M4 junctions 3 to 12 smart motorway

Enhanced Noise Mitigation Study

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Highways England
The Cube
199 Wharfside Street
Birmingham
West Midlands
B1 1RN

URS Infrastructure & Environment UK Ltd
Royal Court
Basil Close
Chesterfield
Derbyshire
S41 7SL

URS Halcrow Hyder mouchel building great relationships

Limitations

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

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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) 1011m of new 2m barrier;
2) 5881m of new 2.5m barrier;
3) 600m of new 3m barrier;
4) 3019m of new 3.5m barrier;
5) 3985m of replacement 3m barrier;
6) 3971m of replacement 3.5m barrier;
7) The 60 year cost is estimated at £9.71m; and
8) 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 241m 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 = 1491m (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 = 867m (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 = 187m
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 = 177m
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 = 714m
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 New 2.0 metre barriers over railway (both carriageways) / length = 100m for each No change for barrier on mainline
EM25 (Ragstone Road /	Existing 1.8 metre barrier	Replacement 3.5 metre barrier / length = 863m (2m on bridges)

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
Winvale, Slough)		
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 = 1117m

Table 1: Barrier Specification by Area		
Area	**Current Environmental Statement Assessment**	**Enhanced Mitigation Proposal (Drawing 2)**
EM34 (St Pauls Close, Harlington)	No barrier	New 2.5 metre barrier / length = 323m
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.