A10.1 Noise and Vibration Terminology

1 Introduction

1.1.1 This appendix provides definitions of some of the terms used in Part 3 (Environmental Assessment), Chapter 10 (Noise and Vibration) to aid understanding.

1.1.2 The sound wave travelling through the air is a regular disturbance in ambient atmospheric pressure. These pressure fluctuations, when of frequencies within the audible range, are detected by the human ear which passes nerve responses to the brain, producing the sensation of hearing. Noise has been defined in a variety of ways and is very much dependent on factors such as the listener's attitude to the source of the sound and their environment, but is essentially any sound that is unwanted by the recipient.

1.1.3 It is impossible to measure the degree of nuisance caused by noise directly, as this is essentially a subjective response of the listener, but it is possible to measure the 'loudness' of that noise. Loudness is related to both the sound pressure (the magnitude of the maximum excursion of the pressure wave around the ambient atmospheric pressure) and the frequency, both of which can be measured.

1.1.4 The human ear is sensitive to a wide range of sound levels; the sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitude of the numbers involved, a logarithmic scale of decibels (dB) based on a reference level of the lowest audible sound is used.

1.1.5 Also, the response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequency to approximate human response. This is achieved by using filters to vary the contribution of different frequencies to the measured level. The 'A' weighting is the most commonly used and has been shown to correlate closely to the non-linear and subjective response of humans to sound.

2 Glossary of Terms

2.1.1 **Noise** — Unwanted Sound.

2.1.2 **Ambient Noise** — Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

2.1.3 **Background Noise** — Background noise is normally defined as the A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using a fast time weighting, F, and quoted to the nearest whole number.

2.1.4 **Decibel** — The range of audible sound pressures is approximately 2×10^{-5} Pascals (Pa) to 200Pa. Using decibel (dB) notation presents this range in a more manageable form, 0dB to 140dB.

2.1.5 **Sound Pressure Level** — The sound pressure level (L_p or SPL) is the instantaneous acoustic pressure and is measured in dB. Since the ear is sensitive to variations in pressure, rather than source power or intensity the measurement of this parameter gives an indication of the impact on people. The L_p is defined as:

$$L_p = 20 \times \log_{10}\left(\frac{p}{p_0}\right)$$

Where:
p is the root mean square (r.m.s.) pressure of the sound in question (in Pa); and
$\mathbf{p_0}$ is the reference sound pressure level of 2 x10^{-5}Pa

2.1.6 **Sound Power Level**

The sound power level (L_w or SWL) is a measure of the acoustic energy output of a source and is a property of the source itself. The L_w is also measured in dB and is defined by:

$$L_W = 10 \times \log_{10}\left(\frac{W}{W_0}\right)$$

Where:
W is the sound power pressure of the sound in question (in Watts); and
$\mathbf{W_0}$ is the reference sound power level of 10^{-12} Watts

2.1.7 **"A" Weighting**

The human ear does not respond uniformly to different frequencies 'A' weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of risk of damage of hearing due to noise and is usually expressed with a capital A in the unit abbreviation (i.e. $_{LAmax,}$ $L_{Aeq,}$ etc.) or a capital A in brackets after a dB level (i.e. 3dB(A)).

2.1.8 **Frequency**

Frequency is defined as the number of cycles per second and is denoted on Hertz (Hz). For sound this is subjectively perceived as pitch.

2.1.9 **Frequency Spectrum**

Analysis of the relative contributions of different frequencies that make up a noise.

2.1.10 **Free Field**

The term 'free field' is used to define noise levels that have been measured or predicted in the absence of any influence of reflections from nearby surfaces, other than the ground. In practice, a noise level is considered to be free field if it is at a distance greater than 3.5m from any reflecting surfaces, other than the ground.

2.1.11 **Façade Level**

A façade level refers to noise levels an assessment location between 1 and 3.5m from the façade of a building or other reflective structure. The difference between the façade and free field noise level depends on the distance from the reflecting surface, but is generally accepted to e 2.5 dB(A) at a distance of 1m.

2.1.12 $\boldsymbol{L_{Aeq,T}}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level in dB of continuous steady sound within a specified time interval, T, has the same r.m.s. sound pressure as a sound that varies with time.

2.1.13 $\boldsymbol{L_{A10,T}}$

The A-weighted sound pressure level of the residual noise in decibels exceeded for 10 % for a given time interval. This is the noise index defined by the government to describe road traffic noise.

2.1.14	$L_{A90,T}$	The A-weighted sound pressure level of the residual noise in decibels exceeded for 90% of the time. This is the noise index that is used to define the background noise level.
2.1.15	L_{Amax}	The maximum r.m.s. A-weighted sound pressure level occurring within a specified time period.
2.1.16	**Fast Time Weighting**	Fast time weighting indicates sound pressure level measurements undertaken using a 125 millisecond moving average time weighting period (i.e. L_{AFmax}).