NV1 - Definition of Noise and Vibration Terms

Noise

Decibels (dB)

Noise can be defined as unwanted sound. Sound in air can be considered as the propagation of energy through the air in the form of oscillatory changes in pressure. The size of the pressure changes in acoustic waves is quantified on a logarithmic decibel (dB) scale firstly because the range of audible sound pressures is very great, and secondly because the loudness function of the human auditory system is approximately logarithmic.

The dynamic range of the auditory system is generally taken to be 0 dB to 140 dB. Generally, the addition of noise from two sources producing the same sound pressure level, will lead to an increase in sound pressure level of 3 dB. A 3 dB noise change is generally considered to be just noticeable, a 5 dB change is generally considered to be clearly discernible and a 10 dB change is generally accepted as leading to the subjective impression of a doubling or halving of loudness.

A-Weighting

The bandwidth of the frequency response of the ear is usually taken to be from about 18 Hz to 18,000 Hz. The auditory system is not equally sensitive throughout this frequency range. This is taken into account when making acoustic measurements by the use of A-weighting, a filter circuit which has a frequency response similar to the human auditory system. All the measurement results referred to in this report are A-weighted.

Units Used to Describe Time-Varying Noise Sources (L_{Aeq}, L_{A10}, L_{A90} and L_{Amax})

Instantaneous A-weighted sound pressure level is not generally considered as an adequate indicator of subjective response to noise because levels of noise usually vary with time.

For many types of noise the Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$) is used as the basis of determining community response. The $L_{Aeq,T}$ is defined as the A-weighted sound pressure level of the steady sound which contains the same acoustic energy as the noise being assessed over a specific time period, T.

The L_{A10} is the noise level exceeded for 10% of the measurement period. It has been used in the UK for the assessment of road traffic noise.

The L_{A90} is the noise level exceeded for 90% of the measurement period. It is generally used to quantify the background noise level, the underlying level of noise which is present even during the quieter parts of the measurement period.

The L_{Amax} is the maximum value that the A-weighted sound pressure level reaches during a measurement period. $L_{Amax\ F}$, or Fast, is averaged over 0.125 of a second and $L_{Amax\ S}$, or Slow, is averaged over 1 second. Maximum noise levels were all monitored using the Fast response.

Vibration Units

Groundborne vibration generally occurs as cyclic movement of the ground and is normally induced by repetitive energy generated at sources, which are directly coupled to the ground. The magnitude of the movement inside properties varies with distance from the source and is dependent on a number of factors which include:

- Ground lithology;
- Foundation design; and
- Floor design.

The human body is sensitive to vibration in the three orthogonal directions and is capable of detecting vibration at magnitudes far below those which are necessary to cause adverse effects on buildings or structures. Vibrations at relatively low levels above the threshold of perception may, however, give rise to a small chance of disturbance and/or adverse comment from residents.

It is widely agreed that the risks of building damage are determined by the maximum peak particle velocity in any of the three orthogonal axes (radial, perpendicular or vertical), at the foundation of the structure. Human response to vibration is, by contrast, generally considered to be related to the forth power average of the vibration acceleration.

Groundborne vibration is a three-dimensional phenomenon. Generally, when assessing vibration felt by the occupants of buildings during the daytime, it is only necessary to measure the vertical component of the vibration. This is because the body is most sensitive to vibration in the z-direction and that the highest vibration in the floor is usually in this direction.

For redevelopment activities, it is common practice to use the peak particle velocity levels to determine both potential disturbance and effects on building structures.