**Cambridge Waste Water Treatment Plant Relocation Project**
Anglian Water Services Limited

# Appendix 17.1: Noise and Vibration Guidance and Policy

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# 1 Noise and Vibration, Standards and Guidance

## 1.1 Standards and Guidance

**Planning Practice Guidance**

1.1.1 The National Planning Practice Guidance includes a dedicated section on noise, which states that: *'plan making and decision making should take account of the acoustic environment and in doing so consider:*

- *Whether or not a significant adverse effect is occurring or likely to occur.*
- *Whether or not an adverse effect is occurring or likely to occur.*
- *Whether or not a good standard of amenity can be achieved'*

1.1.2 In line with the Explanatory Note of the Noise Policy Statement for England, this would include '*identifying whether the overall effect of the noise exposure (including the impact during construction wherever applicable) is, or would be, above or below the significant observed adverse effect level…'*

1.1.3 Among the specific factors to consider where relevant the guidance states: '*In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur*'.

1.1.4 The PPG provides a noise exposure hierarchy which describes the perception and outcomes associated with increasing effect levels which is reproduced in the following table.

**Table 1-1: Examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation**

| Perception | Examples of outcomes | Increasing effect level | Action |
|---|---|---|---|
| No Observed Effect Level | | | |
| Not present | No Effect | No Observed Effect | No specific measures required |
| No Observed Adverse Effect Level | | | |
| Present and not intrusive | Noise can be heard but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life. | No Observed Adverse Effect | No specific measures required |
| Lowest Observed Adverse Effect Level | | | |
| Present and intrusive | Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g., turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life. | Observed Adverse Effect | Mitigate and reduce to a minimum |
| Significant Observed Adverse Effect Level | | | |
| Present and disruptive | The noise causes a material change in behaviour, attitude or other physiological response, e.g., avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area. | Significant Observed Adverse Effect | Avoid |
| Present and very disruptive | Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g., auditory and non-auditory. | Unacceptable Adverse Effect | Prevent |

*Source: Planning Practice Guidance*

### WHO Environmental Noise Guidelines for the European Region 2018

1.1.5 The World Health Organization (WHO) Environmental Noise Guidelines for the European Region provide evidence-based recommendations on the health effects of noise. The guidelines complement the expert-based recommendations of the WHO 'Night Noise Guidelines' (2009) (NNG). The guidelines provide source specific recommendations road

traffic, railway, aircraft and wind turbine noise, and indoor as well as outdoor exposure levels for leisure noise sources. No specific recommendations are provided for industrial or commercial noise sources.

**WHO Night Noise Guidelines for Europe, 2009**

1.1.6 The WHO Night Noise Guidelines for Europe (NNG) suggest on a very precautionary basis, that the population should not be exposed to a NNG value greater than 40 dB of $L_{night,outside}$ (defined as the night noise level outside in free field conditions) during the part of the night when most people are sleeping. However, the precautionary nature of this target is fully appreciated by the WHO and an Interim Target (IT) noise level of 55 dB $L_{night,outside}$ is therefore recommended.

**British Standard (BS) 8233:2014**

1.1.7 BS 8233:2014 provides guidance relating to indoor ambient noise levels for residential dwellings. Guidance recommends that internal noise levels should not exceed 35 dB $L_{Aeq,16hour}$ in living rooms during daytime periods (between 07:00-23:00) and 35 dB $L_{Aeq,8hour}$ in bedrooms during the night-time periods (between 23:00-07:00).

1.1.8 BS 8233:2014 also provides guidance relating to noise levels in external amenity areas which states that it is desirable noise levels do no exceed 50 dB $L_{Aeq,T}$ with an upper guidance value of 55 dB $L_{Aeq,T}$. The upper guidance value is relevant in noisier environments.

1.1.9 The guidance states '*however, it is also recognized that these [external noise level] guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.'*

**British Standard (BS) 4142:2014+A1:2019**

1.1.10 BS 4142:2014+A1:2019 entitled 'Methods for rating and assessing industrial and commercial sound', provides guidance for assessing a new industrial sound source in mixed residential and industrial areas. The methods described in this standard assess the likely effects of the new sound source on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

1.1.11 The level of sound from proposed new plant, the 'rating level', is predicted in terms of the A-weighted equivalent continuous sound level dB $L_{Aeq}$, and compared to the existing background sound level, in terms of $L_{A90}$. The $L_{A90}$ is to be representative of the period being assessed. If the new sound source is impulsive, intermittent, or tonal in nature, then a penalty is added to the 'rating level' to account for the character of the noise.

1.1.12 The following conclusions may be drawn based upon the difference between the rating level and background sound level:

- *"Typically, the greater this difference, the greater the magnitude of the impact;*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on the context;*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and;*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

**British Standard (BS) 5228 Part 1 Noise**

1.1.13 BS 5228-1:2009+A1:2014 provides a methodology for calculating noise levels generated by fixed and mobile plant used for a range of typical construction operations. The Standard includes a database of equivalent continuous noise levels ($L_{Aeq,T}$ dB) at a reference distance of 10m and a simple noise propagation model that can be used to make allowances for source-receiver distances, ground properties, plant usage, etc. The standard does not define strict criteria to determine the significance of noise effects, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are provided.

1.1.14 The Example Method 2 'The 5 dB change method' (BS5228-1 Section E.3.3) states that noise levels generated by construction activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in a significant effect.

1.1.15 The Standard does not define what is meant by works of a shorter duration but Table E.2 in BS5228-1 provides examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation and specifies a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months. This is important because the frequency of occurrence (for example, the number of days) and pattern of occurrence (an event occurring one day per month for twelve months versus twelve events occurring sporadically over a one-month period) affects the potential disturbance caused. BS5228-1 Table E.2 is reproduced below.

**Table 1-2: Examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation**

| Time | Relevant time period | Averaging time, T | Noise insulation trigger level dB $L_{Aeq,T}$ A) |
|---|---|---|---|
| Monday to Friday | 07.00 – 08.00 | 1 h | 70 |
| | 08.00 – 18.00 | 10 h | 75 |
| | 18.00 – 19.00 | 1 h | 70 |
| | 19.00 – 22.00 | 3 h | 65 |
| | 22.00 – 07.00 | 1 h | 55 |
| Saturday | 07.00 – 08.00 | 1 h | 70 |
| | 08.00 – 13.00 | 5 h | 75 |
| | 13.00 – 14.00 | 1 h | 70 |
| | 14.00 – 22.00 | 3 h | 65 |
| | 22.00 – 07.00 | 1 h | 55 |
| Sunday and Public Holiday | 07.00 – 21.00 | 1 h | 65 |
| | 21.00 – 07.00 | 1 h | 55 |
| A) All noise levels are predicted or measured at a point 1 m in front of the most exposed of any windows and doors in any façade of any eligible dwelling. | | | |

Source: BS5228-1 Table E.2

### British Standard (BS) 5228 Part 2 Vibration

1.1.16 The standard BS 5228-2:2009+A1:2014[1] provides guidance on the human and physical effects of vibration, such as levels at which it will cause complaint or cosmetic damage to buildings. BS5228 does not indicate whether particular vibration levels are significant. However, it does state that "*It is likely that vibration of... [1.0mm/s] ...in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents*". The standard also provides a methodology for the calculation of vibration impacts for a range of construction activities that generate vibration.

1.1.17 BS5228-2 Table B.1 provides construction vibration impact guidance values for human receptors as reproduced in Table 1-3.

**Table 1-3: Guidance on effects of vibration levels**

| Vibration Level | Effect |
|---|---|
| **0.14 mm/s** | Vibration may just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies people are less sensitive to vibration. |

[1] British Standards Institution, BS 5228-2:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites" Part 2: Vibration, 2014.

| | |
|---|---|
| **0.3 mm/s** | Vibration might just be perceptible in residential environments. |
| **1.0 mm/s** | It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents. |
| **10 mm/s** | Vibration is likely to be intolerable for any more than a brief exposure to this level in most building environments. |

Source: BS5228-2 Table B.1

### British Standard (BS) 7385-2 and DIN 4150

1.1.18 Vibration nuisance is frequently associated with the assumption that if vibrations can be felt then damage may occur. However, considerably greater levels of vibration are required to cause damage to buildings and structures. The level of vibration that causes adverse effects for human receptors is significantly lower compared to building damage.

1.1.19 BS 5228-2 refers to BS7385-2 includes guidance on the levels of vibration that would be necessary to cause structural damage to different types of buildings. It states that low frequency vibration at a PPV of 15mm/s may cause cosmetic damage in un-reinforced or light framed structures e.g. for residential / light commercial use, and 50mm/s in heavy commercial buildings. These values apply to transient vibration which does not induce a resonant response in structures and low-rise buildings. A source of continuous low frequency vibration may induce a vibration response in buildings or structures at their resonant frequencies. The building would then be subject to additional dynamic forces arising from its own motion. Therefore, BS 5228-2 recommends that the values given should be reduced by 50% to take into account for dynamic magnification due to resonances.

1.1.20 The standard also states: '*Important buildings which are difficult to repair might require special consideration on a case-by-case basis. A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.*'

1.1.21 The German Standard DIN 4150 'Structural Vibration – Part 3: Effect of Vibration on Structures' includes guideline values for the evaluation of short term vibration on buildings with regards to potential damage. The values are presented as a function of frequency and apply at the building foundation. The short term levels of vibration in the frequency bands having the most stringent levels are as follows:

- 3mm/s for particularly sensitive buildings
- 5mm/s for residential buildings
- 20mm/s for industrial and commercial buildings

1.1.22 The Association of Noise Consultants (ANC) Guidelines 'Measurement and Assessment of Groundborne Noise and Vibration' reviews the various criteria for building damage which concludes: "*To be below damage criteria, vibration in any direction should not exceed 3mm/s PPV for transient vibration and 2.5mm/s (below 2mm/s at 1Hz) for continuous vibration (anywhere in the structure). Higher vibration may not necessarily cause damage".* These most stringent criteria are obtained from DIN 4150.

**Design of Roads and Bridges (DMRB) LA111**

1.1.23 DMRB LA111 'Noise and Vibration' describes methodology and guidance for the assessment road traffic noise in the UK. Guidance best reflects EIA methodology as applied to highways projects and assessment of noise impacts due to road traffic. It includes a method of the classification of magnitude of impact, assessment of and determination of significance.

1.1.24 DMRB LA111 provides guidance for comparisons that should be made to assess the impact of changes in road traffic noise. The traffic noise change is based on noise levels associated with Do Minimum (that is, without the proposed scheme) and Do-something (that is, with the proposed scheme) and for the opening year and a design year that is usually 15 years later but can be a shorter interval where appropriate.

**Calculation of Road Traffic Noise**

1.1.25 The Calculation of Road Traffic Noise (CRTN) provides procedures for predicting noise levels for a given flow of road traffic at sensitive receptors. These methodologies are used in the determination of entitlement under the Noise Insulation Regulations and for traffic noise change assessments undertaken in accordance with the DMRB assessment methodology.

# Get in touch

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You can view all our DCO application documents and updates on the application on The Planning Inspectorate website:

**https://infrastructure.planninginspectorate.gov.uk/projects/eastern/cambridge-waste-water-treatment-plant-relocation/**