

POP CITY, BARBIROLI SQUARE

Discharge of Condition 6-Acoustic Testing



Document History

Rev	Date	Comment	Author	Checked
P01	30 March 2021	Draft for comment	CT	GH

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1. INTRODUCTION

MZA Acoustics has been appointed by Savills on behalf of AEW to undertake an assessment of noise impact of a proposed development upon nearby noise sensitive receptors. The assessment is in place to discharge a planning condition relating to noise emissions from the Site, with the impacts measured at nearby noise sensitive premises.

This report is a follow on from previous MZA Acoustics report titled "Pop City, Barbirolli Square – Discharge of Condition 6" and issued in March 2020. In the previous report noise mitigation measures were proposed to satisfy the pre-construction requirements of the Local Authority in relation to noise conditions. This report demonstrates the post completion testing undertaken at the premises required to fully discharge the condition. The post completion testing was undertaken on 24th March 2021.

This report occasionally employs technical terminology. In order to assist the reader, a glossary of terms is presented in Appendix A.

2. SITE DESCRIPTION

The site is located in Manchester city centre at 100 Barbirolli Square, M2 3AB. The development Site is an existing basement level unit that sits below Barbirolli Square, which faces onto The Bridgewater Hall. The Site is bound by the upper floors of the 100 Barbirolli Square office building to the east, Chepstow House residential properties to the south, The Bridgewater Hall to the west and Handlesbanken Manchester HQ to the north.

The nearest residential property is Chepstow House which is located approximately 20m to the south of the Site. Figure 1 presents the site in the context of its surroundings. The site itself has been highlighted in the figure.



Figure 1- Site location in the context of the area. Nearest residential receptor also shown.

The sound climate at the Site is generally dominated by water noise from the Bridgewater Hall Basin which sits immediately in front of the Site. A water feature is located within the basin which runs throughout the daytime and night-time. Further to this water feature, noise road traffic and tram traffic noise also feature.

2.1 Development Proposals

The development proposals involve the refurbishment of the space into a commercial unit. The unit is understood to be predominantly a kitchen and dining space with occasional use as a function hall. The front elevation which faces onto the Bridgewater Basin will be remodelled to allow access for patrons to the waterfront which will feature an outdoor seating area. The exact nature of the remodelling of the façade will depend predominantly upon the sound insulation requirements, as will be discussed throughout this report.

A drawing of the development is shown below in Figure 2.

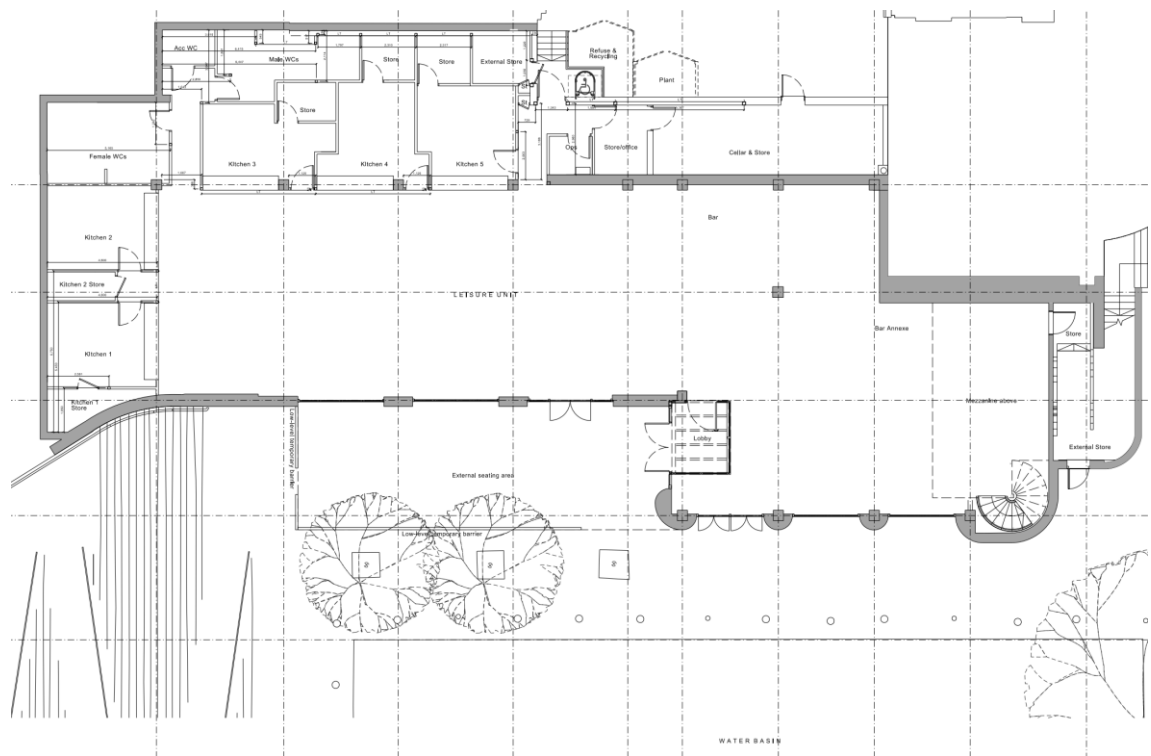


Figure 2- Drawing of development site.

3. GUIDANCE AND CRITERIA

3.1 BS 7445-2:1991 'Description and Measurement of Environmental Noise'

BS 7445-2:1991 'Description and Measurement of Environmental Noise - Part 2: Guide to the acquisition of data pertinent to land use' defines parameters, procedures and instrumentation required for noise measurement and analysis. Accordingly, together with associated guidance within the documents below, this Standard has been used to ensure the survey and data are fit for purpose.

3.2 Manchester City Council Planning Condition

A decision notice has been granted for the development (decision notice 125539/FO/2019), based on a number of planning conditions. One of these (Condition 6) relates to noise emissions from site. Note that the condition has a design element, which is addressed in this report, and an element to be addressed upon completion of the scheme. The condition is as follows:

"6) The premises shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as local planning authority. The scheme shall be implemented in full before the use commences or as otherwise agreed in writing by the City Council as local planning authority.

Where entertainment noise is proposed the LAeq (entertainment noise) shall be controlled to 10dB below the LA90 (without entertainment noise) in each octave band at the facade of the nearest noise sensitive location, and internal noise levels at structurally adjoined residential properties in the 63Hz and 125Hz octave frequency bands shall be controlled so as not to exceed (in habitable rooms) 47dB and 41dB, respectively.

Before the Class A3 use hereby approved commences, the premises shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as Local Planning Authority.

The scheme proposed shall normally include measures such as acoustic lobbies at access and egress points of the premises, acoustic treatment of the building structure, sound limiters linked to sound amplification equipment and specified maximum internal noise levels. Any scheme approved in discharge of this condition shall be implemented in full before the use commences or as otherwise agreed in writing by the City Council as Local Planning Authority.

Upon completion of the development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

Reason - To safeguard the amenities of the occupiers of the building and occupiers of nearby properties."

It should be noted that there are no structurally adjoining residential properties and as such the requirement for the 63HZ and 125Hz octave frequency bands to be controlled to be below 47dB and 41dB, respectively is not applicable here.

4. NOISE MEASUREMENTS

4.1 Environmental Sound Survey

The following section provides a recap of the environmental noise survey previously undertaken by MZA Acoustics. The measurements from this survey were used to inform the background noise levels for the assessment in this report.

Baseline environmental sound monitoring was undertaken at the site on Wednesday Monday 9th to Tuesday 10th July 2018 in order to quantify the existing prevailing background sound levels close to the existing noise sensitive receptors to the proposed development site. The survey commenced at approximately 14:00 hours on the 9th July and concluded at approximately 12:30 on the 10th July. The survey was undertaken initially for the use in the assessment associated with the office phase of the 100 Barbirolli Square development. The noise survey was undertaken by Graham Hornby of MZA Acoustics (Director).

This survey consisted of two unattended measurement locations during critical daytime and night time periods. A description of the measurement locations is detailed below, with the locations highlighted on the plan in Figure 3.

Four long-term fixed and short-term attended noise measurement positions were used during the survey, however, only two are considered relevant to this assessment and as such are the only two that have been included in this report.

- LT1 – Long Term (24-hour measurement) on the 4th Floor balcony on the Cheptsow Street elevation. The noise climate at this location was dominated by road traffic noise.
- LT2 – Long Term (24-hour measurement) on the 6th Floor balcony overlooking Cheptsow House and the canal. The noise climate at this location was dominated by road traffic noise.

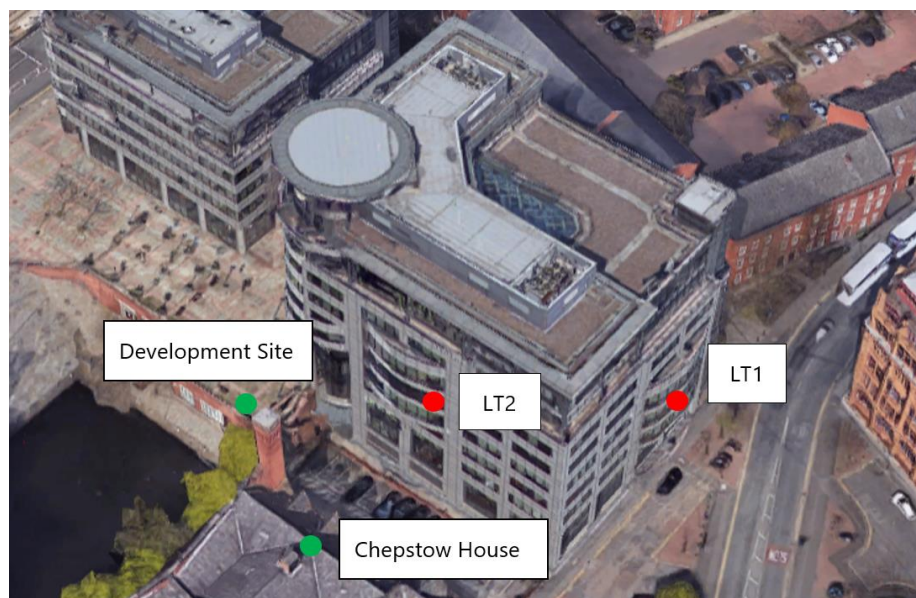


Figure 3- Noise measurement locations and source/receiver locations (courtesy of Google-Maps).

Table 1 presents the results of the noise survey across the four measurement locations.

Measurement Position	Location	Measurement Period	Measured Daytime Noise Levels		Measured Night Time Noise Levels	
			dB L _{Aeq,T}	dB L _{A90,T}	dB L _{Aeq,T}	dB L _{A90,T}
LT1	Balcony overlooking Chepstow Street	14:00 09/07/18 – 12:30 10/07/18	62	55	57	49
LT2	Balcony overlooking Chepstow House	14:30 09/07/18 – 12:00 10/07/18	60	58	51	43

Table 1- Previous MZA survey measurement summary.

LT2 is considered to be representative of the properties most exposed to noise emissions from the development and as such will be used as the basis of the assessment.

4.2 Noise Breakout testing methodology

The post completion testing was undertaken by MZA Acoustics on 26th March 2021 to determine the level of sound break-out from the building.

In order to undertake the testing two speakers were linked and located within the proposed development. A pink noise source was used to create an internal reverberant noise level of sufficient magnitude so as to be clearly measured outside, above the prevailing background noise. As such an internal reverberant sound pressure level of approximately 100 dB(A) was produced. As noted on Figure 4 two source positions were used. Receiver measurements 1, 2, 3 & 4 correspond to source position 1 and receiver measurements 5,6 &7 correspond to source position 2.

Measurements of the noise break-out levels were undertaken immediately outside of the development, directly adjacent to each section of glazing. These measurements were used to determine the level difference (D) in each octave band across different points of the façade.

The internal reverberant sound level was measured using a spatial average method in the positions located immediately on the inside of the doors relative to the outdoor positions. Two 30 second internal measurements were taken at the labelled source positions. External measurements were made at 1m from the external façade at the positions identified in the figures below. Two 30 second measurements were taken at each external position using the moving microphone spatial average method.

Background sound levels were measured at the same positions as the external measurements in the absence of any internal noise source. The sound climate at the Site is generally dominated by water noise from the Bridgewater Hall Basin which sits immediately in front of the Site. a water feature is located within the basin which was operational throughout the survey and is assumed to operate 24-hours a day.

4.3 Equipment

Table 3 details the equipment used during the survey. The sound level meters were field-calibrated before and after measurements using the acoustic calibrator shown. No significant drift in calibration level was recorded (<0.1 dB). The calibrator and sound level meters have been calibrated by a UKAS accredited calibration laboratory within the past year and in the past two years respectively.

Equipment Description	Manufacturer and Type No.	Serial No.	Calibration Expiration Date	Calibration Certificate No.
Sound Level Meter	NTi Audio XL2-TA	A2A-14034-E0	20/10/22	UK-20-075
Pre-amplifier	NTi Audio MA220	9379		
Microphone	NTi Audio MC230A	A19094		
Calibrator	Cirrus CR:515	93522	26/10/21	148196
Broadband Noise Generator	NTI Minirator	G2P-RADNQ-G0	N/A	N/A
Loudspeaker	ART 310-A	RFCZ01844	N/A	N/A
Loudspeaker	ART 310-A	RCCA00066	N/A	N/A

Table 2- Equipment.

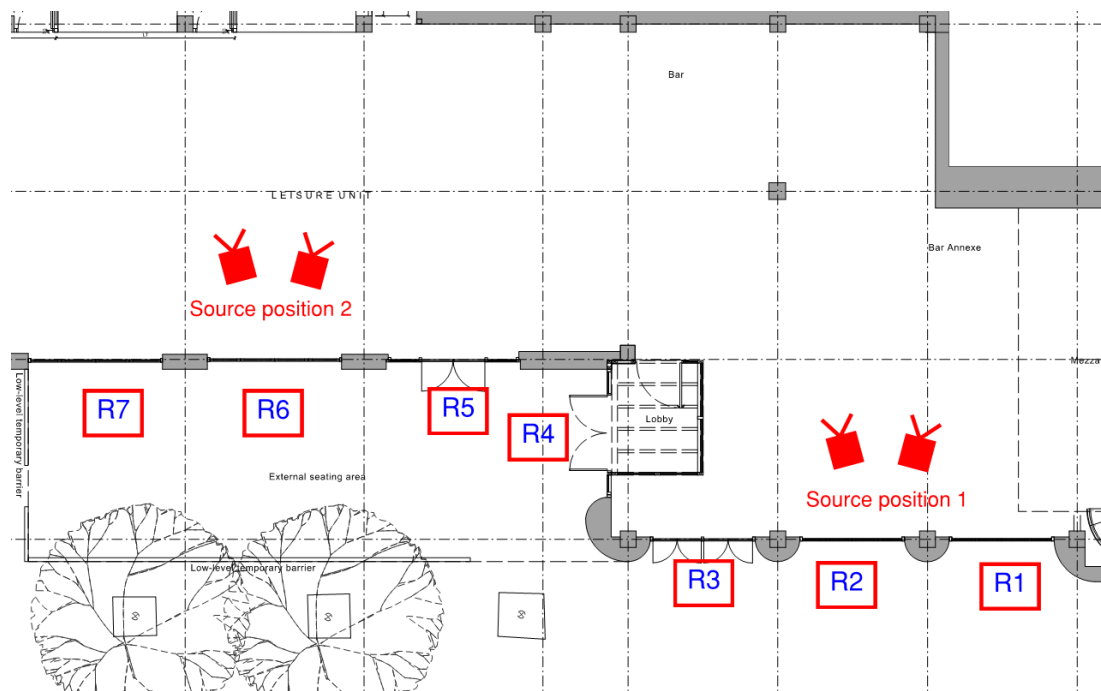


Figure 4- Noise breakout measurement positions

4.4 Results

The results of the noise survey are provided in Tables 3 to 9 below. The level difference was corrected to the background sound level in accordance with ISO 140-4:1998.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	98	106	105	102	100	95	91	88
External	75	79	73	65	63	61	57	51
Background	72	58	54	52	55	58	56	51
Corrected Difference (D)	24	27	31	36	37	35	36	38

Table 3- Receiver position 1.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	98	106	105	102	100	95	91	88
External	73	81	72	64	60	59	56	50
Background	67	59	53	52	54	58	56	50
Corrected Difference (D)	26	26	32	38	41	37	37	39

Table 4- Receiver position 2.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	98	106	105	102	100	95	91	88
External	72	79	73	64	66	60	57	51
Background	68	58	53	51	54	58	56	50
Corrected Difference (D)	27	27	32	38	34	36	36	38

Table 5- Receiver position 3.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	98	106	105	102	100	95	91	88
External	71	80	74	64	60	56	53	47
Background	59	62	51	47	48	52	50	43
Corrected Difference (D)	27	26	31	38	40	39	40	42

Table 6- Receiver position 4.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	96	106	103	99	96	91	89	85
External	72	82	76	63	60	57	55	50
Background	62	55	52	50	53	54	52	46
Corrected Difference (D)	24	24	27	36	36	35	35	36

Table 7- Receiver position 5.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	96	106	103	99	96	91	89	85
External	74	84	76	64	60	58	55	52
Background	57	51	51	49	52	54	52	46
Corrected Difference (D)	22	22	26	34	37	35	35	35

Table 8- Receiver position 6.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Internal	96	106	103	99	96	91	89	85
External	73	84	74	63	59	57	55	50
Background	61	52	53	51	54	54	51	45
Corrected Difference (D)	23	21	28	36	38	36	35	37

Table 9- Receiver position 7.

5. ASESMENT

5.1 Acoustic Design Criteria

Based on the requirements outlined in condition 6 of the planning consent the following criteria are to be applied to the scheme:

1. Entertainment noise (dB L_{Aeq}) shall be controlled to 10 dB below the background noise level (dB L_{A90}) in each octave band at the façade of the nearest noise sensitive location (Chepstow House)
2. Internal noise levels at structurally adjoined residential properties shall be controlled so as not to exceed 47dB in the 63 Hz octave band, and 41dB in the 63Hz and 125Hz octave frequency band, when measured in habitable rooms

As there are no structurally adjoining residential properties criterion 2 above can be dismissed with no need for assessment.

Based on criteria 1 above, Table 10 and Table 11 presents the acoustic design criteria applicable at the façade of the receptor (Chepstow House) and at the façade of the development. Note that Table 10 presents daytime levels (07:00 to 23:00) and Table 11 presents night-time levels (23:00 to 07:00).

The façade element with the lowest background corrected level difference for all octave bands except 125Hz was the one at receiver position 6. These are the sound reduction values used for the assessment to reflect worst case conditions. The value at 125Hz is taken from measurement position 7.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Background noise level at receptor	62	63	56	54	55	49	41	33
Criterion at receptor (background - 10 dB)	52	53	46	44	45	39	31	23
Criterion at 1m from façade of development (20m from receptor)	65	66	59	57	58	52	44	36
Sound insulation level of façade	22	21	26	34	37	35	35	35
Internal Noise limit	87	87	85	91	95	87	79	71

Table 10- Daytime Noise Criteria and internal limit 07:00-23:00.

Description	Measured octave band level, dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Background noise level at receptor	47	50	42	39	40	34	26	17
Criterion at receptor (background - 10 dB)	37	40	32	29	30	24	16	7
Criterion at 1m from façade of development (20m from receptor)	50	53	45	42	43	37	29	20
Sound insulation level of façade	22	21	26	34	37	35	35	35
Internal Noise limit	77	74	71	76	80	72	64	55

Table 11- Night-time noise criteria and internal limit 23:00-0700.

5.2 **Outdoor Noise**

If patrons can gain access to the outdoor area then there is the potential for noise from their activity to disturb residents at nearby properties, particularly at night.

The noise levels presented in Table 10 and Table 11 are the maximum noise levels permitted outdoors during the daytime and the night time. If there is to be outdoor activity then these levels cannot be exceeded.

If there is to be significant activity in this area during the night time (i.e. smoking area during a live music event) then mitigation measures will likely be required. This could be controlled via management of the use of the space, limiting the number of people who can use it at any one time, or by including an acoustically screened area. However, it should be noted that activity in this area will likely need to be limited at night time in order to protect the nearby residents at Chepstow House from noise disturbance.

6. **MITIGATION**

6.1 **Noise Limiter**

It is understood that the development is primarily to be used as a bar and restaurant space. The internal noise limits set are consistent with this type of use. However, past the hours of 2300 and it is recommended that any amplified music is reduced to comply with the internal levels presented in Table 11.

If the development is to be used as a venue for live music it is recommended that a noise limiter is to be installed and connected to the loudspeaker system. During the daytime it is recommended that the noise limiter be set to the octave band levels presented in Tables 10 and past the hours of 23:00 during the night-time set to the levels presented in Table 11. An active limiter is recommended in order to constantly regulate noise levels, as opposed to immediately turning the speaker system off when it reaches the limit threshold.

It is recommended that the noise limiter should be positioned at high level, suspended centrally within the development to capture the reverberant noise level. Locations in close proximity to a loudspeaker, or where the limiter can be touched by patrons, should be avoided.

We recommend the limiter is set with MZA Acoustics in attendance, with an invite sent to the MCC Environmental Health Officer / Licensing Officer.

6.2 **High Level Louvres**

During measurements on site it was noticed that the high level louvres above the glazed sections of the façade were not completely sealed off. This was only the case at the sections of glazing opposite measurements R5, R6 & R7 as shown on Figure 4.

This led to a sound reduction of approximately 5dB lower across the octave bands when in comparison to measurement positions R1-R4. It is expected that the indoor limit would increase by 5dB across the octave bands should the louvres be sealed fully.

7. CONCLUSIONS

MZA Acoustics has been appointed by Savills on behalf of AEW to undertake an assessment of noise impact of a proposed development upon noise sensitive nearby receptors. The assessment is in place to discharge a planning condition relating to noise emissions from the Site, with the impacts measured at nearby noise sensitive premises.

An environmental noise survey has been undertaken to determine prevailing background sound levels in the surrounding area which have been used as the basis of the assessment. Furthermore, a study of the prevailing sound insulation performance of the façade has been undertaken.

The development proposals involve the refurbishment of the space into a commercial unit. The unit is understood to be predominantly a kitchen and dining space with occasional use as a function hall.

Based on the results of the noise surveys external noise criteria have been applied at the façade of the nearest residential receptor (Chepstow House) and immediately outside of the façade of the development. These criteria have been based upon the requirements outlined in Manchester City Council decision notice 125539/FO/2019, Condition 6.

Internal noise limits for the daytime and night-time periods have been provided. Furthermore, advice has been offered with regards to noise limiters on PA systems and with regards to noise control at access points to outdoor areas.

Subject to the above it is considered that the venue can operate as planned whilst satisfying the requirements of condition 6 of the planning decision.

Appendices

Appendix A – Glossary of Acoustic Terminology

Acoustics is the branch of physics concerned with the properties of sound, including ultrasound, infrasound and vibration. A scientist or engineer who works in the field of acoustics is an acoustician or acoustic engineer.

Sound can be measured by a sound level meter or other measuring system. Noise is related to a human response, and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive. Care has been taken in this document to use the most relevant of these terms (whereby 'sound' is used predominantly); however, in most reference documents, and, indeed, generally, 'sound' and 'noise' are used interchangeably. Consequently, just because the term 'noise' is used doesn't necessarily mean a negative effect exists or will occur, and the context of the accompanying text should be taken into account.

Human hearing is able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble), and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain).

The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify sound in a manner that approximates the response of the human ear, a weighting mechanism is used, which reduces the importance of lower and higher frequencies in a similar manner to human hearing.

The weighting mechanism that best corresponds to the response of the human ear (though not necessarily perfectly) is the 'A'-weighting scale. This is widely used for environmental sound measurement, and the levels are denoted as dBA, dB(A) or LAeq, LA90 etc. according to the metric being measured or determined (see the Definitions over leaf).

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB is generally regarded as the minimum difference needed to perceive a change under normal listening conditions. Where other changes occur (associated with the change in sound level), such as additional vehicle movements on a road, which can be seen, then these may result in changes in sound level being more noticeable than they might otherwise be.

Further to such visual clues, and any other non-acoustical factors that affect people's response (such as personal characteristics, and social, residential or environmental factors), the subjective response to a sound is dependent not only upon the sound pressure level and component frequencies, but also its intermittency. Consequently, various metrics have been developed to try and correlate people's attitudes to different sounds with the sound level and its fluctuations. The metrics used in this document, as per the relevant guidance, are defined overleaf.

Airborne Sound	Sound that reaches the point of interest by propagation through air.
Ambient Sound:	Sound from all sources at any given time, from both near and far. Usually measured in terms of L_{Aeq} .
A-Weighting	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Background Sound Level	The A-weighted sound pressure level that can be considered the baseline in the absence of any noise from a specific source of sound under assessment. Measured in terms of $L_{A90, T}$.
Calibration	The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short term measurements, and periodically for longer term monitoring.
Class 1	The Class of a sound level meter describes its accuracy as defined by the relevant international standards – Class 1 is more accurate than Class 2. The older standard IEC 60651 referred to the grade as "Type", whereas the new standard IEC 61672 refers to it as the "Class". The most accurate meters used in the field (as opposed to a laboratory) are Class 1. Class 2 meters can be used in some instances; however MZA Acoustics use Class 1 (or Type 1) meters by default, as required by BS 4142:2014, for example.
Decibel	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds (s_1 and s_2) is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 Pa.
Fast time Weighting (F)	Averaging time used in sound level meters. Defined in BS EN 61672-2:2013 Electroacoustics. Sound level meters. Pattern evaluation tests.
Free-field / Façade	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.
$L_{AF90, T}$	The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the 'background' sound conditions.
L_{AFmax}	The maximum A-weighted sound pressure level during a given time period. L_{max} is sometimes used for the assessment of occasional loud sounds, which may have little effect on the overall L_{eq} noise level, but could still affect the sound environment. Unless described otherwise, it is measured using the fast time-weighting (F).
$L_{eq, T}$	A sound level index called the equivalent continuous sound level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. Where the value is A-weighted, is

	will be presented 'LAeq,T' or 'dBA Leq,T', otherwise it should be an un-weighted (or linear) value.
L _p	See Sound Pressure Level.
Noise	Related to human response to sound. Unwanted sound, or sound that is considered undesirable or disruptive.
Octave Band	Frequency ranges in which the upper limit of each band is twice the lower limit. Octave bands are identified by their geometric mean frequency, or centre frequency.
Sound Absorption Coefficient	A measure of how effective a material is at absorbing sound incident to its surface. The index range is between 0 and 1, where 1 indicates a perfectly absorbent material and 0 indicates a perfectly reflective one.
Sound Power	In a specified frequency band, the rate at which acoustic energy is radiated from a source. In general, the rate of flow of sound energy, whether from a source, through an area, or into an absorber.
Sound Power Level	Of airborne sound, ten times the common logarithm of the ratio of the sound power under consideration of the standard reference power of 1 pW. Expressed in decibels.
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20 Pa (20x10 ⁻⁶ Pascals) on a decibel scale.
Weighted Sound Reduction Index (R _w)	A single-figure quantity which characterises the airborne sound insulating properties of a material or element over a range of frequencies.

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