Updated Position Statement on Further Noise Mitigation

September 2015

The Infrastructure Planning (Examination Procedure) Rules 2010
A14 Cambridge to Huntingdon improvement scheme

Updated Position Statement on Further Noise Mitigation

HE/A14/EX/156

September 2015
Contents

1 Executive Summary .................................................................................................................. 4
2 Introduction ............................................................................................................................... 6
3 National Networks National Policy Statement (NPSNN) ....................................................... 7
4 Mitigation Measures in the ES .................................................................................................. 9
5 Consideration of further noise mitigation ............................................................................. 12
6 Supporting Data and Assumptions ......................................................................................... 16
7 Results and conclusions ......................................................................................................... 17

Appendix A – very Low Noise Surfacing (vLNS) .................................................................... 19
  Introduction ............................................................................................................................... 19
  Noise from road surfacing ....................................................................................................... 19
  Environmental Statement surfacing assumptions .................................................................. 20

Appendix B – whole life costs for noise mitigation options ...................................................... 22
  Noise barriers .......................................................................................................................... 22
  Surfacing ................................................................................................................................ 23

Appendix C – Sustainability appraisal results of further mitigation options ......................... 24

Appendix D – Consideration of benefits compared to costs ..................................................... 49
1 Executive Summary

1.1.1. This updated position statement supersedes the original Position Statement on Further Noise Mitigation (Highways England reference HE/A14/EX/129 and PINS reference REP8-023) and provides supporting evidence to:

- Highways England's commitment set out in its Response to ExA's Second Written Questions 2.10.5 and 2.10.12 (document reference HE/A14/EX/88, PINS reference REP7-023) to provide additional noise mitigation for the A14 Improvement Scheme, and explains the nature of that mitigation and the context in which it has come about; and

- Highways England’s oral submissions with regard to further noise mitigation at the Noise and Air Quality Issue Specific Hearing (ISH), held on 15 September 2015.

1.1.2. The National Policy Statement for National Networks\(^1\) (NPSNN) was designated in December 2014, just before the A14 Development Consent Order (DCO) application was made. It requires Best Available Techniques\(^2\) (BAT) to reduce noise impact to be considered and for adverse impacts/effects\(^3\) on health and quality of life to be mitigated and minimised where it is sustainable to do so\(^4\).

1.1.3. The Environmental Statement (document reference APP-345) sets out the envisaged noise mitigation. It also sets out the approach used to confirm that adverse effects were minimised as far as sustainable at the time the ES was completed and that mitigation is provided on an equitable basis across the scheme.

1.1.4. Since submitting the Development Consent Order (DCO) application Highways England has continued to consider how best to mitigate the adverse impacts and to enhance the benefits of the scheme at residential areas. In particular, Highways England has considered the engineering and financial implications of using new higher performance road surface specifications and/or additional noise barriers to reduce traffic noise levels, all in the context of continuing to meet the requirements of the NPSNN, namely that BAT is considered to reduce noise impacts and for them to be implemented where they are sustainable\(^4\).

1.1.5. The on-going consideration of mitigation has identified that there is a strong sustainability case for providing lengths of very low noise surfacing (vLNS) – i.e. lower noise surfacing than currently specified under DMRB\(^5\) or MCHW\(^6\) – as part of the BAT noise mitigation solution at five locations, four of which are also Important Areas identified under the Government’s 2014 Noise Action Plan for Roads. Two of the ‘BAT’ options also include changes to noise barriers. In summary, these are presented in the Table 1.

---

2 NPSNN 5.189
3 Section 14.2 of Chapter 14 and Appendix 14.3 of the ES set out that whilst NPSNN 5.195 uses the term ‘impacts’ policy and practice guidance make clear that it is ‘adverse effects’ that are to be minimised as far as sustainable.
4 NPSNN 5.195
Table 1: Further mitigation included in the scheme

<table>
<thead>
<tr>
<th>Area</th>
<th>Best Available Techniques (BAT) Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alconbury</td>
<td>Lengthening of Alconbury barrier with a 2m barrier on top of existing bund to protect dwellings at Sharps Lane</td>
</tr>
<tr>
<td>Brampton</td>
<td>9km of vLNS** on A14 with noise barriers unchanged from ES</td>
</tr>
<tr>
<td>Bar Hill</td>
<td>3km of vLNS** on A14 with noise barriers unchanged from ES</td>
</tr>
<tr>
<td>Girton</td>
<td>Lengthening of proposed barrier at SE Girton (part of this barrier could be provided by the noise bunding proposed for the Darwin Green development)</td>
</tr>
<tr>
<td>Orchard Park</td>
<td>3km of vLNS** on A14 with noise barriers unchanged from ES</td>
</tr>
</tbody>
</table>

** -7.5 dB RSI

RSI stands for ‘Road Surface Influence’ and is a parameter used for quantifying road surfacing noise performance. See Appendix A of DMRB HD 213/11 for more information
2 Introduction

2.1.1. The National Policy Statement for National Networks NPS (NPSNN) requires Best Available Techniques8 (BAT) to reduce noise impact to be considered and for them to be implemented, where it is sustainable to do so, in order to minimise adverse noise impacts/effects on health and quality of life.

2.1.2. The Environmental Statement (ES) sets out envisaged noise mitigation and the approach used in the design development to confirm at that stage that adverse impacts have been minimised as far as sustainable. The mitigation strategy set out in the ES, also ensures that mitigation is provided on an equitable basis along the length of the proposed scheme.

2.1.3. Highways England's Response to ExA Second Written Question, 2.10.5 and 2.10.12 (document reference HE/A14/EX/88, PINS reference REP7-023) discusses further noise mitigation along the Cambridge Northern Bypass and at Alconbury. Also in oral submissions to the Noise and Air Quality Issue Specific Hearing (ISH) on 15 September 2015, Highways England confirmed that a further review, extending beyond the assessment locations identified in the Position Statement submitted at deadline 8 of the examination timetable (PINS document reference REP8-023), had identified a strong sustainability case for providing additional mitigation at Bar Hill.

2.1.4. This paper sets out the supporting evidence for the commitment from Highways England to provide additional noise mitigation at the above mentioned areas and also at Brampton. This paper also explains why it is not considered sustainable to provide further mitigation at other locations.

2.1.5. This study takes account of the update to Government's WebTAG that has been published since the ES was finalised (WebTAG is used to evaluate the monetised benefit of additional noise mitigation) and provides a sensitivity test with regard to the further update to WebTAG expected towards the end of 2015.

2.1.6. The information presented in this report is based on CHARM3A traffic data9.

2.1.7. This updated position statement supersedes the original Position Statement on Further Noise Mitigation (Highways England reference HE/A14/EX/129 and PINS reference REP8-023)

---

8 NPSNN 5.189
9 The Local Impact Traffic (LIT) report (PINS reference REP6-002) confirms that the traffic impact model does not resulted in any material change to the assessment of noise effects as reported in the ES. The Sensitivity Test 2 report (PINS reference REP7-027) considers sensitivity to local traffic to A14 speed profiles and also does not result in material changes to the assessment of noise effects as reported in the ES.
3 National Networks National Policy Statement (NPSNN)

3.1.1. 5.189 of NPSNN states that “Applicants should consider using best available techniques to reduce noise impacts”.

3.1.2. 5.195 of NPSNN states: “The Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life from noise as a result of the new development;
- mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and
- contribute to improvements to health and quality of life through the effective management and control of noise, where possible.”

3.1.3. 5.198 of NPSNN states: “Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:

- engineering: containment of noise generated;
- materials: use of materials that reduce noise, (for example low noise road surfacing);
- lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise
- transmission through screening by natural or purpose built barriers”

3.1.4. The Executive Summary of Chapter 14 of the ES set out how the three aims of Government noise policy (and hence 5.195 of the NPSNN) were met by the proposed scheme as submitted:

- adverse effects on health and quality of life are minimised by maximising on-site mitigation as far as is it was identified to be sustainable at the time the ES was completed (meeting the second aim of 5.195) - this includes alignment, low nose surfacing and noise barriers as explained further in the next section;
- significant adverse effects on health and quality of life have then been avoided by the combination of the on-site mitigation, as noted above, and off-site mitigation – i.e. provision of noise insulation (meeting the first aim of 5.195); and
- the Huntingdon bypass would reduce noise at approximately 2,900 dwellings (in Huntingdon, Godmanchester, Fenstanton and Brampton) and low noise surfacing plus noise barriers would reduce noise at a number of Important Areas identified by the Government’s 2014 Noise Action Plan located between Swavesey and Milton (collectively meeting the third aim of 5.195).

---

10 As set out in Chapter 14 to the ES (document reference APP-345) and Appendix 14.03 to the ES (document reference APP-707), significant adverse effects on health and quality of life occur when the noise from the scheme exceeds the relevant Significant Observed Adverse Effect Level (SOAEL).
3.1.5. Since submitting the Development Consent Order (DCO) application Highways England has continued to consider how best to mitigate the adverse impacts of the scheme and to enhance the benefits of the scheme. In particular, Highways England has considered the engineering and financial implications of using new higher performance road surface specifications and/or additional noise barriers to reduce traffic noise levels, all in the context of meeting the requirements of the NPSNN, namely that BAT is considered and for adverse effects to be mitigated and minimised where it is sustainable to do so.
4 Mitigation Measures in the ES

4.1.1. Section 14.2 of chapter 14 to the ES (PINS reference APP-345) sets out that the overall noise mitigation strategy responds to the following principal drivers:

- The Environmental Impact Assessment (EIA) Regulations; i.e. to avoid or reduce likely significant adverse noise effects;

- Government policy; particularly National Planning Statement for National Networks (NPSNN) as discussed in the previous section but also taking account of Government noise policy (Noise Policy Statement for England\(^\text{11}\)), the Planning Practice Guidance (PPG-Noise\(^\text{12}\)) and the Design Manual for Roads and Bridges\(^\text{13}\) (DMRB); and

- The Environmental Noise Regulations; the 2014 Noise Action Plan for Roads published under these Regulations, identifies twenty five (25)\(^\text{14}\) Important Areas have been identified on the existing A1 and the A14 within the study area for the proposed scheme.

4.1.2. Against these drivers, with regard to Table 14.1 of Chapter 14 to the ES and taking into account that the scheme is part ‘on’ and part ‘off’ the existing Strategic Road Network (SRN), the principles for providing operational noise mitigation for the scheme can be summarised as:

1. Relevant to the **first** aim of Government noise policy (NPSNN 5.195) as clarified by Planning Practice Guidance\(^\text{15}\):
   
   i. Is it an important Area?

   ii. Are there unacceptable adverse effects to be prevented?

   iii. Are there significant observed adverse effects to be avoided, as far as sustainable (giving weight to potential health effects\(^\text{16}\))?

2. Relevant to the **second** aim of Government noise policy (NPSNN 5.195):

   i. Are there adverse effects on health and quality of life to be minimised as far as sustainable?

   ii. Are there adverse effects identified as Likely Significant Effects (under EIA) due to noise increase and, for example the number of dwellings in a community so effected, to be avoided or reduced?

3. Relevant to the **third** aim of Government noise policy (NPSNN 5.195):

\(^{11}\) https://www.gov.uk/government/publications/noise-policy-statement-for-england-npse
\(^{12}\) http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/
\(^{13}\) Highways Agency and Welsh Office (2011), Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, HD213/11 Revision 1, Noise and Vibration
\(^{14}\) As noted at para 14.4.67 of chapter 14 to the ES, Important Areas 5142 and 5143 relate to unoccupied / derelict houses and were not considered further in the ES. 14.4.68 of chapter 14 notes that Highways England would continue to monitor and future change in status at these locations.
\(^{15}\) http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/
\(^{16}\) For example paragraph 14.2.86 of chapter 14 to the ES (PINS reference APP-345)
4.1.3. For the sections of the scheme that are ‘on’ the existing SRN, most and sometimes all of the above principles apply. For the sections that are ‘off’ the existing SRN (i.e. Huntingdon Bypass), it is only the principles at 2) in the list above that apply. This is because: firstly the distance between the proposed scheme and the vast majority of dwellings is sufficiently large that combined with the integrated mitigation forecast noise levels are neither significant observed adverse effects nor unacceptable adverse effects; and secondly there is no opportunity, in this instance, to improve the existing environment.

4.1.4. Overall this means that there are ‘in principle’ differences in the triggering of mitigation between the ‘on-line’ and ‘off-line’ sections of the scheme.

4.1.5. In all cases, the forms of noise mitigation proposed in the ES, in line with the NPSN (5.198), that have been integrated into the scheme include:

- Materials: The base proposed scheme assumes low noise road surfacing (LNS) as described in the next section including the assumption that Highways England would have completed installation of low noise surfacing at Important Areas on the existing network by 2021 with or without the proposed scheme (Refer to ES Chapter 14, Section 14.2, paragraph 14.2.22 - document reference APP-345).

- Layout:
  - The alignment of the new sections of the proposed scheme has been selected to minimise environmental impact, including noise, as far as sustainable;
  - The base scheme design for the new Huntingdon Bypass includes landscape earthworks that also reduce wayside noise; and
  - Additional noise mitigation has been incorporated into the scheme (ES Chapter 14, section 14.5), in the form of noise fence barriers.

- Receptor mitigation – Where sustainable scheme mitigation has been exhausted, and the residual noise levels exceed the relevant trigger values at residential dwellings, the noise insulation would be provided in accordance with the Noise Insulation Regulations.

4.1.6. As set out in the ES, the following tests were applied in determining whether additional noise mitigation is sustainable:

- Benefit (monetised benefit of noise reduction evaluated using WebTAG\textsuperscript{17}) compared to cost of the mitigation;
- Engineering practicability;

\textsuperscript{17} The current (November 2014) version of WebTAG has been used to monetise the noise benefits/impacts for the executive summary. Values of monetised noise benefits/impacts from the expected 2015 version of WebTAG are also presented for each location in Appendix C as a positive sensitivity test.
- Other environmental effects potentially caused by the mitigation (for example landscape or visual effects); and
- Stakeholder engagement and consultation responses.

4.1.7. Where additional mitigation was not found to be sustainable then this was not identified in the ES.
5 Consideration of further noise mitigation

5.1.1. The ES identified mitigation that met principles 1) and 3) as set out earlier in this note. Principle 2) was also met by the mitigation identified in the ES based on the best available information available at that time.

5.1.2. This report sets out whether any of the further mitigation options identified since the ES was finalised are sustainable in line with the second principle as set out earlier, i.e. relevant to the second aim of Government noise policy (NPSNN 5.195):

- Are the wider adverse effects on health and quality of life identified in the ES minimised as far as sustainable?
- Are the Likely Significant Effects (under EIA) due to noise increase avoided or reduced as far as sustainable?

Locations

5.1.3. Based on the findings of the ES and in response to NPSNN requirements, at the following locations the sustainability of providing further mitigation has been considered:

- Communities identified in the ES as being subject to residual likely significant effect\(^{18}\) due to adverse noise impacts:
  - Brampton (southwest and southern edge closest to A14/A1);
  - Brampton RAF Base and the committed development at this site (southwestern edge closest to A14/A1); and
  - Fenstanton (Pear Tree Close).

- Locations where Relevant/Written Representations, SoCG or the Local Impact Report (LIR) have sought further noise mitigation and where the ES identified that long term noise levels from the scheme could exceed the relevant Lowest Observed Adverse Effect Level (LOAEL)\(^{19}\):
  - Alconbury;
  - Buckden Marina;
  - Offord Cluny;
  - Hilton;
  - Girton*;
  - Histon/Impington*;

\(^{18}\) These are not significant impacts on health and quality of life as the level of noise falls below the relevant Significant Observed Adverse Effect Level (SOAEL). Rather these are likely significant effects reported in the ES in response to the EIA Regulations that arise from noise levels that fall between the relevant Lowest and Significant Observed Effect Levels (LOAEL and SOAEL) and where noise change impacts and the number and grouping of the affected dwellings, for example, are collectively considered significant. Please refer to Section 14.2 and Table 14.1 of Chapter 14 to the ES (document reference APP-345) and Appendix 14.03 to the ES (document reference APP-707).

\(^{19}\) Refer to Figure 14.07 to the ES (document reference APP-416).
o Orchard Park / Kings Hedges*; and

o Other communities along the line of route where the number of dwellings and their proximity to the scheme would be likely to yield a sufficient monetised benefit to warrant the consideration and potential provision of further mitigation.

Notes:

* South Cambridgeshire District Council requested that Highways England test the mitigation effect, consistent with NPSNN, of the longer noise barriers that were identified in these locations in the 2009 Environmental Statement for the A14 Ellington to Fen Ditton scheme promoted at that time.

Method for evaluating the sustainability of further mitigation

5.1.4. The approach set out in the ES (above) has been applied in determining whether the further mitigation considered in this position statement is sustainable:

- Benefit (monetised benefit of noise reduction evaluated using WebTAG) compared to cost of the mitigation;

- Engineering practicability, for example;
  o The constructability of noise barriers on the shoulders of existing cuttings or embankments;
  o The durability of some noise barrier materials or some very low noise surfacing materials and hence long term maintenance and highway availability impacts;
  o The benefits in maintenance terms of avoiding the use of different surfacing materials along the length of the scheme;

- Other environmental effects potentially caused by the mitigation, for example;
  o landscape or visual effects of noise barriers;
  o change in net carbon emissions associated with either first build materials or the need for increased renewals; and

- Stakeholder engagement and consultation responses, for example;
  o to investigate any request with regard to further mitigation to confirm whether such mitigation would be sustainable and if not why not, ensuring that all stakeholders are treated equitably and consistently; and
  o where noise mitigation is proposed then take account of a relevant stakeholder’s view on, for example, a) the form of mitigation (e.g. fence or landscape earthwork) or b) the balance between noise reduction and visual impact / loss of light.
Further Noise Mitigation Options Considered

5.1.5. The further noise mitigation options that have been considered are:

- Further noise barriers (in addition to those in the ES);
- Increasing the height of noise barriers identified in the ES; and/or
- Extending barrier lengths identified in the ES; and/or
- Very Low Noise Surfacing (vLNS).

Noise performance of Very Low Noise Surfacing (vLNS)

5.1.6. The ES assumptions regarding the noise performance of Low Noise Surfacing are as follows:

- RSI\(^{20}\) -3.5dB, assumed for resurfacing of existing highways (in line with the performance of any Thin Surface Course System (TSCS); and
- RSI -5dB, assumed for new highways (a performance achieved by many TSCSs using smaller aggregate material).

5.1.7. The higher performance lower-noise surfacing solutions assessed in this note (referred to as ‘vLNS’) have a performance of RSI -7.5dB. This is achievable by changing the specification of TSCS and using smaller aggregate material.

5.1.8. As set out in Appendix A, the RSI value gives a good indication of the performance of a newly-laid surface. Over time, the noise performance can diminish as a result of clogging of the voids with detritus and change in the surface texture as a result of consolation by tyres. Both of these effects reach an equilibrium value after a few years. Clogging may be cleansed by tyre pressures on the wet road in winter and texture depth may be restored by the abrasive action of tyres in winter.

5.1.9. This means that the performance over the long-term is generally smaller in magnitude than the RSI value.

5.1.10. DMRB HD213/11 sets out a relationship to estimate the longer term noise performance of thin surfacing systems for use in noise assessments. In this relationship the longer term noise performance is given as: 0.7 * (RSI) dB\(^{21}\). This relationship has been used in this report and in the ES to convert short-term (RSI-based) performance to the long-term performance assumed in the noise calculations and assessments.

5.1.11. Further detail about surfacing performance is given in Appendix A, with surfacing costings given in Appendix B.

\(^{20}\) RSI stands for ‘Road Surface Influence’ and is a parameter used for quantifying road surfacing noise performance. See Appendix A for more information

\(^{21}\) DMRB HD213/11, Para A4.29
Study area

5.1.12. The study area defined in the ES is in accordance with DMRB and is set as 600m from the new or altered roads within the proposed scheme and also 600m from existing roads where the proposed scheme is likely to change road traffic noise levels by 1 dB or more.

5.1.13. This is in line with the benefits evaluated for noise barriers. To err on the side of caution, the Government’s calculation method for road traffic noise (CRTN) only takes account of the higher of either the reduction provided by a noise barrier or the reduction provided by propagation over soft ground. As the land around most of the proposed scheme is soft ground and given that the reduction of noise from soft ground increases with increasing distance from the road, the net benefit of a noise barrier will diminish to zero by around 600m from a road.

5.1.14. However, the second aim of Government noise policy (5.195 of the NPSNN) relates to minimising adverse impacts on health and quality of life. This relates to any residential receptor that is forecast to be exposed to noise levels greater than the relevant Lowest Observed Adverse Effect Level (LOAEL) but is less than the relevant Significant Observed Adverse Effect Level (SOAEL) as defined in the ES\textsuperscript{22} in line with available guidance and best practice. Forecast noise levels exceeding the night time LOAEL and SOAEL are shown respectively by the grey and pink in-filled contours in Figure 14.07\textsuperscript{23} of the ES. As set out in the ES the night-time contours are larger than the equivalent daytime contours so the information presented in Figure 14.07 is a worst case.

5.1.15. The mitigation sustainability appraisals reported in this note therefore take full account of all properties within the LOAEL contour, as they did in preparing the ES, even where this extends further from the road than the DMRB study area.

\textsuperscript{22} Chapter 14 of the ES (document reference APP-345)
\textsuperscript{23} Figure 14.07 of the ES (document reference APP-416)
6 Supporting Data and Assumptions

6.1.1. When considering the calculation of the sustainability of vLNS, it is important to note that Highways England has developed its approach to vLNS for the A14 in response to the issue of the NPSNN in December 2014 and the requirement contained in it to consider Best Available Techniques to reduce noise. DMRB (HD213/11) and MCHW pre-date the NPSNN and so do not provide guidance on the use of vLNS. While the likely effects of vLNS and current whole life costs can be predicted with confidence, Highways England’s approach and in particular its building of evidence of whole life costs will continue to develop as vLNS is implemented.

6.1.2. The whole life costs, including maintenance and renewal, of noise barriers and vLNS are set out in Appendix B.

6.1.3. The lengths and locations of the vLNS and additional / extended noise barriers considered and their sustainability appraisal (including additional 60yr costs) are set out in Appendix C.

6.1.4. With regard to net carbon emissions, there may be differences between types of surfacing. vLNS is assumed to require one additional surface course relaying intervention over a 60-year design life compared to standard TSCSs. However, this would be offset to some degree by vLNS having slightly lower rolling resistance than standard LNS which would reduce vehicles’ fuel emissions.
7 Results and conclusions

7.1.1. The assessment conclusions are that:

- there is no sustainable case for providing further noise barriers (fences or bunds) at any location except a small lengthening of the barrier at Alconbury and a short additional section of barrier at Girton;

- LNS reduces noise at source and provides a very strong sustainability case at Alconbury, Brampton, Bar Hill, Girton and Orchard Park. It provides monetised benefits far in excess of additional costs and substantially reduces the number of dwellings subject to ‘adverse impacts’ referred to in NPSNN para 5.195; and

- there is no sustainable case for providing vLNS on the A14 at the other locations considered – e.g. past Hilton and Fenstanton (Pear Tree Close).

7.1.2. The Tables in Appendix C report on the sustainability of the further mitigation options considered on a location-by-location basis.

7.1.3. A summary of the recommended Best Available Techniques (BAT) outcomes along the route that are additional to the mitigation presented in the ES are presented in the following table:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alconbury</td>
<td>2km of vLNS** on A14. Extension of the Alconbury barrier by a 2m barrier on top of existing bund to protect dwellings at Sharps Lane</td>
<td>0.3</td>
<td>1.6 / 2.0</td>
<td>5 /7</td>
</tr>
<tr>
<td>Brampton</td>
<td>9km of vLNS** on A14 with noise barriers unchanged from ES</td>
<td>0.9</td>
<td>2.8 / 3.2</td>
<td>3/4</td>
</tr>
<tr>
<td>Bar Hill</td>
<td>3km of vLNS** on A14 with noise barriers unchanged from ES</td>
<td>0.4***</td>
<td>3.8 / 4.4</td>
<td>10 / 10</td>
</tr>
<tr>
<td>Girton</td>
<td>2km of vLNS** on A14. Lengthening of proposed barrier at SE Girton (part of this barrier could be provided by the noise bunding proposed for the Darwin Green development)</td>
<td>0.3</td>
<td>2.3 / 2.7</td>
<td>8 / 9</td>
</tr>
<tr>
<td>Orchard Park</td>
<td>3km of vLNS** on A14 with noise barriers unchanged from ES</td>
<td>0.3</td>
<td>3.7 / 4.5</td>
<td>12 / 15</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19km of vLNS** on the A14 and A1 and two lengthened noise barriers</td>
<td>£2.2m</td>
<td>£14.2m / £16.8m</td>
<td>6 / 8</td>
</tr>
</tbody>
</table>

+ Refer to Appendix D
*Monetised benefits/impacts are presented using both the 2014 WebTAG methodology and the expected 2015 WebTAG methodology.

**RSI - 7.5dB surfacing

***net cost would be slightly lower as costs of noise insulation would be avoided

7.1.4. While the likely effects of vLNS and current whole life costs can be predicted with confidence, Highways England’s approach and in particular its building of evidence of whole life costs will continue to develop as vLNS is implemented. Taking this into account, only adopting vLNS where monetised benefits exceed 60yr costs by a factor of two or more is considered prudent when applying public finance until further whole life cost information for vLNS is gathered. Further information on this matter is provided at Appendix D.

7.1.5. Figure 1 indicates where lengths of vLNS, LNS and noise barriers have been integrated in the scheme’s reference design.

![Figure 1: Adopted vLNS, LNS and noise barriers](image-url)

**Legend**

- Blue: Scheme fence barrier
- Green: Scheme landscape barrier
- Brown: Existing fence barriers (to be retained)
- Pink: Enhancement/replacement of existing barriers
- White: Very low noise surface
- Light blue: Low noise surface
Appendix A – very Low Noise Surfacing (vLNS)

Introduction

Highways England (HE) has, over many years, successfully worked with suppliers and contractors to develop a range of Low Noise Surfaces, referred to as Thin Surface Course Systems (TSCS). These are covered in the Design Manual for Roads and Bridges (DMRB), in the Manual of Contract Documents for Highway Works (MCHW) and are the preferred surfacing for new construction and major maintenance on the English strategic road network.

Noise from road surfacing

In general, the use of smaller aggregate sizes in TSCSs and more uniformly-shaped (‘cuboid’-shaped) aggregate results in a smoother surface and hence reduced noise generation.

The noise performance of a road surface is characterised by its ‘Road Surface Influence’ (RSI) value, which is measured using a European standard, the Statistical Pass test BS EN ISO 11819 and which can be reported as part of a surface product’s certification under the Highways Authorities Product Approval Scheme, HAPAS. The RSI value is quoted in decibels (dB) and expresses the surface’s early-life noise performance relative to Hot-rolled Asphalt with 20mm aggregate.

The RSI value gives a good indication of the performance of a newly-laid surface. Over time, however, the noise performance diminishes somewhat as a result of clogging of the voids with detritus and change in the surface texture as a result of consolation by tyres. Both of these effects reach an equilibrium value after a few years. Clogging may be cleansed by tyre pressures on the wet road in winter and texture depth may be restored by the abrasive action of tyres in winter.

This means that the performance over the long-term is smaller in magnitude than the RSI value.

DMRB HS213/11 sets out a relationship to estimate the longer term noise performance of thin surfacing systems for use in noise assessments. In this relationship the longer term noise performance is given as: $0.7 \times (\text{RSI}) \, \text{dB}^{24}$. This relationship has been used in this report to relate short-term (RSI-based) performance to the long-term performance assumed in the ES and in this report.

As discussed in DMRB, it is currently standard to assume RSI values of up to -5 dB. This was the basis for the ES as set out in the next section.

There is now sufficient evidence available to assume RSIs up to -7.5dB based on a revised specification for TSCSs where required to minimise noise where there is a sustainability case for doing so, taking account of the need for example to replace such surfaces more regularly than ‘standard’ LNS.

---

24 DMRB HD213/11, Para A4.29
Environmental Statement surfacing assumptions

The Environmental Statement (ES) road surfacing assumptions are as shown in the following figures A2 and A3.

Do Minimum (without-scheme) scenarios

Figure A2: Surfacing assumptions in the ES for the Do Minimum scenarios, in line with the Noise Action Plan, 2014, and the Road Improvement Strategy

The assumption of -3.5dB RSI surfacing (equating to a long-term performance of -2.5dB) in the Do Minimum scheme was agreed with the Highways Agency (now Highways England). This is in response to the 2014 Noise Action Plan for Roads that identifies 26 Important Areas within the scheme study area. In line with the Road Improvement Strategy these Important Areas and surrounding sections of the network are likely to be resurfaced with -3.5dB RSI surfacing by 2021 if the ES scheme was not taken forward. This is in line with ‘Level 3’ surfacing as defined in HE Interim Advice Note IAN 154/12.

NB longer-term surfacing noise performance values (calculated using the DMRB relationship of 0.7 * (RSI) dB) were used in the ES to inform reported noise outcomes.
Do Something (with-scheme) scenarios

The ES assumed the following surface performances:

- for the ‘new build’ sections of the scheme (i.e. Huntingdon Southern Bypass and realigned A1 passed Brampton) a long-term noise performance of -3.5dB, equating to an RSI of -5dB.
- for the online improvements as part of the scheme, (i.e. Cambridge Northern Bypass, A14 Swavesey to Girton) a long-term noise performance of -2.5dB, equating to an RSI of -3.5dB.

Figure A3: Surfacing assumptions in the ES Do Something scenarios

NB longer-term surfacing noise performance values (calculated using the DMRB relationship of 0.7 * (RSI) dB) were used in the ES to inform reported noise outcomes.
Appendix B – whole life costs for noise mitigation options

Noise barriers

Costings for noise barriers were based on the latest available information at the time of writing. Costings were based on the use of absorptive noise fence barriers, on the basis that this is the most common type of barrier proposed on the A14 scheme. The costings were provided with the following assumptions:

- Absorptive environmental barrier fencing with steel posts.
- A nominal allowance of 40% added to unit rates for prelims and method related charges
- No specific traffic management allowances have been included within the initial construction, routine maintenance or renewal costs
- 20 year renewal (complete) period for noise barriers
- Annual inspect and repair visits by a two made gang. These take 3, 4 & 5 days for the 2m, 3m and 4m high barrier respectively

The costs are detailed below in Table B1:

<table>
<thead>
<tr>
<th>1000m absorptive environmental barrier fencing 2.00m high with steel posts</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total: Installation</td>
<td>208,893.47</td>
</tr>
<tr>
<td>Total: 60 yr Routine Maintenance</td>
<td>57,768.96</td>
</tr>
<tr>
<td>Total: 60 yr Renewal of New Asset</td>
<td>155,198.24</td>
</tr>
<tr>
<td>Total</td>
<td><strong>£421,860.66</strong></td>
</tr>
<tr>
<td>1000m absorptive environmental barrier fencing 3.00m high with steel posts</td>
<td>£</td>
</tr>
<tr>
<td>Total: Installation</td>
<td>259,933.34</td>
</tr>
<tr>
<td>Total: 60 yr Routine Maintenance</td>
<td>77,025.28</td>
</tr>
<tr>
<td>Total: 60 yr Renewal of New Asset</td>
<td>193,118.52</td>
</tr>
<tr>
<td>Total</td>
<td><strong>£530,077.13</strong></td>
</tr>
<tr>
<td>1000m absorptive environmental barrier fencing 4.00m high with steel posts</td>
<td>£</td>
</tr>
<tr>
<td>Total: Installation</td>
<td>434,044.77</td>
</tr>
<tr>
<td>Total: 60 yr Routine Maintenance</td>
<td>96,281.60</td>
</tr>
<tr>
<td>Total: 60 yr Renewal of New Asset</td>
<td>322,475.30</td>
</tr>
<tr>
<td>Total</td>
<td><strong>£852,801.68</strong></td>
</tr>
</tbody>
</table>

Table B1: Costs per linear metre for noise barriers of 2m, 3m and 4m above road level

Noise barrier costs per linear metre used in the noise mitigation analysis work are therefore as follows:

- 2m barrier: £422
- 3m barrier: £530
- 4m barrier: £853
Surfacing

Costings have been assumed based on assumptions listed below.

General
The NPV is calculated over a 60 year period with an effective discount rate of 3.5% per annum for years 1-30 and 3.0% for years 31-60; taken from the HM Treasury Green Book Initial Construction in 2015.

-3.5dB RSI surfacing
Binder CAPEX is assumed as £9/m2
Surface course is assumed as £6/m2
Surface course interventions are assumed at years 0, 12, 24, 36, and 48
Binder course interventions are assumed at years 0 and 36

-5dB RSI surfacing
Based on Fig 4.5 of TRL674, it is assumed that no additional interventions of either surface or binder course are required for -5dB RSI surfacing relative to -3.5dB RSI surfacing over a 60-year life.
Binder CAPEX is assumed as £9.50/m2
Surface course is assumed as being 5% more expensive than -3.5dB RSI surfacing. With a -3.5dB RSI surfacing value of £6, this means an -5dB RSI surfacing value of £6.30.
Surface course interventions are assumed at years 0, 12, 24, 36, and 48
Binder course interventions are assumed at years 0 and 36

-7.5dB RSI surfacing
It is assumed that one additional intervention to lay surface course will be required over a 60-year life relative to -3.5dB RSI surfacing.
Surface course is assumed as £6/m2
Binder CAPEX is assumed as £10/m2
Surface course interventions are assumed at years 0, 10, 20, 30, 40, and 50
Binder course interventions are assumed at years 0, and 30

Base cost assumptions, for 1 square metre of surface are as follows:
-3.5dB RSI surfacing: £31.57
-5dB RSI surfacing: £32.99
-7.5dB RSI surfacing: £36.84
Appendix C – Sustainability appraisal results of further mitigation options

Please refer to the following tables.
Table C1: Sustainability appraisal of further noise mitigation options (compared to ES) – Alconbury

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Impacts</th>
<th>WebTAG (£ Change): 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng./Env. issues</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alconbury</td>
<td>Extension of 4m barrier (placed as close as possible to road) from end of current ES barrier to A1(M)/B1043 junction (Figure C1)</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 8→7 666 &gt; LOAEL to 666 128 &gt; SOAEL to 128</td>
<td>+0.1M / +0.2M</td>
<td>+0.1M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost equivalent to monetised benefit but the noise impact is not materially improved)</td>
<td></td>
</tr>
<tr>
<td>Alconbury</td>
<td>2,000m of -7.5dB RSI surfacing. Noise barriers as per ES</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 8→7 666 &gt; LOAEL to 666 128 &gt; SOAEL to 93**</td>
<td>+1.5M / +1.8M</td>
<td>+0.2M</td>
<td>-</td>
<td>N/A</td>
<td>Yes. (benefits are 10x costs but does not remove all noise impacts)</td>
<td></td>
</tr>
<tr>
<td>Alconbury</td>
<td>2,000m of -7.5dB RSI surfacing. Existing barriers retained and not upgraded (cost saving).</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 8→7 666 &gt; LOAEL to 666 128 &gt; SOAEL to 93**</td>
<td>-0.1M / -0.2M</td>
<td>-0.8M</td>
<td>-</td>
<td>New adverse likely significant effect</td>
<td>No. (reduction in cost exceeds loss in monetised benefits – but new likely significant adverse effect introduced in an Important Area)</td>
<td></td>
</tr>
<tr>
<td>Alconbury</td>
<td>2,000m of -7.5dB RSI surfacing. ES barriers + addition of fence barrier on top of existing bund at Alconbury South (Figure C2)</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 8→7 666 &gt; LOAEL to 666 128 &gt; SOAEL to 67</td>
<td>+1.6M / +2.0M</td>
<td>+0.3M</td>
<td>-</td>
<td>N/A</td>
<td>Yes. Combination of additional barrier and improved surfacing reduce adverse impacts. Benefits are more than 5x costs.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:* increase in mitigation costs relative to the ES; 60yr money.
**these numbers are identical but this has been confirmed to be a co-incidence.
*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and VlNS.
Table C2: Sustainability appraisal of further noise mitigation options (compared to ES) – Brampton

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brampton (ON-C04 &amp; ON-C05)</td>
<td>Addition of 950m length 3m tall barrier between the new A14 and the realigned A1(M) – (Figure C3)</td>
<td>Major: 0 → 0</td>
<td>+0.3M / +0.4M</td>
<td>-0.5M**</td>
<td>Visual: negligible impact</td>
<td>No</td>
<td>No. (cost exceeds monetised benefit and significant adverse effect at Brampton RAF base remains)</td>
<td></td>
</tr>
<tr>
<td>Brampton (ON-C04 &amp; ON-C05)</td>
<td>Extend ES barrier south past the Lenton Lakes (3m height), plus 3m fence barrier on east side of the A1(M) southbound to A14 southbound onramp. (Figure C4)</td>
<td>Major: 0 → 0</td>
<td>+0.1M / +0.1M</td>
<td>+1.0M**</td>
<td>Visual: negligible impact</td>
<td>No</td>
<td>No. (cost exceeds monetised benefit and significant adverse effect at Brampton RAF base remains)</td>
<td></td>
</tr>
<tr>
<td>Brampton (ON-C04 &amp; ON-C05)</td>
<td>9,000m of -7.5dB RSI surfacing on A14 and realigned A1 in addition to ES barriers.</td>
<td>Major: 0 → 0</td>
<td>+2.8M / +3.2M</td>
<td>+0.9M</td>
<td>N/A</td>
<td>No</td>
<td>Yes. (monetised benefits more than 3x costs and significant effects are removed)</td>
<td>Yes</td>
</tr>
<tr>
<td>Brampton (ON-C04 &amp; ON-C05)</td>
<td>4m barrier @ 8.4m from centre of nearest carriageway from existing northern point as far south as Buckden Road crossing (Figure C5)</td>
<td>Major: 0 → 0</td>
<td>+0.4M / +0.5M</td>
<td>+1.6M**</td>
<td>Visual: negligible impact</td>
<td>No</td>
<td>No. (cost of barrier exceeds monetised benefit. Significant adverse effect at the Barracks site remains.)</td>
<td></td>
</tr>
<tr>
<td>Brampton (ON-C04 &amp; ON-C05)</td>
<td>9,000m of -7.5dB RSI surfacing on A14 and realigned A1. ES barrier reduced from 4m height to 3m. (Figure C6)</td>
<td>Major: 0 → 0</td>
<td>+2.6M / +3.0M</td>
<td>+0.8M</td>
<td>Visual: adverse impact*** Eng: N/A</td>
<td>Yes</td>
<td>No. (monetised benefits more than 3x costs and significant effects avoided but cost savings relative to ES are not substantiated and visual impact increased.)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:* increase in mitigation costs relative to the ES; 60yr money. **Cost includes widening of engineering earthworks to accommodate additional barriers, additional safety barriers and any costs for bridge widening to accommodate barriers. ***Lower barrier would increase adverse impact of scheme by increasing visibility of high-sided vehicles. LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN. SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN.

*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing.
Table C3: Sustainability appraisal of further noise mitigation options (compared to ES) – Buckden Marina

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Estimated Cost (£)* (change)</th>
<th>Eng. / Env. issues</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckden Marina ++</td>
<td>2m long barrier (On Great Ouse viaduct and extending ~400m to the west of the viaduct)</td>
<td>Major: 0→0 Moderate: 0→0 Minor: 7→0</td>
<td>+0.2M / +0.2M</td>
<td>+£0.9M**</td>
<td>Negligible additional visual impact. Some eng issues****</td>
<td>Yes</td>
<td>No. Costs exceed monetised benefit.</td>
<td>No</td>
</tr>
<tr>
<td>Buckden Marina ++</td>
<td>-7.5dB RSI vLNS for length of 1500m past Buckden Marina</td>
<td>Major: 0→0 Moderate: 0→0 Minor: 7→7</td>
<td>+0.1M / +0.1M</td>
<td>+£0.2M</td>
<td>No</td>
<td>No. Costs exceed monetised benefit.</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

* increase in mitigation costs relative to the ES; 60yr money.
** Cost comprises £0.25M for viaduct widening to accommodate viaduct barrier, £0.1M for embankment widening west of the viaduct to accommodate barrier and £0.55M for barrier costs (based on £421 per linear metre for a 2m barrier)
****Additional visual intrusion of barrier would be balanced by the barrier screening the view of vehicles/headlights on the viaduct. Uncosted potential engineering issues: Additional wind loading for Great Ouse viaduct could result in enhanced bearings, though cost implications would be small.

LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NNNPS
SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NNNPS

++ Please refer Highways England’s response to Buckden Marina Residents Association’s deadline 8 submission for the noise assessment at the marina lodges, details of the sustainability of different further noise mitigation options and sensitivity tests thereto allowing for summer and winter baselines and upwind and downwind conditions (PINS reference REP9-018). With reference to REP9-018, the highest ratio of benefit to costs identified is 1.5 (comparing benefits evaluated with downwind scheme noise, using WebTAG 2015 (draft) monetisation and the BMRA winter baseline - in combination this is an unlikely outcome). The ratio of 1.5 is also still less than the minimum ratio of 2 required for Highways England to adopt vLNS into the scheme at this or any other location (please refer to Appendix D for further information).
### Table C4: Sustainability appraisal of further noise mitigation options (compared to ES) – Offord Cluny

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£)</th>
<th>Cost (£)* (change)</th>
<th>Eng. / Env. issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
</table>
| Offord Cluny - Noise barrier                           | Additional 2m barrier for length of 1100m (Figure C7). | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
244 > LOAEL to 110  
0 > SOAEL to 0 | +0.2M / +0.1M  
WebTAG (2014 webtag / 2015 webtag) | +0.5M  
Cost (£)* (change) | - | N/A | No. (cost of barrier exceeds monetised benefit) |      |
| Offord Cluny - 7.5dB RSI surfacing                      | 2000m of -7.5dB RSI surfacing | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
244 > LOAEL to 110  
0 > SOAEL to 0 | +0.1M / +0.1M  
WebTAG (2014 webtag / 2015 webtag) | +0.2M  
Cost (£)* (change) | - | N/A | No. (costs equivalent to monetised benefit) |      |

Notes:
* increase in mitigation costs relative to the ES; 60yr money.

LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN
SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN
*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing
### Table C5: Sustainability appraisal of further noise mitigation options (compared to ES) – Hilton and Conington

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng / Env issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilton</td>
<td>2m barrier for length of 4000m (Figure C8)</td>
<td>Major: 0→0  Moderate: 3→3  Minor: 1→1 170 &lt;LOAEL to 170 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+1.7M</td>
<td>Visual adverse impact for barrier option</td>
<td>N/A</td>
<td>No. (cost of barrier exceeds monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Hilton</td>
<td>4000m of -7.5dB RSI surfacing</td>
<td>Major: 0→0  Moderate: 3→0  Minor: 1→3 170 &lt;LOAEL to 19 0 &gt;SOAEL to 0</td>
<td>+0.3M / +0.4M</td>
<td>+0.4M</td>
<td>-</td>
<td>N/A</td>
<td>No. (costs equivalent to monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Conington Noise Barrier</td>
<td>2m barrier for length of 2900m (Figure C9)</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 13→13 51 &gt;LOAEL to 51 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+1.2M</td>
<td>Visual adverse impact for barrier option</td>
<td>N/A</td>
<td>No. (cost of barrier exceeds monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Conington -7.5dB RSI surfacing</td>
<td>3000m -7.5dB RSI surfacing</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 13→0 51 &gt;LOAEL to 51 0 &gt;SOAEL to 0</td>
<td>+0.1M / +0.1M</td>
<td>+0.3M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost of -7.5dB RSI surfacing exceeds benefits)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:* increase in mitigation costs relative to the ES; 60yr money.
LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN
SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN
*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing.

**Table C5:** Sustainability appraisal of further noise mitigation options (compared to ES) – Hilton and Conington

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng / Env issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilton</td>
<td>2m barrier for length of 4000m (Figure C8)</td>
<td>Major: 0→0  Moderate: 3→3  Minor: 1→1 170 &lt;LOAEL to 170 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+1.7M</td>
<td>Visual adverse impact for barrier option</td>
<td>N/A</td>
<td>No. (cost of barrier exceeds monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Hilton</td>
<td>4000m of -7.5dB RSI surfacing</td>
<td>Major: 0→0  Moderate: 3→0  Minor: 1→3 170 &lt;LOAEL to 19 0 &gt;SOAEL to 0</td>
<td>+0.3M / +0.4M</td>
<td>+0.4M</td>
<td>-</td>
<td>N/A</td>
<td>No. (costs equivalent to monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Conington Noise Barrier</td>
<td>2m barrier for length of 2900m (Figure C9)</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 13→13 51 &gt;LOAEL to 51 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+1.2M</td>
<td>Visual adverse impact for barrier option</td>
<td>N/A</td>
<td>No. (cost of barrier exceeds monetised benefit)</td>
<td></td>
</tr>
<tr>
<td>Conington -7.5dB RSI surfacing</td>
<td>3000m -7.5dB RSI surfacing</td>
<td>Major: 0→0  Moderate: 0→0  Minor: 13→0 51 &gt;LOAEL to 51 0 &gt;SOAEL to 0</td>
<td>+0.1M / +0.1M</td>
<td>+0.3M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost of -7.5dB RSI surfacing exceeds benefits)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:* increase in mitigation costs relative to the ES; 60yr money.
LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN
SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN
*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing.
### Table C6: Sustainability appraisal of further noise mitigation options (compared to ES) – Fenstanton (Pear Tree Close)

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change)</th>
<th>Cost (£)* (change)</th>
<th>Eng./Env. issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pear Tree Close Noise barrier</td>
<td>2m barrier for 1400m barrier length (Figure C10)</td>
<td>Major: 0→0 &lt;br&gt; Moderate: 13→13 &lt;br&gt; Minor: 9→9 &lt;br&gt; 34 &gt;LOAEL to 34 &lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+0.9M**</td>
<td>Visual adverse impact for barrier option</td>
<td>No</td>
<td>No. (negligible noise benefits and adverse visual impacts introduced)</td>
<td></td>
</tr>
<tr>
<td>Pear Tree Close -7.5dB RSI surfacing</td>
<td>2,200m of -7.5dB RSI surfacing</td>
<td>Major: 0→0 &lt;br&gt; Moderate: 13→1 &lt;br&gt; Minor: 9→12 &lt;br&gt; 34 &gt;LOAEL to 34 &lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.1M / +0.1M</td>
<td>+0.2M**</td>
<td>-</td>
<td>Yes</td>
<td>No. (cost of -7.5dB RSI surfacing exceeds monetised benefit but significant effect is removed)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Increase in mitigation costs relative to the ES; 60yr money.
- Potential extent of -7.5dB RSI surfacing overlaps with the potential extent for Hilton, so total costs for both combined would be less than the sum of the costs listed separately for the two options.
- Cost includes widening of engineering earthworks to accommodate additional barriers and additional safety barriers.
- LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN.
- SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN.
- Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing.
### Table C7: Appraisal of further mitigation options at Bar Hill

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)(^*) (change)</th>
<th>Eng./Env. issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? (^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Hill (inc’ IA5140)</td>
<td>Addition of 3km of vLNS with performance of -7.5dB RSI</td>
<td>Major: 0(\rightarrow)0</td>
<td>+3.8M (\rightarrow) +4.4M</td>
<td>+£0.4M***</td>
<td>N/A but avoids likely need for noise insulation at ~7 properties</td>
<td>Yes. (monetised benefit exceeds costs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes
* increase in mitigation costs relative to the ES; 60yr money.
** barriers assumed to be placed 8.5m from the centre of the nearest carriageway
*** net cost could be slightly lower as costs of noise insulation would be avoided

LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NNNPS
SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NNNPS
Table C8: Sustainability appraisal of further noise mitigation options (compared to ES) – Girton (Important Area)

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Impacts ES → further mitigation</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng / Env issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
</table>
| Girton SW                                              | 310m extension of barrier M25 (3m, absorptive inner face) (Figure C11) – in line with 2009 ES | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
2 > LOAEL to 1  
1 > SOAEL to 1 |  
+1.7k / +2.0k | +0.1M  
- | N/A  
No. (cost of barrier exceeds monetised benefit.) |
| Girton SE                                              | 460m** extension of barrier M26 (3m, absorptive inner face) (Figure C11) – in line with 2009 ES | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
~250 > LOAEL to ~250  
2 > SOAEL to 2 |  
+0.5M / +0.5M | +0.2M**  
| N/A  
Yes, (Current red line boundary can accommodate barrier extension: barrier can merge with Darwin Green bunding) |
| Girton NW                                              | 80m extension of barrier M28 (4m, absorptive inner face) (Figure C11) – in line with 2009 ES | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
~270 > LOAEL to ~270  
19 > SOAEL to 19 |  
+0.0M / +0.0M | +0.05M  
| Engineering complications identified (gas main)  
| N/A  
No. (cost of barrier exceeds monetised benefit.)  
| NB: the ES barriers provide a significant beneficial effect at Weavers Field |
| Girton NE                                              | 90m extension of barrier M27 (3m, absorptive inner face) (Figure C11) – in line with 2009 ES | Major: 0 → 0  
Moderate: 0 → 0  
Minor: 0 → 0  
~40 > LOAEL to ~40  
4 > SOAEL to 4 |  
+0.1M / +0.1M | +0.05M  
| Engineering complications identified (gas main)  
| N/A  
No. (costs similar to benefits) |

Notes:* increase in mitigation costs relative to the ES; 60yr money.

** noise mitigation covering the eastern half of this barrier length is now likely to be provided by a proposed mitigation bund as part of the Darwin Green development – in this case the cost of the barrier would be approximately £0.1M as opposed to £0.2M.

LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN

SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN

*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing.
### Table C9: Sustainability appraisal of further noise mitigation options (compared to ES) – Girton (Important Area)

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£) Change: Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng. / Env. issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girton</td>
<td>2,000m -7.5dB RSI surfacing Existing barriers left unchanged (Figure C12)</td>
<td>Major: 0 → 0&lt;br&gt;Moderate: 0 → 0&lt;br&gt;Minor: 0 → 0&lt;br&gt;~560 &gt;LOAEL to ~400&lt;br&gt;26 &gt;SOAEL to 26</td>
<td>+2.0M / +2.2M</td>
<td>-0.1M</td>
<td>N/A</td>
<td>Yes. (substantial increase in monetised benefits at no additional cost [cost of -7.5dB RSI surfacing covered by reduced barrier costs]. Additionally, not building the ES barriers avoids temporary impact on mature planting and disruption as barriers are constructed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girton</td>
<td>2,000m -7.5dB RSI surfacing with ES barriers</td>
<td>Major: 0 → 0&lt;br&gt;Moderate: 0 → 0&lt;br&gt;Minor: 0 → 0&lt;br&gt;~560 &gt;LOAEL to ~400&lt;br&gt;26 &gt;SOAEL to 7</td>
<td>+2.3M / +2.7M</td>
<td>+0.2M</td>
<td>N/A</td>
<td>Yes. (monetised benefits more than 10x costs) Magnitude and number of beneficial impacts increased compared to ES. This determines BAT as Girton is an Important Area.</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**<br> increase in mitigation costs relative to the ES; 60yr money.<br> LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN<br> SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN<br> *Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing
Table C10: Sustainability appraisal of further noise mitigation options (compared to ES) – Impington and Orchard Park

<table>
<thead>
<tr>
<th>Name of the area considered (ES Significant Effect ID)</th>
<th>Further Mitigation Option</th>
<th>Impacts ES → further mitigation</th>
<th>Noise impact and benefit</th>
<th>WebTAG (£ Change): Nov 2014 webtag / 2015 webtag</th>
<th>Cost (£)* (change)</th>
<th>Eng / Env issues re: ES scheme</th>
<th>Significant effect removed?</th>
<th>Sustainable? (Comments)</th>
<th>BAT? *</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orchard Close / Woodhouse Farm</strong></td>
<td>150m extension of barrier M29 (2m height; absorptive inner face) (Figure C13)</td>
<td>Major: 0→0&lt;br&gt; Moderate: 0→0&lt;br&gt; Minor: 0→0&lt;br&gt; 1 &gt;LOAEL to 1&lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+0.1M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost of barrier far exceeds monetised benefit.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Impington Farm</strong></td>
<td>New 370m barrier at Impington Farm (2m height; absorptive inner face) (Figure C13)</td>
<td>Major: 0→0&lt;br&gt; Moderate: 0→0&lt;br&gt; Minor: 0→0&lt;br&gt; 1 &gt;LOAEL to 1&lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.0M / +0.0M</td>
<td>+0.2M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost of barrier far exceeds monetised benefit.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Impington</strong></td>
<td>220m extension of barrier M30 and 70m extension of barrier M33 (both 4m height; absorptive inner face) - (Figure C13)</td>
<td>Major: 0→0&lt;br&gt; Moderate: 0→0&lt;br&gt; Minor: 0→0&lt;br&gt; 205 &gt;LOAEL to 191&lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.1M / +0.1M</td>
<td>+0.3M</td>
<td>-</td>
<td>N/A</td>
<td>No. (cost of barrier exceeds monetised benefit.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Blackwell Caravan Site</strong></td>
<td>230m extension of barrier M31 (3m, absorptive inner face) (Figure C14)</td>
<td>Major: 0→0&lt;br&gt; Moderate: 0→0&lt;br&gt; Minor: 0→0&lt;br&gt; 33 &gt;LOAEL to 33&lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+0.1M / +0.2M</td>
<td>+0.1M</td>
<td>-</td>
<td>N/A</td>
<td>No. (benefits approximately equal to barrier costs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Orchard Park</strong></td>
<td>3,000m -7.5dB RSI surfacing with ES barriers</td>
<td>Major: 0→0&lt;br&gt; Moderate: 0→0&lt;br&gt; Minor: 0→0&lt;br&gt; 684 &gt;LOAEL to 547&lt;br&gt; 0 &gt;SOAEL to 0</td>
<td>+3.7M / +4.5M</td>
<td>+0.3M</td>
<td>-</td>
<td>N/A</td>
<td>Yes. (Benefits significantly greater than costs)</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Notes:* increase in mitigation costs relative to the ES; 60yr money.<br>LOAEL = Lowest Observed Adverse Effect Level and is basis for the second aim of the noise test at 5.195 of NPSNN<br>SOAEL = Significant Observed Adverse Effect Level and is basis for the first aim of the noise test at 5.195 of NPSNN<br>*Best Available Technique to reduce noise impact. The optimal BAT solutions may be a refined combination of barrier and -7.5dB RSI surfacing
Figure C1: Alconbury extended noise barrier option (not sustainable)
Figure C2: Alconbury extended barrier with 2m fence barrier atop existing bund (confirmed as sustainable)
Figure C3: Brampton additional barrier option between A1(M) and A14 (not sustainable)
Figure C4: Brampton - additional barrier option (not sustainable)
Figure C5: Brampton: Option with further barriers closer to the carriageways (not sustainable)
Figure C6: Brampton option with vLNS and reduced height barrier (not sustainable)
Figure C7: Buckden Marina/Offord Cluny barrier option (not sustainable)
Figure C8: Hilton with 2m noise barrier option (not sustainable)
Figure C9: Conington noise barrier option (not sustainable)
Figure C10: Pear Tree Close barrier option (not sustainable)
Figure C11: Girton barrier extensions options (only M26 noise barrier extension is sustainable)
Figure C12: Girton: existing noise barriers
Figure C13: Barrier extension options around Impington (not sustainable)
Figure C14: Barrier extension option at Blackwell Caravan Site (not sustainable)
Appendix D – Consideration of benefits compared to costs

The Position Statement on Further Noise Mitigation and this update to the Position Statement provide sustainability appraisals for a range of further mitigation options.

A key part of each appraisal is the comparison of monetised benefits compared to costs. The appendix provides further information on the ‘magnitude’ of the difference between benefits and costs considered necessary by Highways England to integrate vLNS into any part of the A14 improvement scheme.

As set out at paragraph 6.1.1 of the original Position Statement and para 6.1.1 of this updated Position Statement:

“When considering the calculation of the sustainability of vLNS, it is important to note that Highways England has developed its approach to vLNS for the A14 in response to the issue of the NPSNN in December 2014 and the requirement contained in it to consider Best Available Techniques to reduce noise. DMRB (HD213/11) and MCHW pre-date the NPSNN and so do not provide guidance on the use of vLNS. While the likely effects of vLNS and current whole life costs can be predicted with confidence, Highways England’s approach and in particular its building of evidence of whole life costs will continue to develop as vLNS is implemented.”

vLNS has therefore only been adopted at locations where the monetised benefits exceed 60yr costs by a factor of two or more.

This is because

- ‘Optimism bias\(^{25}\)’. The evaluation of 60yr noise mitigation costs as presented in this Position Statement do not take account of ‘optimism bias’. At this stage of the scheme’s development an optimism bias of at least 15% would often apply in terms of cost.

- Sensitivity / Risk: In addition to the sensitivity testing presented in Appendix B to the Position Statement, if the renewal period for vLNS were to shorten by around a year, then the net 60yr differential costs for vLNS compared to proven LNS would double. This means that the costs presented in Appendix C used for each sustainability appraisal would double\(^{26}\). Additionally, with a further additional resurfacing required in the 60yr appraisal period it is likely that adverse costs arising from monetised greenhouse gas (carbon) would also need

\(^{25}\) To redress the tendency for appraisers to tend to overstate benefits, and understate timings and costs, guidance such as the Green Book advises that appraisers should make explicit adjustments for this bias. These take the form of increasing estimates of the costs and / or decreasing income/benefits.

\(^{26}\) Appendix B sets out that it is currently assumed that vLNS would need to be renewed every 10 years as compared to typically 12 years for ‘standard’ LNS. This means the vLNS has to be renewed one more time in 60 yrs compared to ‘standard’ LNS (i.e. five renewals in 60yrs rather than four). The 60yr cost of vLNS is therefore the cost of this additional renewal. If the period to renewal for vLNS were to be just under 9 years, rather than the 10 assumed, then vLNS would need two additional renewals in 60yrs than ‘standard’ LNS and hence the additional costs of providing vLNS (as set out in Appendix C) would double.
to be taken into account (as noted in the Position Statement reduced vehicle emissions due to reduced rolling resistance of vLNS would go towards offsetting the additional embedded carbon of one additional renewal in 60yrs, but the embedded carbon in a second renewal would need to monetised). Collectively these are considered material adverse sensitivities.

Taking the above into account, only adopting vLNS where monetised benefits exceed 60yr costs by a factor of two or more is considered prudent when applying public finance until further whole life cost information for vLNS is gathered.