Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 7B: Glossary of Acoustic Terminology

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

APFP regulation Number: 5(2)*(a)*

Planning Inspectorate Reference Number: TR010043

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Document Reference: 6.2 – Technical Appendix 7B

Version Number: 0 – Revision for Submission

Date: 30 April 2019

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1 Glossary of Acoustic Terminology

1.1.1 Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

1.1.2 Furthermore, the perception of noise may be determined by several factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all factors when assessing the significance of a noise source.

1.1.3 The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

1.1.4 The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

1.1.5 Table 1.1 and 1.2 set out the specific noise and vibration terminology used in Chapter 7: Noise and Vibration.

Table 1.1: Noise Terminology

Terminology	Description
Ambient sound level, $L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. It is a measure of the combination of "residual sound" and the "specific sound" when present.
Annual Average Weekday Traffic (AAWT)	The average volume of vehicle traffic of a highway or road for a year, excluding weekends and bank holidays, and adjusted for seasonal variations.
A-weighting, dB(A)	The unit of sound level weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Basic noise level (BNL)	The measure of road traffic sound at a reference distance of 10 m from the nearside carriageway edge. It is determined by obtaining the estimated sound level from the 18 hour flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in the Calculation of Road Traffic Noise (1988).
Calibration	The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short term measurements, and periodically for longer term monitoring.
Class 1	The Class of a sound level meter describes its accuracy as defined by the relevant international standards – Class 1 is more accurate than Class 2. The older standard IEC 60651 referred to the grade as "Type", whereas the new standard IEC 61672 refers to it as the "Class". The most accurate meters used in the field (as opposed to a laboratory) are Class 1. Class 2 meters can be used in some instances; however, WSP use Class 1 (or Type 1) meters by default, as required by BS 4142:2014, for example.
Context	The circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood. When considering context, pertinent

Terminology	Description
	factors include: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; evidence on human response to the sound; and the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20Log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 µPa.
Façade level	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
$L_{AF10,18h}$	The $L_{AF10,18h}$ level is the arithmetic mean of all the levels of L_{AF10} during the period from 06:00 to 24:00. From research, it has been found that subjective response to road traffic noise is closely linked to higher sound levels experienced and is correlated well with the $L_{AF10,18h}$ index. Unless stated otherwise, it should be measured/ presented using the fast time-weighting (F).
$L_{AF10,T}$	The A-weighted sound pressure level exceeded for 10% of the time over the period, T, measured using fast time-weighting (F).
$L_{AF90,T}$	The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the 'background' sound conditions.
L_{AFmax}	The maximum A-weighted sound pressure level during a given time period. L_{max} is sometimes used for the assessment of occasional loud sounds, which may

Terminology	Description
	have little effect on the overall L_{eq} noise level, but could still affect the sound environment. Unless described otherwise, it is commonly measured using the fast time-weighting (F).
$L_{eq,T}$	A time-averaged sound level index called the equivalent continuous sound level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. Where the value is A-weighted, it will be presented '$L_{Aeq,T}$' or 'dBA $L_{eq,T}$', otherwise is should be an un-weighted (or linear) value.
Line source	A sound source composed of many point sources in a defined line, such as a train, flow of traffic on a motorway, or constant aircraft take-offs and landings. Sound levels measured from line sources decrease at a rate of 3 dB per doubling of distance.
$L_{night,outside}$	The $L_{night,outside}$ index is the equivalent continuous sound level $L_{Aeq,8h}$ for the period 23:00 to 07:00 hours assessed outside a dwelling and is free-field.
L_{night}	The L_{night} is a façade level derived from the $L_{AF10,18h}$ using the TRL conversion method.
Point source	A sound source whose dimensions are small compared to the propagation distances involved. Due to the Inverse Square Law, the sound level pressure level decreases by 6 dB every time the distance between the measurement point and the source is doubled.
Rating level, $L_{Ar,Tr}$	The equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$, see also Specific Sound Level) of the sound, plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed (or absent) to such a degree that it does not contribute to the ambient sound.
Sound level metrics, Indices or Parameters	Sound levels usually fluctuate over time, so it is often necessary to consider an average or statistical sound level. This can be done in several ways, so a number of different metrics have been defined, according to how the averaging or statistics are carried out.

Terminology	Description
Sound pressure level (sound level), L_p	The sound level is the sound pressure relative to a standard reference pressure of 20 Pa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound pressure	Sound, or sound pressure, is a fluctuation in air pressure around the static ambient pressure.
Soundscape	Acoustic environment as perceived or experienced and/or understood by a person or people, in context.
Specific sound level, L_s = $L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
Specific sound source	Sound source being assessed.
Third-octave band	Octave bands sub-divided into three parts, equal to 23% of the centre frequency. Used when octave analysis is not discrete enough. The cut-off frequencies have a ratio of 2 1/3, which is approximately 1.26. For example, a 1 kHz third-octave band filter has a centre frequency of 1000 Hz with lower and upper frequencies of 891 Hz and 1112 Hz respectively.

Table 1.2: Vibration Terminology

Terminology	Description
Displacement, velocity and acceleration	Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement (how far from the equilibrium position that something moves), velocity (how fast something moves), or acceleration (the rate of change of velocity).
Amplification	A general term used to indicate the increase in noise or vibration, or the amount (in decibels) by which it is increased.
Transfer function	Transfer function of a vibrating system is the ratio of the output or response of the system to the input excitation, usually expressed as a complex function of frequency.
Vibration dose value (VDV)	This is a measure of the amount of vibration that is experienced over a specified period, and has been defined so as to quantify the human response to vibration in terms of comfort and annoyance. The Vibration Dose Value is used to assess the likely levels of adverse comment about vibration, and is defined mathematically as the fourth root of the time integral of the fourth power of the acceleration, after it has been frequency weighted to consider the frequency response of the human body to a vibration stimulus. Measured in units of m·s-1.75
Peak Particle Velocity (PPV)	PPV is the maximum speed (in a given direction) of oscillation about a point of equilibrium. PPV is measured in three dimensional planes.
Peak Vector Sum (PVS)	The PVS is the square root of the sum of the square of the PPV values in all three vector dimensions. The PVS is always greater than the individual PPV vector values.