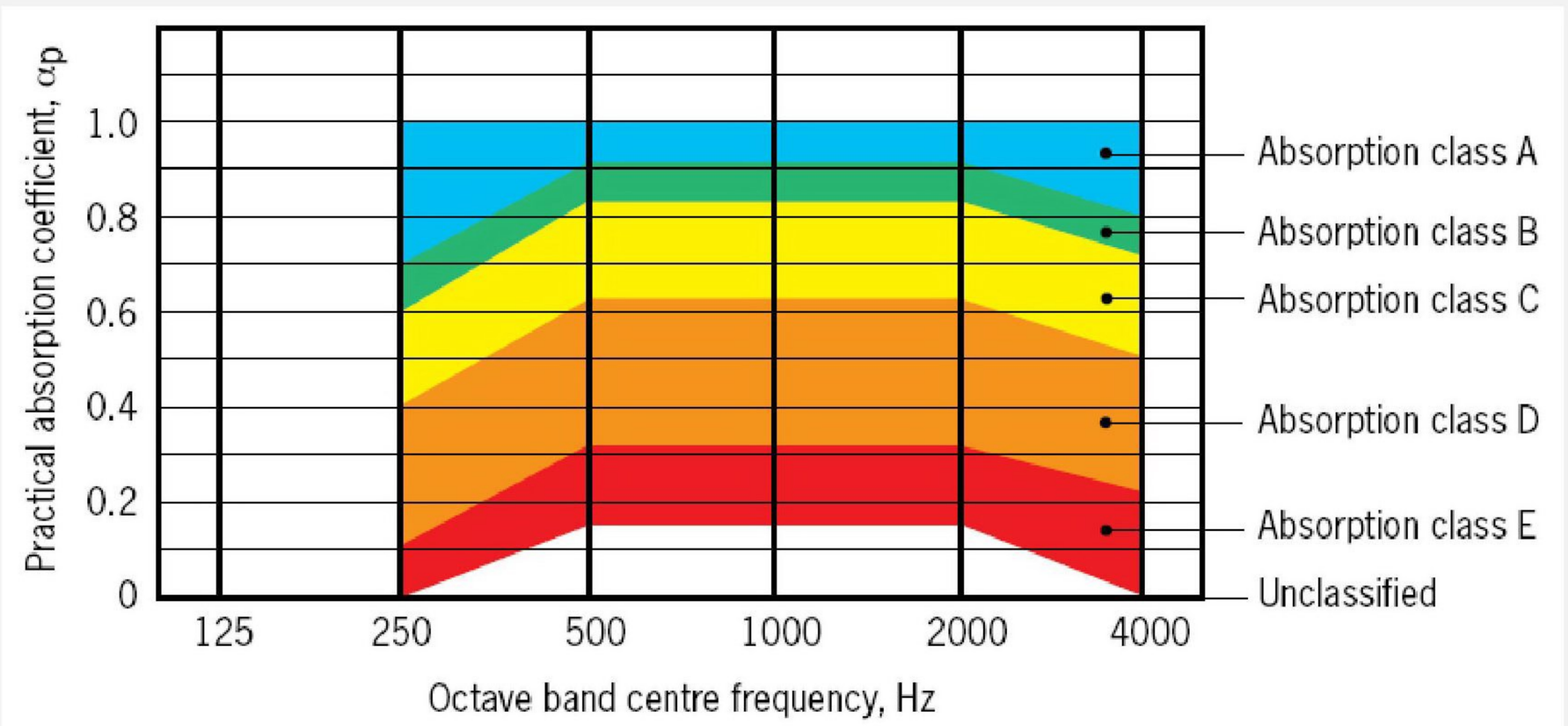
‘A’ Weighting

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).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class ‘A’ absorber would be very acoustically absorptive, a Class ‘E’ absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall ‘practical’ coefficient.

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.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw}.

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.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

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 sound 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.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

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.