A303 Amesbury to Berwick Down

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8.37.13 - Responses to the ExA's Written Questions - Noise and Vibration Effects (Ns.2)

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A303 Amesbury to Berwick Down

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Responses to the ExA's Written Questions - Noise and Vibration Effects (Ns.2)

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List of Chapters

13 Noise and Vibration Effects (Ns.2)

Question Ns.2.1

Tranquillity

The issue of tranquillity appears to remain in dispute in that the visitors to the WHS and particularly the Stones would appear to influence the degree of tranquillity at the Stones and in the vicinity of the Stones. As a consequence, the degree of effect from the current road is arguably reduced and the degree of benefit from its removal in respect of tranquillity in the area of the Stones may be regarded as less significant.

Do you consider that tranquillity will be achieved at the Stones as a consequence of the scheme?

Highways England response

1. Tranquillity is defined over a range, such as that used by CPRE in their tranquillity map of 'most tranquil' to 'least tranquil', rather than as an absolute definition of tranquil or not tranquil.
2. With regard to the Stones and their immediate vicinity, it is agreed that visitors are an important noise source which would have an impact in terms of the level of tranquillity experienced at this location. As a result, the improvement in tranquillity due to the major reduction in traffic noise at the Stones and in their immediate vicinity as a result of traffic using the existing A303 being redirected into the tunnel, will be less than at locations in the wider WHS where traffic noise from the A303 is dominant. Nevertheless, the major reduction in road traffic noise, combined with the removal of the sight of road traffic due to the tunnel (given that tranquillity levels are based on not just noise, but other factors such as landscape and visual impacts), cannot have anything other than a beneficial effect on tranquillity at the Stones and their immediate vicinity.

Question Ns.2.3

Noise

REAC Table - PW NOI 1 b) – "*the preliminary works contractor may*" offer [REP4-020].

What happens in the event the contractor chooses not to offer?

This wording needs to be re-examined to ensure safeguards offered are provided if required.

Highways England response

1. Based on the nature of the preliminary works (as defined in paragraphs 1.2.9 to 1.2.11 of the Outline Environmental Management Plan) the risk of those works triggering the noise insulation/temporary re-housing criteria is considered to be very low. However, it is acknowledged that the current OEMP does not provide the same level of protection in respect of noise insulation and temporary rehousing for residents from the preliminary works as the main works. Therefore, the OEMP has been revised (as reflected in the version submitted at Deadline 6) to remove PW-NOI3 h) and to include an additional clause (PW-NOI6) which is the equivalent of MW-NOI4. This additional clause ensures the preliminary works contractor will offer noise insulation/temporary re-housing if the relevant criteria are met:

   "PW-NOI6 Noise insulation and temporary re-housing:

2. The preliminary works contractor (utilities, roads and ground investigation) shall offer noise insulation or temporary re-housing to qualifying parties when:

   a. noise levels are predicted or measured by the preliminary works contractor to exceed the relevant trigger level (as defined in BS 5228-1, Table E.2) for at least 10 days out of any period of fifteen consecutive days or alternatively 40 days in any six month period at affected properties;

   b. the property complies with all other requirements of the Noise Insulation Regulations 1975 (as amended);

   c. the property is lawfully occupied as a permanent dwelling; and

   d. noise insulation does not already exist that is of an equivalent standard to that which would be allowed for under the Noise Insulation Regulations 1975 (as amended).

3. The preliminary works contractor (utilities, roads and ground investigation) shall consider all applications supported by evidence for noise insulation or temporary rehousing from occupiers who may have special circumstances. Special circumstances could include night workers, those working in home occupations, local businesses or buildings that provide community facilities

requiring a particularly quiet environment and those with a medical condition which will be seriously aggravated by construction noise, and provide noise insulation or temporary re-housing where it is demonstrated that this is necessary."

Question Ns.2.4

Piling

i. Has the terminology for non-impact piling now been agreed?

ii. Has this been consistently set out through the documentation to ensure consistency at the River Till, Countess roundabout or other areas within the site where piling may occur?

Highways England response

i. Has the terminology for non-impact piling now been agreed?

1. Yes. At the Noise and Vibration Issue Specific Hearing (that took place on 12 June 2019) the Environment Agency welcomed the commitment to non-impact piling at the River Till [REP4-049]. To confirm in answer to a query raised in that submission, non-impact piling is the same as non-percussive piling – the terms can be used interchangeably. The agreement with Wiltshire Council to non-impact piling at both the River Till and Countess Junction is set out in the Statement of Common Ground (SoCG) with Wiltshire [REP4 - 022] page 3-63.

ii. Has this been consistently set out through the documentation to ensure consistency at the River Till, Countess roundabout or other areas within the site where piling may occur?

2. The commitment to non-impact piling is consistent throughout the OEMP (REP4-020 - items D-NOI4 at Countess Junction and MW-BIO3 at the River Till). In addition, MW-G9 requires the contractor to undertake environmental risk assessment for piling at Countess Junction and at the River Till. Recent discussions with Wiltshire Council have not identified any other locations where piling would be a potential cause of concern.

Question Ns.2.5

Noise

Paragraph 5.195 of the NPSNN sets out three tests for assessing National Infrastructure Projects. The third bullet states:

"contribute to improvements to health and quality of life through the effective management and control of noise, where possible."

To date no barrier is proposed on the northern side of the viaduct crossing the River Till and the specification for the southern barrier is not currently set out.

Please advise how you consider this meets this requirement of the NPSNN and achieve where possible effective management and control of noise.

Highways England response

1. This issue was addressed in the response to the first written questions (Ns.1.41 and Ns.1.45 [REP2-034]). This issue was further discussed at the Noise and Vibration Issue Specific Hearing in [REP4-033, Agenda Item 5 ii].
2. The NPSNN requires that the scheme demonstrates compliance with the aims to avoid significant adverse impacts on health and quality of life, mitigate and minimise adverse impacts on health and quality of life and contribute to improvements to health and quality of life where possible, in the context of sustainable development.
3. The operational traffic noise impact assessment has not identified a need for a barrier on the north side of the River Till viaduct as:
    a. such a barrier would not avoid a significant adverse effect on health or quality of life, mitigate an adverse effect on health or quality of life, or contribute to an improvement in health or quality of life; and
    b. such a barrier is not considered to constitute sustainable development.
4. This is primarily due to the lack of residential properties, or other noise sensitive receptors at which people's health or quality of life could be materially affected, located to the north of the River Till. The only potentially affected feature is a public right of way (PRoW). Given the linear nature of the PRoW, the range of noise impacts along the PRoW, the absolute noise levels, and the transient usage of a PRoW, a material change in the experience of using the footpath as a whole, which could affect people's health or quality of life, is not anticipated due to the scheme. Similarly, the inclusion of a barrier on the north side of the River Till viaduct would not be anticipated to achieve a material improvement in people's health or quality of life compared to the situation without a barrier.
5. With regard to whether a barrier on the north side of the River Till viaduct would be sustainable development, in addition to the absolute level of traffic

noise and the change due to the scheme with and without a barrier, various other factors have been considered, these include the cost versus the benefit, engineering practicality and generation of knock-on impacts (such as ecological effects, landscape and visual effects). In the absence of residential properties or other noise sensitive receptors, and considering the nature of the impact at the PRoW, such a barrier is not considered to constitute sustainable development. In addition, in contrast to the barrier on the south side of the River Till viaduct, the consultation/stakeholder engagement responses did not highlight a strong preference for a barrier on the north side.

6. Consequently, on balance, the Applicant considers that the funding of a noise barrier on the north side is not justified, particularly when reference is had to the NNNPS test referred to – namely, that a barrier on the north side would not provide effective management and control of noise (as there is no requirement for such management or control in this location) and, indeed, given the lack of receptors in the vicinity, no improvement to health or quality of life would arise from the implementation of such a barrier.
7. As confirmed in the Statement of Common Ground (SoCG) [REP4 – 022 page 3-60] based on the Peer Review exercise completed on behalf of Wiltshire Council, Wiltshire Council are content that the proposed operational mitigation identified in the Environmental Statement and secured in the Outline Environmental Management Plan (OEMP) (REP4-020) is suitable and sufficient. No need for a barrier on the north side of the River Till viaduct was identified.
8. At the Noise and Vibration Issue Specific Hearing in [REP4-033, Agenda Item 5 ii] it was explained that with regards to the environmental barrier on the southern side, it was not deemed essential mitigation from a noise or visual perspective. The reduction in an adverse traffic noise effect is limited to one property, Foredown House. The major increase in traffic noise and subsequent significant adverse effect at the property remains with the barrier in place. When deciding on the mitigation measures that should be implemented, the Applicant has taken into account the policy requirements of the NPSNN, in particular the requirement to consider whether mitigation can be considered to be sustainable. Whilst the traffic noise benefit of a barrier on the southern side of the River Till viaduct would not outweigh the costs and therefore such a barrier would not constitute sustainable mitigation, the strong response in favour of including a solid barrier on the southern side in the consultation process resulted in the decision to include the environmental barrier in the scheme.
9. The exact nature of the solid environmental barrier on the south side of the River Till Viaduct will be determined at the detailed design stage. Due to the limited noise benefit provided by the barrier, and therefore it not forming essential mitigation in respect of traffic noise impacts, Highways England does not consider a specific acoustic specification is required to be settled at

this stage. However, its overall implementation (and height) is secured through the OEMP (item D-LAN2).

Question Ns.2.6

Vibration effects on archaeology

i. Is it reasonable to say that the vibration analysis has been carried out to assess impacts upon human health and buildings, but not been specifically designed to assess impacts on archaeology bar the analysis of potential impacts on the Stonehenge monument itself?

ii. Can you point out where the specific archaeological analysis in respect of vibration is within the ES?

Highways England response

1. Taking both points together, it is not agreed that vibration analysis was not undertaken in respect of impacts on archaeological assets, aside from the Stonehenge monument.
2. The Noise and Vibration chapter of the Environmental Statement (ES) [APP-047] includes consideration of construction vibration impacts in terms of building damage, annoyance to people, and, due to the level of interest in the potential impact at Stonehenge, at the Stones. Further analysis of the potential impact of vibration from the TBM on heritage assets was undertaken as part of the environmental impact assessment process, however this identified that the risk of potentially significant effects was minimal. This analysis was based on the proximity of heritage assets to the tunnel, the tunnel depth, the conservative prediction methodology for vibration from tunnelling adopted in the assessment, and the nature of the heritage assets above the tunnel.
3. This analysis informed the text in the ES in para 9.2.5 to 9.2.9 in Appendix 6.1 Heritage Impact Assessment [APP-195] which reports on the vibration impacts on heritage assets. Supplementary detail to this analysis was provided at the Issue Specific Hearings as reported in the written summary of oral submissions made at that hearing [REP4-033] 6 iii. In summary:
   - the identified barrows along the route of the tunnel that could be subject to vibration effects (where the tunnel is close to the surface) have already been excavated, either completely or in part, and backfilled removing potentially sensitive burials and artefacts;
   - the identified barrows are unlikely to contain voids and have settled to their current position over approx. 5000 years;
   - disturbance from previous/current activities including World War One airfield operations, agricultural ploughing and/or animal burrowing has occurred; and
   - individual artefacts in the soil are usually fragmented. They are supported by the soil matrix, not surrounded by voids and therefore are much less

sensitive to vibration than artefacts in the open air, display cases or with voids around them.

Question Ns.2.7

Vibration effects on archaeology

In light of the comments made by the different parties to date can you advise on the latest position in respect of:

i. An agreed methodology for measuring vibration and what standards could be used to safeguard archaeological remains.

ii. The level at which significant effects might occur.

iii. How any vibration will be monitored to protect archaeology.

iv. Mechanism/ mitigation to avoid potential adverse effects including any agreed positions of monitoring locations.

Highways England response

i. An agreed methodology for measuring vibration and what standards could be used to safeguard archaeological remains.

1. Whilst Highways England will continue to discuss with key stakeholders the issue of the methodology for measuring vibration during detailed design, it does not consider that it is necessary to finalise that at this stage. The precise details of the vibration monitoring methodology will be set out in the Noise and Vibration Management Plan required by MW-NOI3 of the Outline Environmental Management Plan (OEMP) [REP4-020]. MW-NOI6 of the OEMP provides that the monitoring proposal will be included within the Noise and Vibration Management Plan. MW-G7 of the OEMP requires various management plans, including the Noise and Vibration Management Plan to be prepared in consultation with Wiltshire Council, the Environment Agency, Historic England and Natural England on those aspects that are relevant to their functions. As such, key stakeholders will feed into the process of determining the final vibration monitoring regime, including in relation to archaeology. The Noise and Vibration Management Plan will set out specific details of the vibration monitoring methodology in terms of the choice of transducers, method of coupling, measurement locations, measurement durations, etc., in accordance with the requirements of the relevant British Standards (BS 7385: 1993, BS ISO 4866:2010, and BS 5228: 2009+A1: 2014 as referenced in MW-NOI5 of the OEMP [REP4-020]).

ii. The level at which significant effects might occur.

2. There is no standard threshold for construction vibration levels significantly affecting archaeological earthworks, such as burial mounds, and buried assets, due to the unique and varying sensitivity of such assets. MW-NOI5 in the OEMP submitted at Deadline 6 states:

'The main works contractor shall identify, in consultation with the members of HMAG, any potentially vibration sensitive cultural heritage assets, including the Stonehenge Monument, based on the sensitivity of the assets

and proximity to tunnelling works. Should assets be identified, actions to control or mitigate impacts (including monitoring) shall be agreed between the main works contractor, the operator of the equipment and The Authority as appropriate, in consultation with the members of HMAG.'

3. Therefore, heritage assets including archaeology will be considered on a case by case basis based on the final detailed design, tunnelling methodology, and asset sensitivity to determine the need for monitoring and actions to control or mitigate impacts. As detailed above, amendments have been made to the OEMP at Deadline 6 to ensure this would be done in consultation with the members of the Heritage Monitoring and Advisory Group (HMAG).

iii. How any vibration will be monitored to protect archaeology.

4. Information on how the precise details of the vibration monitoring methodology will be determined, and how this is secured in the OEMP, are provided in the response to i) above. The vibration monitoring of any identified potentially sensitive heritage assets will be used to inform the implementation of actions to control or mitigate impacts is detailed in iv) below.

5. It is noted that vibration from tunnelling is also covered by the Ground Movement Monitoring Strategy required by items MW-G7 and MW-CH8 of the OEMP. Further details of this Strategy are provided below in iv) and in the response to Ns.2.8.

iv. Mechanism/ mitigation to avoid potential adverse effects including any agreed positions of monitoring locations

6. The decision to implement a bored tunnel rather than a cut and cover tunnel was a deliberate design decision taken in order to preserve surface archaeology and avoid damage and disturbance as far as possible to archaeological sites, including those that contribute to the Outstanding Universal Value of the World Heritage Site. There is also mitigation embodied within the selection of the tunnel boring machine with the use of a closed-face TBM for the main tunnel construction to control excavation induced ground movement and vibration. This is confirmed in the revised OEMP as submitted at Deadline 4 item D-CH32 [REP4-020].

7. As required by MW-NOI5 the main works contractor shall identify, in consultation with the members of HMAG, any potentially vibration sensitive cultural heritage assets that are at risk from ground vibration from the tunnel. Such assets are also required to be identified by the Ground Movement Monitoring Strategy (MW-G7 and MW-CH8 of the OEMP). As part of this strategy, and in accordance with MW-NOI5, the contractor shall develop contingencies using a suite of tool box items from further investigation, assessment and monitoring during construction to identify measures to ensure the protection of heritage assets. This could range from simply

slowing down the TBM to instigating ground stabilisation measures including grouting.

8. Monitoring locations will be contained within the Noise and Vibration Management Plan prepared by the main works contractor (MW-NOI3, d). At this stage, before detailed design is completed, a commitment has been made to vibration monitoring at the Stonehenge monument when the tunnel boring machine is within 250m of the monument (MW-NOI6), due to the level of interest in the Stones. MW-NOI6 also includes a commitment to monitor vibration at Stonehenge Cottages when the tunnel boring machine is within 250m of the cottages, due to the potential for annoyance impacts.
9. Additional vibration monitoring locations at potentially sensitive heritage assets, such as barrows, will be determined on the basis of the further analysis required by MW-NOI5 to identify any potentially vibration sensitive cultural heritage assets based on the sensitivity of the assets and proximity to tunnelling works (MW-NOI6).
10. Finally, although the Stonehenge Visitor Centre is remote from any construction works, based on a request from the English Heritage Trust, vibration monitoring at the Visitor Centre has also been agreed (MW-NOI6). The details of the monitoring at the Visitor Centre will be determined in consultation with the English Heritage Trust and set out in the Noise and Vibration Management Plan.

Question Ns.2.8

Settlement effects on archaeology

In light of the comments made by the different parties to date can you advise on the latest position in respect of:

i. An agreed methodology for measuring settlement, and what standards could be used to safeguard archaeological remains.

ii. The level at which significant effects might occur.

iii. How the settlement will be monitored to protect archaeology.

iv. Mechanism/ mitigation to avoid potential adverse effects including any agreed positions of monitoring locations.

Highways England response

i. An agreed methodology for measuring settlement, and what standards could be used to safeguard archaeological remains.

1. MW-CH1 of the Outline Environmental Management Plan (OEMP) [REP4-020] requires the main works contractor to develop a Scheme-wide Heritage Management Plan (HMP), based upon the Detailed Archaeological Mitigation Strategy (DAMS) (the implementation of which is required pursuant to DCO Requirement 5, Schedule 2) indicating how the historic environment is to be protected in a consistent and integrated manner and coordinated with all other relevant environmental topics. The HMP shall be prepared in consultation with the members of the Heritage Monitoring and Advisory Group (HMAG) and Wiltshire Council Archaeology Service (WCAS) and approved by Wiltshire Council in consultation with Historic England to the extent the works the subject of the approval would ordinarily trigger the need for scheduled monument consent.
2. In accordance with the DAMS and the OEMP (MW-G7 and MW-CH8) [REP4-020], the main works contractor is required to develop a Ground Movement Monitoring Strategy (GMMS) to be approved by Highways England prior to tunnelling works commencing. The strategy will identify heritage assets that are at risk of ground surface movement caused by settlement and as part of the strategy the contractor shall develop contingencies and identify measures to ensure the protection of the assets. The scheme-wide HMP will make reference to, and take into account, the GMMS in relation to the protection of archaeological remains and the protection of heritage assets above the tunnel.
3. There is no standard threshold or assessment for tunnelling induced settlement levels affecting archaeological earthworks, such as burial mounds and buried assets, due to the unique and varying sensitivity of such assets. The impact has therefore been assessed by reference to the geotechnical stability of the earthwork following a more conventional approach

comparable with tunnelling through a railway embankment which is extremely sensitive to ground movement. As explained at Issue Specific Hearing 2 (Cultural Heritage) and Issue Specific Hearing 4 (Flood Risk) and recorded in written summaries [REP4-030] and [REP4-032] the impact on assets would be controlled through the tunnel activity itself and ground support provided by using a closed-face Tunnel Boring Machine (TBM) [REP4-020 (D-CH32)].

4. For the purposes of monitoring, a series of trigger levels would be established in the GMMS to determine when there would be a need for intervention. These trigger levels would be informed by the assessment of the maximum amount of settlement that could occur without having an adverse effect on archaeological earthworks. The development of trigger levels is best practice for asset protection and risk management within tunnelling and is discussed in industry guidance such as that produced by the International Tunnelling Association and the British Tunnelling Society.

ii. The level at which significant effects might occur.

5. As explained at Issue Specific Hearing 2 (Cultural Heritage) and recorded in written summaries [REP4-030] a detailed assessment of ground movement has been undertaken and the results set out in the Land Instability Risk Assessment Report [APP-278], ES Appendix 10.6. The risk assessment sets out the staged process taken to assessing ground movement. The Applicant has looked at how the ground may move and has also looked at the features in the landscape and has then carried out an assessment of the effect of any movement on those assets to determine whether there could be any adverse effects. The assessment has shown that any changes to heritage assets would be negligible

iii. How the settlement will be monitored to protect archaeology.

6. At Issue Specific Hearing 2 (Cultural Heritage) and recorded in written summaries [REP4-030] (see agenda item 7(iii) under the heading “DAMS paragraph 4.2.6”) the Applicant explained that the provision of monitoring is well established over the last decade, and that the monitoring of the ground for excavation movements would help validate the process of tunnelling and manage risk to ensure asset protection.

7. The Applicant further explained that ground movement monitoring would be undertaken following establishment of a baseline movement survey. The baseline movement survey will show whether there are any existing seasonal fluctuations in the ground level that are not attributable to the construction works. Following the capture of baseline movements, the detailed design construction monitoring will be implemented in accordance with best practice. This requires a series of monitoring points to be installed at regular intervals, both along the alignment and perpendicular to the tunnel, and confirms the frequency of monitoring in relation to the location of the TBM and active tunnelling works.

8. In accordance with MW-G7 and MW-CH8 of the OEMP [REP4-020], the contractor will develop a GMMS during the detailed design to be approved by Highways England prior to tunnelling works commencing. The strategy will identify heritage assets that are at risk of excessive ground surface movement caused by settlement and develop contingencies for their protection. The strategy will be developed in consideration of the items above in compliance with best practice and the results of baseline monitoring.
9. The DAMS [REP4-024] paragraph 5.26 to 5.28 (an updated version of which is submitted at Deadline 6) discusses the likely methodology that the main works contractor could adopt for ground movement monitoring including the baseline monitoring.

iv. Mechanism/ mitigation to avoid potential adverse effects including any agreed positions of monitoring locations.

10. In accordance with MW-G7 and MW-CH8 of the OEMP [REP4-020] the contractor will develop a GMMS during the detailed design to be approved by Highways England prior to tunnelling works commencing. The positioning and installation of the monitoring installations will be part of this strategy which shall be developed in accordance with requirements of the DAMS [REP4-024] (an updated version of which is submitted at Deadline 6) which states in para 5.2.8 that the requirement for these will be scoped to minimise the number of installations required. The locations of these installations will be selected to avoid known archaeological remains: baseline monitoring locations would be placed along existing field boundaries to minimise obstructions. Survey teams will visit the monitoring locations regularly throughout the monitoring programme; the means of access and archaeological constraints will be identified in the contractor's Heritage Management Plan, for approval by Wiltshire Council (in consultation with Historic England, to the extent the works the subject of the approval would ordinarily trigger the need for schedule monument consent).
11. **References:**

a. AITES/ITA WG2 – Research. (2011). Monitoring and Control in Tunnel Construction (ITAReport No 0009/Nov 2011). Lausanne: ITA

b. British Tunnelling Society (2011). Monitoring Underground Construction, A Best Practice Guide. London: ICE Publishing

c. ITA tech Activity Group - Monitoring. (2015). Guidelines on Monitoring Frequencies in Urban tunnelling (ITA Report No 3-V2/May 2015). Lausanne: ITA

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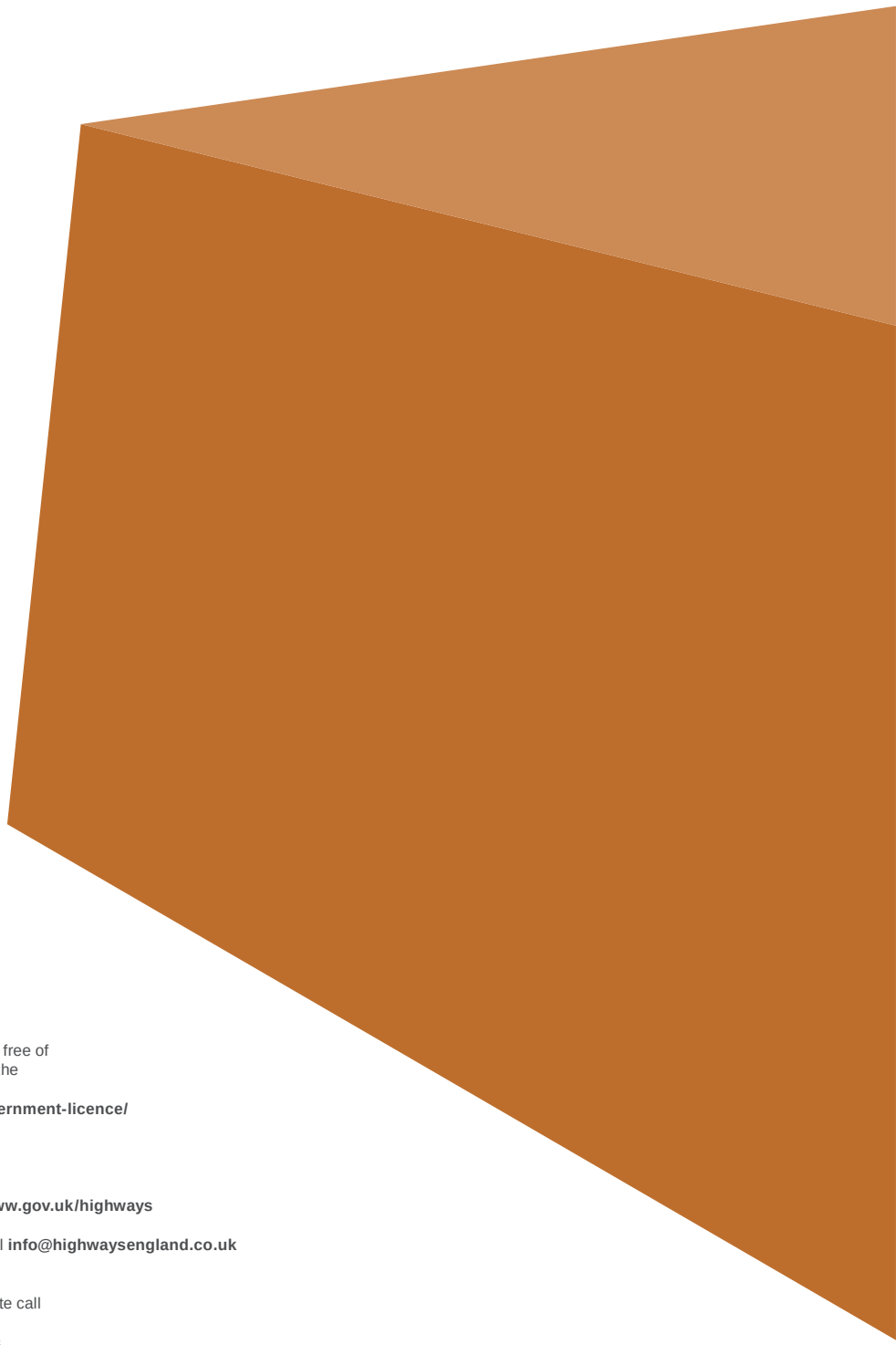

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