



HIGH SPEED TWO PHASE ONE INFORMATION PAPER

E20: CONTROL OF AIRBORNE NOISE FROM ALTERED ROADS AND THE OPERATIONAL RAILWAY

This paper outlines the measures that will be put in place to control airborne noise from altered roads and the operational railway.

It will be of particular interest to those potentially affected by the Government's proposals for high speed rail.

This paper was prepared in relation to the promotion of the Bill for Phase One of the scheme which is now enacted. Although the contents were maintained and updated as considered appropriate during the passage of the Bill (including shortly prior to the enactment of the Bill in February 2017) the contents are now historic and are no longer maintained.

If you have any queries about this paper or about how it might apply to you, please contact the HS2 Public Enquiries desk in the first instance.

The Helpdesk can be reached at:

**High Speed Two (HS2) Limited
Two Snowhill, Snow Hill Queensway
Birmingham, B4 6GA**

by email: HS2enquiries@hs2.org.uk

or by phone: 08081 434 434 (lines are open 24 hours)

Version 1.5

Last updated: 23rd February 2017

E20: CONTROL OF AIRBORNE NOISE FROM ALTERED ROADS AND THE OPERATIONAL RAILWAY

1. Introduction

- 1.1. High Speed Two (HS2) is the Government's proposal for a new, high speed north-south railway. The proposal is being taken forward in two phases: Phase One will connect London with Birmingham and the West Midlands and Phase Two will extend the route to Manchester, Leeds and beyond.
- 1.2. HS2 Ltd is the non-departmental public body responsible for developing and promoting these proposals. The company works to a Development Agreement made with the Secretary of State for Transport.
- 1.3. In November 2013, HS2 Ltd deposited a hybrid Bill¹ with Parliament to seek powers for the construction and operation of Phase One of HS2 (sometimes referred to as 'the Proposed Scheme'). The Bill is the culmination of nearly six years of work, including an Environmental Impact Assessment (EIA), the results of which were reported in an Environmental Statement (ES) submitted alongside the Bill. The Secretary of State has also published draft Environmental Minimum Requirements (EMRs), which set out the environmental and sustainability commitments that will be observed in the construction of the Proposed Scheme.
- 1.4. The Bill is being promoted through Parliament by the Secretary of State for Transport (the 'Promoter'). The Secretary of State will also appoint a body responsible for delivering the Proposed Scheme under the powers granted by the Bill.
- 1.5. This body is known as the 'nominated undertaker'. There may well be more than one nominated undertaker – for example, HS2 Ltd could become the nominated undertaker for the main railway works, while Network Rail could become the nominated undertaker for works to an existing station such as Euston. But whoever they are, all nominated undertakers will be bound by the obligations contained in the Bill and the policies established in the EMRs.
- 1.6. These information papers have been produced to explain the commitments made in the Bill and the EMRs and how they will be applied to the design and construction of the Proposed Scheme. They also provide information about the Proposed Scheme itself, the powers contained in the Bill and how particular decisions about the project have been reached.

¹The High Speed Rail (London – West Midlands) Bill, hereafter 'the Bill'.

2. Overview

- 2.1. This Information Paper describes the application of the aims set out in the Noise Policy Statement for England for airborne noise from the Proposed Scheme and outlines the measures that will be put in place to control the effects of airborne noise that might otherwise arise from altered roads and the operational railway during the operation of the Proposed Scheme.
- 2.2. Airborne noise from altered roads and the operational railway could result in adverse impacts on people nearby.

3. Objectives

- 3.1. The nominated undertaker will take all reasonable steps to design and construct altered roads, and to design, construct, operate and maintain the operational railway so that the combined airborne noise from these sources, predicted in all reasonably foreseeable circumstances, does not exceed the lowest observed adverse effect levels set out in Table 1 of Appendix B.
- 3.2. Where it is not reasonably practicable to achieve this objective, the nominated undertaker will reduce airborne noise from the altered roads and the operational railway as far as is reasonably practicable.
- 3.3. Noise insulation will be offered with the aim that airborne noise from altered roads and the operational railway does not give rise to significant adverse effects on health and quality of life that would otherwise be expected when airborne noise exceeds the significant observed adverse effect levels set out in Table 1 of Appendix B. Eligibility for noise insulation is explained in Section 5 below.
- 3.4. Where possible, the nominated undertaker will also contribute to the improvement of health and quality of life through the control of airborne noise.
- 3.5. Effects on health and quality of life are primarily avoided and minimised through the control of airborne noise at residential dwellings. It is recognised that effects can also occur when people are engaged in noise sensitive activities away from their home. To deliver the Policy aims, reasonable steps will be taken to control airborne noise from altered roads and the operational railway to the levels set out in Table 2 of Appendix B for noise sensitive non-residential buildings and external amenity spaces (see Glossary).
- 3.6. For detail on the Airborne Noise Policy for altered roads and the operational railway adopted for HS2 Phase One see Appendix A.

4. Control Measures

- 4.1. The likely airborne noise impact from altered roads and the operational railway has been assessed and the findings reported in the Environmental Statement.

- 4.2. The following measures to control airborne noise from altered roads and the operational railway will be considered in the following order by the nominated undertaker:
- reduce noise generation at source;
 - reduce noise propagation through the design, specification, construction and maintenance of noise fence barriers and/or landscape earthworks; and
 - reduce the amount of noise entering eligible properties through the offer of noise insulation.
- 4.3. To ensure that the measures to control airborne noise are reasonable, the nominated undertaker will take account of the set of shared UK principles that underpin the Government's sustainable development strategy².

5. Provision of noise insulation

- 5.1. Noise insulation measures, including ventilation where required, will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996 and the Noise Insulation Regulations 1975 (as amended 1988)^{3,4,5}. Qualification for noise insulation under the Regulations will be identified and noise insulation offered at the time that the Proposed Scheme becomes operational.
- 5.2. In addition, following the general time-window of eligibility described in the Noise Insulation Regulations (Railways and Other Guided Transport Systems) 1996, where airborne noise from the use of new or additional railways authorised by the Bill, altered roads authorised by the Bill or the combined airborne noise from both, is predicted outside a permanent dwelling in all reasonably foreseeable circumstances to exceed the significant observed adverse effect levels set out in Table 1 of Appendix B, the nominated undertaker will offer noise insulation.

6. More information

- 6.1. More detail on the Bill and related documents can be found at: www.gov.uk/HS2

² TSO (The Stationery Office) (2005), Securing the future: delivering UK sustainable development strategy, London.

³ Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.

⁴ Her Majesty's Stationery Office (1975), The Noise Insulation Regulations, London.

⁵ Her Majesty's Stationery Office (1988), The Noise Insulation (Amendment) Regulations, London.

Appendix A

HS2 Phase One Airborne Noise Policy for altered roads and the operational railway⁶

The Noise Policy Statement for England (2010)

1. The aims set out in the Noise Policy Statement for England (NPSE) apply to the design, construction and operation of HS2 Phase One.

<p style="text-align: center;">Noise Policy Aims</p> <p>Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:</p> <ul style="list-style-type: none">• avoid significant adverse impacts on health and quality of life;• mitigate and minimise adverse impacts on health and quality of life; and• where possible, contribute to the improvement of health and quality of life.
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2. Government's guiding principles of sustainable development include: ensuring a strong, healthy and just society; using sound science responsibly; living within environmental limits; achieving a sustainable economy; and promoting good governance.
3. There is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation.
4. The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation. They are:
 - NOEL – No Observed Effect Level - the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise; and
 - LOAEL – Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
5. The NPSE extends these to the concept of a significant observed adverse effect level.
 - SOAEL – Significant Observed Adverse Effect Level - The level above which significant adverse effects on health and quality of life occur.
6. The NPSE notes "It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently,

⁶Note: all sound levels reported in this Appendix are outdoor free-field levels unless otherwise stated

the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

Planning Practice Guidance - Noise (2014)

7. Government's Planning Practice Guidance on noise (PPG) provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.
8. As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.
9. The LOAEL is described in PPG as the level above which "noise starts to cause small changes in behaviour and/or attitude, 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 perceived change in the quality of life."
10. PPG identifies the SOAEL as the level above which "noise causes a material change in behaviour and/or attitude, 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."

HS2 Sustainability Policy (2013)

11. HS2's sustainability policy sets out HS2 Ltd's commitment to be an exemplar project. It states that HS2 "will promote high speed rail and balance community, environmental and economic issues". The key theme identified that relates to noise impact is "Environmental change: seek to avoid significant adverse effects on communities, business and the natural, historic and built environment. Minimise impacts where they occur and deliver enhancements as far as practicable to ensure there is no net loss to the natural environment". This reflects the Noise Policy Statement for England's three aims and the need to avoid HS2 Phase One's noise impact being treated in isolation.

LOAELs for operational airborne noise from altered roads and the operational railway

12. Outdoor sound levels of 50 dB $L_{pAeq,day}$ and 40 dB $L_{pAeq,night}$ are considered the LOAELs for operational airborne noise from altered roads and the operational railway.
13. In the WHO Night Noise Guidelines for Europe⁷ a level of 40 dB L_{night} outdoors is said to be "equivalent to the LOAEL for night noise".

⁷World Health Organisation, Night Noise Guidelines for Europe 2009

14. For the daytime level, the information used to support the WHO Guidelines for Community Noise⁸ indicate that daytime sound levels of less than 50 dB L_{pAeq} cause little or no serious annoyance in the community.
15. The WHO Guidelines for Community Noise also identify 60 dB L_{pAFMax} outside as the guideline value for sleep disturbance with windows open. For this reason, sound levels of 60 dB L_{pAFMax} at the façade is also considered the LOAEL for operational railway noise at night.

SOAELs for operational airborne noise from altered roads and the operational railway

16. Sound levels of 65 dB $L_{pAeq,day}$ and 55 dB $L_{pAeq,night}$ are considered the SOAELs for operational airborne noise from altered roads and the operational railway.
17. The daytime SOAEL is consistent with the daytime trigger level in the UK's Noise Insulation (Railways and Other Guided Transport Systems) Regulations⁹. The WHO Night Noise Guidelines for Europe sets the Interim Target at 55 dB $L_{pAeq,8hr}$ outside dwellings. This noise threshold has been taken to be the night-time SOAEL.
18. HS2 Ltd has considered research findings on adverse effects on nonrestorative sleep which indicate that adverse effects on sleep can be avoided if the maximum noise level inside the bedroom do not exceed 65 dB when more than 20 discreet events occur. For this reason, a sound level of 80 dB L_{pAFMax} at the façade when more than 20 train passbys occur and 85 dB L_{pAFMax} at the façade when 20 or fewer train passbys occur are considered the SOAELs for operational railway noise at night.

⁸ World Health Organisation (1999) Guidelines for Community Noise. World Health Organisation, Geneva

⁹ Statutory Instrument 1996 No. 428. The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996. HMSO.

Appendix B

Operational airborne noise impact and effect levels from altered roads and the operational railway¹⁰

Table 1 - Noise effect levels for permanent residential buildings

Time of day	Lowest Observed Adverse Effect Level (dB)	Significant Observed Adverse Effect Level (dB)
Day (0700 – 2300)	50 L _{pAeq, 16hr}	65 L _{pAeq, 16hr}
Night (2300 – 0700)	40 L _{pAeq, 8hr}	55 L _{pAeq, 8hr}
Night (2300 – 0700)	60 L _{pAFMax} (at the façade, from any nightly noise event)	80 L _{pAFMax} (at the façade, from more than 20 nightly train passbys), or 85 L _{pAFMax} (at the façade, from 20 or fewer nightly train passbys)

Table 2 - Noise impact levels for noise sensitive non-residential buildings and external amenity spaces

Examples	Day 0700-2300	Night 2300-0700
Large and small auditoria; concert halls; sound recording & broadcast studios; and theatres	60 dB L _{pAFMax} OR 50 dB L _{pAeq, 16hr}	60 dB L _{pAFMax} OR 50 dB L _{pAeq, 8hr}
Places of meeting for religious worship; courts; cinemas; lecture theatres; museums; and small auditoria or halls	50 dB L _{pAeq, 16hr}	n/a
Schools; colleges; hospitals; hotels; and libraries	50 dB L _{pAeq, 16hr}	45 dB L _{pAeq, 8hr}
Offices and external amenity spaces	55 dB L _{pAeq, 16hr}	n/a

¹⁰ Note: all sound levels reported in this Appendix are outdoor free-field levels unless otherwise stated

Glossary

At the façade – with reference to sound pressure measurement locations: a position 1m from the building.

Decibel (dB) - Between the quietest audible sound and the loudest tolerable sound there is a ten million to one ratio in sound pressure (measured in Pascal (Pa)). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audible sound covers a range of approximately 0-140 dB.

External Amenity Spaces - As referred to in the Planning Practice Guidelines – Noise (2014), these are relatively quiet outdoor areas: for sole use by residents as part of the amenity of their dwelling; protected for sole use by a limited group of residents as part of the amenity of their dwelling; or protected as publicly accessible for residents as part of the amenity of their dwelling that are nearby.

dB(A) - The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.

$L_{pAeq, T}$ - An index used internationally to measure and assess environmental sound from sources such as roads and railways. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value.

$L_{pAeq, day}$ - Equivalent weekday sound pressure level between 07:00 and 23:00 hrs

$L_{pAeq, night}$ - Equivalent weekday sound pressure level between 23:00 and 07:00 hrs

L_{pAFmax} - The maximum A-weighted sound pressure level, where F indicates that the level is measured using a sound level meter's fast time weighting. It can be used to represent the "peak" noise level of an event such as a passing train. It is generally used when assessing the likelihood of night-time sleep disturbance.

Outdoor free-field – with reference to sound pressure measurement locations: a position more than 3.5m from all sound-reflecting surfaces other than the ground.

Permanent residential buildings – man-made structures that contain one or more dwelling units with a roof and walls standing more or less permanently in one place.