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Glossary of acoustic terminology

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Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)
APFP Regulation 5(2)(a)

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11.1 Glossary of Acoustic Terminology

Decibel (dB)

11.1.1 The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (Lp) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

dB(A)

11.1.2 The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

11.1.3 In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{pA10}, L_{pA90}, and L_{pAeq} for the 'A' weighted equivalent continuous noise level.

Equivalent continuous sound level

11.1.4 An index for assessment for overall noise exposure is the equivalent continuous sound level, L_{peq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Frequency

11.1.5 Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, e.g. 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or narrow frequency bands.

Maximum noise level

11.1.6 The maximum noise level identified during a measurement period. Experimental data has shown that the human ear does not generally register the full loudness of transient sound events of less than 125ms duration and fast time weighting (F) has an exponential time constant of 125ms which reflects the ear's response. Slow time weighting (S) has an exponential time constant of 1s and is used to allow more accurate estimation of the average sound level on a visual display.

11.1.7 The maximum level measured with fast time weighting is denoted as $L_{pAmax,\,F}$. The maximum level measured with slow time weighting is denoted $L_{pAmax,\,S}$.

Sound pressure level

11.1.8 The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

11.1.9 The sound pressure level (L_p) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10^{-5}Pa (the threshold of hearing).

11.1.10 Thus L_p (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (i.e. 2x10^{-5} Pa).

11.1.11 The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dBLpA and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Free Field:

11.1.12 An external sound field in which no significant sound reflections occur (apart from the ground).

Statistical noise levels

11.1.13 For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{p10}, the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that L_{pAeq} is used in BS 8233 for assessing traffic noise). The L_{90}, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period.

11.1.14 A weighted statistical noise levels are denoted L_{pA10}, dBL_{pA90} etc. The reference time period (T) is normally included, e.g. $dBL_{pA10, 5min}$ or $dBL_{pA90, 8hr}$.

Table 11-1 Typical noise levels

Noise Level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night

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