



CROSSRAIL INFORMATION PAPER

D25 – NOISE FROM FIXED INSTALLATIONS

This paper explains the measures that will be put in place to control the effects of noise and vibration from the operation of fixed installations designed and installed as part of Crossrail.

It will be of particular relevance to those in close proximity to Crossrail stations, ventilation shafts and sidings.

This is not intended to replace or alter the text of the paper itself or any commitments contained in it, and it is important that you read the paper in order to have a full understanding of the subject. If you have any queries about this paper or about how noise and vibration from the operation of Crossrail fixed installations might affect you, please contact either your regular Petition Negotiator at CLRL or the Crossrail helpdesk, who will be able to direct your query to the relevant person at CLRL. The helpdesk can be reached at:

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APPROVED

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1. Introduction

1.1 This Information Paper explains the measures that will be put in place to control the effects of noise and vibration from the operation of fixed installations designed and installed by the nominated undertaker as part of the Crossrail scheme, but it does not cover rail-served or other installations provided by the nominated undertaker for other parties affected by the scheme and not intended for use by the Crossrail operator as part of the operational Crossrail system.

1.2 The term “fixed installations” is used to describe the following:

- forced ventilation shafts located along the tunnelled sections;
- draught relief shafts located along the tunnelled sections;
- electrical trackside equipment located along the surface railway;
- power supply facilities e.g. transformers located along the surface railway;
- mechanical ventilation and air conditioning equipment associated with Crossrail buildings including those located at depots, sidings, control rooms and stations;
- static sources of noise located at depots and sidings (for example train washes, wheel lathes and stationary trains) but excluding noise from the movement of trains; and
- public address systems and audible warning systems at stations, depots and sidings.

1.3 The measures that are available to control the effects of noise from each of these sources are set out below.

1.4 As described in the Crossrail Environmental Statement (ES¹), the Crossrail scheme includes 26 tunnel forced ventilation shafts. The shafts house large ventilation fans that are sources of noise whose significance was assessed in the preparation of the ES. It is proposed to operate these fans intermittently in response to circumstances such as demands during congested running in the tunnels and emergency response.

1.5 To avoid a significant noise impact from the operation of the tunnel forced ventilation fans, noise attenuators will be designed and installed on each side of the tunnel ventilation fans as necessary to meet the Crossrail assessment criterion for fixed plant.

¹ The term 'Environmental Statement' refers to the Environmental Statement deposited with the Crossrail Bill in February 2005, the four Environmental Statements accompanying the Additional Provisions, the four Supplementary Environmental Statements submitted during the passage of the Bill, and their Non-Technical Summaries and errata, which together comprise the Crossrail Environmental Statement. The term 'the Main ES' refers specifically to the Environmental Statement produced (with its Non-Technical Summary) in February 2005. See <http://billdocuments.crossrail.co.uk/>.

2. The Crossrail Assessment Criterion for Fixed Installations

- 2.1 In accordance with BS 4142:1997 (Method for Rating industrial noise affecting mixed residential and industrial areas), the Crossrail assessment criterion for fixed installations other than public address systems and audible warning systems is founded upon the difference between the noise from the fixed installations (expressed in terms of the rating level) and the existing background noise (expressed in terms of the $L_{A90,T}$ noise level). The rating level takes account of tonal or impulsive characteristics of mechanical and electrical services plant.
- 2.2 The Crossrail assessment criterion is as follows: airborne noise arising from fixed installations is not significant if the predicted value, as determined for the worst-affected residential building, obtained by subtracting the existing background noise level ($L_{A90,T}$) from the rating level of the fixed installations in normal operation is not more than +5 dB, assessed in accordance with BS 4142:1997. For the purposes of the Crossrail Environmental Statement (ES) it was applied to existing known residential buildings, and future developments based upon the Greater London Authority's London Development Monitoring System using the most recently available data at the time.
- 2.3 The $L_{A90,T}$ is the A weighted noise level exceeded for 90% of the specified measurement period in the absence of the noise which is the subject of the assessment. The lowest background noise ($L_{A90,T}$) levels occur at night, so any use and assessment of the operation of the fixed installations at night constitutes the strictest test. BS 4142:1997 requires that, at night, the reference time interval for determining the specific noise level is 5 minutes, and it is likely that any occasion on which a tunnel forced ventilation shaft fan will run at night will involve continuous noise for a duration of at least 5 minutes. This means that the specific noise level does not need to be corrected for duration. If the noise has distinguishing characteristics, for example, in the case of fans it is tonal, a further 5 dB correction is then added and the specific noise level becomes the rating level.
- 2.4 Thus, effectively, the Crossrail assessment criterion means that, for the usual case of fan noise with an audible tone, the forced ventilation shaft fan sound level alone should not be greater than the background $L_{A90,T}$ noise level without it.
- 2.5 The nominated undertaker will be required to design and construct fixed installations (including the forced ventilation shafts which will include noise attenuators on both sides of each fan and other forms of mitigation as necessary, but excluding public address systems and audible warning systems) so that, with additional allowances made for calculation uncertainty, under all reasonably foreseeable circumstances the assessment at the worst-affected residential building, as identified in the ES, obtained by subtracting the existing² background

² Defined as that which exists at the time of the detailed design and is agreed with the local authorities in accordance with Section 3.2 of this IP.

noise level ($L_{A90,T}$) from the rating level $L_{Ar,Tr}$ of the fixed installations in normal operation, is not more than +5 dB, determined in accordance with BS 4142:1997.

2.6 While the degree of attenuation required is site dependent, not least because of different levels of background noise at different sites, the nominated undertaker will (in cases not covered by paragraph 2.9 below) be required to use reasonable endeavours when designing the fixed installations to reduce the noise below the design criterion set out in Section 2.5 where it is practicable to do so.

2.7 In recognition of the local authorities' preference for rating levels which are no greater than $L_{A90,T}-5$ for Crossrail, the nominated undertaker will prior to the commencement of procurement of equipment provide to the relevant local planning authority the following information in situations where, despite using reasonable endeavours to reduce noise levels below the design criterion of $L_{A90,T}+5$ referred to in paragraph 2.5 at the worst-affected residential building, as identified in the ES, the overall rating noise levels associated with tunnel ventilation, draught relief and the operation of plant and equipment at the deep level station sites are still expected to be above $L_{A90,T}-5$:

- the calculated rating levels at the most sensitive receivers under the range of operational modes anticipated, including noise from mechanical fan operation and draught relief;
- for tunnel ventilation, the frequency and duration of use of the fans expected as a result of possible congestion and train headway simulations;
- details of the performance of noise mitigation incorporated into the deep level station, ventilation shaft and headhouse structures;
- a description of the limitations to any or further mitigation being practicable.

For the purposes of the above commitment, the term 'deep-level station' refers to stations with sub-surface platforms within tunnels, accessed from ground level.

2.8 In the following paragraphs of this IP (i) references to the surface railway are to the Crossrail running lines, and do not include depots and sidings, and (ii) references to surface stations do not include any deep-level station as defined in paragraph 2.7

Fixed Installations associated with Surface Railway and Surface Stations

2.9 The nominated undertaker will, notwithstanding paragraph 2.5, be required to employ best practicable means³ in designing and constructing the fixed installations associated with the surface railway and surface stations (including electrical trackside equipment located along the surface railway, power supply facilities e.g. transformers located along the surface railway and static noise sources associated with Crossrail at surface railway stations, but excluding public

³ 'Best practicable means' for this purpose is to be interpreted by reference to section 79(9) (a) to (d) of the Environmental Protection Act 1990. The 'current state of technical knowledge' under 79(9)(a) is interpreted for the purpose of this IP as being the state of technical knowledge at the time that design information is submitted to the relevant local authority prior to the construction of the installation beginning.

address systems and audible warning systems) with the aim of reducing noise so that, with additional allowances made for calculation uncertainty, under all reasonably foreseeable circumstances the assessment at the worst-affected residential building, as identified in the ES, obtained by subtracting the existing⁴ background noise level ($L_{A90,T}$) from the rating level $L_{Ar,T}$ of the fixed installations in normal operation, is not more than $L_{A90,T}-5$, determined in accordance with BS 4142:1997. Where despite the employment of best practicable means, rating levels at the worst-affected residential building are expected to exceed $L_{A90,T}-5$, the nominated undertaker will prior to the commencement of procurement of equipment provide to the relevant local planning authority the following information:

- the calculated rating levels at the most sensitive receivers under the range of operational modes anticipated;
- details on the performance of the proposed noise mitigation measures;
- a description of the limitations to any or further mitigation being practicable.

3. Protocol for the Application of the Crossrail Design Criterion to the Design of Fixed Installations

3.1 With the exception of public address systems and audible warning systems which are addressed solely in Section 4 of this IP, the nominated undertaker will be required to apply the Crossrail design criterion to the totality of all fixed installations at a single Crossrail development and the specific noise source defined by BS 4142:1997 shall mean all the fixed installation noise sources (including mechanical plant and machinery) installed and operated in any location within the Crossrail development. Thus, for example, at a central London station it will apply to the design of the forced ventilation shafts, draught relief shafts and station mechanical ventilation and air conditioning equipment.

3.2 When designing all fixed installations other than public address systems and audible warning systems, the nominated undertaker will be required to:

- Incorporate the design criterion into contract documents such that it will apply to the design of all the fixed installations that are to be installed and operated in any location within the Crossrail development.
- When designing fixed installations, take the further endeavours which are referred to in paragraph 2.6 or 2.9 (as the case may be) to reduce the noise below the design criterion in paragraph 2.5.
- Translate the design criterion into specific requirements in specifications for the procurement and operation of Crossrail plant, equipment and machinery for fixed installations taking into account the further endeavours referred to in bullet point 2 above.

- Determine the relevant $L_{A90,T}$ levels, to be jointly established with the relevant local authorities.
- Procure, install and commission plant, equipment and machinery, including noise attenuation equipment that meets the specific requirements referred to in bullet point three above.
- Provide details of the measures undertaken to ensure that, under all reasonably foreseeable circumstances, the design process and procurement process for fixed installations is adequate to achieve compliance with the design criterion taking into account the endeavours referred to in bullet point 2 above (including proposals for maintenance and monitoring) to the relevant local authority whose comments will be taken into account.
- Before the fixed installation may be operated, satisfactorily complete the standard suite of acceptance tests required for such plant and provide information on those tests to the relevant local authority.

4. Noise from Public Address Systems and Audible Warning Systems

- 4.1 The nominated undertaker will be required to agree appropriate criteria for assessing noise arising from any new or materially altered public address system and audible warning systems with the relevant local authority, prior to the specification and detailed design of such systems. Such systems shall be designed to meet the agreed noise criteria. In the event that appropriate noise criteria cannot be agreed with a relevant local authority, any dispute will be resolved in accordance with the procedure set down in clause 63 of the Bill (arbitration).