APPENDIX 12B: DESCRIPTION OF NOISE AND VIBRATION UNITS

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

Examples of typical sound intensity levels within the decibel range of 0 to 120dB are listed below:

- Four engine jet aircraft at 100m 120dB
- Riveting of steel plate at 10m 105dB
- Pneumatic drill at 10m 90dB
- Circular wood saw at 10m 80dB
- Heavy road traffic at 10m 75dB
- Telephone bell at 10m 65dB
- Male speech, average at 10m 50dB
- Whisper at 10m 25dB
- Threshold of hearing, 1000Hz 0dB

Frequency

Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18,000Hz. The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

A-Weighting

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.

Sound Power Level (L_W) and Sound

These two units are used to express sound level. Sound power level is the inherent property of a source, whilst sound pressure level is dependent on surroundings/distance/directivity etc. The sound level that is measured on a meter

Pressure Level (L_P)	is the sound pressure level, L_P.
$L_{Aeq,T}$	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.
L_{A10}	The noise level exceeded for 10% of the measurement period. It has been used in the UK for the assessment of road traffic noise.
L_{A90}	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.
L_{Amax}	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.
$L_{10,1\text{-hour}}$	The L_{10} level measured over a 1 hour period.
$L_{10,18\text{-hour}}$	The arithmetic average of the $L_{10,1\text{-hour}}$ levels for the 18 hour period between 06:00 hours and 24:00 hours on a normal working day. It is a common traffic noise descriptor.
Ambient noise	The totally encompassing sound in a given situation.
Free Field	Free field noise levels are measured or predicted such that there is no contribution made up of reflections from nearby building façades.
Façade Noise Level	A noise level measured or predicted at the façade of a building, typically at a distance of 1m, containing a contribution made up of reflections from the façade itself (+3dB).
Sound Reduction Index (R)	The sound reduction index is a single-number rating of the sound reduction through a wall or other building element. Since the sound reduction may be different at different frequencies, test measurements are subjected to a standard procedure which yields a single number that is about equal to the average sound reduction in the middle of the human hearing range.
Weighted Sound Reduction Index (R_W)	The R_W incorporates a correction for the ears' response. It is derived from comparing the window sound insulation to frequency curve with a family of reference curves.
R_{TRA}	Traffic noise reduction – by adopting an idealised but typical spectrum of road traffic noise dominated by low frequencies, an index R_{TRA} (reduction of road traffic noise) is derived. By comparing this with the sound reduction of the window in dB(A) it represents the likely in service performance for road traffic noise attenuation.