Balfour Beatty VINCI Working on behalf of HS2

Contract No 1MC13

Noise Demonstration Report for Cubbington to Stonehouse Area

Document no: 1MC08-BBV_MSD-EV-REP-NS01_NL03-100087

Revision	Author	Reviewed by	Approved by	Date approved	Reason for revision
C03	M S Forni MIOA	S Dyne FIOA/ C Nestoras MIOA	T Akers T Southwood	04/08/2022	For HS2 Acceptance

STAKEHOLDER REVIEW REQUIRED (SRR)	PURPOSE OF SRR
☒COUNTY/DISTRICT/LONDON BOROUGH COUNCIL ☐LOV ☐LUL ☐NRL ☐TFL ☐UTILITIES COMPANY ☐OTHER	☐ACCEPTANCE ☒APPROVAL ☐NO OBJECTION ☐CONSENT

Handling Instructions: Produced by BBV for project use only

Review Required

Team	Yes/No	Name	Position	Date
Quality				
Health & Safety				
Environment & Sustainability				
Other teams if required				

Revision History

Previous Revision	Author	Reviewed By	Approved By	Date Approved	Reason for Review
P01	M S Forni MIOA	S Dyne FIOA	T Akers	09/04/2021	First issue S3
C01	M S Forni MIOA	S Dyne FIOA	T Akers/S Marce	22/04/2021	For HS2 Acceptance
P02	M S Forni MIOA	S Dyne FIOA	T Akers	17/11/2021	For Acceptance
P03	M S Forni MIOA	S Dyne FIOA/ C Nestoras MIOA	T Akers	08/12/2021	For Acceptance
C02	M S Forni MIOA	S Dyne FIOA/ C Nestoras MIOA	T Akers S Marce	09/12/2021	For HS2 Acceptance
P04	M S Forni MIOA	S Dyne FIOA/ C Nestoras MIOA	T Akers	28/06/2022	For Acceptance
C03	M S Forni MIOA	S Dyne FIOA/ C Nestoras MIOA	T Akers T Southwood	04/08/2022	For HS2 Acceptance

Revision Summary

Paragraph Modified	Details of Modification

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GLOSSARY OF TERMS

Term	Description
AFARP	As far as is reasonably practicable
ARFC	All reasonably foreseeable circumstances
CBA	Cost Benefit Analysis
CRTN	Calculation of Road Traffic Noise
dB	Decibel
dB(A)	'A' weighted Decibel.
Downside	In the direction away from London and towards Birmingham
EIA	Environmental impact assessment
EMRs	Environmental Minimum Requirements
ES	Environmental Statement
LOAEL	Lowest observed adverse effect level
LPA	Local planning authority
L_{pAeq}	'A' weighted equivalent continuous sound level
L_{pAFmax}	maximum 'A' weighted sound pressure level
NDR	Noise Demonstration Report
Nominated Undertaker	The body or bodies appointed to implement the powers of the hybrid Bill to construct and maintain the railway.
SEL	Sound exposure level
SOAEL	Significant observed adverse effect level
the Act	The High-Speed Rail (London – West Midlands) Act 2017
TNPM	Train Noise Prediction Model
U&As	Undertakings and Assurances

Term	Description
Upside	In the direction towards London and away from Birmingham

Executive Summary

This report describes the options considered for the additional airborne noise mitigation in the Cubbington to Stonehouse area and discusses the final mitigation design solution and resultant noise impact at receptors. It sets out a justification for the mitigation design in compliance with planning forum notes 10 and 14.

The report shows that only mitigation embedded within the design would be required in the Cubbington to Stonehouse area.

1. INTRODUCTION

Background and Aim

This Noise Demonstration Report is compiled in accordance with the High Speed Two (HS2) Phase 1 Planning Memorandum (paragraph 7.5.2) and Planning Forum Note 14[1]: Operational Noise from the Railway and Altered Roads.

The information in this Noise Demonstration Report (NDR) shows, as far as is reasonably practicable at the current stage in the design process, how the noise mitigation performs and the expected conditions. While not material to approvals under paragraph 2 or 3, this information will provide reassurance in advance of the request for approval under paragraph 9 that the mitigation is appropriate and will present an opportunity to raise concerns.

This NDR is for the Schedule 17 Paragraph 3 application and future reports will be provided for later stages including Schedule 17 Paragraph 9 application.

In addition to the requirements to control airborne noise set out in Information Paper E20[2] mitigation is also required to meet any undertakings and assurances that are relevant to the Cubbington to Stonehouse area although no such undertakings or assurances have been identified for this area.

Structure of Report

- Site Location
- Policy, Requirements and Standards
- Description of the Works
- Methodology
- Assumptions
- Results
- Conclusions

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833184/PFN_14_Operational_Noise.pdf

[2] Information paper E20: Control of airborne noise from altered roads and the operational railway

2. SITE LOCATION

This report considers noise levels and mitigation in the Cubbington to Stonehouse area.

The relevant section of track is approximately 3110m long between the Cubbington Retaining Wall as originally proposed (approx. chainage 134+715) and a location between the re-aligned A445 and the re-aligned B4113 Stoneleigh Road (approx. chainage 137+882) and includes the following assets:

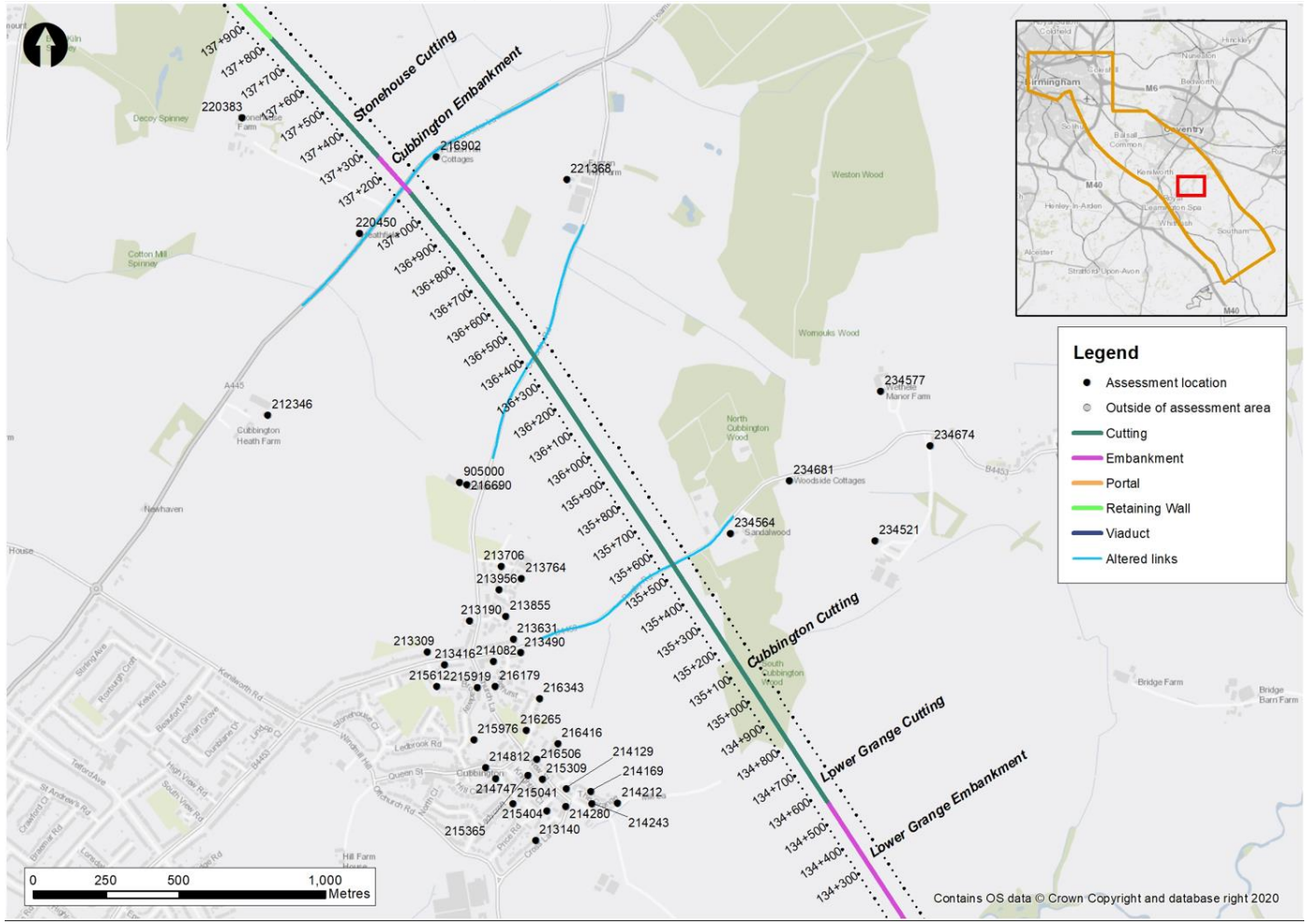
- Cubbington retaining wall/cutting;
- Cubbington Cutting;
- Coventry Road Overbridge; and
- A445 Leicester Lane.

The assessment area comprises a single community, Cubbington, on the downside (in the direction away from London and towards Birmingham) comprising almost 600 potentially affected dwellings. Additionally, there are a number of scattered receptors on the downside and upside typically comprising single dwellings, the exception being a terrace of cottages comprising four dwellings adjacent to A445 Leicester Lane.

The non-residential receptors are located on the upside and comprising 12, classified as eight G5 (offices and general commercial), three G4 (schools, hotels, hospitals and libraries) and two G3 (places of meting for religious worship, courts, cinemas, lecture theatres, museums and small auditoria or halls).

Figure 1 presents the alignment of the track showing the main features in different colours and shows the relevant assessment locations for this assessment. The assessment locations for this area as reported in the ES (as amended) are shown as black dots in the figure. The one exception is receptor number 905000 (Oakdene Children's Nursery) adjacent to Coventry Road which was previously represented by receptor number 216690. It was considered necessary to refine calculations at this location and to this end a more accurately placed receptor was created.

Figure 1. Cubbington to Stonehouse chainages, engineering features and assessment locations



Baseline noise and the ES operational noise levels were obtained from the Community Forum Area CFA17 Operational assessment Sound, noise and vibration[3], as updated by SES/AP2[4].

Description of significant adverse effects due to operational noise identified at the time of the ES

Residential receptors - individual buildings

The ES did not identify any significant adverse effect due to operational noise on residential receptors in Cubbington to Stonehouse area.

Residential receptors – communities

The ES did not identify any significant adverse effect due to operational noise on communities in Cubbington to Stonehouse area.

Non-residential receptors

The ES did not identify any significant adverse effect due to operational noise on non-residential receptors in Cubbington to Stonehouse area.

Corrections to the main ES

There are no corrections to the original ES affecting operational noise.

Amendments and changes to the design within the SES and APs

No amendments were introduced in the Supplementary Environmental Statement and Additional Provision (SES/AP) of the Environmental Statement Volume 2, Community forum area report CFA17, Offchurch and Cubbington which would affect noise levels in the Cubbington to Stonehouse area.

3. POLICY, REQUIREMENTS AND STANDARDS

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.

[3] CFA17 Offchurch and Cubbington operational assessment (SV-004-017)
[4] Supplementary Environmental Statement and Additional Provision 2 Environmental Statement Volume 2 Community forum area report CFA17 Offchurch and Cubbington

The High-Speed Rail (London – West Midlands) Act 2017, referred to from this point forward as "the Act", provides powers for the construction and operation of Phase 1 of High Speed Two for the works, for which HS2 Ltd is the nominated undertaker. The Secretary of State has also published Environmental Minimum Requirements (EMRs), which set out the environmental and sustainability commitments that will be observed in the construction of the Proposed Scheme.

Section 20 to the Act grants deemed planning permission for the works authorised by it, subject to the conditions set out in Schedule 17. Schedule 17 includes conditions requiring various matters to be approved by the relevant Local Planning Authority (LPA).

Schedule 17 of the Act sets out the specific grounds on which the LPA may impose conditions on approvals or refuse requests for approval. With respect to noise as one of the specific grounds the LPA may refuse to approve plans or specifications if "the design or external appearance of the building works ought to be modified to preserve the local environment or local amenity and is reasonably capable of being so modified". This ties in with HS2 Ltd commitment to reduce airborne noise as far as is reasonably practicable (AFARP).

The following section provides a summary of the Environmental Minimum Requirements (EMRs) and relevant information papers that have been produced to explain the commitments made in the Act and the Undertakings and Assurances (U&As) given by the Secretary of State and how they will be applied to the design and construction of HS2 Phase 1.

Environmental Minimum Requirements (EMRs)

The EMRs set out environmental and sustainability commitments that will be observed during the construction and operation of the Proposed Scheme. The EMRs include the Code of Construction Practice (CoCP) and a series of other supporting documents.

The EMR general principles[5] state:

The controls contained in the EMRs, along with powers contained in the Act and the Undertakings given by the Secretary of State, will ensure that impacts which have been assessed in the ES will not be exceeded, unless any new impact or impacts in excess of those assessed in the ES:

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/618074/General_principles.pdf

- results from a change in circumstances which was not likely at the time of the ES[6]; or
- would not be likely to be environmentally significant[7]; or
- results from a change or extension to the project, where that change, or extension does not itself require environmental impact assessment (EIA) under either (i) article 4(1) of and paragraph 24 of Annex 1 to the EIA Directive[8]; or (ii) article 4(2) of and paragraph 13 of Annex 2 to the EIA Directive[9]; or
- would be considered as part of a separate consent process (and therefore further EIA if required).

In the circumstances described in the first bullet point above, if the significant adverse impacts identified in the ES are likely to be exceeded, HS2 and their contractors will take all reasonable steps to minimise or eliminate those additional impacts. If despite these reasonable steps, significant adverse impacts remain, HS2 and their contractors will report them.

Information Paper E20: Control of Airborne Noise from Altered Roads and the Operational Railway

Information Paper E20 outlines the measures that are required to be put in place to control operational airborne noise. It sets out various objectives to minimise operational noise effects as summarised below.

HS2 and their contractors will take all reasonable steps to design and construct the scheme so that the combined airborne noise predicted, in all reasonably foreseeable circumstances (ARFC), does not exceed the Lowest Observed Adverse Effect Level (LOAEL) at residential receptors.

Where it is not reasonably practicable to achieve this objective, HS2 and their contractors will reduce airborne noise as far as is reasonably practicable (AFARP).

HS2 and their contractors are required to consider the following measures to control operational noise, ranked in order of desirability:

- reduce noise generation at source;

[6] *In addition, Supplementary Environmental Statements and Additional Provision Environmental Statements were published and tabled by the Promoter in July 2015, September 2015, October 2015 and December 2015.*
[7] *i.e. a situation that could not reasonably have been anticipated at the time of the Environmental Statement. This covers all effects (both positive and adverse) where those effects are simply of no environmental significance.*
[8] *2011 consolidated EIA Directive (2011/92/EU).*
[9] *Broadly, this would not allow those changes or extensions to the project (once it has received Royal Assent) which would give rise to adverse environmental effects within the EIA.*

- reduce noise propagation through noise barriers and/or landscape earthworks; and
- reduce the amount of noise entering eligible properties through the offer of noise insulation.

Noise insulation will be offered with the aim that operational airborne noise from the scheme 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 (SOAEL) at residential receptors.

The applicable LOAEL and SOAEL values for residential receptors are presented in Appendix A.

Undertakings and assurances

There are no undertakings and assurances (U&A) that are specifically applicable to the Cubbington to Stonehouse area.

Mitigation Appraisal Requirements

HS2 and their contractors are required to consider a list of potential mitigation measures and undertake a proportionate Cost Benefit Analysis (CBA) and consider all relevant acoustic and non-acoustic costs and benefits including:

- Monetary benefit of noise reduction compared to cost;
- Engineering practicability;
- Impacts on other environmental disciplines, including landscape and visual; and,
- Consultation and stakeholder engagement responses.

4. DESCRIPTION OF THE WORKS

The Cubbington to Stonehouse area comprises an area between the Cubbington Cutting and the commencement of Stonehouse Park Retaining Wall, of length 3167m. Three roads intersect the scheme, the B4453 Rugby Road, Coventry Road and the A445 Leicester Lane.

The majority of the scheme in the Cubbington to Stonehouse area is aligned within a cutting (i.e. below the level of the surrounding ground) or a false cutting (at a shallower alignment or at grade, with landscaping earthworks being used to give greater 'depth').

Where these features obstruct the line of view of the railway, then they will act as noise barriers.

The Proposed Scheme will be aligned below the three roads intersecting the route. The A445 Leicester Lane and Coventry Road will be realigned to the south of their existing alignment and the B453 Rugby Road will be realigned to the north. The realigned sections of road will be up to 1km in length and be elevated on embankments.

Design changes since the Hybrid Bill

The retained section of the scheme (Cubbington Retaining Wall) of approximately 500m length between Mill Lane (approx. chainage 134+700) and the commencement of Cubbington Cutting (approx. chainage 135+200) has been replaced by a continuous cutting.

The vertical alignment has been raised by approximately 2m throughout the Cubbington area. This has been offset by an increase in effective height on parts of Cubbington Cutting.

Additional landscaping earthwork bunds have been incorporated into the scheme.

Scheme Design Updates

Scheduled works that are specifically part of this application are set out above. Scheme design updates that have been considered in the noise modelling are set out below:

- The track alignment incorporates a reduction of the spacing distance between track axes from 5000mm to 4700mm for high-speed sections of the Phase 1 scheme;
- The face of noise barriers (other than parapets) has been offset to 4400mm from the track alignment as opposed to 4700mm at the time of the Phase 1 ES;
- Standard viaduct parapets are non-absorbent and 1.2m above railhead compared with absorbent and 1.4m above railhead at the time of the ES but where additional noise mitigation is needed the height is increased and absorption introduced; and
- Concrete robust kerbs (which were not present at the time of the ES) of height 0.35m above railhead and 2m from the nearest track centreline have now been incorporated into in the scheme design.

The reduction of the distance between track alignments, combined with the closer alignment of noise barriers has the capacity to provide a greater noise shielding effect.

Two further changes impact modelled noise levels routewide. These are:

- the track support system has been revised to concrete slabs in lieu of ballasted track envisaged in the ES; and
- the just-TSI compliant trains model which was the noisiest type have been removed, the revised source terms are provided in Table 12.

ES mitigation

At the time of the ES there was no additional acoustic mitigation.

At the time of the ES there were no major impacts reported at residential receptors exposed to noise above LOAEL; four moderate impacts in the daytime and two moderate impacts in the night-time were reported; one minor impact in the daytime and three minor impacts were also reported at night-time; and 10 negligible impacts were reported during the daytime and 34 during the night-time. There were also 134 receptors where the L_{pAFMax} was at or greater than LOAEL.

Candidate mitigation options

The primary objective of this report is to provide evidence that all reasonable steps are taken into the Proposed Design so that the cumulative airborne noise from the railways and altered roads, predicted in all reasonably foreseeable circumstances (ARFC), does not exceed the Lowest Observed Adverse Effect Level (LOAEL) at residential receptors.

Where it is not reasonably practicable to achieve this objective, various noise mitigation scenarios are proposed and evaluated against the noise criteria and the non-acoustic criteria i.e. visual and landscape effects, engineering practicability and value for money.

The Proposed Design corresponds to the option that reduces airborne noise as far as is reasonably practicable (AFARP).

In this section, the main outcome of the impact assessment is presented. First, a comparison of Option 0 (no additional noise mitigation) with the Phase 1 ES (and supplementary environmental statements, SESs, and additional provisions, (APs)) design is made in terms of noise effects. Then, each noise mitigation design option is analysed and compared to determine the “as far as reasonably practicable” (AFARP) scenario, considering both the resulting noise impact classification and, as previously mentioned, the non-acoustic criteria.

For each design option, it is stated whether there is a noise material change with respect to the ES, or not. One option (see Figure 2) was considered and studied in detail before reaching The Design (Option 0 in grey) for which consent is sought. The alternative mitigation option considered is not selected for one or several of the reasons set out below:

- The option would be considerably more expensive than the recommended mitigation option with only a marginal further reduction in noise levels compared with the recommended option; and/or
- It produces a greater adverse visual / landscape impact than the recommended option with only marginally improved acoustic results.

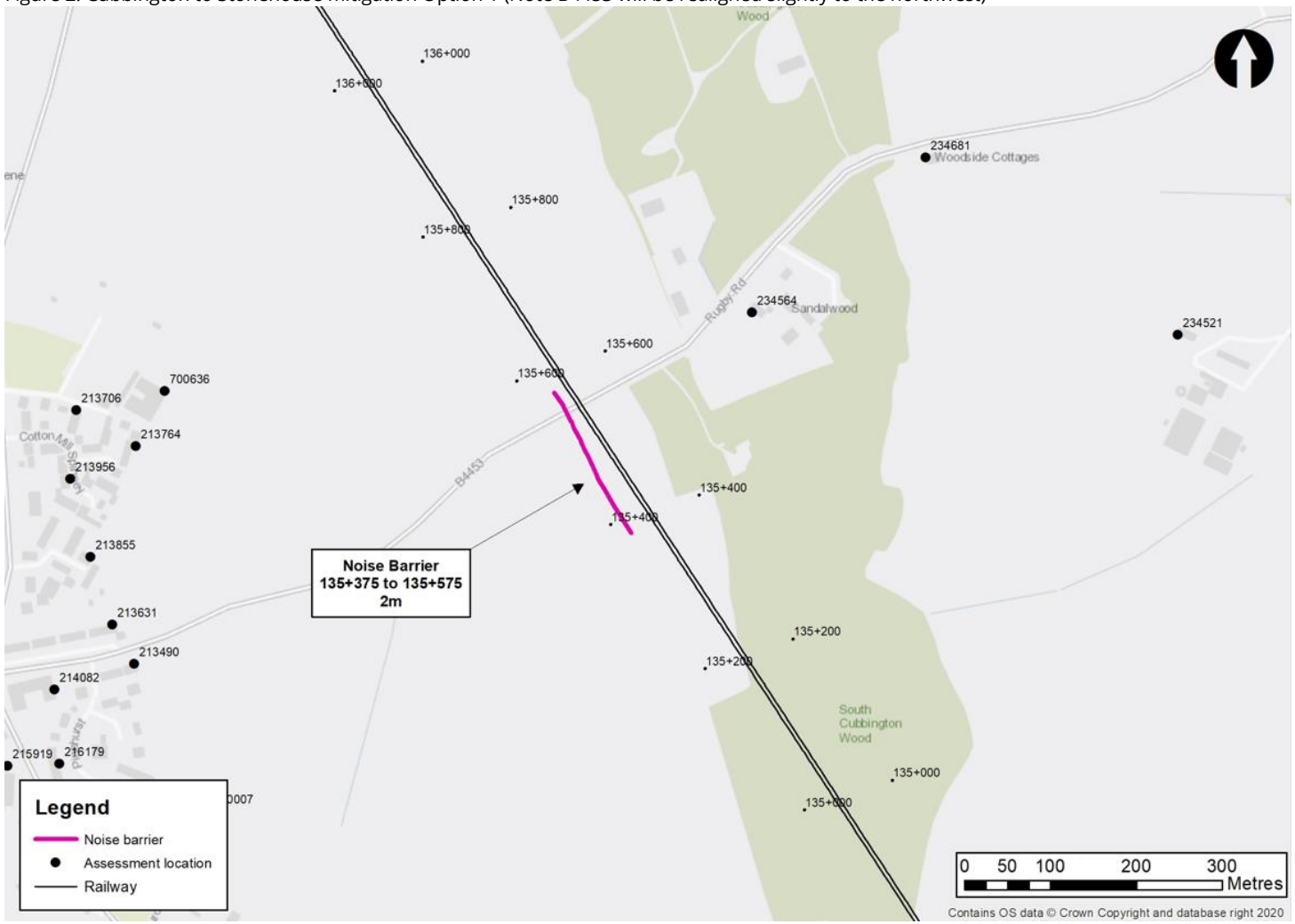
A classification has been used to rank the noise assessment outcomes, benefit in comparison with cost, and environmental implication which is primarily the landscape and visual outcome in each case. These classifications are set out in Table 1.

Table 1. impact classifications for noise and landscape/visual when comparing options

Classification	Noise assessment	Benefit in comparison with cost	Environmental implication
✓✓	Materially beneficial reduction in noise levels; removal of one or more significant adverse effects on a community basis	Substantial benefits and/or relatively low mitigation cost	Significantly better or materially better effects than the ES mitigation
✓	Reduction in the number of major, minor or moderate impacts for receptors above LOAEL but no material change	Some benefits and/or relatively high mitigation cost	Better effects than the ES but not materially better effects
~	Similar number of major, minor or moderate impacts for receptors above LOAEL and no material change	Comparable benefits and mitigation costs with the ES design	About the same effects as the ES mitigation
×	Increase in the number of major, minor or moderate impacts for receptors above LOAEL but no material change	Reduced benefits or increased costs in comparison with the ES design	Worse effects than the ES but not materially worse effects
××	Materially adverse increase in noise levels, number of major, minor or moderate impacts for receptors above LOAEL	Substantially reduced benefits of increased costs in comparison with the ES design	Significantly worse or materially worse effects than the ES mitigation

The candidate mitigation option that was considered is shown in Figure 2 and findings discussed in sections following.

Figure 2. Cubbington to Stonehouse mitigation Option 1 (Note B4453 will be realigned slightly to the northwest)



On the upside, receptor locations are relatively isolated and at distances from the Proposed Scheme such that the effectiveness of acoustic barriers was limited and would have a low benefit compared to cost. These were therefore not considered in detail and mitigation options were restricted to the downside only.

For each option assessment findings are detailed as follows:

Option 0. The ES concluded that no mitigation was required in this area. Any changes from ES design as outlined above have not resulted in the removal of any screening features of the scheme design, thus Option 0 reflects the ES design. In developing Option 0 four dwellings would have been above SOAEL. These dwellings (Furzen Hill Cottages) consist of an isolated row of cottages adjacent to A445 Leicester Lane and perpendicular to the Proposed Design. The option of extending the existing derailment bund underneath the A445 Leicester Lane Overbridge was found effective in reducing noise levels at these properties and was subsequently incorporated into the Scheme design. With the extended derailment bund there is no change in the number of receptors above LOAEL compared with the ES despite a combination of changes in the HS2 train source terms, flows and the alignment and features in the current design.

Option 1 was a 2m high, 200m long barrier located to the east of the re-aligned B4453 Rugby Road at the top of the HS2 cutting earthworks, where the earthworks attenuation was considered least effective, with the aim of reducing LOAEL exceedances at receptors in Cubbington. However modelling showed that Option 1 had little effect. Analysis showed that compared with the ES there would be no change in the number of receptors above LOAEL. Option 1 is therefore not recommended..

A summary analysis of the mitigation scenarios considered for the Cubbington to Stonehouse assessment area is presented in Table 2.

Option 0 is the recommended design solution as other candidate mitigation option has only little influence. From Figure 1 it can be seen that throughout the majority of the Cubbington to Stonehouse assessment area the Proposed Scheme is contained within cutting which already provides effective noise attenuation and which limits the effectiveness of additional mitigation.

Table 2. Option appraisal summary table

Scenario	Description	Noise benefit to relative cost[1]	Noise Material Change[2]	Engineering Constraints	Environmental Implication[3]	Consultation / Stakeholder[4]
ES design [comparison Design]	~	~	~	~	~	Petitions from local stakeholders received.
Option 0	Consolidated Design. No additional mitigation other than that provided other characteristics of scheme design	~	~ No change in number of receptors exposed to daytime and night-time L_{pAeq} LOAEL but marginally more receptors above night-time L_{pAFmax} LOAEL. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 1	As Option 0 but with 2m high, 200m long barrier	✓	~ No change in number of receptors exposed to daytime and night-time L_{pAeq} LOAEL but marginally more receptors above night-time L_{pAFmax} LOAEL. No material change.	No additional constraints	× Increased visual impact	Further stakeholder engagement req'd.

1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

5. METHODOLOGY

Calculation Methodology

Appendix B sets out the technical methodology for the prediction of airborne noise from operational trains in detail.

Airborne noise from the operational railway has been assessed according to the HS2 methodology which requires predictions of noise emission from five discrete sources at different heights above the top of the rail to represent the sources of noise associated with High-Speed Rail. The total noise emission from the train is calculated from the sum of contribution of these sources, individually corrected for propagation to the assessment location. The methodology includes corrections to account for future rolling stock being quieter than current TSI-compliant trains and to allow representation of an individual track to better allow for divergence of the up and down tracks. Two tracks have been accounted for in the calculations.

Airborne noise from altered roads

Airborne noise from altered roads has been calculated and assessed in accordance with the methodology set out in the Calculation of Road Traffic Noise (CRTN) and the updated procedure in the Design Manual for Roads and Bridges (DMRB).

Assessment Methodology

In accordance with the information paper E20 and the EIA methodology, the impact of The Design is assessed against:

- The number of residential properties exceeding the Lowest Observed Adverse Effect Level (LOAEL);
- The number of residential properties exceeding the Significant Observed Adverse Effect Level (SOAEL);
- The number of residential properties with noise impacts;
- The number of properties eligible for noise insulation; and
- The number of non-residential properties with noise impacts, although none of these are considered sensitive.

The outcomes of this assessment are presented in Section 7.

6. ASSUMPTIONS

The assumptions for the assessments can be seen in Appendix C of this report. These include the available information at this stage of the design. For the operational railway these are assumed train service patterns, track form, rolling stock parameters and noise sources, and planned operational train speeds; for civil engineering assets the design of noise barriers and other mitigating devices.

The validation of the methodology and potential uncertainty is described below.

Uncertainties and Limitations

The Train Noise Prediction Method (TNPM) was originally validated against a large number of high-speed train noise measurements covering a broad range of scenarios, including propagation over flat ground up to distances of 800m from the railway, effects of screening (including reflective and absorptive barriers) and varying angles of view. The overall regression analyses gave a standard error, for the goodness of fit between predicted and measured levels of approximately 3dB(A) for SEL and L_{pAFmax}. This means that the difference between predicted and measured sound levels is typically within ±3dB(A). Consistent with the Hybrid Bill Scheme the mean levels predicted with TNPM are presented in this report.

Any source of noise that could occur, or any mitigation that is installed or constructed to control noise and/or vibration but is not subject to an acoustic specification / standard requires an assumption. Such assumptions are defined when taking into consideration the likely application of existing technology with reference to the probability of the noise and/or vibration occurring. This includes reference to sensitivity tests and regression analysis between predicted and measured levels such as those presented in Appendix SV-001-000: Annex D2 of the ES and set out in the methodology section of this report. Assumptions in all reasonably foreseeable circumstances are taken on a reasonable worst case. As such, under the majority of operating conditions, lower noise levels than those predicted in this assessment would be expected.

7. RESULTS

The proposed mitigation design was described in Section 3. Predicted noise levels for the proposed design at the assessment locations shown in Figure 1 are presented in Table 3.

Noise levels predicted for the proposed Noise Mitigation Design (Option 0, titled 'The Design' in the tables) described in Section 3 are provided in Table 3 and Table 4 for L_{pAeq} and L_{pAFmax} respectively, as well as the noise levels calculated in the Phase 1 ES and those that would be experienced for the proposed civil engineering assets design without any additional noise barrier (named 'No Mitigation'). Where no additional mitigation is proposed beyond the scheme as presented, then values under 'No Mitigation' will be the same as those under 'The Design' as is the case here. Tabulated values are provided only where LOAEL has been exceeded at an assessment location in any category. Calculations for all assessment locations, irrespective of level are presented in Table 13 and Table 14.

These tables show the noise levels due to Proposed Scheme only (operational railway and altered roads) and also the Do Something noise levels by combining Proposed Scheme noise levels and Baseline noise levels, for the cases mentioned above, namely:

- the ES design (after SES & APs);
- the No Mitigation design (current design of civil engineering assets without any additional noise barrier); and
- the Design (mitigation option 0).

The receptor IDs correspond to those used in the Phase 1 ES study, to allow for direct comparison. This is the case for receptor IDs that represent individual receptor locations as well as groups of receptors. All values reported in tables are rounded to the nearest decibel.

Receptor locations where noise levels (for Proposed Scheme Only) are at or above LOAEL (as defined in Appendix A) are shaded in blue in Table 3 and Table 4.

All noise levels presented in the tables below are free-field and include the following:

- Daytime noise level $L_{pAeq,07:00\text{-}23:00}$ denoted *;
- Night-time noise level $L_{pAeq,23:00 - 07:00}$ denoted **; and
- Maximum noise levels due to HS2 trains $L_{pAF,max}$ denoted *, in the Proposed Scheme only column; the value is always for the HS2 conventional compatible train (CC).

The following points are also noted:

- Where the Proposed Scheme modifies an existing source, i.e. road or railway realignments, the Proposed Scheme only level in the table includes the sound from the modified source. In this situation the Do something level (Opening

year baseline + Year 15 traffic, denoted ***) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment.

- The Proposed-Scheme-Only noise levels are calculated assuming Year 15 traffic;
- The Do-Nothing noise levels correspond to expected Opening year baseline sound levels;
- The Do-Something noise levels are determined as the combination of Opening year baseline sound levels and noise levels due to the Proposed Scheme for Year 15 traffic;
- Receptor label G is for: (G1) theatres, large auditoria and concert halls, (G2) sound recording and broadcast studios, (G3) places of meeting for religious worship, courts, cinemas, lecture theatres, museums and small auditoria or halls, (G4) schools, colleges, hospitals, hotels and libraries, and (G5) offices and general commercial premises; and
- Receptor label R denotes residential properties.

Table 3. Noise level summary of The Design compared to the ES Design (L_{pAeq})

Assessment location - *Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL*				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something***		No Mitigation Proposed Scheme only		No Mitigation Do Something***		The Design Proposed Scheme only		The Design Do Something***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
212346	Leicester Lane, Leamington Spa	R	5	51	50	49	41	52	50	48	40	52	50	48	40	52	50
213490	Pinehurst, Cubbington	R	6	59	47	50	43	59	47	51	44	59	47	51	44	59	47
213631	Rugby Road, Cubbington	R	19	59	47	48	41	59	47	50	42	59	47	50	42	59	47
216690	Coventry Road, Cubbington	R	1	48	35	50	40	51	40	50	41	51	41	50	41	51	41
216902	Leicester Lane, Cubbington	R	4	65	56	61	52	61	52	62	53	63	53	62	53	63	53
220383	Leicester Lane, Stoneleigh	R	3	45	41	53	45	53	45	54	45	54	46	54	45	54	46
220450	Leicester Lane, Cubbington	R	1	65	56	59	51	63	54	59	50	64	54	59	50	64	54
221368	Coventry Road, Kenilworth	R	1	48	35	52	43	53	43	53	43	53	43	53	43	53	43
234564	Rugby Road, Cubbington	R	4	59	47	59	47	59	47	60	49	60	49	60	49	60	49

* Day denotes $L_{pAeq,07:00-23:00}$
** Night denotes $L_{pAeq,23:00-07:00}$

*** Do something level (Opening year baseline + Year 15 traffic, denoted ***) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment

Table 4. Noise level summary of the Design and ES Design for mitigated and non-mitigated cases (L_{pAFmax})

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L_{pAFmax} dB	L_{pAFmax} * dB	L_{pAFmax} * dB	L_{pAFmax} * dB
212346	Leicester Lane, Leamington Spa	R	5	65	59	59	59
213190	Coventry Road, Cubbington	R	17	64	57	58	58
213490	Pinehurst, Cubbington	R	6	55	61	61	61
213631	Rugby Road, Cubbington	R	19	55	61	61	61
213706	Cotton Mill Spinney, Cubbington	R	10	57	60	59	59
213764	Thorn Stile Close, Cubbington	R	8	54	62	62	62
213855	Three Cornered Close, Cubbington	R	14	59	61	61	61
213956	Cotton Mill Spinney, Cubbington	R	30	54	59	57	57
214082	Church Lane, Cubbington	R	3	55	58	55	55
214243	The Grange, Cubbington	R	11	48	56	58	58
216179	Pinehurst, Cubbington	R	8	47	57	58	58
216265	Church Hill, Cubbington	R	10	36	58	58	58
216343	Austen Court, Cubbington	R	14	37	60	60	60
216416	Church Hill, Cubbington	R	3	31	58	58	58
216690	Coventry Road, Cubbington	R	1	46	65	64	64
216902	Leicester Lane, Cubbington	R	4	72	80	82	82
220383	Leicester Lane, Stoneleigh	R	3	50	66	68	68
220450	Leicester Lane, Cubbington	R	1	72	75	72	72
221368	Coventry Road, Kenilworth	R	1	46	65	66	66
234521	Rugby Road, Weston Under Wetherley	R	2	40	55	58	58
234564	Rugby Road, Cubbington	R	4	55	67	71	71
234681	Rugby Road, Cubbington	R	2	60	59	62	62

* $L_{pAF,max}$ in the 'Proposed Scheme only' columns; the value is always for the HS2 conventional compatible train (CC)

The number of residential receptors predicted to exceed LOAEL and SOAEL for the proposed mitigation design and for the ES are presented in Table 5. Change classification of impacts is presented in Table 6 and exceedances for non-residential receptors is presented in Table 7.

It can be seen from Table 5 that compared with the ES there are no increases in the number of receptors exceeding LOAEL and the numbers are identical to the ES for the daytime and at night. There is, however, a small increase in L_{pAFMax} LOAEL exceedances at night-time. Table 6 shows there is no change in the numbers of receptors within the impact classifications compared with the ES. The moderate and minor impacts that have been identified occur at relatively isolated properties away from the main part of the community of Cubbington.

Table 5. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design

	> LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	20	44	139	0	0	4
ES Design	20	44	134	0	0	4

Table 6. Number of major, moderate and minor residential impacts due to The Design and the ES Design

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	4	2	1	3
ES Design	0	0	4	2	1	3

Table 7 shows that although one non-residential receptor is exposed to noise above the noise impact level, the noise level changes between Do Something and Do Nothing (i.e. the change due to HS2) at this receptor means that this is not a significant adverse effect.

Table 7. Number of non-residential receptors that exceed the noise impact levels

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	1	0	0	0
ES Design	1	0	0	0

8. CONCLUSIONS

The report demonstrates that all reasonable steps have been taken to ensure that the predicted cumulative airborne noise from altered roads and operational railways, in all foreseeable practical circumstances, does not exceed lowest adverse effect levels. Where it has not been reasonably practicable to achieve this objective, the report shows how airborne noise has been reduced as far as reasonably practicable. The mitigation has been assessed as far as reasonably practicable at this stage of the design process and has been shown to result in effects within the scope of those reported in the HS2 ES. As such the report complies with the requirements of planning forum notes 10 and 14.

Appendix A – LOAEL and SOAEL values from Information Paper E20

The below tables outline the applicable LOAEL and SOAEL values, and design objectives from Information Paper E20.

Table 8. Noise effect levels for permanent residential buildings from the operation of altered roads and railway

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 9. Noise impact levels for noise sensitive non-residential buildings and external amenity spaces from the operation of altered roads and railway

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

Appendix B – Detailed Technical Methodology

Airborne Noise from the Operational Railway

Rail noise modelling has been undertaken using the NoiseMap software package. This implements the airborne noise calculation methodology (commonly referred to as the Train Noise Prediction Model (TNPM)). This validated methodology has been used for the HS2 Environmental Statement and, prior to that, the detailed design of the Channel Tunnel Rail Link (HS1). The method to predict airborne sound from operation has modelled the propagation including the following effects: topography, ground type, reflections, shielding by barriers and buildings, air absorption, and meteorology.

The TNPM methodology allows for sources of varying heights to be put onto the same track segments. Figure 3 shows the heights of the five sources defined as distances above rail. The source terms which have been used for each of these source contributions are set out in Appendix C.

Figure 3. Train noise sources

The speed dependence relationships for each of the above sources, in terms of SEL, which is used to predict $L_{pAeq,T}$ at the receptors, are:

R_{SEL} + $20\log_{10}V$ for rolling sound;

B_{SEL} + $60\log_{10}V$ for body aerodynamic sound;

S_{SEL} - $10\log_{10}V$ for starting sound (V < 250 kph); and

P_{SEL} + $60\log_{10}V$ for pantograph and pantograph recess sound.

where R_{SEL} is the source term for rolling sound, B_{SEL} is the source term for body aerodynamic sound, S_{SEL} is the source term for starting sound and P_{SEL} is the source term for pantograph and pantograph recess sound and V is the train speed in kph. S_{SEL} is not applicable for predictions of airborne noise when train speeds are 250 kph or above.

The speed dependence relationships for each of the above sources, in terms of L_{pAFmax} are:

$R_{LpAF,max}$ + $30\log_{10}V$ for rolling sound;

$B_{LpAF,max}$ + $70\log_{10}V$ for body aerodynamic sound;

$S_{LpAF,max}$ for starting sound; and

$P_{LpAF,max}$ + $70\log_{10}V$ for pantograph and pantograph recess sound.

where $R_{LpAF,max}$ is the source term for rolling maximum sound, $B_{LpAF,max}$ is the source term for body aerodynamic maximum sound, $S_{LpAF,max}$ is the source term for starting sound and $P_{LpAF,max}$ is the source term for pantograph and pantograph recess maximum sound and V is the train speed in kph.

To account for the differing source heights resulting in different distance attenuation, ground absorption and shielding the calculations for propagation from source to receptors have been undertaken for each source individually for both $L_{pAeq,T}$ and $L_{pAF,max}$ calculations. $L_{pAeq,T}$ will be logarithmically summed at the receptor location to provide a single figure value and $L_{pAF,max}$ will be summed in accordance with Equation 1 at the receptor location to provide a single figure value.

$$L_{pAFmax}=MAX[(R_{LpAF,max} \oplus B_{LpAF,max} \oplus S_{LpAF,max}) , (R_{LpAF,max} \oplus P_{LpAF,max} \oplus S_{LpAF,max})] \quad \text{(Equation 1)}$$

Where $\oplus$ is the symbol for logarithmical addition of values.

Predictions of airborne sound take into account the acoustic performance of civil engineering assets, trackwork and trains throughout the life of the operational railway

with a maintenance programme agreed with HS2 and thereby account for all reasonably foreseeable circumstances in accordance with HS2 Information Paper E20.

Predictions of airborne sound from existing conventional railways unaltered by the proposed scheme and construction railways have been made in accordance with the technical memorandum, the Calculation of Railway Noise (CRN), the CRN Supplement 1 and the AEAT supplementary sources terms. This will include source terms and rolling noise corrections as specified by the CRN methodology.

Airborne Noise from Altered Roads

Airborne noise from altered roads has been calculated in accordance with the methodology set out in the Calculation of Road Traffic Noise (CRTN) and assessed in accordance with the updated procedure in the Design Manual for Roads and Bridges (DMRB).

When there have been no significant changes since the ES study, results from road noise calculations from roads altered by the scheme presented for the ES have been utilised. This data will be updated as further information comes available.

Noise levels used in the assessment

The baseline (Do-Nothing) noise level is the LAeq for the daytime or night-time as reported in the CFA report of the ES and amended by the APs/SESs.

There are three values for the noise level due to HS2 traffic: the daytime L_{Aeq}, the night-time L_{Aeq} and the L_{AFmax}. The daytime L_{Aeq} is a combination of noise from the HS2 trains calculated using NoiseMap for the daytime service pattern and source terms, added to the noise from the daytime L_{Aeq} for altered links at a receptor. A similar calculation is carried out for night-time L_{Aeq} values using a combination of night-time L_{Aeq} for the HS2 trains combined with the night-time L_{Aeq} for altered links. The L_{AFmax} traffic noise is the maximum L_{AFmax} for the night-time service pattern for the HS2 sources using the same methodology as set out in the ES. The daytime/ night-time HS2 traffic L_{Aeq} and the L_{AFmax} for residential receptors are compared with the respective LOAEL and SOAEL values for dwellings as set out in Information Paper E20, Control of airborne noise from altered roads and the operational railway and which are also set out in Appendix A.

Do-Something levels are the noise levels with HS2. There are three values for Do-Something: the daytime L_{Aeq}, the night-time L_{Aeq} and the L_{AFmax}. The daytime L_{Aeq} is a combination of the daytime Do-Nothing L_{Aeq} less the associated daytime L_{Aeq} contribution from the links that are to be altered, the daytime L_{Aeq} from the trains, and

the daytime L_{Aeq} from the altered links. The night-time Do-Something level is calculated in a similar way but using the night-time levels in each case. The Do-Something L_{AFmax} is the same as the HS2 traffic L_{AFmax}. The correction applied when the scheme modifies a link, involving the subtraction of the noise that would be altered by HS2 is done so as not to double count the sound associated with the link on its new and existing alignment.

For the ES cases, the values used in calculations for Do-Nothing, HS2 traffic and Do-Something are as reported in the CFA report of the ES updated where appropriate by the APs or SESs. For the proposed design, noise from the HS2 trains is calculated using NoiseMap for the daytime service pattern in Table 11 and source terms given in Table 12. In both cases where receptors have multiple assessment heights, the maximum value corresponding to HS2 traffic is used in the subsequent analysis.

Classification of impact

The Do-Something noise levels are compared with the Do-Nothing noise levels for the daytime and night-time. These differences are classified as major, minor, moderate, negligible, or beneficial as set out below. The number of major, moderate and minor impacts are reported in Table 10.

Table 10. Classification of noise impact

Do-Something less Do-Nothing	Impact classification
10dB or more	Major
5dB to 9.9dB	Moderate
3dB to 4.9dB	Minor
0dB to 2.9dB	Negligible
<0dB	Beneficial

On a precautionary basis the design exercise has therefore considered mitigation for all receptors that would be exposed to noise at or above LOAEL (not just above LOAEL) with calculations carried out to the nearest 0.1dB. The summary tables set out below for the Design and ES comparison present noise levels rounded to the nearest 1dB as presented in the Community Forum Area reports for consistency and assessment locations are highlighted only when the unrounded levels are equal to or exceed LOAEL.

Relevant U&As

When considering candidate mitigation any U&As setting out required noise levels, mitigation types or heights etc. are also considered and over-ride any barrier height reduction that could otherwise be achieved through noise control identified as reasonably practicable by considering the monetary benefit of noise reduction compared to cost and other influencing factors.

Non-residential receptors

The noise impacts on non-residential receptors are calculated and reported. When the HS2 traffic noise exceeds the noise impact levels, professional judgement is used to determine if a new significant adverse effect arises, and includes factors such as whether a significant adverse effect was reported at the time of the ES and SES and the baseline noise level at the receptor.

Appendix C – Assumptions

Rail modelling assumptions

The HS2 rolling stock and service pattern is made up of two train fleets:

Phase 1 fleet will be made up of Conventional Compatible (CC) trains that can run on both the High Speed and the classic rail network, and

Phase 2b fleet will be made up of Captive (CP) trains that are dedicated to the High Speed network.

The one-way train service pattern data is summarised in Table 11 and train source data in Table 12, normalised to 200m long trains.

Table 11. Train flow data

Scheme	Train	Daytime Flow, 16h 07:00 – 23:00	Night-time Flow, 8h 23:00 – 07:00
Phase 1 Year 15 Flows	CC (360kph)	22	1
	CC (330kph)	191	12
	CP (360kph)	22	1
	CP (330kph)	222	13

Table 12. Train source data

Source	SEL dB at 25m		$L_{pAF,max}$ dB at 25m	
	Conventional Compatible train	Captive train	Conventional Compatible train	Captive train
Rolling	92	92	89	89
Body Aerodynamic	92	90	89	87
Start-up / Power	74	74	73	73
Pantograph Well	n/a	n/a	n/a	n/a
Raised Pantograph	76	76	78	78

Note: Sound emissions from each train running at 320kph on assumed HS2 infrastructure, expressed in terms of the SEL and L_{pAFmax} 25 m from nearest track and 3.5m above ground

Where swing nose crossovers were envisaged in the ES, no correction to the rolling sound source term was applied. For other crossovers a correction factor of +2.5dB

defined in CRN was applied to the affected track segments when predicting airborne noise from the railway.

A +1dB correction has been applied to track sections on viaducts.

Noise from porous portals

Train sources (rail/wheel interface, body aerodynamic, start-up, and pantograph) will continue to produce noise while within a tunnel/ porous portal and some of this will be transmitted into the community through the openings on the roof of the porous portal and at the open end of the porous portal. Noise contribution from these sources has been considered by retaining the track length within the porous portals with a 10dB attenuation and positioning the source at the top of the porous portal. This is the same assumption as was made at the time of the ES.

Appendix D - Calculation results at all receptors

Table 13 and Table 14 show the predicted L_{pAeq} noise levels for the daytime and night-time, and predicted L_{pAFmax} noise levels respectively. The information in these tables is similar to the results presented within the main body of the report except that noise levels in this appendix are reported for all assessment locations as opposed to only for assessment locations where LOAEL is exceeded.

Table 13. Noise level summary of the Design compared to the ES Design – all levels are $L_{pAeq,T}$

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
212346	Leicester Lane, Leamington Spa	R	5	51	50	49	41	52	50	48	40	52	50	48	40	52	50
213140	Cross Lane, Cubbington	R	17	55	45	37	28	55	45	39	30	55	45	39	30	55	45
213190	Coventry Road, Cubbington	R	17	58	53	44	36	58	53	44	36	58	53	44	36	58	53
213190	Coventry Road, Cubbington (Car Dealer)	G5	1	58	53	44	36	58	53	44	36	58	53	44	36	58	53
213190	Walsh House, Coventry Road, Cubbington (Office)	G5	1	58	53	44	36	58	53	44	36	58	53	44	36	58	53
213309	Rugby Road, Cubbington	R	18	59	58	43	35	59	58	43	35	59	58	43	35	59	58
213416	Rugby Road, Cubbington	R	26	65	64	40	31	65	64	42	34	65	64	42	34	65	64
213490	Pinehurst, Cubbington	R	6	59	47	50	43	59	47	51	44	59	47	51	44	59	47
213631	Rugby Road, Cubbington	R	19	59	47	48	41	59	47	50	42	59	47	50	42	59	47
213706	Cotton Mill Spinney, Cubbington	R	10	54	51	47	39	54	51	47	38	55	51	47	38	55	51
213706	Waverley Equestrian Training Centre, Coventry Road, (Training)	G4	1	54	51	47	39	54	51	47	38	55	51	47	38	55	51
213764	Thorn Stile Close, Cubbington	R	8	46	43	48	39	49	44	48	40	49	44	48	40	49	44

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
213855	Three Cornered Close, Cubbington	R	14	58	48	47	38	58	48	48	40	58	48	48	40	58	48
213956	Cotton Mill Spinney, Cubbington	R	30	50	40	45	36	51	41	45	37	51	41	45	37	51	41
213956	Coventry Road, Cubbington (Office)	G5	1	50	40	45	36	51	41	45	37	51	41	45	37	51	41
214082	Church Lane, Cubbington	R	3	59	47	42	33	59	47	42	34	59	47	42	34	59	47
214129	New Street, Cubbington	R	7	48	41	42	34	48	41	42	34	49	41	42	34	49	41
214169	The Grange, Cubbington	R	19	37	33	42	35	42	35	43	35	43	36	43	35	43	36
214212	The Grange, Cubbington	R	8	45	38	41	33	46	39	44	35	47	39	44	35	47	39
214243	The Grange, Cubbington	R	11	45	38	41	33	46	39	43	35	47	39	43	35	47	39
214280	Cross Lane, Cubbington	R	15	51	41	40	32	51	42	42	34	51	41	42	34	51	41
214747	Hillcrest, Leamington Spa	R	25	61	47	38	30	61	47	40	31	61	47	40	31	61	47
214812	High Street, Cubbington	R	18	61	47	37	29	61	47	39	31	61	47	39	31	61	47
214812	Cubbington Brewery, Queen Street, Cubbington (Brewery)	G5	1	61	47	37	29	61	47	39	31	61	47	39	31	61	47
214812	Queen Street, Cubbington (Shopping)	G5	1	61	47	37	29	61	47	39	31	61	47	39	31	61	47
215041	Ladycroft, Leamington Spa	R	35	61	47	38	29	61	47	39	31	61	47	39	31	61	47

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
215309	New Street, Cubbington	R	15	48	41	39	30	48	41	41	32	49	41	41	32	49	41
215365	Knightley Close, Leamington Spa	R	35	56	42	38	30	56	42	40	32	56	42	40	32	56	42
215404	Price Road, Leamington Spa	R	53	51	41	38	29	51	41	40	31	51	41	40	31	51	41
215612	Broadway, Leamington Spa	R	52	59	59	40	32	59	59	41	33	59	59	41	33	59	59
215612	Cubbington Village Hall, Broadway, Cubbington (Hall)	G3	1	59	59	40	32	59	59	41	33	59	59	41	33	59	59
215919	Broadway, Leamington Spa	R	33	55	45	41	32	55	45	42	34	55	45	42	34	55	45
215976	Broadway, Leamington Spa	R	51	56	42	39	31	56	42	41	32	56	42	41	32	56	42
215976	High Street, Cubbington, (General Commercial)	G5	1	56	42	39	31	56	42	41	32	56	42	41	32	56	42
215976	Queen Street, Cubbington (Shopping)	G5	1	56	42	39	31	56	42	41	32	56	42	41	32	56	42
215976	Queen Street, Cubbington (Shopping)	G5	1	56	42	39	31	56	42	41	32	56	42	41	32	56	42
216179	Pinehurst, Cubbington	R	8	50	40	41	32	51	41	42	34	51	41	42	34	51	41
216265	Church Hill, Cubbington	R	10	53	36	41	33	53	36	43	34	53	37	43	34	53	37
216265	St. Mary's Church, Cubbington, (Church)	G3	1	53	36	41	33	53	36	43	34	53	37	43	34	53	37

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
216343	Austen Court, Cubbington	R	14	43	33	45	36	45	36	46	36	46	36	46	36	46	36
216416	Church Hill, Cubbington	R	3	45	28	42	33	46	33	43	34	47	34	43	34	47	34
216416	Cubbington Church Of England Primary School, Church Hill, (Primary School)	G4	1	45	28	42	32	46	32	43	34	47	34	43	34	47	34
216506	New Street, Cubbington	R	18	58	41	40	32	58	41	41	33	58	41	41	33	58	41
216690	Coventry Road, Cubbington	R	1	48	35	50	40	51	40	50	41	51	41	50	41	51	41
905000	Oakdene Day Nursery, Coventry Road (Nursery)	G4	1	48	35	50	42	51	42	43	36	48	36	43	36	48	36
216902	Leicester Lane, Cubbington	R	4	65	56	61	52	61	52	62	53	63	53	62	53	63	53
220383	Leicester Lane, Stoneleigh	R	3	45	41	53	45	53	45	54	45	54	46	54	45	54	46
220450	Leicester Lane, Cubbington	R	1	65	56	59	51	63	54	59	50	64	54	59	50	64	54
221368	Coventry Road, Kenilworth	R	1	48	35	52	43	53	43	53	43	53	43	53	43	53	43
234521	Rugby Road, Weston Under Wetherley	R	2	44	32	42	33	46	35	43	34	47	36	43	34	47	36
234564	Rugby Road, Cubbington	R	4	59	47	59	47	59	47	60	49	60	49	60	49	60	49
234564	Cubbington Wood Yard, Rugby Road (General Commercial)	G5	1	59	47	59	51	59	51	60	49	60	49	60	49	60	49

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
234577	Rugby Road, Weston Under Wetherley	R	1	49	37	39	31	49	37	40	32	49	38	40	32	49	38
234674	Rugby Road, Weston Under Wetherley	R	1	54	42	38	30	54	42	39	31	54	42	39	31	54	42
234674	Grove Rise, Rugby Road, Weston Under Wetherley (Office)	G5	1	54	42	38	30	54	42	39	31	54	42	39	31	54	42
234681	Rugby Road, Cubbington	R	2	64	52	46	38	64	52	47	39	64	52	47	39	64	52

* Day denotes $L_{pAeq,07:00-23:00}$

** Night denotes $L_{pAeq,23:00-07:00}$

*** Do something level (Opening year baseline + Year 15 traffic, denoted ***) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment

Table 14. Noise level summary of the Design compared to the ES Design – all levels are L_{pAFMax}

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L_{pAFmax} dB	L_{pAFmax}* dB	L_{pAFmax}* dB	L_{pAFmax}* dB
212346	Leicester Lane, Leamington Spa	R	5	65	59	59	59
213140	Cross Lane, Cubbington	R	17	43	52	52	52
213190	Coventry Road, Cubbington	R	17	64	57	58	58
213190	Coventry Road, Cubbington (Car Dealer)	G5	1	64	57	58	58
213190	Walsh House, Coventry Road, Cubbington (Office)	G5	1	64	57	58	58
213309	Rugby Road, Cubbington	R	18	68	55	55	55
213416	Rugby Road, Cubbington	R	26	69	56	56	56
213490	Pinehurst, Cubbington	R	6	55	61	61	61
213631	Rugby Road, Cubbington	R	19	55	61	61	61
213706	Cotton Mill Spinney, Cubbington	R	10	57	60	59	59
213706	Waverley Equestrian Training Centre, Coventry Road, (Training)	G4	1	57	60	59	59
213764	Thorn Stile Close, Cubbington	R	8	54	62	62	62
213855	Three Cornered Close, Cubbington	R	14	59	61	61	61
213956	Cotton Mill Spinney, Cubbington	R	30	54	59	57	57
213956	Coventry Road, Cubbington (Office)	G5	1	54	59	57	57
214082	Church Lane, Cubbington	R	3	55	58	55	55
214129	New Street, Cubbington	R	7	51	56	56	56
214169	The Grange, Cubbington	R	19	43	56	56	56
214212	The Grange, Cubbington	R	8	48	56	57	57
214243	The Grange, Cubbington	R	11	48	56	58	58
214280	Cross Lane, Cubbington	R	15	41	55	55	55
214747	Hillcrest, Leamington Spa	R	25	68	54	54	54
214812	High Street, Cubbington	R	18	68	53	54	54
214812	Cubbington Brewery, Queen Street, Cubbington (Brewery)	G5	1	68	53	54	54
214812	Queen Street, Cubbington (Shopping)	G5	1	68	53	54	54
215041	Ladycroft, Leamington Spa	R	35	68	53	53	53

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L_{pAFmax} dB	L_{pAFmax}* dB	L_{pAFmax}* dB	L_{pAFmax}* dB
215309	New Street, Cubbington	R	15	51	54	55	55
215365	Knightley Close, Leamington Spa	R	35	63	54	55	55
215404	Price Road, Leamington Spa	R	53	41	52	54	54
215612	Broadway, Leamington Spa	R	52	64	55	55	55
215612	Cubbington Village Hall, Broadway, Cubbington (Hall)	G3	1	64	55	55	55
215919	Broadway, Leamington Spa	R	33	48	57	57	57
215976	Broadway, Leamington Spa	R	51	63	55	55	55
215976	High Street, Cubbington, (General Commercial)	G5	1	63	55	55	55
215976	Queen Street, Cubbington (Shopping)	G5	1	63	55	55	55
215976	Queen Street, Cubbington (Shopping)	G5	1	63	55	55	55
216179	Pinehurst, Cubbington	R	8	47	57	58	58
216265	Church Hill, Cubbington	R	10	36	58	58	58
216265	St. Mary's Church, Cubbington, (Church)	G3	1	36	58	58	58
216343	Austen Court, Cubbington	R	14	37	60	60	60
216416	Church Hill, Cubbington	R	3	31	58	58	58
216416	Cubbington Church Of England Primary School, Church Hill, (Primary School)	G4	1	31	58	58	58
216506	New Street, Cubbington	R	18	38	55	56	56
216690	Coventry Road, Cubbington	R	1	46	65	64	64
216690	Oakdene Day Nursery, Coventry Road (Nursery)	G4	1	46	65	64	64
216902	Leicester Lane, Cubbington	R	4	72	80	82	82
220383	Leicester Lane, Stoneleigh	R	3	50	66	68	68
220450	Leicester Lane, Cubbington	R	1	72	75	72	72
221368	Coventry Road, Kenilworth	R	1	46	65	66	66
234521	Rugby Road, Weston Under Wetherley	R	2	40	55	58	58
234564	Rugby Road, Cubbington	R	4	55	67	71	71

Assessment location - Note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L_{pAFmax} dB	L_{pAFmax}* dB	L_{pAFmax}* dB	L_{pAFmax}* dB
234564	Cubbington Wood Yard, Rugby Road (General Commercial)	G5	1	55	67	71	71
234577	Rugby Road, Weston Under Wetherley	R	1	45	53	54	54
234674	Rugby Road, Weston Under Wetherley	R	1	50	50	53	53
234674	Grove Rise, Rugby Road, Weston Under Wetherley (Office)	G5	1	50	50	53	53
234681	Rugby Road, Cubbington	R	2	60	59	62	62

* denotes L_{pAFmax} in the 'Proposed Scheme only' column; the value is always for the HS2 conventional compatible train (CC)