M4 junctions 3 to 12 smart motorway

Enhanced Noise Mitigation Study

Document No: 514451-MUH-00-ZZ-RP-EN-400158

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Limitations

All limitations in line with the Highways England Project Support Framework (Consultancy) 2011 – 2015

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CONTENTS:

1 INTRODUCTION

1.1 The effects of the Scheme on the noise environment in the vicinity of the Scheme between junctions 3 and 12 of the M4 motorway has been reported in Chapter 12 of the Environmental Statement ("ES") for the Scheme (Application Document Reference 6-1, APP-152). That assessment identified measures to mitigate the noise effects of the Scheme, namely low noise surfacing across all lanes and a number of new noise barriers. The heights and extents of the new noise barriers are defined in Table 12.2.1 of Appendix 12.2 of the ES (Application Document Reference 6-3, APP-348). The locations and extents of existing noise barriers and these new noise barriers are provided in Drawing 12.2 (Application Document Reference 6-2, APP 257-260).

1.2 The noise and vibration assessment, as reported in Chapter 12 of the ES (Application Document Reference 6-1, APP-152), is for the Scheme with the mitigation in place. That assessment demonstrates that the magnitude of impact for the Scheme is minor beneficial in the short-term and negligible in the long-term. The significance of effect for the operation of the Scheme is assessed as slight beneficial in the short-term and neutral in the long-term, with the vast majority of the Scheme corridor experiencing negligible or minor reductions in noise levels with the Scheme in operation (see paragraph 12.4.110 of the ES). These noise reductions are shown in Drawing 12.4 for the short-term, and in Drawing 12.5 for the long-term (Application Document Reference 6-2, APP 265-272).

1.3 However, in compliance with the requirements of the National Networks National Policy Statement ("NN NPS") at paragraphs 3.2 and 5.195 (bullet point 3), it is noted in paragraph 12.4.112 of the ES that there is the potential to improve further the noise climate within the Scheme corridor. A qualitative appraisal of an enhanced noise mitigation study to achieve this is provided in Appendix 12.5 of the ES (Application Document Reference 6-3, APP-351). This enhanced mitigation strategy comprises the provision of additional noise barriers and the replacement of some existing noise barriers with higher noise barriers.

1.4 This report presents the results of a quantitative assessment of this enhanced mitigation study.

2 APPROACH AND ASSESSMENT CRITERIA

2.1 In paragraph 5.193, the NN NPS states that developments must be undertaken in accordance with statutory requirements for noise and that due regard must have been given to the relevant sections of the Noise Policy Statement for England (“NPSE”), the National Planning Policy Framework (“NPPF”) and the Government’s associated planning guidance on noise.

2.2 The NPSE sets out the long term vision of the government’s noise policy, which is to “promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development”.

2.3 This long-term vision is supported by three aims:

a) avoid significant adverse impacts on health and quality of life;

b) mitigate and minimise adverse impacts on health and quality of life; and

c) where possible, contribute to the improvements of health and quality of life.

2.4 The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

2.5 The 'Explanatory Note' within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects', using the following concepts:

a) No Observed Effect Level ("NOEL") - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;

b) Lowest Observable Adverse Effect Level ("LOAEL") - the level above which adverse effects on health and quality of life can be detected; and

c) Significant Observed Adverse Effect Level ("SOAEL") - the level above which significant adverse effects on health and quality of life occur.

2.6 The NPSE recognises that "it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, for different receptors and at different times of the day".

2.7 The Night Noise Guidelines for Europe define the LOAEL at 40 dB $L_{Aeq,8h}$ (free field), necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise. However, it is recognized in the Guidelines that many people are exposed to noise levels above this value and the Guidelines therefore recommend an interim target of 55 dB $L_{Aeq,8h}$ (free field). All EU Member States are encouraged to gradually reduce the proportion of the population exposed to levels above the interim target within the context of meeting wider sustainable development objectives.

2.8 As the entire detailed study area was found to be above the daytime and night time LOAEL, the enhanced noise mitigation is focussed on those residential areas which would experience noise levels equal to or above the daytime or night-time SOAEL with the Scheme in operation. That is, those residential areas subject to the highest noise levels. Of course, providing noise reductions to these areas will also provide some noise reductions to adjacent areas subject to noise levels between the LOAEL and SOAEL.

2.9 For daytime (07:00 to 23:00), the SOAEL is set at 63 dB $L_{Aeq,16h}$ (free field). This is equivalent to 68 dB $L_{A10,18h}$ (façade), which is consistent with the daytime trigger level for noise insulation in the Noise Insulation (Amendment) Regulations 1988 ("NIR"). For night-time (23:00 to 07:00), the SOAEL is set at 55 dB $L_{Aeq,8h}$ (free field). This aligns with the interim night-time outdoor target level provided in the Night Noise Guidelines for Europe.

2.10 There is general consensus among acoustic consultants and Local Authority Environmental Health Officers that these values for daytime and night-time SOAEL are applicable for the effects of road traffic noise. Examples of this approach are the A14 Cambridge to Huntingdon Improvement DCO, HS2 Operational Noise Environmental Statement and, for night-time SOAEL values, guidance from Birmingham City Council.

2.11 The 3D computer model for the Scheme, the outputs of which were reported in the ES, was employed to provide contour plots of the daytime and night-time SOAEL values within the Scheme corridor. Thus, those areas within the Scheme corridor which would experience noise levels equal to or above the daytime and night-time SOAEL values with the Scheme in operation were identified.

2.12 As would be expected, the daytime and night-time areas with noise levels at or above the SOAEL are roughly coincident, with the extent of the areas for the night-time period being slightly larger. Because of the larger extent of the night-time areas, the night-time noise levels were the driver for this enhanced mitigation study.

2.13 Drawing 1 (Appendix D), comprising a key plan and 15 sheets, shows the residential areas within the Scheme corridor, which would experience noise levels equal to or above the night-time SOAEL with the Scheme in operation (without enhanced mitigation). These areas are labelled EM1 to EM34 (Drawing 1 also shows the 600m detailed study area employed in the DMRB assessment for the Scheme, as reported in Chapter 12 of the ES).

2.14 For each of these areas, one of the following interventions was modelled in the 3D computer model for the Scheme:

1) Installing a new barrier;
2) Replacing an existing barrier or proposed barrier with a higher barrier; or
3) Installing a new barrier and replacing an existing barrier or proposed barrier with a higher barrier.

2.15 The choice of the intervention employed depended on the particular area. For each of the areas EM1 to EM34, which are shown on Drawing 1, a range of barrier heights was modelled, from 2.5 metres to 4.0 metres, in 0.5 metre steps, 4.0 metres generally being the maximum height for noise barriers employed on the strategic road network.

2.16 Noise levels to the individual residential properties in each area were calculated with and without the intervention. Thus, the reductions in noise levels resulting from the intervention were quantified.

2.17 The calculated noise reductions to each area (for each barrier height) were used to determine whether to propose a new and/or replacement barrier for each area based on the outcome of a three part process:

1) Noise Reductions
   - A new barrier should provide a minimum 3 dB noise reduction.
   - A replacement barrier should provide a minimum 1 dB noise reduction for each 0.5 metre increase in height.

2) Cost / benefit analysis using Draft TAG Monetisation calculation (details of the process are provided in Appendix A) for health benefits of noise reductions in combination with the 60 year life costs of new or replacement barriers (Appendix B).

3) Professional judgement to decide the benefits of a barrier in noise reduction terms, even though cost/benefit may be poor. Similarly, where cost/benefit may be good, but small noise reductions may preclude provision of a barrier.

2.18 A summary of the analysis for parts 1), 2) and 3) for all of the areas EM1 to EM34 is provided in Appendix C.

2.19 Where the application of part 3) has resulted in a barrier recommendation of lower or higher height than the barrier recommendation from parts 1) and 2), the reasoning was based on consideration of the scale of the change at individual properties. For example, in some cases noise benefits from the provision of local noise barriers would only be experienced by small groups of properties close to the M4. However, those noise benefits would be significant (moderate or major) and therefore it was considered that the noise barrier should be provided. In other cases, it was considered that a reduction in the proposed noise barrier height was appropriate, where the reduction to the next band (4m to 3.5m and 3.5m to 3m) did not have a significant effect at individual properties. Details at each of these locations are as follows:

a) EM2: One property would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;
b) EM3: Two properties would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;
c) EM4: One property would experience a major noise decrease and one property would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;
d) EM8A: One property would experience a major noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;
e) EM9: 52 properties (out of a total of 815 properties in the study) would experience low end minor noise reductions as a result of changing the noise barrier from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended;
f) EM10: 12 properties (out of a total of 160 properties in the study) would experience low end minor noise reductions as a result of changing the noise barrier from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended;
g) EM12: One property would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;

h) EM13: One property would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;

i) EM14: Three properties would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;

j) EM15: 12 properties (out of a total of 494 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended;

k) EM17: Two properties would experience a moderate noise decrease from the provision of a 2.5m barrier so a 2.5m barrier has been recommended;

l) EM18: One property (out of a total of 150 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. One property (out of a total of 150 properties in the study) would experience minor noise reduction resulting from a change from 3m barrier to 3.5m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier and the 3m barrier, a 3m barrier has been recommended;

m) EM23: 20 properties (out of a total of 869 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended;

n) EM25: Nine properties (out of a total of 508 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended;

o) EM31: Three properties (out of a total of 386 properties in the study) would experience low end minor noise reductions resulting from a change from 3.5m barrier to 4m barrier. Seven properties (out of a total of 386 properties in the study) would experience low end minor noise reductions resulting from a change from 3m barrier to 3.5m barrier. Given the minimal benefits of the 4m barrier over the 3.5m and the 3m barrier, a 3m barrier has been recommended;

p) EM32: One property (out of a total of 948 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. One property (out of a total of 948 properties in the study) would experience low end minor noise reduction resulting from a change from a 3m barrier to a 3.5m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier and the 3m barrier, a 3m barrier has been recommended;

q) EM33: Nine properties (out of a total of 2569 properties in the study) would experience low end minor noise reductions resulting from a change from a 3.5m barrier to a 4m barrier. Given the minimal benefits of the 4m barrier over the 3.5m barrier, a 3.5m barrier has been recommended; and

r) EM34: One property (out of a total of 267 properties in the study) would experience low end minor noise reductions resulting from a change from a 2.5m barrier to a 3m barrier. Given the minimal benefits of the 3m barrier over the 2.5m barrier, a 2.5m barrier has been recommended.

2.20 The final enhanced mitigation strategy was also assessed for visual impacts. The results of the visual impact assessment are provided in Appendix G.

3 RESULTS

3.1 The proposed new and/or replacement barriers for each of the areas EM1 to EM34 are provided in Table 1. Drawing 2 (Appendix E), comprising a key plan and 15 sheets, shows the areas EM1 to EM34 and the heights and extents of the barrier proposals for each area.

3.2 The assessment was based on a worst-case approach, assuming all barriers are reflective. Where additional barriers are provided as part of the enhanced noise mitigation study, and their presence would expose sensitive receptors in the locale to elevated noise levels due to noise reflections, high performance absorptive barriers will be installed (e.g. the Lower Earley and Winnersh barriers to prevent an increase in reflected noise to Arborfield and Newland). Absorptive barriers have a sound absorbing face to the motorway side, which reduces traffic noise being reflected from the barrier to receptors on the other side of the motorway to a negligible amount.

3.3 Drawing 3 (Appendix F), comprising a key plan and 15 sheets, shows the noise level change contours (Do-Something 2022 minus Do-Minimum 2022) within the Scheme corridor with the enhanced mitigation strategy in place. The effects of the enhanced noise mitigation are evident in these areas (EM1 to EM34) which have a revised barrier provision as a result of this study.

3.4 Table 2 shows the numbers of residential properties at or above the SOAEL (63 dB $L_{Aeq,16h}$ for daytime, 55 dB $L_{Aeq,8h}$ for night-time) for the Do-Minimum and Do-Something scenarios. It can be seen that, with the provision of the enhanced mitigation:

a) The number of properties at or above the daytime SOAEL will reduce by 1009 in the short term, when compared with the scenario without the Scheme in 2022;

b) The number of properties at or above the night-time SOAEL will reduce by 2457 in the short term, when compared with the scenario without the Scheme in 2022;

c) The number of properties at or above the daytime SOAEL will reduce by 841 in the long term, when compared with the scenario without the Scheme in 2022; and

d) The number of properties at or above the night-time SOAEL will reduce by 2232 in the long term, when compared with the scenario without the Scheme in 2022.

3.5 Inspection of the results of the visual impact assessment in Appendix G shows that the visual changes resulting from the implementation of the enhanced noise mitigation are either Beneficial or Neutral for the areas EM1 to EM34.

4 SUMMARY

4.1 A quantitative assessment of an enhanced noise mitigation strategy for the Scheme has been carried out. The calculated reduction in noise levels from the implementation of new and/or replacement barriers has been assessed using a three-part process comprising the magnitude of noise level reductions, a cost / benefit analysis and the application of professional judgement. The findings are summarised as follows:

1) 5882m of new 2.5m barrier;
2) 774m of new 3m barrier;
3) 3035m of new 3.5m barrier;
4) 3985m of replacement 3m barrier;
5) 3403m of replacement 3.5m barrier;
6) The 60 year cost is estimated at £9.71m; and
7) 3339 residential of properties will benefit from this approach. When compared to the scenario “Do-Something 2022 without enhanced mitigation”:
   - 10 properties: major noise reductions (> 5 dB)
   - 289 properties: moderate noise reductions (3 to 5 dB)
   - 3040 properties: minor noise reductions (1 to 3 dB).

4.2 The visual changes resulting from the implementation of the enhanced noise mitigation study are either Beneficial or Neutral for the areas EM1 to EM34.

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
EM1 (Calcot)	No barrier	New 2.5 metre barrier / length = 640m
EM2 (Mill Road)	No barrier	New 2.5 metre barrier / length = 200m
EM3 (Kirtons Farm Road)	No barrier	New 2.5 metre barrier / length = 473m
EM4 (Pingewood Road)	No barrier	New 2.5 metre barrier / length = 473m
EM5 (Hartley Court Road)	Existing 1.8 metre barrier	No change
EM6 (Whitley Wood)	Existing 1.8 metre barrier. Existing 3 metre barrier to northern side of B3270.	Additional 250m of new 2.0 metre barrier No change to existing barriers.
EM7 (Brookers Hill)	No barrier	No change
EM8 (Lower Earley)	No barrier	New 2.5 metre barrier / length = 2126m
EM8A (off Cutbush lane)	No barrier	New 2.5 metre barrier / length = 125m
EM9 (Mill Lane and Winnersh)	Existing 2.0 metre barrier New 2.0 metre barrier to Mill Lane area	Replacement 3.5 metre barrier / length = 1188m (2m on bridges) New 3.5 metre barrier to Mill Lane area / length = 297m (2m on bridges)
EM10	Existing 1.9 metre barrier	Replacement 3.5 metre barrier / length

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
(Mill Lane and Sindlesham)	New 2.0 metre barrier to Mill Lane area	= 583m (2m on bridges) New 3.5 metre barrier to Mill Lane area / length = 314m (2m on bridges)
EM11 (Emmbrook)	No barrier	New 3.5 metre barrier / length = 577m (excluding bridges)
EM12 (Mare Lane)	No barrier	New 2.5 metre barrier / length = 390m
EM13 (Littlefield Lane – south)	No barrier	New 2.5 metre barriers / total length = 626m
EM14 (Littlefield Lane – north)	No barrier	New 2.5 metre barrier / length = 260m
EM15 (Holyport Road / Eskdale Gardens)	Existing 2.0 metre barrier	Replacement 3.5 metre barrier / length = 816m (2m on bridges)
EM16 (Windsor Road / Upper Bray Road)	Existing 2.0 metre barrier	No change
EM17 (Old Marsh Lane / Amerden Lane)	Existing 2.0 metre barriers	Replacement 3.0 metre barriers / length = 600m New 3.0 metre barrier / length = 280m
EM18 (Dorney	Existing 1.8 metre barrier	Replacement 3.0 metre barrier / length = 336m

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
Reach)		New 3.0 metre barrier / length = 277m
EM19 (Lake End Road)	Existing 2.0 metre barrier	No change
EM20 (West Point / Mercian Way, Cippenham	Existing 2.4 metre barrier	Replacement 3.0 metre barrier / length = 335m New 3.0 metre barrier / length = 236m
EM21 (Hunters Way, Cippenham)	Existing 2.0 metre barrier on bund	No change
EM22 (Haswell Crescent)	Existing 2.0 metre barrier on bund	No change
EM22A (Wood Lane)	No barrier	No change
EM23 (Cooper Way, Slough)	Existing 2.0 metre barrier Existing 1.8 metre barrier (on mainline across junction)	Replacement 3.5 metre barrier / length = 167m No change for barrier on mainline New 3.5 metre barrier / length = 793m
EM24 (Spackmans Way, Slough)	Existing 1.8 metre barrier Existing 1.8 metre barrier (on mainline across junction)	Replacement 3.0 metre barrier / length = 320m No change for barrier on mainline
EM25 (Ragstone Road / Winvale, Slough)	Existing 1.8 metre barrier	Replacement 3.5 metre barrier / length = 784m (2m on bridges)

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
EM26 (The Myrke)	New 2.5 metre barrier / length = 150m	New 2.5 metre barrier/ barrier length increased from 150 metres (as proposed in the Environmental Statement) to 245 metres
EM27 (Datchet)	Existing 2.0 metre barrier	No change
EM28 (Datchet)	Existing 2.0 metre barrier	No change
EM29 (Ditton Road, Langley)	Existing 1.8 metre barrier	No change
EM30 (Grampian Way, Langley)	Existing 1.8 metre barriers New 2.0 metre barrier on mainline across junction	No change to existing barriers or those proposed by the current ES Assessment
EM31 (Severn Crescent / Sutton Lane, Brands Hill)	Existing 2.0 metre barriers New 2.0 metre barrier on mainline across junction	Replacement 3.0 metre barriers / length = 510m No change to new barrier on mainline across junction proposed by the current ES Assessment
EM31A (Old Slade Lane)	Existing 2.0 metre barrier	No change
EM32 (West Drayton)	Existing 2.0 metre barriers	Replacement 3.0 metre barrier / length = 1884m
EM33 (Hayes)	Existing 1.8 metre barrier	Existing barrier – no change New 3.5 metre barrier / length = 1131m
EM34 (St Pauls	No barrier	New 2.5 metre barrier / length = 323m

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
Close, Harlington)		
EM34 (Cranford Park)	No barrier	New 2.0 metre barrier / length = 570m

Table 2: Numbers of Residential Properties at or above the SOAEL		
Scenario	**Daytime**	**Night-time**
Do-Minimum 2022	3548	6325
Do-Minimum 2037	3098	4730
Do-Something 2022 without enhanced mitigation	2831	4503
Do-Something 2037 without enhanced mitigation	3020	4724
Do-Something 2022 with enhanced mitigation	2539	3868
Do-Something 2037 with enhanced mitigation	2707	4093

APPENDIX A: DRAFT TAG MONETIZATION

Below is an extract from the Department for Transport document *Forthcoming Change to WebTAG – Updates to Noise Valuation*, which describes the approach to the monetization of noise induced health effects.

Detail

In November 2014 Defra published a report (*Environmental noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet*) summarising several recent research projects on the impacts of noise, and providing guidance on how these different 'impact pathways' should be appraised in project appraisals. In conjunction with the *noise modelling tool* accompanying it, this Defra report forms the basis of the forthcoming changes to TAG guidance on noise impacts described in this document[1].

The revised noise section of TAG Unit A3 and a new version of TAG Data Book Table A3.1 are included at the end of this document. A new TAG Noise Workbook, applying the forthcoming guidance, is also available on the WebTAG site.

The impact pathway approach

Previously, the treatment of noise in transport appraisal has focused on annoyance, with monetisation of impacts through evidence from a hedonic-pricing study of the impact of transport noise on house prices. However, there is a growing evidence base on the impact of environmental noise on health outcomes (see, e.g. *Burden of disease from environmental noise*, WHO, 2011).

Defra have adopted an impact pathway approach to identify the different ways in which noise can impact on people's lives and, where sufficiently robust evidence exists, provide monetary values for the different impact pathways for use in cost-benefit analysis. The impact pathways identified by Defra for monetisation are:

- Annoyance / amenity,
- Sleep disturbance,
- Acute Myocardial Infarction (AMI),
- Stress and dementia (through increased hypertension).

Each impact pathway leads to an estimate of the number of Disability Adjusted Life Years (DALYs) lost for an increase in noise (or gained with a decrease in noise), based on the population affected and a 'disability weights' (DWs) reflecting the severity of the impact for those affected. This is then monetised through a value of £60,000 per DALY, consistent with valuation of health impacts in other areas.

This approach is applied to annoyance and sleep disturbance as well as the more directly health-based impact pathways, based on DWs from WHO's 2011 report. Using the DALY-based approach for annoyance, rather than the previous hedonic-pricing based values, guards against the risk of double counting as the hedonic values may have incorporated elements from other impact pathways (such as sleep disturbance).

An example output sheet from the accompanying Draft TAG Workbook is provided below.

Noise Workbook - Worksheet 1

Proposal Name:	0
Present Value Base Year	2010
Current Year	2015
Proposal Opening year:	0
Project (Road, Rail or Aviation):	road

Net present value of change in noise (£):	#DIV/0!

*positive value reflects a **net benefit** (i.e. a reduction in noise)

Net present value of impact on sleep disturbance (£):	#DIV/0!
Net present value of impact on amenity (£):	#DIV/0!
Net present value of impact on AMI (£):	#DIV/0!
Net present value of impact on stroke (£):	#DIV/0!
Net present value of impact on dementia (£):	#DIV/0!

Quantitative results

Households experiencing increased daytime noise in forecast year:	0
Households experiencing reduced daytime noise in forecast year:	0
Households experiencing increased night time noise in forecast year:	n/a
Households experiencing reduced night time noise in forecast year:	n/a

Qualitative Comments:

Data Sources:

APPENDIX B: ESTIMATED 60 YEAR LIFE COSTS FOR NOISE BARRIERS

1. Noise barrier 60 year life costs, supplied by Highways England, are shown in Table 3 below. Numbers in italics are interpolated from the supplied data.

Table 3 - Noise barrier 60 years costs used in assessment

BARRIER HEIGHT (METRES)	COST / METRE
2	£422
2.5	£476
3	£530
3.5	£692
4	£853
4.5	£1,014
5	£1,175

APPENDIX C: ASSESSMENT SUMMARY

1. Table 4 below is extracted from the spreadsheet which implements parts 1), 2) and 3) of the three part assessment process, namely:
   1) Noise Reductions
      - A new barrier should provide a minimum 3 dB noise reduction.
      - A replacement barrier should provide a minimum 1 dB noise reduction for each 0.5 metre increase in height.
   2) Cost / benefit analysis using Draft TAG Monetisation calculation (details of the process are provided in Appendix A) for health benefits of noise reductions in combination with the 60 year life costs of new or replacement barriers (Appendix B).
   3) Professional judgement to decide the benefits of a barrier in noise reduction terms, even though cost/benefit may be poor. Similarly, where cost/benefit may be good, but small noise reductions may preclude provision of a barrier.

2. Each column provides the analysis for one of the identified areas (EM1 to EM34).

   - Z0 is the Do Something scenario as presented in the ES (retention, or replacement on a like-for-like basis, of existing barriers plus a small number of additional barriers).
   - Z1 is the Z0 scenario (with barrier heights increased by 0.5 metres) plus additional 2.5 metre high barriers.
   - Z2 is the Z1 scenario, with all barrier heights increased by 0.5 metres.
   - Z3 is the Z2 scenario, with all barrier heights increased by 0.5 metres.
   - Z4 is the Z3 scenario, with all barrier heights increased by 0.5 metres.

3. In the “Noise benefit?” section of each table, the following applies;

   Yes The noise reduction criteria are met; and

   No The noise reduction criteria are not met.

4. In the “Conclusion” section of each table, the following applies;-

   TRUE The noise reduction criteria are met **and** the cost/benefit analysis is favourable

   FALSE The noise reduction criteria are not met **and/or** the cost/benefit analysis is unfavourable

The noise reduction criteria are:

- A new barrier should provide a minimum 3 dB noise reduction.
- A replacement barrier should provide a minimum 1 dB noise reduction for each 0.5 metre increase in height.

Table 4: Summary of enhanced noise mitigation study assessment results

Total Benefit	EM1	EM2	EM3	EM4
Z0	£503,206	£6,787	£12,195	£28,154
Z1	£1,177,439	£51,059	£55,826	£81,687
Z2	£1,342,598	£51,059	£74,199	£83,015
Z3	£1,486,680	£51,059	£77,425	£84,628
Z4	£1,569,741	£52,981	£92,720	£100,186

Total Cost of Barriers	EM1	EM2	EM3	EM4
Z1	£304,640	£95,200	£225,148	£225,148
Z2	£339,200	£106,000	£250,690	£250,690
Z3	£442,880	£138,400	£327,316	£327,316
Z4	£545,920	£170,600	£403,469	£403,469

Noise benefit? (2022)	EM1	EM2	EM3	EM4
Total Number of houses	466	4	6	7
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	A	A
Z0 to Z1	Yes	Yes	Yes	Yes
Z1 to Z2	No	No	No	No
Z2 to Z3	No	No	No	No
Z3 to Z4	No	No	No	No

Noise benefit? (2022)	EM1	EM2	EM3	EM4
Total Number of houses	466	4	6	7
Additional or Higher?	A	A	A	A
Z0 to Z1 no. houses meet criteria	3	1	2	3
Z1 to Z2 no. houses meet criteria	0	0	0	0
Z2 to Z3 no. houses meet criteria	0	0	0	0
Z3 to Z4 no. houses meet criteria	0	0	0	0

Relative Max Noise benefit (2022)	EM1	EM2	EM3	EM4
Total Number of houses	466	4	6	7
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	A	A
Z0 to Z1 relative max benefit (dB)	-3.1	-3.3	-4.0	-5.8
Z1 to Z2 relative max benefit (dB)	-0.6	-0.3	-0.6	-0.4
Z2 to Z3 relative max benefit (dB)	-0.5	-0.1	-0.7	-0.5
Z3 to Z4 relative max benefit (dB)	-0.5	-0.2	-0.4	-0.4

Absolute Max Noise benefit (2022)	EM1	EM2	EM3	EM4
Total Number of houses	466	4	6	7
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	A	A
Z1 absolute max benefit (Z1 to Z0) (dB)	-3.1	-3.3	-4.0	-5.8
Z2 absolute max benefit (Z2 to Z0) (dB)	-3.7	-3.6	-4.6	-6.2
Z3 absolute max benefit (Z3 to Z0) (dB)	-4.1	-3.7	-5.0	-6.7
Z4 absolute max benefit (Z4 to Z0) (dB)	-4.6	-3.9	-5.3	-7.1

Total Benefit > Total Cost?	EM1	EM2	EM3	EM4
Z1	£369,592	-£50,928	-£181,517	-£171,615
Z2	£500,191	-£61,728	-£188,687	-£195,829
Z3	£540,594	-£94,128	-£262,087	-£270,842
Z4	£520,615	-£124,406	-£322,944	-£331,437

Conclusion	EM1	EM2	EM3	EM4
Z1	TRUE	FALSE	FALSE	FALSE
Z2	FALSE	FALSE	FALSE	FALSE
Z3	FALSE	FALSE	FALSE	FALSE
Z4	FALSE	FALSE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	NEW 2.5M BARRIER	NO NEW BARRIER	NO NEW BARRIER	NO NEW BARRIER
NOTES	WITH 2.5M BARRIER: 3 PROPERTIES-MODERATE DECREASES / 70 PROPERTIES-MINOR DECREASES	WITH 2.5M BARRIER: 1 PROPERTY-MODERATE DECREASE / 3 PROPERTIES-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 2 PROPERTIES-MODERATE DECREASE / 3 PROPERTIES-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 1 PROPERTY-MAJOR DECREASE / 2 PROPERTIES-MODERATE DECREASE / 4 PROPERTIES-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.
FINAL RECOMMENDATION	NEW 2.5M BARRIER.	NEW 2.5M BARRIER.	NEW 2.5M BARRIER.	NEW 2.5M BARRIER.

Total Benefit	EM5	EM6	EM7	EM8
Z0	£100,527	£15,416	£45,459	£1,511,306
Z1	£220,471	£224,242	£237,152	£6,358,347
Z2	£291,084	£339,460	£299,406	£7,383,534
Z3	£380,884	£485,217	£343,986	£8,351,966
Z4	£492,883	£583,024	£445,956	£9,177,375

Total Cost of Barriers	EM5	EM6	EM7	EM8
Z1	£279,412	£226,100	£404,124	£1,011,976
Z2	£311,110	£251,750	£449,970	£1,126,780
Z3	£406,204	£328,700	£587,508	£1,471,192
Z4	£500,711	£405,175	£724,197	£1,813,478

Noise benefit? (2022)	EM5	EM6	EM7	EM8
Total Number of houses	103	224	205	1358
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	A	A
Z0 to Z1	Yes	No	No	Yes
Z1 to Z2	Yes	No	No	No
Z2 to Z3	Yes	No	No	No
Z3 to Z4	Yes	No	No	No

Noise benefit? (2022)	EM5	EM6	EM7	EM8
Total Number of houses	103	224	205	1358
Additional or Higher?	H	H	A	A
Z0 to Z1 no. houses meet criteria	9	0	0	68
Z1 to Z2 no. houses meet criteria	7	0	0	0
Z2 to Z3 no. houses meet criteria	8	0	0	0
Z3 to Z4 no. houses meet criteria	7	0	0	0

Relative Max Noise benefit (2022)	EM5	EM6	EM7	EM8
Total Number of houses	103	224	205	1358
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	A	A
Z0 to Z1 relative max benefit (dB)	-1.9	-0.9	-2.3	-4.2
Z1 to Z2 relative max benefit (dB)	-1.3	-0.8	-0.6	-0.9
Z2 to Z3 relative max benefit (dB)	-1.3	-0.6	-0.5	-0.7
Z3 to Z4 relative max benefit (dB)	-1.3	-0.4	-0.5	-0.7

Absolute Max Noise benefit (2022)	EM5	EM6	EM7	EM8
Total Number of houses	103	224	205	1358
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	A	A
Z1 absolute max benefit (Z1 to Z0) (dB)	-1.9	-0.9	-2.3	-4.2
Z2 absolute max benefit (Z2 to Z0) (dB)	-3.0	-1.4	-2.9	-4.6
Z3 absolute max benefit (Z3 to Z0) (dB)	-4.3	-1.9	-3.4	-4.9
Z4 absolute max benefit (Z4 to Z0) (dB)	-5.5	-2.2	-3.9	-5.3

Total Benefit > Total Cost?	EM5	EM6	EM7	EM8
Z1	-£159,467	-£17,274	-£212,431	£3,835,064
Z2	-£120,553	£72,294	-£196,023	£4,745,448
Z3	-£125,847	£141,101	-£288,981	£5,369,468
Z4	-£108,355	£162,433	-£323,700	£5,852,591

Conclusion	EM5	EM6	EM7	EM8
Z1	FALSE	FALSE	FALSE	TRUE
Z2	FALSE	FALSE	FALSE	FALSE
Z3	FALSE	FALSE	FALSE	FALSE
Z4	FALSE	FALSE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	NO CHANGE	NO CHANGE	NO NEW BARRIER	NEW 2.5M BARRIER
NOTES	WITH 2.5M BARRIER: 9 PROPERTIES-MINOR DECREASE	WITH 2.5M BARRIER: ALL PROPERTIES-NEGLIGIBLE DECREASE	WITH 2.5M BARRIER: 29 PROPERTIES-MINOR DECREASE	WITH 2.5M BARRIER: 68 PROPERTIES-MODERATE DECREASE / 711 PROPERTIES-MINOR DECREASE
FINAL RECOMMENDATION	NO CHANGE.	NO CHANGE.	NO NEW BARRIER.	NEW 2.5M BARRIER.

Total Benefit	EM9	EM10	EM11	EM12
Z0	£242,844	£123,245	£438,628	£6,191
Z1	£656,055	£502,435	£991,740	£30,703
Z2	£1,237,149	£740,828	£1,097,010	£32,031
Z3	£2,007,621	£1,009,510	£1,237,661	£39,657
Z4	£2,932,313	£1,184,119	£1,437,679	£45,955

Total Cost of Barriers	EM9	EM10	EM11	EM12
Z1	£689,248	£335,104	£283,220	£185,640
Z2	£767,440	£373,120	£315,350	£206,700
Z3	£1,002,016	£487,168	£411,740	£269,880
Z4	£1,235,144	£600,512	£507,535	£332,670

Noise benefit? (2022)	EM9	EM10	EM11	EM12
Total Number of houses	**815**	**160**	**533**	**6**
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	**A/H**	**A/H**	**A**	**A**
Z0 to Z1	Yes	Yes	No	Yes
Z1 to Z2	Yes	Yes	Yes	No
Z2 to Z3	Yes	Yes	Yes	No
Z3 to Z4	Yes	Yes	No	No

Noise benefit? (2022)	EM9	EM10	EM11	EM12
Total Number of houses	**815**	**160**	**533**	**6**
Additional or Higher?	**A/H**	**A/H**	**A**	**A**
Z0 to Z1 no. houses meet criteria	22	37	0	1
Z1 to Z2 no. houses meet criteria	34	29	2	0
Z2 to Z3 no. houses meet criteria	48	17	6	0
Z3 to Z4 no. houses meet criteria	52	12	0	0

Relative Max Noise benefit (2022)	EM9	EM10	EM11	EM12
Total Number of houses	**815**	**160**	**533**	**6**
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	**A/H**	**A/H**	**A**	**A**
Z0 to Z1 relative max benefit (dB)	-5.6	-3.3	-2.4	-3.1
Z1 to Z2 relative max benefit (dB)	-1.5	-1.8	-1.0	-0.6
Z2 to Z3 relative max benefit (dB)	-1.5	-1.7	-1.1	-0.7
Z3 to Z4 relative max benefit (dB)	-1.8	-1.2	-0.8	-0.5

Absolute Max Noise benefit (2022)	EM9	EM10	EM11	EM12
Total Number of houses	**815**	**160**	**533**	**6**
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	**A/H**	**A/H**	**A**	**A**
Z1 absolute max benefit (Z1 to Z0) (dB)	-5.6	-3.3	-2.4	-3.1
Z2 absolute max benefit (Z2 to Z0) (dB)	-6.2	-4.3	-2.8	-3.7
Z3 absolute max benefit (Z3 to Z0) (dB)	-7.0	-5.2	-3.2	-4.4
Z4 absolute max benefit (Z4 to Z0) (dB)	-7.5	-6.4	-3.9	-4.9

Total Benefit > Total Cost?	EM9	EM10	EM11	EM12
Z1	-£276,037	£44,086	£269,892	-£161,128
Z2	£226,865	£244,463	£343,032	-£180,859
Z3	£762,761	£399,097	£387,292	-£236,414
Z4	£1,454,325	£460,363	£491,516	-£292,906

Conclusion	EM9	EM10	EM11	EM12
Z1	FALSE	TRUE	FALSE	FALSE
Z2	TRUE	TRUE	TRUE	FALSE
Z3	TRUE	TRUE	TRUE	FALSE
Z4	TRUE	TRUE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	NEW AND REPLACEMENT 4M BARRIERS	NEW AND REPLACEMENT 4M BARRIERS	NEW 3.5M BARRIER	NO NEW BARRIER
NOTES	52 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIERS. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIER RECOMMENDED.	12 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIERS. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIERS RECOMMENDED.	WITH 3.5M BARRIER: 6 PROPERTIES-MODERATE DECREASE / 99 PROPERTIES-MINOR DECREASE	WITH 2.5M BARRIER: 1 PROPERTY-LOW END MODERATE DECREASE / 1 PROPERTY-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.
FINAL RECOMMENDATION	NEW AND REPLACEMENT 3.5M BARRIER.	NEW AND REPLACEMENT 3.5M BARRIERS.	NEW 3.5M BARRIER.	NEW 2.5M BARRIER.

Total Benefit	EM13	EM14	EM15	EM16
Z0	£21,933	£5,789	£238,402	£53,089
Z1	£103,469	£111,733	£794,304	£124,822
Z2	£121,133	£124,688	£1,237,332	£210,130
Z3	£131,822	£146,744	£1,641,933	£252,258
Z4	£131,822	£151,013	£2,018,982	£290,268

Total Cost of Barriers	EM13	EM14	EM15	EM16
Z1	£297,976	£124,236	£388,416	£212,772
Z2	£331,780	£138,330	£432,480	£236,910
Z3	£433,192	£180,612	£564,672	£309,324
Z4	£533,978	£222,633	£696,048	£381,291

Noise benefit? (2022)	EM13	EM14	EM15	EM16
Total Number of houses	18	8	494	79
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	H	H
Z0 to Z1	Yes	Yes	Yes	Yes
Z1 to Z2	Yes	Yes	Yes	Yes
Z2 to Z3	Yes	Yes	Yes	Yes
Z3 to Z4	Yes	No	Yes	Yes

Noise benefit? (2022)	EM13	EM14	EM15	EM16
Total Number of houses	18	8	494	79
Additional or Higher?	A	A	H	H
Z0 to Z1 no. houses meet criteria	1	3	23	2
Z1 to Z2 no. houses meet criteria	1	2	11	4
Z2 to Z3 no. houses meet criteria	1	1	14	2
Z3 to Z4 no. houses meet criteria	1	0	12	1

Relative Max Noise benefit (2022)	EM13	EM14	EM15	EM16
Total Number of houses	18	8	494	79
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	H	H
Z0 to Z1 relative max benefit (dB)	-5.1	-4.7	-1.6	-1.3
Z1 to Z2 relative max benefit (dB)	-1.2	-1.2	-1.6	-1.2
Z2 to Z3 relative max benefit (dB)	-1.2	-1.1	-1.6	-1.1
Z3 to Z4 relative max benefit (dB)	-1.0	-0.9	-1.6	-1.1

Absolute Max Noise benefit (2022)	EM13	EM14	EM15	EM16
Total Number of houses	18	8	494	79
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A	A	H	H
Z1 absolute max benefit (Z1 to Z0) (dB)	-5.1	-4.7	-1.6	-1.3
Z2 absolute max benefit (Z2 to Z0) (dB)	-6.3	-5.9	-3.2	-2.5
Z3 absolute max benefit (Z3 to Z0) (dB)	-7.5	-7.0	-4.8	-3.6
Z4 absolute max benefit (Z4 to Z0) (dB)	-8.5	-7.9	-5.9	-4.7

Total Benefit > Total Cost?	EM13	EM14	EM15	EM16
Z1	-£216,440	-£18,292	£167,487	-£141,039
Z2	-£232,580	-£19,431	£566,450	-£79,869
Z3	-£323,302	-£39,657	£838,860	-£110,155
Z4	-£424,088	-£77,409	£1,084,532	-£144,112

Conclusion	EM13	EM14	EM15	EM16
Z1	FALSE	FALSE	TRUE	FALSE
Z2	FALSE	FALSE	TRUE	FALSE
Z3	FALSE	FALSE	TRUE	FALSE
Z4	FALSE	FALSE	TRUE	FALSE

SPREADSHEET RECOMMENDATION	NO NEW BARRIER	NO NEW BARRIER	REPLACEMENT 4M BARRIER	NO CHANGE
NOTES	WITH 2.5M BARRIER: 1 PROPERTY-MAJOR DECREASE / 7 PROPERTIES-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 3 PROPERTIES-MODERATE DECREASE / 5 PROPERTIES-MINOR DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES, 2.5M BARRIER RECOMMENDED.	12 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIER. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 2 PROPERTIES-MINOR DECREASE
FINAL RECOMMENDATION	NEW 2.5M BARRIER.	NEW 2.5M BARRIER.	REPLACEMENT 3.5M BARRIER.	NO CHANGE.

Total Benefit	EM17	EM18	EM19	EM20
Z0	£37,463	£234,059	£17,168	-£78,013
Z1	£110,109	£535,728	£34,938	£293,425
Z2	£140,823	£676,698	£34,938	£469,367
Z3	£187,353	£795,339	£51,913	£601,941
Z4	£221,646	£867,900	£53,241	£664,969

Total Cost of Barriers	EM17	EM18	EM19	EM20
Z1	£409,836	£291,788	£79,968	£289,886
Z2	£456,330	£324,890	£89,040	£356,900
Z3	£595,812	£424,196	£116,256	£449,067
Z4	£734,433	£522,889	£143,304	£540,998

Noise benefit? (2022)	EM17	EM18	EM19	EM20
Total Number of houses	18	150	5	236
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A/H	H	A/H
Z0 to Z1	Yes	Yes	Yes	Yes
Z1 to Z2	Yes	Yes	Yes	No
Z2 to Z3	Yes	Yes	Yes	No
Z3 to Z4	No	Yes	Yes	No

Noise benefit? (2022)	EM17	EM18	EM19	EM20
Total Number of houses	18	150	5	236
Additional or Higher?	A/H	A/H	H	A/H
Z0 to Z1 no. houses meet criteria	14	46	1	38
Z1 to Z2 no. houses meet criteria	3	2	1	0
Z2 to Z3 no. houses meet criteria	3	1	1	0
Z3 to Z4 no. houses meet criteria	1	1	1	0

Relative Max Noise benefit (2022)	EM17	EM18	EM19	EM20
Total Number of houses	18	150	5	236
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A/H	H	A/H
Z0 to Z1 relative max benefit (dB)	-3.2	-2.5	-1.6	-3.2
Z1 to Z2 relative max benefit (dB)	-2.2	-1.1	-1.7	-0.8
Z2 to Z3 relative max benefit (dB)	-2.1	-2.0	-1.2	-0.7
Z3 to Z4 relative max benefit (dB)	-3.2	-1.4	-1.1	-0.6

Absolute Max Noise benefit (2022)	EM17	EM18	EM19	EM20
Total Number of houses	18	150	5	236
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A/H	H	A/H
Z1 absolute max benefit (Z1 to Z0) (dB)	-3.2	-2.5	-1.6	-3.2
Z2 absolute max benefit (Z2 to Z0) (dB)	-3.7	-3.2	-3.3	-3.7
Z3 absolute max benefit (Z3 to Z0) (dB)	-5.8	-4.3	-4.5	-4.3
Z4 absolute max benefit (Z4 to Z0) (dB)	-9.0	-5.7	-5.6	-4.8

Total Benefit > Total Cost?	EM17	EM18	EM19	EM20
Z1	-£337,190	£9,882	-£62,199	£81,552
Z2	-£352,970	£117,750	-£71,271	£190,480
Z3	-£445,922	£137,084	-£81,512	£230,887
Z4	-£550,250	£110,953	-£107,232	£201,984

Conclusion	EM17	EM18	EM19	EM20
Z1	FALSE	TRUE	FALSE	TRUE
Z2	FALSE	TRUE	FALSE	FALSE
Z3	FALSE	TRUE	FALSE	FALSE
Z4	FALSE	TRUE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	NO CHANGE	NEW AND REPLACEMENT 4M BARRIERS	NO CHANGE	NEW AND REPLACEMENT 3M BARRIERS
NOTES	WITH 3M BARRIER:2 PROPERTIES-MODERATE DECREASE. GIVEN USEFUL NOISE REDUCTIONS TO THESE PROPERTIES AND CARAVAN PARK, 3M BARRIER RECOMMENDED.	8 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3M TO 4M BARRIER.1 PROPERTY-MINOR DECREASE RESULTING FROM CHANGE FROM 3M TO 4M BARRIER. WITH 3 M BARRIER: 7 PROPERTIES-MODERATE DECREASE / 69 PROPERTIES-MINOR DECREASE. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3M BARRIER, 3M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 1 PROPERTY-MINOR DECREASE	EXISTING BARRIER IS 2.4M WITH 3M BARRIER: 9 PROPERTIES-MODERATE DECREASE / 29 PROPERTIES-MINOR DECREASE
FINAL RECOMMENDATION	NEW AND REPLACEMENT 3M BARRIERS.	NEW AND REPLACEMENT 3M BARRIERS.	NO CHANGE.	NEW AND REPLACEMENT 3M BARRIERS.

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Total Benefit	EM21	EM22	EM23	EM24
Z0	N/A	N/A	£792,499	£186,099
Z1	N/A	N/A	£1,536,536	£1,006,288
Z2	N/A	N/A	£2,558,547	£1,401,525
Z3	N/A	N/A	£3,570,928	£1,758,590
Z4	N/A	N/A	£4,477,669	£2,040,819

Total Cost of Barriers	EM21	EM22	EM23	EM24
Z1	N/A	N/A	£456,960	£152,320
Z2	N/A	N/A	£508,800	£169,600
Z3	N/A	N/A	£664,320	£221,440
Z4	N/A	N/A	£818,880	£272,960

Noise benefit? (2022)	EM21	EM22	EM23	EM24
Total Number of houses	N/A	N/A	869	429
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	N/A	N/A	A/H	H
Z0 to Z1	N/A	N/A	Yes	Yes
Z1 to Z2	N/A	N/A	Yes	No
Z2 to Z3	N/A	N/A	Yes	No
Z3 to Z4	N/A	N/A	Yes	No

Noise benefit? (2022)	EM21	EM22	EM23	EM24
Total Number of houses	N/A	N/A	869	429
Additional or Higher?	N/A	N/A	H	H
Z0 to Z1 no. houses meet criteria	N/A	N/A	76	57
Z1 to Z2 no. houses meet criteria	N/A	N/A	54	0
Z2 to Z3 no. houses meet criteria	N/A	N/A	43	0
Z3 to Z4 no. houses meet criteria	N/A	N/A	20	0

Relative Max Noise benefit (2022)	EM21	EM22	EM23	EM24
Total Number of houses	N/A	N/A	869	429
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	N/A	N/A	A/H	H
Z0 to Z1 relative max benefit (dB)	N/A	N/A	-1.7	-1.6
Z1 to Z2 relative max benefit (dB)	N/A	N/A	-1.4	-0.8
Z2 to Z3 relative max benefit (dB)	N/A	N/A	-1.2	-0.8
Z3 to Z4 relative max benefit (dB)	N/A	N/A	-1.1	-0.7

Absolute Max Noise benefit (2022)	EM21	EM22	EM23	EM24
Total Number of houses	N/A	N/A	869	429
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	N/A	N/A	A/H	H
Z1 absolute max benefit (Z1 to Z0) (dB)	N/A	N/A	-1.7	-1.6
Z2 absolute max benefit (Z2 to Z0) (dB)	N/A	N/A	-2.8	-2.4
Z3 absolute max benefit (Z3 to Z0) (dB)	N/A	N/A	-4.0	-3.2
Z4 absolute max benefit (Z4 to Z0) (dB)	N/A	N/A	-5.1	-3.9

Total Benefit > Total Cost?	EM21	EM22	EM23	EM24
Z1	N/A	N/A	£287,077	£667,869
Z2	N/A	N/A	£1,257,248	£1,045,826
Z3	N/A	N/A	£2,114,110	£1,351,052
Z4	N/A	N/A	£2,866,291	£1,581,760

Conclusion	EM21	EM22	EM23	EM24
Z1	N/A	N/A	TRUE	TRUE
Z2	N/A	N/A	TRUE	FALSE
Z3	N/A	N/A	TRUE	FALSE
Z4	N/A	N/A	TRUE	FALSE

SPREADSHEET RECOMMENDATION	N/A	N/A	NEW AND REPLACEMENT 4M BARRIERS	REPLACEMENT 2.5M BARRIER
NOTES	EXISTING 2M BARRIER ON HIGH BUND (OVERALL HEIGHT 5 TO 6M). NO FURTHER MITIGATION REQUIRED.	EXISTING 2M BARRIER ON HIGH BUND (OVERALL HEIGHT 5 TO 6M). NO FURTHER MITIGATION REQUIRED.	20 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIER. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 57 PROPERTIES-MINOR DECREASES. WITH 3M BARRIER: 255 PROPERTIES-MINOR DECREASES. GIVEN USEFUL NOISE REDUCTIONS WITH 3M BARRIER, 3 METRE BARRIER RECOMMENDED.
FINAL RECOMMENDATION	NO CHANGE.	NO CHANGE.	NEW AND REPLACEMENT 3.5M BARRIERS (NO CHANGE TO BARRIER ON THE MAINLINE).	3M REPLACEMENT BARRIER.

Total Benefit	EM25	EM26	EM27	EM28
Z0	£414,761	£90,201	-£29,325	£266,781
Z1	£955,235	£156,886	£61,940	£517,930
Z2	£1,337,828	£214,530	£120,344	£766,933
Z3	£1,649,824	£225,255	£177,195	£894,622
Z4	£1,891,884	£259,377	£247,934	£1,101,506

Total Cost of Barriers	EM25	EM26	EM27	EM28
Z1	£373,184	£129,850	£377,468	£457,912
Z2	£415,520	£169,540	£420,290	£509,860
Z3	£542,528	£208,985	£548,756	£665,704
Z4	£668,752	£248,430	£676,429	£820,586

Noise benefit? (2022)	EM25	EM26	EM27	EM28
Total Number of houses	508	62	171	202
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	A/H	H	H
Z0 to Z1	Yes	Yes	Yes	No
Z1 to Z2	Yes	Yes	No	No
Z2 to Z3	Yes	Yes	No	No
Z3 to Z4	Yes	No	No	No

Noise benefit? (2022)	EM25	EM26	EM27	EM28
Total Number of houses	508	62	171	202
Additional or Higher?	H	A/H	H	H
Z0 to Z1 no. houses meet criteria	16	6	1	0
Z1 to Z2 no. houses meet criteria	9	1	0	0
Z2 to Z3 no. houses meet criteria	8	1	0	0
Z3 to Z4 no. houses meet criteria	9	0	0	0

Relative Max Noise benefit (2022)	EM25	EM26	EM27	EM28
Total Number of houses	508	62	171	202
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	A/H	H	H
Z0 to Z1 relative max benefit (dB)	-2.6	-1.3	-1.4	-0.8
Z1 to Z2 relative max benefit (dB)	-1.7	-1.0	-0.9	-0.7
Z2 to Z3 relative max benefit (dB)	-1.3	-1.2	-0.7	-0.8
Z3 to Z4 relative max benefit (dB)	-1.3	-0.9	-0.9	-0.9

Absolute Max Noise benefit (2022)	EM25	EM26	EM27	EM28
Total Number of houses	508	62	171	202
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	A/H	H	H
Z1 absolute max benefit (Z1 to Z0) (dB)	-2.6	-1.3	-1.4	-0.8
Z2 absolute max benefit (Z2 to Z0) (dB)	-4.0	-2.2	-2.3	-1.3
Z3 absolute max benefit (Z3 to Z0) (dB)	-5.0	-3.4	-3.0	-2.0
Z4 absolute max benefit (Z4 to Z0) (dB)	-6.2	-4.3	-3.9	-2.5

Total Benefit > Total Cost?	EM25	EM26	EM27	EM28
Z1	£167,290	-£63,165	-£286,204	-£206,763
Z2	£507,547	-£45,211	-£270,621	-£9,709
Z3	£692,535	-£73,931	-£342,236	-£37,864
Z4	£808,371	-£79,254	-£399,170	£14,138

Conclusion	EM25	EM26	EM27	EM28
Z1	TRUE	FALSE	FALSE	FALSE
Z2	TRUE	FALSE	FALSE	FALSE
Z3	TRUE	FALSE	FALSE	FALSE
Z4	TRUE	FALSE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	REPLACEMENT 4M BARRIER	NO CHANGE FROM PROPOSED 2.5M BARRIER	NO CHANGE	NO CHANGE
NOTES	20 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIER. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIER RECOMMENDED.	6 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 2.5M TO 3M BARRIER	WITH 2.5M BARRIER: 1 PROPERTY-MINOR DECREASE.	WITH 2.5M BARRIER: ALL PROPERTIES-NEGLIGIBLE DECREASES.
FINAL RECOMMENDATION	REPLACEMENT3.5 M BARRIER.	NO CHANGE FROM PROPOSED 2.5M BARRIER.	NO CHANGE.	NO CHANGE.

Total Benefit	EM29	EM30	EM31	EM32
Z0	£139,809	£1,155,509	£379,750	£509,107
Z1	£199,912	£1,268,217	£646,524	£1,067,096
Z2	£245,737	£1,364,248	£800,032	£1,807,298
Z3	£320,361	£1,489,947	£1,026,793	£2,625,678
Z4	£345,151	£1,668,657	£1,211,402	£3,279,380

Total Cost of Barriers	EM29	EM30	EM31	EM32
Z1	£49,980	£620,704	£242,760	£896,784
Z2	£55,650	£691,120	£270,300	£998,520
Z3	£72,660	£902,368	£352,920	£1,303,728
Z4	£89,565	£1,112,312	£435,030	£1,607,052

Noise benefit? (2022)	EM29	EM30	EM31	EM32
Total Number of houses	261	469	386	948
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	H	H
Z0 to Z1	No	Yes	Yes	Yes
Z1 to Z2	No	Yes	Yes	Yes
Z2 to Z3	No	Yes	Yes	Yes
Z3 to Z4	No	Yes	Yes	Yes

Noise benefit? (2022)	EM29	EM30	EM31	EM32
Total Number of houses	261	469	386	948
Additional or Higher?	H	H	H	H
Z0 to Z1 no. houses meet criteria	0	3	13	37
Z1 to Z2 no. houses meet criteria	0	2	20	26
Z2 to Z3 no. houses meet criteria	0	4	7	1
Z3 to Z4 no. houses meet criteria	0	6	3	1

Relative Max Noise benefit (2022)	EM29	EM30	EM31	EM32
Total Number of houses	261	469	386	948
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	H	H
Z0 to Z1 relative max benefit (dB)	-0.4	-1.5	-1.5	-1.3
Z1 to Z2 relative max benefit (dB)	-0.2	-1.2	-1.4	-1.4
Z2 to Z3 relative max benefit (dB)	-0.3	-1.4	-1.3	-1.1
Z3 to Z4 relative max benefit (dB)	-0.2	-2.3	-1.0	-1.1

Absolute Max Noise benefit (2022)	EM29	EM30	EM31	EM32
Total Number of houses	261	469	386	948
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	H	H	H	H
Z1 absolute max benefit (Z1 to Z0) (dB)	-0.4	-1.5	-1.5	-1.3
Z2 absolute max benefit (Z2 to Z0) (dB)	-0.5	-2.6	-2.6	-2.7
Z3 absolute max benefit (Z3 to Z0) (dB)	-0.6	-3.8	-3.9	-3.8
Z4 absolute max benefit (Z4 to Z0) (dB)	-0.8	-5.2	-4.9	-4.9

Total Benefit > Total Cost?	EM29	EM30	EM31	EM32
Z1	£10,123	-£507,996	£24,014	-£338,794
Z2	£50,279	-£482,381	£149,982	£299,672
Z3	£107,893	-£567,930	£294,122	£812,843
Z4	£115,777	-£599,164	£396,622	£1,163,221

Conclusion	EM29	EM30	EM31	EM32
Z1	FALSE	FALSE	TRUE	FALSE
Z2	FALSE	FALSE	TRUE	TRUE
Z3	FALSE	FALSE	TRUE	TRUE
Z4	FALSE	FALSE	TRUE	TRUE

SPREADSHEET RECOMMENDATION	NO CHANGE	NO CHANGE	REPLACEMENT 4M BARRIER	REPLACEMENT 4M BARRIER
NOTES	WITH 2.5M BARRIER: ALL PROPERTIES-NEGLIGIBLE DECREASES.	WITH 2.5M BARRIER: 3 PROPERTIES-LOW END MINOR DECREASE. NEW 2M BARRIER ON MAINLINE OVER JUNCTION	36 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3M TO 4M BARRIER. GIVEN MINIMAL BENEFITS OF4M BARRIER OVER 3M BARRIER, 3M BARRIER RECOMMENDED. NEW 2M BARRIER ON MAINLINE OVER JUNCTION.	113 PROPERTIES-LOWER END MINOR DECREASE S RESULTING FROM CHANGE FROM 3M TO 4M BARRIER. GIVEN MINIMAL BENEFITS OF4M BARRIER OVER 3M BARRIER, 3M BARRIER RECOMMENDED.
FINAL RECOMMENDATION	NO CHANGE.	NO CHANGE.	REPLACEMENT3M BARRIER (NO CHANGE TO 2M BARRIER ON THE MAINLINE).	REPLACEMENT 3M BARRIER.

Total Benefit	EM33	EM34	EM31A	EM8A	EM22A
Z0	£2,220,592	-£82,993	£53,097	£3,095	£21,609
Z1	£3,106,182	£309,797	£62,051	£20,070	£69,157
Z2	£4,050,130	£361,814	£62,051	£35,062	£78,133
Z3	£5,097,122	£423,985	£63,379	£35,062	£84,431
Z4	£6,054,036	£442,503	£63,379	£37,317	£86,044

Total Cost of Barriers	EM33	EM34	EM31A	EM8A	EM22A
Z1	£538,356	£153,748	£162,792	£59,500	£106,148
Z2	£599,430	£171,190	£181,260	£66,250	£118,190
Z3	£782,652	£223,516	£236,664	£86,500	£154,316
Z4	£964,743	£275,519	£291,726	£106,625	£190,219

Noise benefit? (2022)	EM33	EM34	EM31A	EM8A	EM22A
Total Number of houses	2569	14	66	1	16
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A	H	A	A
Z0 to Z1	Yes	Yes	No	Yes	No
Z1 to Z2	Yes	Yes	No	Yes	No
Z2 to Z3	Yes	No	No	Yes	No
Z3 to Z4	Yes	No	No	Yes	No

Noise benefit? (2022)	EM33	EM34	EM31A	EM8A	EM22A
Total Number of houses	2569	267	66	1	16
Additional or Higher?	A/H	A	H	A	A
Z0 to Z1 no. houses meet criteria	30	14	0	1	0
Z1 to Z2 no. houses meet criteria	35	1	0	1	0
Z2 to Z3 no. houses meet criteria	16	0	0	1	0
Z3 to Z4 no. houses meet criteria	9	0	0	1	0

Relative Max Noise benefit (2022)	EM33	EM34	EM31A	EM8A	EM22A
Total Number of houses	2569	267	66	1	16
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A	H	A	A
Z0 to Z1 relative max benefit (dB)	-1.3	-4.9	-0.3	-5.2	-2.6
Z1 to Z2 relative max benefit (dB)	-1.7	-1.1	-0.2	-1.0	-0.4
Z2 to Z3 relative max benefit (dB)	-1.5	-0.9	-0.2	-1.3	-0.4
Z3 to Z4 relative max benefit (dB)	-1.3	-0.8	-0.1	-1.1	-0.4

Absolute Max Noise benefit (2022)	EM33	EM34	EM31A	EM8A	EM22A
Total Number of houses	2569	267	66	1	16
Additional (A), Replacement Higher (H) or Additional and Replacement Higher (A/H) Barrier	A/H	A	H	A	A
Z1 absolute max benefit (Z1 to Z0) (dB)	-1.3	-4.9	-0.3	-5.2	-2.6
Z2 absolute max benefit (Z2 to Z0) (dB)	-2.8	-6.0	-0.5	-6.2	-3.0
Z3 absolute max benefit (Z3 to Z0) (dB)	-3.9	-6.9	-0.7	-7.5	-3.4
Z4 absolute max benefit (Z4 to Z0) (dB)	-5.0	-7.7	-0.8	-8.6	-3.8

Total Benefit > Total Cost?	EM33	EM34	EM31A	EM8A	EM22A
Z1	£347,234	£239,042	-£153,838	-£42,525	-£58,600
Z2	£1,230,108	£273,616	-£172,306	-£34,283	-£61,666
Z3	£2,093,879	£283,462	-£226,382	-£54,533	-£91,494
Z4	£2,868,701	£249,977	-£281,444	-£72,403	-£125,784

Conclusion	EM33	EM34	EM31A	EM8A	EM22A
Z1	TRUE	TRUE	FALSE	FALSE	FALSE
Z2	TRUE	TRUE	FALSE	FALSE	FALSE
Z3	TRUE	FALSE	FALSE	FALSE	FALSE
Z4	TRUE	FALSE	FALSE	FALSE	FALSE

SPREADSHEET RECOMMENDATION	NEW AND REPLACEMENT 4M BARRIERS	NEW 3M BARRIER	NO CHANGE	NO NEW BARRIER	NO NEW BARRIER
NOTES	EXISTING BARRIER - NO CHANGE. 8 PROPERTIES-LOWER END MINOR DECREASES RESULTING FROM CHANGE FROM 3.5M TO 4M BARRIER. WITH NEW 3.5M BARRIER: 21 PROPERTIES-MODERATE DECREASES / 170 PROPERTIES MINOR DECREASES. GIVEN MINIMAL BENEFITS OF 4M BARRIER OVER 3.5M BARRIER, 3.5M BARRIER RECOMMENDED.	1 PROPERTY-LOWER END MINOR DECREASE RESULTING FROM CHANGE FROM 2.5M TO 3M BARRIER. GIVEN MINIMAL BENEFITS OF 3M BARRIER OVER 2.5M BARRIER, 2.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: ALL PROPERTIES-NEGLIGIBLE DECREASES.	WITH 2.5M BARRIER: 1 PROPERTY-MAJOR DECREASE. GIVEN USEFUL NOISE REDUCTION TO THIS PROPERTY, 2.5M BARRIER RECOMMENDED.	WITH 2.5M BARRIER: 1 PROPERTY - MID RANGE MINOR DECREASE. ALL REMAINING PROPERTIES-LOW END MINOR OR NEGLIGIBLE DECREASES.
FINAL RECOMMENDATION	NEW 3.5M BARRIER. NO CHANGE TO EXISTING BARRIER.	NEW 2.5M BARRIER.	NO CHANGE.	NEW2.5M BARRIER.	NO CHANGE.

APPENDIX D: RESIDENTIAL AREAS WITHIN THE SCHEME CORRIDOR WHICH WOULD EXPERIENCE NOISE LEVELS EQUAL TO OR ABOVE THE NIGHT-TIME SOAEL WITH THE SCHEME IN OPERATION (WITHOUT ENHANCED NOISE MITIGATION) – DRAWING 1 (KEY PLAN PLUS SHEETS 1 TO 15)

APPENDIX E: PROPOSED NOISE BARRIER HEIGHTS AND EXTENTS FOLLOWING PROVISION OF ENHANCED MITIGATION – DRAWING 2 (KEY PLAN PLUS SHEETS 1 TO 15)

APPENDIX F: ENHANCED NOISE MITIGATION: CHANGE IN ROAD TRAFFIC NOISE LEVELS (DO-SOMETHING 2022 MINUS DO-MINIMUM 2022) - DRAWING 3 (KEY PLAN PLUS SHEETS 1 TO 15)

APPENDIX G: VISUAL IMPACT ASSESSMENT

The following table provides the results of the visual impact assessment for the final enhanced noise mitigation strategy.

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM1	East Bound - Approx. chainage 62100 to Theale Underbridge	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with additional planting between blocks in existing retained vegetation	The new barrier would be a perceptible new feature in views from residential properties to the north and would help to reduce the visual effects of transient traffic on the realigned slip road and M4 mainline beyond. The blocks of retained vegetation in combination with additional planting not previously indicated within the Order limits and replacement planting as indicated on Engineering Design Report, Annex 1, Environmental Masterplan ("EM") sheet 2 would, over time and by Design Year 2037, help integrate the barrier in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM2	East Bound - Approx. chainage 59950 to 59750	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with replacement planting along outward facing side of barrier	The new barrier is unlikely to be visible from adjacent residential properties to the north due to the nature of the intervening vegetation. The west section of the barrier would be visible from an adjacent short section of footpath, but additional planting not previously indicated in EM sheet 3 would, over time and by Design year 2037, integrate the barrier in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Neutral

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM3	East Bound - Approx. chainage 57730 to 57250	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with replacement planting along outward facing side of barrier	The new barrier would be a visible new element in winter views / summer glimpses from an adjacent residential property to the north. The barrier would help screen most transient vehicles in the winter view / summer glimpses and additional planting not previously indicated within the Order limits in EM sheet 4 would, over time and by Design Year 2037, integrate the barrier in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM4	West Bound - Approx. chainage 57730 to 57250	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with replacement planting along outward facing side of barrier	The new barrier is unlikely to be visible from the adjacent high sensitivity (residential) receptors to the south due to the nature of the intervening vegetation.	Neutral
EM6	East Bound – Approx. chainage 53900 to 53650	2.0m (New)	New barrier would run along the back of verge between the M4 and the B3270	Timber Barrier	The new barrier will not be visible from adjacent high sensitivity (residential) receptors to the north due to the existing 3.0m high noise barrier on the opposite side of the B3270 and will only be visible to users of the local road.	Neutral
EM8	East Bound - Approx. chainage 52720 to 52200	2.5m (new)	New barrier would run along Order limits resulting in localised loss of some vegetation.	Timber barrier	The new barrier, although it would form a prominent linear edge to the local road (B3270 Lower Earley Way), would help to screen views to the traffic on the M4.	Neutral

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM8	East Bound - Approx. chainage 52200 to 51700	2.5m (new)	New barrier would run along back of verge resulting in limited loss of vegetation	Timber barrier	The new barrier at this location would be remote and not visible from high sensitivity (residential) receptors.	Neutral
EM8	East Bound - Approx. chainage 51700 to 51250	2.5m (new)	New barrier would run at back of Order limits and would result in the loss of some vegetation	Timber barrier	The new barrier, although it would form a prominent linear edge to the local road (B3270 Lower Earley Way), would help to screen views to the traffic on the adjacent M4.	Neutral
EM8	East Bound - Approx. chainage 51250 to 50550	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with new planting on adjacent embankment	The new barrier would not be visible from high sensitivity visual receptors such as residential properties and Public Rights of Way.	Neutral
EM8a	West Bound - Approx. chainage 51830 to 51700	2.5m (new)	New barrier would run along back of verge and would result in the loss of some vegetation	Timber barrier with new planting on outward facing side of barrier	The new barrier would be a perceptible new element from the University of Reading Farm in winter views and filtered summer glimpses and would help to screen views to most of the transient traffic on the M4. Additional planting not previously indicated within the Order limits in EM sheet 7 would, over time and by Design Year 2037, integrate the barrier in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM9	East Bound - Approx. chainage 49160 to 48860	3.5m (new)	New barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The new barrier would be a visible new element in winter views / summer glimpses from adjacent residential properties to the north. The barrier would help screen most transient vehicles in the winter view / summer glimpses and new planting as indicated in EM sheet 9 would, over time and by Design Year 2037, integrate the barrier in the view.	Beneficial
EM9	West Bound - Approx. chainage 49070 to 48750	3.5m (new)	New barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The new barrier would be a visible new element in winter views / summer glimpses from adjacent residential property to the south. The barrier would help screen most transient vehicles in the winter view / summer glimpse and additional planting not previously indicated within the Order limits in EM sheet 9 would, over time and by Design Year 2037, integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM9	East Bound - Approx. chainage 48500 to 47020	3.5m (2.0m)	Increased height barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The taller barrier would be a perceptible new element in winter views / summer glimpses from a limited number of adjacent residential properties to the north. Where it is visible it would help screen most transient vehicles in the winter view / summer glimpse and additional planting not previously indicated in EM sheets 9 and 10 would, over time and by Design Year 2037, integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
					Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	
EM10	West Bound - Approx. chainage 48750 to 48250	3.5m (replacement - previous barrier 1.9m)	Increased height barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The taller barrier would be a perceptible new element in winter views / summer glimpses from adjacent residential property to the south. The barrier would help screen most transient vehicles in the winter view / summer glimpse and additional planting not previously indicated within the Order limits in EM sheet 9 would, over time and by Design Year 15, integrate the barrier in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM11	West Bound - Approx. chainage 47560 to 46980	3.5m (new)	Increased height barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The new barrier would be a perceptible new element in winter views / summer glimpses from a limited number of adjacent residential property to the south. Where it is visible it would help screen most transient vehicles in the winter view / summer glimpse and additional planting not previously indicated within the Order limits in EM sheet 10 would, over time and by Design Year 15, integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM12	East Bound - Approx. chainage 39400 to Beenhams Heath overbridge	2.5m (new)	New barrier would run along back of verge resulting in limited loss of vegetation	Timber barrier	The new barrier would not be visible from high sensitivity visual receptors such as residential properties and Public Rights of Way.	Neutral
EM13	West Bound - Approx. chainage 37970 to 37300	2.5m (new)	New barrier. Location to be confirmed - Back of verge or Order limits	Timber barrier	The new barrier would be a perceptible new element in winter views / summer glimpses from a limited number of adjacent business and residential properties to the south. Where it is visible it would help screen most transient vehicles in the winter view / summer glimpses.	Beneficial
EM14	East Bound - Littlefield Green overbridge to approx. chainage 37300	2.5m (new)	New barrier. Location to be confirmed - Back of verge or Order limits	Timber barrier	The new barrier would be a perceptible new element in winter views / summer glimpses from a limited number of adjacent residential properties to the north. Where it is visible it would help screen most transient vehicles in the winter view / summer glimpses.	Beneficial
EM15	West Bound - Approx. chainage 33250 to 32400	3.5m (replacement - previous barrier 2.0m)	Increased height barrier would run along back of verge and would result in the loss of vegetation on upper part of adjacent embankment	Timber barrier with replacement planting along outward facing side of barrier	The taller barrier would be a perceptible new element in winter views / summer glimpses from a limited number of adjacent residential property to the north. Where it is visible it would help screen most transient vehicles in the winter view / summer glimpses and additional planting not previously indicated within the Order limits in EM sheet 18 would, over time and by Design Year 2037, integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM17	East Bound - Approx. chainage 31320 to 30970	3.0m (new)	New barrier would run along back of verge on top of new earthworks	Timber barrier with replacement planting along outward facing side of barrier	The new barrier would be a visible new element in views from the adjacent Amerden Caravan Park to the north. The barrier would help screen most transient vehicles in these views and new planting on the embankment will, over time, integrate the barrier.	Beneficial
EM17	East Bound - Approx. chainage 31320 to 30790	3.0m (new)	New barrier would run along back of verge on top of new earthworks	Timber barrier with replacement planting on adjacent regraded earthworks	The new barrier would be a visible new element in views from the adjacent Amerden Caravan Park to the north and a public footpath immediately adjacent to it. The barrier would help screen most transient vehicles in views from the caravan park and additional planting on a re-graded embankment, not previously indicated within the Order limits in EM sheet 19, would, over time and by Design Year 2037, integrate the barrier. The barrier would screen vehicles in views from the public footpath immediately adjacent to it. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM17	East Bound - Approx. chainage 30790 to 30720	3.0m (replacement - previous barrier 2.0m)	Increased height barrier along Order limits	Timber barrier	The taller barrier would be a visible new element in views from adjacent residential properties to the north. Where it is visible it would help to marginally reduce the amount of transient traffic visible in the view.	Neutral
EM17	East Bound - Approx. chainage 30720 to Marsh Lane overbridge	3.0m (replacement - previous barrier 2.0m)	Increased height barrier would run along back of verge and would result in loss of	Timber barrier with replacement planting along outward facing	The taller barrier would be a perceptible new element in views from adjacent residential properties to the north. Where it is visible it would help to marginally reduce the amount of transient traffic visible in the view. Replacement planting as	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
			adjacent vegetation	side	indicated in EM sheet 19 would, over time and by Design Year 2037, help to integrate the barrier.	
EM17	East Bound - Marsh Lane overbridge to Approx. chainage 30370	3.0m (replacement - previous barrier 2.0m)	Increased height barrier would run along back of verge and would result in loss of adjacent vegetation	Timber barrier with replacement planting along outward facing side	The taller barrier would be a perceptible new element in views from the adjacent residential properties to the north. Where it is visible it would help to marginally reduce the amount of transient traffic visible in the view. Additional planting not previously indicated within the Order limits in EM sheet 19 would, over time and by Design Year 2037, help to integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM18	West Bound - Approx. chainage 31320 to 30770	3.0m (new)	New barrier along Order limits	Timber barrier	The new barrier would be a visible new element in filtered views from the adjacent property to the south and a public footpath immediately adjacent to it. The barrier would help screen most transient vehicles in views from the property. The barrier would screen vehicles in views from the public footpath.	Beneficial
EM18	West Bound - Approx. chainage 30770 to Marsh Lane overbridge	3.0m (replacement - previous barrier 2.0m)	Increased height barrier would run along back of verge and would result in loss of adjacent vegetation	Timber barrier	The taller barrier would be a perceptible new element in views from residential properties to the south. Where it is visible it would help to marginally reduce the amount of transient traffic visible in the view.	Neutral

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM20	East Bound - Approx. chainage 28970 to 28680	3.0m (replacement - previous barrier 2.4m)	Increased height barrier would run along back of verge	Timber barrier	The taller barrier will be visible from adjacent allotments in filtered views through intervening vegetation.	Neutral
EM20	East Bound - Approx. chainage 28680 to Oldway Lane Accommodation overbridge	3.0m (new)	New barrier along Order limits could potentially impact on tree roots of adjacent trees within adjacent recreation ground.	Timber barrier	The new barrier would form a visible feature along the south edge of the recreation ground. The barrier would help to screen transient traffic in many views, including slightly more distant views from residential properties which overlook the recreation ground. Highways England considers that the trees which lie within the adjacent Recreation Ground, and where the roots could potentially be disturbed by the installation of this barrier, would fall under the requirements of paragraph 8.4.17 of the Environmental Statement.	Beneficial
EM23	East Bound - Approx. chainage 27340 to 26550	3.5m (new)	New barrier along top of shallow false cut would result in loss of some scrub vegetation	Timber barrier	The new barrier east of Wood Lane overbridge would be visible from the adjacent open space. The barrier would help to further screen transient traffic in views from the adjacent open space.	Neutral
EM23	East Bound - Approx. chainage 26550 to 26420	3.5m (replacement - previous barrier 2.0m)	Increased height barrier along Order limits would result in the loss of some vegetation	Timber barrier	The taller barrier east of Wood Lane overbridge would be visible from the adjacent open space. The barrier would help to further screen the transient traffic in views from the adjacent open space.	Neutral

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM24	East Bound - Approx. chainage 25940 to 25630	3.0m (replacement previous barrier 1.8m)	Increased height barrier at back of verge on top of steepened realigned earthworks	Timber barrier with replacement planting on outward facing side of barrier	The taller barrier would be visible in views from adjacent residential properties to the north. The barrier would further reduce the visibility of traffic on the eastbound on slip. Replacement planting as indicated in the EM sheet 22 on the lower un-steepened slopes would, over time and by Design Year 15, help to integrate the barrier.	Beneficial
EM25	East Bound - Approx. chainage 25490 to 25140	3.0m (replacement previous barrier 1.8m)	Increased height barrier at back of verge on top of steepened realigned earthworks	Timber barrier with replacement planting on outward facing side of barrier	The taller barrier would be visible in glimpses from adjacent residential properties to the north. The barrier would further reduce the visibility of traffic on the motorway. Replacement planting as indicated in EM sheet 22 on the lower un-steepened slope would, over time and by Design Year 2037, help to soften / integrate barrier.	Beneficial
EM25	East Bound - Approx. chainage 25140 to 24650	3.0m (replacement previous barrier 1.8m)	Increased height barrier at back of verge with loss of vegetation on adjacent embankment	Timber barrier with replacement planting on outward facing side of barrier	The taller barrier would be visible in glimpses from adjacent residential properties to the north. The barrier would further reduce the visibility of traffic on the motorway. The combination of additional planting not previously indicated within the Order limits in EM sheet 22 on the adjacent embankment would, over time and by Design year 2037, help to integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM26	West Bound – Approx. chainage 24500 to 24255	2.5m	Barrier extended by 95m (from 150m proposed in the Environmental Statement to 245m) at back of verge with some loss of vegetation	Timber barrier	The extended barrier would be visible in oblique upper storey views from adjacent residential properties	Neutral
EM31	West Bound - Approx. chainage 19810 to Sutton Lane overbridge	3.0m (replacement - previous barrier 2.0m)	Increased height barrier at back of verge with some loss of vegetation	Timber barrier	The taller barrier would be visible in filtered winter views and occasional summer glimpses from adjacent residential properties.	Neutral
EM31	West Bound - Sutton Lane overbridge to approx. chainage 19260	3.0m (replacement - previous barrier 2.0m)	Increased height barrier at back of verge with some loss of vegetation	Timber barrier	The taller barrier is relatively remote from high sensitivity receptors such as residential properties and Public Rights of Way.	Neutral
EM32	East Bound - Approx. chainage 15960 to 15700	3.0m (replacement - previous barrier 2.0m)	Increased height barrier runs at back of verge with loss of some vegetation on embankment.	Timber barrier with replacement planting on outward facing side	The taller barrier would be visible from the adjacent open space to the north in filtered winter views through intervening retained vegetation on lower embankment slopes. Additional planting not previously indicated within the Order limits in EM sheet 27 adjacent to the barrier would, over time and by Design Year 2037, help integrate it in the view. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Neutral

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM32	East Bound - Approx. chainage 15700 to 14420	3.0m (replacement - previous barrier 2.0m)	Increased height barrier runs along top of shallow cutting slope with loss of adjacent vegetation.	Timber barrier with replacement planting on outward facing side	The taller barrier would be visible from adjacent residential properties to the north in filtered winter views and summer glimpses through intervening retained vegetation on lower embankment slopes. The barrier would help to further screen transient traffic on the M4 in the filtered winter views and summer glimpses. A combination of additional planting not previously indicated within the Order limits and replacement planting as indicated in EM sheets 27 and 28 would, over time and by Design Year 2037, help to integrate the barrier in most views. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial
EM32	East Bound - Approx. chainage 14420 to 14050	3.0m (replacement - previous barrier 2.0m)	Increased height barrier runs at back of verge with loss of some vegetation on embankment.	Timber barrier with replacement planting on outward facing side	The taller barrier would be visible from adjacent residential properties to the north in filtered winter views and summer glimpses through intervening retained vegetation on lower embankment slopes. The barrier would help to further screen transient traffic on the M4 in the filtered winter views and summer glimpses. The combination of additional planting not previously indicated in the EM sheet 22 on the adjacent embankment would, over time and by Design year 2037, help to integrate the barrier. A revised EM, incorporating the additional planting proposed, will be submitted to the Examination at Deadline VI. All proposed planting/landscaping is secured under Requirement 9, Schedule 2 of the Draft DCO.	Beneficial

Barrier Ref	Location	Height (m)	Impacts	Mitigation	Visual Effect	Visual Change
EM33	East Bound - Approx. chainage 12350 to 11220	3.5m (new)	New barrier along Order limits with some vegetation removal and limited space for planting	Timber barrier	The new barrier would be visible from residential properties to the north in heavily filtered views through existing block of trees at the north edge. The barrier would help to screen most transient vehicles on the M4 in the view.	Beneficial
EM34	West Bound - Approx. chainage 12650 to 12330	2.5m (new)	New barrier along Order limits with some vegetation removal and limited space for replacement planting	Timber barrier	The new barrier would be visible from residential properties along the west edge of the Harlington Conservation Area and in heavily filtered views through existing block of trees at the north edge. The barrier would help to screen most transient vehicles on the M4 in the view.	Beneficial. Also potential heritage benefit from reduced noise
EM34	West Bound - Approx. chainage 11820 to 11250	2.0m (New)	New barrier along Order limits with some vegetation removal and limited space for replacement planting.	Timber barrier	The new barrier would be visible from the adjacent high sensitivity publically accessible Crane Meadows and from the path at the north edge of Cranford Park. The barrier would help to screen most transient vehicles on the M4 in the view.	Beneficial.