Appendix A12.1: Glossary of Acoustical Terminology

1 Introduction

1.1 This appendix provides definitions of some of the terms used in Chapter 12 (Noise and Vibration) to aid understanding of the assessment.

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 dependant 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.

1.3 The human ear is sensitive to a wide range of sound levels; the sound pressure level of the threshold of pain (200 Pascals (Pa)) is over a million times that of the quietest audible sound (2×10^{-5} Pa). In order to reduce the relative magnitude of the numbers involved and present this range of sound pressure levels in a manageable way, a logarithmic scale of decibels (dB) based on a reference level of the lowest audible sound is used, resulting in a range of 0dB to approximately 120dB.

1.4 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.

1.5 Noise is defined as unwanted sound. With noise being assessed as a logarithmic ratio of pressure levels, i.e. decibels, it is sometimes helpful to consider the relationship between the subjective evaluation of noise levels and the actual objective measured levels. The general description in Table 1 may provide some assistance in understanding this relationship.

Table 1: Typical Noise Levels and Subjective Evaluation

A-weighted Noise Level L_A (dB)	Description
120	Threshold of pain
100	Diesel drop hammer at 10 meters (m) distance
95	Pneumatic drill at 7m distance
85	Heavy diesel lorry at 40 kilometres per hour (kph) at 7m distance
85	Jet aircraft take-off 150m distance
70	Passenger car at 60kph at 7m distance
65	Train at 40kph at 25m distance
60	Busy general office
55	Communication starts becoming difficult
40	Quiet library
35	Typical bedroom
20	Leaves rustling lightly
0	Threshold of hearing

2 Glossary of Terms

2.1 **Sound Pressure Level**: The sound pressure level (LP or SPL) is the instantaneous acoustic pressure and is measured in decibels (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 SPL is defined as:

$$SPL = 10\log_{10}(\frac{p^2}{p_{ref}^2}) \text{ or } SPL = 20\log_{10}(\frac{p}{p_{ref}})$$

where:

p is the root mean square (rms) pressure of the sound in question in pascals (Pa)

p_{ref} is the reference sound pressure, defined as the limit of human audibility (2×10^{-5} Pa)

2.2 L_{eq}: The L_{eq} is defined as the equivalent continuous sound level and is the most widely used parameter for assessing environmental noise. Since this descriptor is a type of average level, it must, by definition, have an associated time period over which the measurement is referring to. This is often included in the abbreviation in the form $L_{eq,T}$, where T is the time period (i.e. $L_{Aeq,5min}$). The formula for calculating the L_{eq} is:

$$L_{eq} = 10\log_{10}(\frac{1}{t_2 - t_1}\int_{t_1}^{t_2}\frac{p^2}{p_{ref}^2}.dt)$$

2.3 In practice, since most modern sound level meters are digital and hence take periodic samples of the SPL, the L_{eq} will be the logarithmic average of all the SPL samples taken in the measurement period.

2.4 L_{max}: The L_{max} is defined as the maximum rms level recorded during a measurement period.

2.5 L_n: The L_n is a statistical descriptor and refers to the level that is exceeded for n% of the time during a particular measurement period. Again, the measurement period that the descriptor refers to is often included in the abbreviation in the format $L_{n,T}$. Two of the most commonly used statistical descriptors used for environmental noise assessments are the L_{90} and the L_{10}. These are described in more detail below.

2.6 L_{10}: The L_{10} refers to the level exceeded for 10% of the measurement period and is commonly used in assessing road traffic noise as it has been found to give a good indication of the subjective human response to this type of noise.

2.7 L_{90}: The L_{90} refers to the level exceeded for 90% of the measurement period and is widely considered to represent background noise, or the underlying noise in an area between noisy events (such as cars passing etc.).

2.8 **Free-field**: The term "free-field" refers to noise levels that have been measured or predicted in the absence of any influence of reflections from nearby surfaces. In practice, a measurement is considered to be free-field if it is taken at a distance of over 3.5 m from any acoustically reflective surfaces, except the ground.

2.9 **Peak Particle Velocity**: The peak particle velocity (PPV) is the instantaneous maximum velocity reached by the vibrating element as it oscillates about its rest position and is measured in millimetres per second (mm/s).