

Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure



File Ref WG/REB/OBJ0270.6 – GWT/Altringham

Llywodraeth Cymru
Welsh Government

Objection Ref OBJ0270

Response to Objector's Evidence: Professor John Altringham

(Gwent Wildlife Trust)

1. GROUNDS FOR OBJECTION

1.1. Details

1.1.1. Professor John Altringham has submitted a Statement of Evidence dated February 2017 in relation to the draft statutory Orders associated with the Welsh Government's proposals for the M4 Corridor around Newport, which has been received via the Programme Officer.

1.1.2. The Welsh Government understands the evidence submitted within John Altringham's Statement to be based on the following:

1. Considers that the bat surveys along the proposed route described in the Environmental Statement (ES) use appropriate methods and are reasonable in scope but considers that there are some gaps.
2. Considers that the ES concerns itself almost entirely with the impact of the proposed M4 extension during construction and makes little reference to the long-term, landscape-scale impact of the operational phase of the road. States that the Berthinussen & Altringham (2012a, 2015a) report makes clear that major roads, whether under construction or long-established, are associated with lower bat activity and species diversity for at least 1-1.6 km either side of the road. Considers that the ES does not understand this basic ecological principle and suggests that it wrongly assumes without any evidential basis for doing so that there is lots of empty habitat waiting for these displaced bats to move into.
3. States that persistent, landscape scale effects of operational roads are not unique to bats and considers that no thought is given in the ES as to how these might be mitigated against, for bats or any other mammal or bird.
4. States that the ES assesses the likely impact of the construction of the road on bats as moderate adverse without effective mitigation and that it is claimed that the package of mitigation measures proposed would reduce the impact to slight adverse. However, a competent authority can only grant consent for a project if it is "convinced" that the project would not adversely affect the integrity of the protected site concerned. In order to be satisfied of this the competent authority must be satisfied that "no reasonable scientific doubt remains as to the absence of such effects."

5. Considers the mitigation measures proposed would be at best high-risk and largely ineffective and at worst completely ineffective.
6. Refers to Table 10.18 of the ES and suggests that most species would not benefit from the mitigation, which is based on flawed evidence.
7. Considers that in addition to passing over much important evidence, the ES fails to draw the critical distinction between the use of a structure by individual bats and its effectiveness at protecting bat populations.
8. States that the ES cites reports that describe the use of overpasses and underpasses by small numbers of bats in support of their value as mitigation tools. States that there is no mention of the number of bats that no longer go near a site, or fail to cross the road, or those that cross the road at risk of being killed. States that the purpose of mitigation is to ensure that a very large majority of the bats present before construction continue to cross the road safely after construction. Considers that, by these criteria, most mitigation is untested or failing.
9. Considers that many of the mitigation measures proposed in the ES are insufficiently detailed to allow proper assessment. By way of example, the proposed noise plan (ES 10.8.412) and lighting plan (ES 10.8.405) should be significantly more detailed for it to be possible to assess their likely effectiveness.
10. States that bat boxes are put forward as effective replacements to lost roosts and considers that bat boxes and bat barns represent a high risk, poorly assessed mitigation/compensation 'solution' to lost roosts – there is no guarantee that they would work and a high probability that they would not.
11. Considers that there is no evidence provided to support the conclusion that the bat boxes would be suitable alternative roosts or that bats chased out of roosts would have suitable alternative roosts. Considers that this proposal is not effective mitigation but is simply eviction.
12. Considers that Paragraph 10.8.385 of the ES suggests that “all roosting bats would be captured and relocated to bat roost boxes suitable for the species of bat being displaced”. Considers that some species, such as horseshoe bats, do not use any of the commonly available roost boxes. Little is known about “suitability” when it comes to size, location,

- temperature and function (e.g. suitability as a nursery, mating site, etc.) for any species. Considers that “suitable” here appears simply to be used to mean that a given species may have been seen to use a similar box somewhere, at some time, for some unknown purpose. Considers that, on the basis of current scientific knowledge, there are very significant uncertainties and risks associated with this approach. Considers that it cannot properly be said to be effective mitigation. Considers that, if the habitat around the roost has been degraded by construction, no roost may be suitable, since habitat is an important part of roost choice in bats.
13. Considers that at paragraph 10.8.386 the ES is forced to acknowledge the severe consequences of the use of these high-risk displacement methods. It states, “Should displacement and relocation of bats result in the loss of, or reduced access to favourable foraging sites, alternative roosting sites and/or other bats in the area, the effect could be significant with regard to the long term viability of the population.”
 14. Considers that the state of scientific knowledge is such that there is too little published information available on bat barns and similar structures to enable a satisfactory assessment of their effectiveness as a mitigation measure. Little if any weight can therefore be given to the proposal at ES 10.8.387 that “in order to minimise the impact of displacement, a bat barn would be provided north of Magor.”
 15. Considers that the proposals to mitigate the effect of the proposed M4 extension upon bats through the use of bat boxes/barns (as proposed in the ES) therefore fails to provide satisfactory scientific evidence to support the effectiveness of these structures. The ES simply does not appear to properly appreciate the high risk nature of the measures proposed.
 16. Considers that there is a longstanding issue regarding compliance in use of bat boxes and bat barns.
 17. Considers that the approach to monitoring in the ES is flawed with no specifics given regarding the metrics and threshold that would prompt action in the event of failure or what action would be taken in such an event. There does not appear to be a satisfactory contingency plan if the

high risk mitigation measures proposed are unsuccessful and suggests a more detailed monitoring plan is required.

18. Considers that that the ES at 10.9.268 fails to take account of the strong possibility that bats simply do not use the roosts.
19. There is no reference to what information the monitoring measures would provide to guide any relocation. Moreover, if bats don't use the roosts provided, then providing more would be an entirely futile exercise.
20. States that the ES acknowledges at 10.8.388 that major roads can present a barrier to the movement of some bat species. Berthinussen and Altringham (2012) recorded a significant reduction in bat activity up to 1.6 km from an 80 km section of the M6 in Cumbria, England. This reduction in activity was considered in part to be due to the barrier effect of major roads." Considers that this is, however, an understatement. Considers that major roads are a barrier to most bat species and the "significant reduction" was in fact a three-fold decrease in activity. Considers that, despite referring elsewhere to the 2015 DEFRA report, the ES does not cite the additional evidence contained in the report for this effect, through the study of seven more roads: motorways and A roads. Considers that this is a substantial omission.
21. States that the ES at 10.9.271 suggests that planting should be used to help guide bats towards alternative safe crossing points. Considers that the fact that habitat corridors cannot be retained demonstrates a significant problem with the proposed mitigation strategy. Considers that the whole point of mitigation is to make it possible for bats to continue to use existing flight lines by providing road crossing structures along them. To sever/remove these flight lines adds to the damage done by increasing the barrier effect the road would have and increasing fragmentation of bat populations and habitat.
22. Considers that over the road structures, with the probable exception of wide green bridges, are not effective at helping bats cross safely. Under the road solutions (culverts and underpasses) have the potential to be effective if large enough, sited on pre-existing commuting routes and well connected to the landscape. Unfortunately, most of those proposed in the ES would be too small, most would be placed well away from known

commuting routes and many would probably be poorly connected to existing commuting routes.

23. At 10.8.391 the ES states “research commissioned by the Highways Agency (2011) confirmed that many bat species, in particular low-level gleaning species, will use underpasses.....” The document referred to does not include recent developments in the field and makes the error of supposing that use by an unknown proportion of bats equates to effective protection of populations. The Highways Agency’s report was a review of the poor evidence available at the time. The state of scientific knowledge has now moved on and the out-dated approach relied upon in the ES is incorrect. It is followed by a detailed species by species description, but almost all of it is anecdotal, qualitative and again reliant on the wholly inadequate definition that use equates to effectiveness. In any event, the smallest underpass/culvert reported to be used by bats in the list was 1.2 m in diameter – significantly larger than the height proposed for many of the culverts along the M4 route.
24. Considers that Table 10.18 (p10-270 et seq.) of the ES is a lengthy catalogue of mitigation measures that the table itself shows are very unlikely to work. The 900 mm diameter culverts are too small for most species to use at all, and probably for any to use effectively. Most of the remainder are lower than the recommended height of 3 m and some would carry roads. Many of the culverts are displaced considerable distances from the known commuting routes and where attempts to divert bats to new crossing points have been studied (Berthinussen & Altringham (2012b, 2015a) this has been unsuccessful.
25. At 10.8.393 the ES states that “overbridges constructed as part of the Scheme would also provide potential crossing points for bats.” Considers that the ES itself presents evidence to suggest these would not be effective and his published evidence adds weight to that conclusion.
26. At 10.8.395 the ES states that, “The construction of these potential bat crossing points would be completed as soon as practicable during construction”. Considers that the use of the words “as soon as practicable”, and similar phrases, are widespread in the ES and mean that there can be no guarantee that the works would be properly timed.

Even if the proposed mitigation measures were likely to be successful their timing would be critical. Failure properly to time the works would aggravate the adverse effect of the proposed construction works upon the bat population.

27. ES 10.8.396 states that “in order to improve the probability of bats finding and using crossing points (including culverts), in accordance with recommendations published by the Highways Agency (2011), crossing points would be constructed along, or as close as practicable to, sites where bat activity has been recorded to be high or very high”. Considers that the use of this wording again suggests that (even on the dubious assumption crossings points could provide satisfactory mitigation) there can be little certainty regarding whether or not crossings can and would actually be suitably located.
28. Considers that, as regards the use of planting to guide bats towards alternative safe crossing points, this strategy is largely untested and, like almost all of the proposed mitigation measures, extremely high risk.
29. The ES states at 10.8.400 that “bat corridors would be installed during night time hours between at least March and September inclusive (the main period of bat activity) and until landscape planting has become sufficiently developed to provide a permanent alternative.” Considers that this suggests that the corridors would need to be constructed and dismantled every day. This increases the risk that ultimately the mitigation would not be provided which, in the context of reported failures even to implement one-off mitigation measures, is not encouraging. Considers that, even if the measure were effectively implemented, there is no evidence that artificial ‘bat corridors’ (such as lines of hazel hurdle fencing) being retained in or connected to high and very high bat activity areas (ES 10.8.400) would encourage the use of new crossings in a way which effectively mitigates the harm from the proposed M4 extension. Considers that there is no evidence to suggest that the installation of mammal exclusion fencing would be able successfully “to guide some species of foraging and commuting bats towards box culverts and mammal crossings, thereby encouraging their use” (ES 10.8.403). Anecdotal observations suggest that even with low flying bats this strategy does not work.

30. Considers that in addition to there being no proper consideration of the long-term effects of the operational road on bats, there is considerable scientific uncertainty about the likely success of the short-term construction mitigation plan, and as such the plan does not meet the requirements of European law which demands that the success of the mitigation must be “beyond reasonable scientific doubt”.

2. REBUTTAL

2.1. Points Raised

2.1.1. The above points are dealt with by topic by the relevant witness Richard Green in the following sections. Readers should also make reference to the Proofs of Evidence in their entirety for a full understanding of the Welsh Government's case. For ease of reference the places where the above points are addressed in this Rebuttal are listed in the table below:

Objector's point reference	Rebuttal paragraph reference	Objector's point reference	Rebuttal paragraph reference
1	2.2.1	16	2.2.15
2	2.2.2	17	2.2.16
3	2.2.3	18	2.2.17
4	2.2.4	19	2.2.18
5	2.2.5	20	2.2.19
6	2.2.6	21	2.2.20
7	2.2.7	22	2.2.6
8	2.2.8	23	2.2.6
9	2.2.9	24	2.2.6
10	2.2.10	25	2.2.21
11	2.2.11	26	2.2.22
12	2.2.12	27	2.2.23
13	2.2.13	28	2.2.24
14	2.2.14	29	2.2.25
15	2.2.14	30	2.2.26

2.2. Richard Green (Ecology - Bats)

2.2.1. Response to **Point 1** (Considers that the bat surveys along the proposed route described in the Environmental Statement (ES) use appropriate methods and are reasonable in scope but considers that there are some gaps):

1. Gaps in survey have subsequently been addressed and additional survey results are included in the December 2016 ES Supplement (Document 2.4.14).

2.2.2. Response to **Point 2** (Considers that the ES concerns itself almost entirely with the impact of the proposed M4 extension during construction and makes little reference to the long-term, landscape-scale impact of the operational phase of the road. States that the Berthinussen & Altringham (2012a, 2015a) report makes clear that major roads, whether under construction or long-established, are associated with lower bat activity and species diversity for at least 1-1.6 km either side of the road. Considers that the ES does not understand this basic ecological principle and suggests that it wrongly assumes without any evidential basis for doing so that there is lots of empty habitat waiting for these displaced bats to move into):

1. The ES (Document 2.3.2) assesses effects of land take (section 10.7), construction (10.8) and operation (10.9) separately. The assessment of operation on bats is described in paragraphs 10.9.262 to 10.9.288.
2. The assessment acknowledges the findings of Berthinussen and Altringham (2012), which identified low bat activity and diversity extending to up to 1.6 km on either side of a well-established major road (the M6 motorway in Cumbria) which they considered showed that roads have a long term negative impact on bat populations and that the scale of the impact was interpreted as indicating a barrier effect.
3. However, in my experience, the presence of a trunk road does not necessarily preclude important bat populations utilising habitats adjacent to and even under the road. On the A487 Porthmadog, Tremadog and Minffordd Bypass scheme, for which I undertook bat survey and ecological assessment, and was part of the employer's agent team reviewing bat mitigation and monitoring, a lesser horseshoe bat maternity roost existed adjacent to the A487 prior to construction of the new road. The bats using this roost were a qualifying feature of the Meirionnydd Oakwoods and Bat Sites Special Area of Conservation. The roost is still present following the opening of the new road in 2011, which is located less than 100 metres from the roost. Monitoring of the roost since scheme construction to 2016 (5 years after opening) concluded that there was no downward trend in roost numbers and that the numbers using the roost were in line with the trend for roosts in Meirionethshire and Caernarfonshire. Four lesser horseshoe bat maternity roosts are present along Section 2 of the A465 Heads of Valleys road. The bats using these

- roosts are a qualifying feature of the Usk Bat Sites Special Area of Conservation. Three of these roosts are located approx. 300 m, 290 m, 110 m from the road, whilst the fourth is located directly under the road in a viaduct. There is a similar lesser horseshoe bat roost under a road bridge at Pontneddfechan, further west on the A465, and another was identified in 2016 in the A470 viaduct structure over the Taf Fawr to the north of the A465/ A470 junction west of Merthyr. There is also a lesser horseshoe bat maternity roost in the Wynhol viaduct on the M5.
4. The assessment also acknowledges that research by the same authors (Berthinussen and Altringham, 2015) found that “Little evidence exists for the effectiveness of currently used mitigation structures for bats on roads, such as underpasses, bridges and wire gantries.”
 5. However, there are some road scheme monitoring reports that are not necessarily in the public domain, where effectiveness has been considered. For example, monitoring of the A487 Porthmadog, Tremadog and Minffordd Bypass, considered effectiveness of bat mitigation, particularly looking at percentage of lesser horseshoe bats using safe crossing points consisting of oversized culverts and an overbridge. Surveyors were positioned to observe bats using the crossings and flying over the carriageway. In 2012, the year after opening, it was concluded that, on average, 92% of bats which crossed the scheme did so safely using the mitigation provided.
 6. The assessment includes consideration of effects on or caused by ‘Bat Roosts’, ‘Risk of Injuries and Fatalities – Foraging and/or Commuting Bats’, ‘Disruption of Bat Movement’, ‘Operational Lighting’, ‘Long Term Maintenance and Management’. The assessment recognises that there is limited firm evidence to confirm the effectiveness of recommended mitigation measures. Therefore, ‘Operational Monitoring’ (to be agreed with NRW and forming part of the Bat Mitigation Strategy, Appendix SS10.5 of Document 2.4.14) is proposed to inform the need for amendments to the mitigation and evaluate the use/‘success’ of mitigation measures.
 7. With mitigation measures, it is considered that the potential impact of operation of the new section of motorway on the local bat population

could be reduced to Minor Adverse and the significance of effects to Slight. However, the exact significance of impact is not possible to estimate as evidence relating to the effectiveness of mitigation described is limited, and the probability that bats would use the culverts and/or mammal crossings or will cross the new section of motorway without injury is not possible to predict exactly. Therefore, on a precautionary basis the magnitude of impact is assessed as Moderate Adverse and the significance of effects as Moderate.

8. This assessment recognises that habitat loss, degradation, and fragmentation may lead to displacement and population decline in the short to medium-term.
 9. As stated in 6.2.9 of my Proof of Evidence (WG1.20.1), in terms of habitat loss, in my opinion, there would be a moderate adverse effect of moderate significance on bats due to temporary habitat loss in the short (1-3 years) and medium-term (4-9 years). This will extend into the long-term (greater than 9 years), until woodland planting and other habitats proposed as part of the Scheme landscaping (refer to 5.2.2 – 5.2.7 of WG1.20.1) mature sufficiently to provide habitat structure and sufficient invertebrate biomass. I estimate this to be between 10 and 20 years to be of notable value to bats and 50 to 100 years to reach full woodland maturity. In the long-term, I consider the magnitude of habitat loss to reduce to minor adverse between 10 and 20 years and to neutral within 50 years, when habitats have matured.
 10. In terms of fragmentation (6.1.12 of WG1.20.1), in my opinion, even after taking into account mitigation, on a precautionary basis the magnitude of impact is correctly assessed as moderate adverse and the significance of effects as moderate. The magnitude of impact could be reduced by increasing headroom in culverts, where possible.
- 2.2.3. Response to **Point 3** (States that persistent, landscape scale effects of operational roads are not unique to bats and considers that no thought is given in the ES as to how these might be mitigated against, for bats or any other mammal or bird):
1. Section 10.5 of the ES includes details of Ecological Mitigation and Monitoring. Mitigation for effects on bats is included within this section

and is expanded upon in the Draft Bat Mitigation Strategy (December ES Supplement Appendix SS10.5). This is to be further developed in consultation with NRW. Mitigation includes: retention of roosts where possible (Berryhill Farm and The Conifers), pre-construction surveys; careful removal of bat roosts under ecological watching brief; lighting design (during construction and operation) to minimise spill; increasing culvert sizes to improve effectiveness for commuting bats; provision of mammal crossings; temporary guidance measures during construction; design of planting to guide bats to culverts; replacement habitats, including reens, woodland, reedbed, species-rich grassland, linear belts of trees and shrubs and hedgerows; ecological enhancement of land at Maerdy Farm, Tatton Farm and Caldicot Moor; provision of a bat barn north of Magor; provision of bat boxes along the Scheme; monitoring of mitigation measures so that modifications can be made if necessary/possible.

2. For other mammal and bird species refer to section 10.9 of Chapter 10: Ecology and Nature Conservation of the ES Volume 1, which considers impacts on other species.
3. Refer also to response to Point 2 above

2.2.4. Response to **Point 4** (States that the ES assesses the likely impact of the construction of the road on bats as moderate adverse without effective mitigation and that it is claimed that the package of mitigation measures proposed would reduce the impact to slight adverse. However, a competent authority can only grant consent for a project if it is “convinced” that the project would not adversely affect the integrity of the protected site concerned. In order to be satisfied of this the competent authority must be satisfied that “no reasonable scientific doubt remains as to the absence of such effects.”):

1. As stated in my response to 4.1 above, with mitigation measures, it is considered that the potential impact of operation of the new section of motorway on the local bat population could be reduced to Minor Adverse and the significance of effects to Slight. However, the exact significance of impact is not possible to estimate as evidence relating to the effectiveness of mitigation described is limited, and the probability that

- bats would use the culverts and/or mammal crossings or will cross the new section of motorway without injury is not possible to predict exactly. Therefore, on a precautionary basis the magnitude of impact is assessed as Moderate Adverse and the significance of effects as Moderate, not slight adverse as implied by Professor John Altringham.
2. I sought clarification by email from Professor John Altringham as to whether he is referring to the Appropriate Assessment in relation to the Wye Valley and Forest of Dean SAC or ecological impacts on bats in general. His response was as follows. *“Although the Waddenzee case concerned an SPA, I believe that the principle that there should be no reasonable scientific doubt regarding the effectiveness of the mitigation measures applies not only to SPA/SAC but also to whether there would be disturbance to a protected species, in accordance with Article 12 of Directive 92/43/EEC and/or whether or not a proposal is likely to be detrimental to the favourable conservation status of a species, in accordance with Article 16 of that Directive.”*
 3. The ‘Waddenzee Judgement’ was in relation to potential effects on integrity of a European Site, which under the EU Habitats Directive 1992, is subject to Appropriate Assessment. The Habitats Directive is transposed into UK law through The Conservation of Habitats and Species Regulations 2010.
 4. Pursuant to Article 6(3) of the Habitats Directive, a competent authority, taking account of the conclusions of the appropriate assessment of the implications of the project for the European site concerned, in the light of the site's conservation objectives, are to authorise such activity only if they have made certain that it will not adversely affect the integrity of that site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.
 5. Paragraph 2.1.9 of WG1.20.1 states, ‘Assessment of Impacts on European Sites (AIES) has been carried out following guidance in DMRB HD44/09 to fulfil the requirements of the Conservation of Habitats and Species Regulations 2010 in relation to potential effects on European sites, including the Wye Valley and Forest of Dean Bat Sites Special Area

of Conservation (SAC), which includes lesser horseshoe bat and greater horseshoe bat as qualifying features.

6. Paragraph 6.5.2 of WG1.20.1 states, 'Considering the distance between the Scheme and the SAC and the limited numbers of lesser and greater horseshoe bats recorded in the survey area during 2014 and 2015, with mitigation, including a new bat house and provision of under-road crossings, the Scheme would not conflict with the Conservation Objectives of the SAC. It is therefore concluded, and I agree, that there would be no adverse effect on the viability of the SAC bat populations or integrity of the SAC with regard to bats. NRW, in principle, agree with the conclusion (subject to not finding any lesser or greater horseshoe bat maternity roosts, and provision of hedges throughout the eastern section of the Scheme to ensure foraging and commuting routes are provided).'
7. Article 12 refers to measures to establish a system of strict protection for animal species listed in Annex IV (a). Article 16 refers to derogation from the provisions of Article 12, 13, 14 and 15 (a) and (b), provided that there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range. Whilst Directive 92/43/EEC embodies the precautionary principle, the 'no reasonable scientific doubt remains as to the absence of such effects' test is not the approach used by regulating authorities for assessment of effects on European protected species, including for derogation licences..

2.2.5. Response to **Point 5** (Considers the mitigation measures proposed would be at best high-risk and largely ineffective and at worst completely ineffective):

1. As explained above, the Appropriate Assessment followed DMRB guidance and meets the required 'standard' under EU and UK law. The principle of not consenting a project unless "no reasonable scientific doubt remains as to the absence of such effects" does not apply to European protected species, such as bats.
2. As stated in my response to Point 2, the ES does not ignore evidence in the DEFRA report and acknowledges uncertainties in the effectiveness of mitigation measures. The assessment takes a precautionary approach

and assesses the magnitude of impact as Moderate Adverse and the significance of effects as Moderate (paragraph 10.9.288 of the ES).

2.2.6. Response to **Points 6, 22, 23 and 24** (Refers to Table 10.18 of the ES and suggests that most species would not benefit from the mitigation, which is based on flawed evidence), (Considers that over the road structures, with the probable exception of wide green bridges, are not effective at helping bats cross safely. Under the road solutions have the potential to be effective if large enough, sited on pre-existing commuting routes and well connected to the landscape. Unfortunately, most of those proposed in the ES would be too small, most would be placed well away from known commuting routes and many would probably be poorly connected to existing commuting routes), (At 10.8.391 the ES states “research commissioned by the Highways Agency (2011) confirmed that many bat species, in particular low-level gleaning species, will use underpasses...” The document referred to does not include recent developments in the field and makes the error of supposing that use by an unknown proportion of bats equates to effective protection of populations. The Highways Agency’s report was a review of the poor evidence available at the time. The state of scientific knowledge has now moved on and the out-dated approach relied upon in the ES is incorrect. It is followed by a detailed species by species description, but almost all of it is anecdotal, qualitative and again reliant on the wholly inadequate definition that use equates to effectiveness. In any event, the smallest underpass/culvert reported to be used by bats in the list was 1.2 m in diameter – significantly larger than the height proposed for many of the culverts along the M4 route), (Considers that Table 10.18 (p10-270 et seq.) of the ES is a lengthy catalogue of mitigation measures that the table itself shows are very unlikely to work. The 900 mm diameter culverts are too small for most species to use at all, and probably for any to use effectively. Most of the remainder are lower than the recommended height of 3 m and some would carry roads. Many of the culverts are displaced considerable distances from the known commuting routes and where attempts to divert bats to new crossing points have been studied (Berthinussen & Altringham (2012b, 2015a) this has been unsuccessful):

1. ES Table 10.18 is currently being updated to include approximate available headroom in culverts and an assessment of the 'effectiveness' of potential increases (following recommendations in Berthinussen & Altringham (2015)¹ and Møller et al (2016)²), with recommendations for which culverts should be increased and to what size.
 2. The assessment takes a precautionary approach and assumes that severance effects will remain, despite provision of culverts, underpasses and overbridges.
- 2.2.7. Response to **Point 7** (Considers that in addition to passing over much important evidence, the ES fails to draw the critical distinction between the use of a structure by individual bats and its effectiveness at protecting bat populations):
1. The Welsh Government recognises that roads have detrimental effects on bats, including severance and mortality of bats, potentially leading to a reduction in bat abundance and species diversity up to 1.6 km distance from a major road.
 2. Whilst several studies have been undertaken on bats and roads, most notably Berthinussen and Altringham 2015, precise predictions cannot be made on exactly how roads will affect bats, i.e., to what extent crossing structures will be effectively used by bats and to what extent bat populations will be affected, e.g., causing bats to move away from the area or a decrease in reproductive success. The mitigation proposed and to be designed in detail (in consultation with NRW) aims to minimise the effects on bats within the constraints posed by the road alignment, both vertically and horizontally. Particularly given the restrictions of headroom in culverts, the Welsh Government acknowledge that all adverse effects cannot be prevented and residual effects will remain, assessed as of moderate adverse significance.
- 2.2.8. Response to **Point 8** (States that the ES cites reports that describe the use of overpasses and underpasses by small numbers of bats in support of their

¹ Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure. Anna Berthinussen & John Altringham, School of Biology, University of Leeds, Leeds LS2 9JT. Final report 2015

² CEDR(Conference of European Directors of Roads) Call 2013: Roads and Wildlife. Safe Bat Paths. Fumbling in the dark – effectiveness of bat mitigation measures on roads. Effectiveness of mitigating measures for bats – a review (November 2016).

value as mitigation tools. State that there is no mention of the number of bats that no longer go near a site, or fail to cross the road, or those that cross the road at risk of being killed. States that the purpose of mitigation is to ensure that a very large majority of the bats present before construction continue to cross the road safely after construction. Considers that, by these criteria, most mitigation is untested or failing):

1. There is little robust scientific evidence from other road schemes on the number of bats that no longer go near a site once a road is built, or fail to cross the road, or those that cross the road at risk of being killed. The Welsh Government notes the findings of Berthinussen & Altringham 2012b and Berthinussen and Altringham (2015) and the findings of these studies have informed the assessment. As stated, it is recognised that there is considerable uncertainty over how effective proposed crossing mitigation will be and that residual effects will remain, assessed as of moderate adverse significance.

2.2.9. Response to **Point 9** (Considers that many of the mitigation measures proposed in the ES are insufficiently detailed to allow proper assessment. By way of example, the proposed noise plan (ES 10.8.412) and lighting plan (ES 10.8.405) should be significantly more detailed for it to be possible to assess their likely effectiveness):

1. Effects of construction noise and lighting (to which the quoted paragraphs refer) are considered in paragraphs 5.3.1, 5.3.2, 6.3.1 & 6.3.2 of WG1.20.1.
2. With regard to effects of noise during operation, Berthinussen and Altringham (2011) conclude, "Noise pollution also cannot explain the observed decrease in bat activity and diversity in proximity to the road, because noise levels were low and unchanging beyond 100 m." Traffic noise levels were not included in their models as they were considered to be irrelevant to the scale of their study because of the short operating ranges observed. Noise levels decreased significantly with distance from the road, but 89% of the change occurred in the first 50 m and no significant variation was found beyond 100 m. Studies on the gleaning greater mouse-eared bat *Myotis myotis* (Schaub, Ostwald & Siemers 2008; Siemers & Schaub 2011) show that even species that hunt by

listening for prey-generated noise are not likely to be affected by roads more than 100 m away.

3. They also conclude in their study that any effect of light pollution from road and vehicle lights is also likely to operate over short distances, because of the inverse square relationship between distance and light intensity. Section 6.4.6 of my proof states “The new section of motorway would be unlit apart from junctions and their approaches and the River Usk Crossing. As part of the Scheme, in order to minimise the potential impact of operational lighting, where practicable and safe, lighting would take into account best practice recommendations and guidelines published by the Bat Conservation Trust and the Institution of Lighting Engineers (2009) (Document 11.3.6).
4. Where lighting is installed, light fixtures would be directed towards the new road and away from culverts, mammal crossings, underpasses and overbridges, as well as surrounding habitat of potential value to bats (including areas of woodland, scrub, watercourses and mature trees) and buildings of known or potential value to roosting bats. In my opinion the magnitude of impact of road lighting on bats would be minor adverse and the effect of lighting on foraging and commuting bats would be of slight significance.

2.2.10. Response to **Point 10** (States that bat boxes are put forward as effective replacements to lost roosts and considers that bat boxes and bat barns represent a high risk, poorly assessed mitigation/compensation ‘solution’ to lost roosts – there is no guarantee that they would work and a high probability that they would not):

1. Bat boxes can be a useful conservation measure and are used by a variety of species. It is recognised that the use of bat boxes is variable. This may depend on a number of factors, including location/surrounding habitats, placement (height/orientation) and existing available roosts nearby. That is why at least three bat boxes will be installed for each tree roost to be lost during construction and six will be installed for building day roosts to be demolished (refer to Document 2.4.14 Appendix SS10.5, D.3.5 – D.3.10 of the Draft Bat Mitigation Strategy). The exact number and location of boxes will be agreed with NRW.

2. To put the research referred to in context, Stone et al. (2013) state in their discussion on 'Effectiveness of Mitigation', "*We could not determine whether mitigation was effective because of the inadequate and inconsistent postdevelopment data on bat-derogation license return forms.*" They go on to say, "*Although bats use artificial roosts there is a lack of empirical data to evaluate the effectiveness of bat boxes, lofts, and barns as mitigation tools.*"
3. They also state, "*the absence of bats postdevelopment does not necessarily indicate failure of the mitigation measures because species such as *Myotis nattereri* (Swift 1997) and *P. pygmaeus* (Bartonička et al. 2008) frequently switch roosts and may take time to return and reach predevelopment abundance (e.g., *M. nattereri* took 3 years to return to one roost subjected to development and mitigation) (Mitchell-Jones 2004).*"
4. They state, "*Bat boxes are not good alternative bat roosts*" and refer to Tuttle & Hensley (1993). This paper is about the success of bat houses (a US term given to a type of bat box) and starts with the headline "*A new BCI study on bat house use in the United States reveals that bats are occupying bat houses season after season in record numbers...*". This type of box can be used as part of the roost mitigation, such as providing 'bat houses' on poles at Water Treatment Areas, as referred to in paragraph D.3.13 of the Draft Bat Mitigation Strategy (Appendix SS10.5 of Document 2.4.14).
5. In my experience, private and commercial developers pay far less attention to the detail of providing good bat roost design than the Welsh Government and it is fair to say that monitoring is much more limited than on such a road scheme. Therefore, monitoring may only involve one visit, maybe a year after bat boxes are provided. Indeed, Natural England do not normally require any monitoring for licensed development that only requires the provision of a few bat boxes. One assumes that this is because it is their view that bat boxes are established and uncontroversial mitigation. Bat boxes are standard mitigation practice for loss of low value bat roosts and are designed to mimic the cavities found within trees. The use of bat boxes is promoted by Natural England in their

Bat Mitigation Guidelines (2004) and they are commonly accepted by NRW as mitigation for licence applications.

6. Similarly, it is acknowledged that bat barns may not always be used by bats. This may be due to poor design, location and availability of alternative roosts. I have extensive experience in providing bat barns/houses and have designed several that have been successful, including buildings adopted by both lesser horseshoe and brown long-eared bats as breeding roosts. Most recently, I designed a bat house on the A465 Heads of the Valleys Section 2. This was designed primarily to be suitable as a lesser horseshoe bat maternity roost. Construction was completed in September 2015 and it was first used by at least three different lesser horseshoe bats, including a mother with juvenile, in the summer of 2016. Whilst it has not yet been used as a maternity roost, initial signs are encouraging and it was not provided as a replacement roost, but as an additional roost should bats choose to use it instead of remaining in a maternity roost under a viaduct. When bats are accustomed to using roosts that are not being removed, it may take some time for them to adopt new roosts.
7. The bat barn to be provided at Magor is not for the purpose of replacing a maternity roost but to provide a new favourable roosting opportunity for lesser horseshoe bats recorded in this area, i.e., recorded flying through the Mill Reen Underpass. By locating it to the north of the M4, it provides better access to more extensive woodland habitat, with the aim of reducing the need for crossing the M4. The bat barn will also provide a suitable building for use by common pipistrelle bats, in replacement for the loss of Woodland House at Magor, where three common pipistrelle bats have been observed. Bat boxes will also be provided in replacement for this roost. The Welsh Government is currently considering dismantling Woodland House and the coach house and rebuilding on a different site. These could provide replacement bat roosts, albeit on a different site. As nothing has been confirmed, WG cannot provide details but consideration will be made to providing bat roosts if appropriate, e.g., surrounding habitat is favourable.

2.2.11. Response to **Point 11** (Considers that there is no evidence provided to support the conclusion that the bat boxes would be suitable alternative roosts

or that bats chased out of roosts would have suitable alternative roosts. Considers that this proposal is not effective mitigation but is simply eviction).

1. In addition to my response to Point 10 above, as contradictory evidence to the claim that bat boxes would not provide suitable alternative roosts I refer to a recent Welsh trunk road scheme, the A470 Cwm-bach to Newbridge-on-Wye. The Ecological Monitoring Report 2016 (Post Construction Year 5) includes results of bat box monitoring. Species recorded in the locality included both common and soprano pipistrelle and brown long-eared bat, which reflects in the design of boxes erected. The boxes were erected in early 2010 prior to the site clearance phase.
2. In 2016, 60 of the 81 bat boxes surveyed were being used by four different species of bats, including soprano and common pipistrelles, Natter's and brown long-eared bats (i.e. a 74% overall occupancy). This represented an increase from 42.5% and 46.9% in the final year of the construction phase and the first year of the aftercare period respectively. Over the aftercare period, the Schwegler bat box type 2FD has been the most successful with an average occupancy of over 75%. A summary of the percentage occupancy achieved each year is set out in Table 2.5 below.

Table 2.5 : Percentage occupancy of bat boxes 2010-2016

Phase	Construction		Post Construction				
	2010	2011	2012	2013	2014	2015	2016
All	39.5%	42.5%	46.9%	53.0%	71.6%	58.5%	74.1%
1FF	50%	50%	55%	27%	100%	55%	82%
1FW	33%	33%	67%	33%	67%	33%	67%
2F	50%	46%	42%	41%	67%	50%	75%
2FD	50%	58%	64%	72%	84%	80%	77%
2FN	23%	23%	30%	53%	53%	47%	66%

- 2.2.12. Response to **Point 12** (Considers that Paragraph 10.8.385 of the ES suggests that “all roosting bats would be captured and relocated to bat roost boxes suitable for the species of bat being displaced”. Considers that some species, such as horseshoe bats, do not use any of the commonly available roost boxes. Little is known about “suitability” when it comes to size, location, temperature and function (e.g. suitability as a nursery, mating site, etc.) for any species. Considers that “suitable” here appears simply to be used to mean that a given species may have been seen to use a similar box

somewhere, at some time, for some unknown purpose. Considers that, on the basis of current scientific knowledge, there are very significant uncertainties and risks associated with this approach. Considers that it cannot properly be said to be effective mitigation. Considers that, if the habitat around the roost has been degraded by construction, no roost may be suitable, since habitat is an important part of roost choice in bats):

1. Capture and relocation of bats is standard practice when demolishing buildings under licence. The alternative is to let bats fly away during daylight, at increased risk of predation, to find their own alternative roost. This is unlikely to be acceptable to NRW. Moving bats to a nearby bat box provides them with a safe place to spend the day. They may then choose to roost elsewhere after the following night, as they will know of alternative roosts in the area. Moving them to a box at least shows them where an additional roost that they may not be aware of is present. Relatively few roosts will be directly affected. All replacement roosts are to provide alternatives for roosts of low conservation significance. Maternity roosts will be retained along with connecting habitats.
2. The only lesser horseshoe bat roost to be demolished is the coach house at Woodland House, Magor. This was recently discovered by myself, as access to the building had not previously been possible. It is considered that the building is a day and/or night roost used by one or a small number of bats, although this is to be confirmed by further survey in May and June 2017. The bat barn north of Magor will provide a suitable alternative roost. Bats will be able to commute to and from the bat barn and the area around Magor along existing tree lines and hedges, Mill Reen and woodland running north-south through the village and proposed woodland planting will provide improved commuting and foraging habitats (refer to Woodland House Daytime Bat Survey report by Richard Green Ecology February 2017³ and ES Figure 2.6 (Document 2.3.2) for Landscape Environmental Masterplan sheets 12 and 13).
3. As set out in the Draft Bat Mitigation Strategy (Appendix SS10.5 of Document 2.4.14), the total number of known tree roosts that would be

³ To be submitted to the Inquiry into the Listed Building Consent Called-in application for the proposed demolition of Woodland House, which will take place on 20 June 2017, concurrently to the M4CaN Inquiry.

destroyed consists of three confirmed and three probable roosts, affecting low numbers (between one and three bats) of common pipistrelle, brown long-eared and noctule bats. The total number of buildings with roosting bats that would be destroyed consists of nine buildings, affecting seven low value common pipistrelle bat roosts, two low value soprano pipistrelle bat roosts, one low value brown long-eared bat roost and one common pipistrelle bat maternity roost. Since the Draft Bat Mitigation Strategy was produced further discussion and design has been undertaken within the Welsh Government and its project team.

4. It is now proposed to retain the common pipistrelle bat maternity roost at The Conifers, which is mentioned above and is also the low value brown long-eared bat roost and one of the low value soprano pipistrelle bat roosts mentioned. Considering the additional lesser horseshoe day/night roost found at Woodland House, the updated list of building roosts to be destroyed consists of nine buildings, affecting seven low value common pipistrelle bat roosts, one low value soprano pipistrelle bat roost and one low value lesser horseshoe bat roost. New roosts will be located in favourable habitats, such as on mature trees along existing reens, tree lines, woodland and at Water Treatment Areas. Some of these will be away from the road, in mitigation areas at Maerdy Farm and Tatton Farm.
5. Stone et al. (2013) suggest that because some common pipistrelle nursery colonies may move on average every 12 days, the loss of a few roosts may not have a negative effect on their local conservation status. Therefore, even if the roosts at Berryhill Farm and The Conifers are abandoned during construction, the bats are likely to have alternative available roosts nearby.

2.2.13. Response to Point 13 (Considers that at paragraph 10.8.386 the ES is forced to acknowledge the severe consequences of the use of these high-risk displacement methods. It states, “Should displacement and relocation of bats result in the loss of, or reduced access to favourable foraging sites, alternative roosting sites and/or other bats in the area, the effect could be significant with regard to the long term viability of the population.”):

1. Paragraph 10.8.387 of the ES (Document 2.3.2) goes on to say that alternative bat roosts will be provided to minimise the impact of

displacement. The assessment of effects on bats acknowledges the adverse effects on bats, and assesses the magnitude of impact as Moderate Adverse and the significance of effects as Moderate. The assessment followed the precautionary principle.

2.2.14. Response to **Points 14 and 15** (Considers that the state of scientific knowledge is such that there is too little published information available on bat barns and similar structures to enable a satisfactory assessment of their effectiveness as a mitigation measure. Little if any weight can therefore be given to the proposal at ES 10.8.387 that “in order to minimise the impact of displacement, a bat barn would be provided north of Magor.”), (Considers that the proposals to mitigate the effect of the proposed M4 extension upon bats through the use of bat boxes/barns (as proposed in the ES) therefore fails to provide satisfactory scientific evidence to support the effectiveness of these structures. The ES simply does not appear to properly appreciate the high risk nature of the measures proposed):

1. Refer to responses to Points 10, 11 & 12.

2.2.15. Response to **Point 16** (Considers that there is a longstanding issue regarding compliance in use of bat boxes and bat barns):

1. The Welsh Government treats its environmental and legislative duties very seriously. Processes will be put in place through a Construction Environmental Management Plan and an Operations and Maintenance Manual that ensure licence requirements are complied with. Auditing of all ecology works would be undertaken by Arcadis (the Employers Agent) and post works monitoring will be reported as part of the Bat Mitigation Strategy (Appendix SS10.5 of Document 2.4.14), and would form part of the NRW licence requirements for the Scheme, should it be granted permission.
2. Commitment 130 in the Register of Environmental Commitment includes monitoring of bat populations.
3. Extensive monitoring has been/is being undertaken on previous/existing WG road schemes that I have been/am involved with, i.e., the A487 Porthmadog, Tremadog and Minffordd Bypass and the A465 Heads of Valleys Section 2 improvement. This was done in consultation and agreement with NRW.

4. The March 2017 Environmental Progress Meeting Minutes for the A465 HoV scheme include the following text with regard to comments on bats from NRW. “Stuart Reid noted NRW are generally encouraged by the 2016 monitoring reports. NRW have a limited set of comments to feed back. John Messenger noted that signs were very encouraging. The evidence does not suggest a decline in the population which could have been expected to have occurred by now without the mitigation measures. To be able to say there is no cause for concern so far, is an achievement to the project.”

2.2.16. Response to **Point 17** (Considers that the approach to monitoring in the ES is flawed with no specifics given regarding the metrics and threshold that would prompt action in the event of failure or what action would be taken in such an event. There does not appear to be a satisfactory contingency plan if the high risk mitigation measures proposed are unsuccessful and suggests a more detailed monitoring plan is required):

1. The ES (Document 2.3.2) at Chapter 10 confirms monitoring of the operational phase would include bat activity and use of roosts (existing and proposed) and analysis of results will be undertaken in accordance with NRW requirements (paragraphs 10.9.282 – 10.9.284).
2. Paragraph 10.9.285 of the ES (Document 2.3.2) states, “Results of [monitoring] surveys would be provided to NRW on at least an annual basis or as otherwise requested by NRW, and would be used to inform the need for any amendments to mitigation and ongoing habitat management in order to ensure effectiveness and inform the need for amendments to the mitigation”.
3. Monitoring proposals are expanded in section E.2 of the Draft Bat Mitigation Strategy (Appendix SS10.5 of Document 2.4.14). These include agreeing specifics with NRW. The need for further monitoring will be reviewed after each year’s monitoring in discussion with NRW. Quantitative monitoring would include counting the number of bats using retained maternity roosts that could be affected by the Scheme, namely Berryhill Farm and The Conifers. Data from 2016 and 2017 would be used as a baseline against which to measure. This would enable an assessment of whether bats were deterred from using these roosts but

not necessarily of whether there are any population effects, as bats may simply move from these roosts to other roosts in the area. The bat activity data gathered during manual transects and static bat detectors in 2014 and 2015 do not provide an adequate baseline against which to monitor and determine any effects on bat populations, as the data were gathered from along the proposed Scheme or very close to it and bat activity is bound to change in those locations because of the presence of the road. There are insufficient replicates of manual transect data to provide any meaningful analysis, as bat activity clearly varies considerably between survey visits for each transect. Previous schemes have used numbers of bats in nearby roosts as proxies for population effects. Only maternity or significant hibernation roosts are suitable for such monitoring, as insufficient data would be available if considering occasional summer day roosts used by only small numbers of bats.

4. Other quantitative monitoring would include surveys of potential crossing structures to determine numbers and percentages of bats safely crossing the road using the structures, i.e., to determine the effectiveness of the structures as safe bat crossing locations. It is proposed to agree a sample of crossing locations with NRW as part of the developing Bat Mitigation Strategy.
5. The need for further monitoring will be reviewed after each year's monitoring in discussion with NRW. Results of the monitoring surveys will be reviewed and if considered necessary and possible, measures will be taken to rectify any issues.

2.2.17. Response to **Point 18** (Considers that that the ES at 10.9.268 fails to take account of the strong possibility that bats simply do not use the roosts):

1. The provision of replacement bat roosts follows guidance in English Nature's Bat Mitigation Guidelines (2004) and will be licensed by NRW; therefore being to their satisfaction. All maternity roosts (Berryhill Fam – common pipistrelle and brown long-eared maternity roosts; and The Conifers – common pipistrelle maternity roost with brown long-eared present) will be retained along with vegetation connecting roosts to retained foraging habitats. These two roosts are close to each other and it is entirely possible that bats using each roost are part of the same

breeding colony. Bats will therefore be able to choose between roosts, depending on which is considered most favourable by the bats. Further survey of these roosts, including internal inspection, will be undertaken in summer 2017 to update the baseline against which during and post construction survey results can be compared. Monitoring will be undertaken throughout construction and during operation for a period to be agreed with NRW. The findings will further refine necessary mitigation measures to be provided. Further mitigation could include another bat barn in the area if considered necessary (refer to paragraph 10.7.239 of the ES, Document 2.3.2).

2. Refer also to response to Point 17 regarding monitoring.

2.2.18. Response to **Point 19** (There is no reference to what information the monitoring measures would provide to guide any relocation. Moreover, if bats don't use the roosts provided, then providing more would be an entirely futile exercise):

1. The ES (Document 2.3.2) is not stating that mitigation failures are "likely" to emerge. The assessment takes a precautionary approach and suggests best practice is to monitor so as to enable any remedies to be set in place where required so as to ensure mitigation is effective. EIA Directive 2014/52/EU will require the monitoring of significant adverse effects on the environment resulting from the construction and operation of a project, inter alia, to identify unforeseen significant adverse effects, in order to be able to undertake appropriate remedial action. Any such remedial action is likely to reduce adverse effects and would not change the assessment made in the ES or SIAA.
2. The example of bat box mitigation amendments provided relates to relocation of boxes in response to monitoring surveys, i.e. should monitoring confirm bat boxes have not been utilised, alternative locations may be selected in order to help increase the chance of use. This is not to suggest the original location will be selected incorrectly but to recognise that not everything can be guaranteed and we would not wish to miss opportunities to take action in order to increase the potential for mitigation to be of maximum benefit where possible. Habitat favourability can vary considerably over a short area and so moving and/or providing

more boxes in different locations would provide alternative opportunities/additional roost sites so this would not be considered futile.

3. All monitoring will be agreed with NRW and detailed in the Bat Mitigation Strategy. Any mitigation amendments or additions in response to monitoring surveys will be agreed with NRW.
4. The number and value of roosts affected is low, i.e., nine buildings, affecting seven low value common pipistrelle bat roosts, one low value soprano pipistrelle bat roost and one low value lesser horseshoe bat roost; and tree roosts comprising three confirmed and three probable roosts, affecting low numbers (between one and three bats) of common pipistrelle, brown long-eared and noctule bats.
5. At least three bat boxes will be installed for each tree roost to be lost during construction and six, two of each of the above designs will be installed for building day roosts to be demolished. However, as different bat species will not be placed into the same roost box, additional roost boxes will be installed in order to accommodate bats as necessary.
6. The availability of replacement roosts will therefore be greater than the number removed. Whilst these may not be used immediately, as it may take some time for bats to find them, bats will have alternative roosts available in the area.
7. For further information, refer to response to my response to Point 10 and the reference to roost switching in bats.

2.2.19. Response to **Point 20** (States that the ES acknowledges at 10.8.388 that major roads can present a barrier to the movement of some bat species. Berthinussen and Altringham (2012) recorded a significant reduction in bat activity up to 1.6 km from an 80 km section of the M6 in Cumbria, England. This reduction in activity was considered in part to be due to the barrier effect of major roads." Considers that this is, however, an understatement. Considers that major roads are a barrier to most bat species and the "significant reduction" was in fact a three-fold decrease in activity. Considers that, despite referring elsewhere to the 2015 DEFRA report, the ES does not cite the additional evidence contained in the report for this effect, through the study of seven more roads: motorways and A roads. Considers that this is a substantial omission):

1. It is acknowledged that major roads are a barrier to most bat species. However, it can be seen that bats will find and use culverts and underpasses, for example Mill Reen Underpass under the existing M4. However, numbers of bats crossing may be reduced from the number of bats flying along Mill Reen in that location before the road was built.
2. As stated in paragraph 7.8.16 of WG1.20.1, survey results have shown that some of the highest bat activity areas are close to the existing M4 and common pipistrelle bat maternity roosts have been found at Berryhill Farm and The Conifers, approximately 140 and 300 m from the existing M4.

2.2.20. Response to **Point 21** (States that the ES at 10.9.271 suggests that planting should be used to help guide bats towards alternative safe crossing points. Considers that the fact that habitat corridors cannot be retained demonstrates a significant problem with the proposed mitigation strategy. Considers that the whole point of mitigation is to make it possible for bats to continue to use existing flight lines by providing road crossing structures along them. To sever/remove these flight lines adds to the damage done by increasing the barrier effect the road would have and increasing fragmentation of bat populations and habitat):

1. The nature of the Scheme means that hedgerows and other habitat corridors will inevitably be lost and it is not possible to provide sufficiently sized underpasses on all severed corridors that would be effective for all bat species. Therefore, linear planting will be undertaken where possible in order to help guide commuting bats along replacement/alternative habitat corridors to safe crossing points. Refer to Figure 2.6 of the ES (Document 2.3.2) for Environmental Management Plans showing planting and culvert locations. These will be developed further during detailed design, in consultation with NRW.

2.2.21. Response to **Point 25** (At 10.8.393 the ES states that “overbridges constructed as part of the Scheme would also provide potential crossing points for bats.” Considers that the ES itself presents evidence to suggest these would not be effective and his published evidence adds weight to that conclusion):

1. The ES (Document 2.3.2) suggests these could be potential crossing points and hence solid parapets will be installed in order to increase their potential value; however, it is not suggested these will definitely be used, as acknowledged in the ES, which takes this into account in the impact assessment.

2.2.22. Response to **Point 26** (At 10.8.395 the ES states that, “The construction of these potential bat crossing points would be completed as soon as practicable during construction”. Considers that the use of the words “as soon as practicable”, and similar phrases, are widespread in the ES and mean that there can be no guarantee that the works would be properly timed. Even if the proposed mitigation measures were likely to be successful their timing would be critical. Failure properly to time the works would aggravate the adverse effect of the proposed construction works upon the bat population):

1. This detailed programme information was not available at the time of writing the ES (Document 2.3.2). ES paragraph 10.7.243 provides more information on timing and explains that temporary measures will be used to connect surrounding hedgerows and woodland edge to crossing points located close to sites of high and very high value to bats. These temporary measures will be installed immediately following vegetation removal if during the active season or by the following March if during the winter (refer to paragraph 10.5.40 of the ES (Document 2.3.2)). This is also included in paragraph 10.8.400. These measures will be developed further in consultation with NRW as part of the iterative Bat Mitigation Strategy (Appendix SS10.5 of Document 2.4.14).

2.2.23. Response to **Point 27** (ES 10.8.396 states that “in order to improve the probability of bats finding and using crossing points (including culverts), in accordance with recommendations published by the Highways Agency (2011), crossing points would be constructed along, or as close as practicable to, sites where bat activity has been recorded to be high or very high”. Considers that the use of this wording again suggests that (even on the dubious assumption crossings points could provide satisfactory mitigation) there can be little certainty regarding whether or not crossings can and would actually be suitably located):

1. ES (Document 2.3.2) Table 10.18 is currently being updated to an assessment of the 'effectiveness' of structures (following recommendations in Berthinussen & Altringham (2015) and Møller et al (2016)), with consideration made to location of culverts in relation to recorded bat activity.
2. The assessment takes a precautionary approach and assumes that severance effects will remain, despite provision of culverts, underpasses and overbridges.

2.2.24. Response to **Point 28** (Considers that, as regards the use of planting to guide bats towards alternative safe crossing points, this strategy is largely untested and, like almost all of the proposed mitigation measures, extremely high risk):

1. Bats are known to forage and commute along hedgerows and woodland edge, and indeed do so on this Scheme, hence the proposal. In time, it is expected that bat species more likely to fly through culverts would change their behaviour and adopt culverts for crossing under the road.
2. Although we appreciate that Berthinussen & Altringham (2012b) assessed one such mitigation strategy to be a failure, their report states, "No bats were observed flying along the planted diversion to the underpass, but observers were only able to monitor this where it left the original commuting route". Their report includes a photograph of the trees and shrubs (approximately two years after planting). The single line of trees and shrubs varies from approx. 1.5 – 2 m high. At that height, the value of such a line of vegetation is likely to be low but is likely to increase as the vegetation grows. We would not wish to remove such a strategy on the basis of a sample size of one.

2.2.25. Response to **Point 29** (The ES states at 10.8.400 that "bat corridors would be installed during night time hours between at least March and September inclusive (the main period of bat activity) and until landscape planting has become sufficiently developed to provide a permanent alternative." Considers that this suggests that the corridors would need to be constructed and dismantled every day. This increases the risk that ultimately the mitigation would not be provided which, in the context of reported failures even to implement one-off mitigation measures, is not encouraging. Considers that, even if the measure were effectively implemented, there is no evidence that

artificial 'bat corridors' (such as lines of hazel hurdle fencing) being retained in or connected to high and very high bat activity areas (ES 10.8.400) would encourage the use of new crossings in a way which effectively mitigates the harm from the proposed M4 extension. Considers that there is no evidence to suggest that the installation of mammal exclusion fencing would be able successfully "to guide some species of foraging and commuting bats towards box culverts and mammal crossings, thereby encouraging their use" (ES 10.8.403). Anecdotal observations suggest that even with low flying bats this strategy does not work):

1. Such structures, e.g., Heras fencing panels or debris netting strung across the road on ropes, are easy to erect and dismantle each day. Site foremen would be tasked with ensuring this is done and it would form part of the Construction Environment Management Plan. The Environmental Clerk of Works would monitor the provision of bat corridors every day. An independent auditor would also carry out unannounced site visits to check, amongst other things, that this is done.
2. Berthinussen & Altringham (2012b) state that "Commuting bats use linear habitat elements not just for navigation, but also to obtain protection from predation and wind and as foraging microhabitats. It is to create such a protective element that the fencing is proposed. No definitive study has been undertaken on the effectiveness of such structures but monitoring on the A465 HoV Section 2 has shown that lesser horseshoe bats continue to fly through a culvert under the road where vegetation has been cleared adjacent to the road and a double line of debris netting erected to 'guide' them to retained vegetation and a nearby culvert under a side road. Monitoring of the A487 Portmadog, Tremadog and Minffordd Bypass The use of temporary guide fencing comprising Heras panels and debris netting (along the same alignments as cleared vegetation) was observed being used by bats, though no experimental manipulation of conditions on site was carried out to determine whether bats were reliant on the fencing to navigate along, or whether they were also able to use these commuting routes from memory.
3. Whilst it cannot be guaranteed that bats will follow the fencing, it is considered better to provide something to assist bats to cross open spaces, as opposed to providing nothing.

2.2.26. Response to **Point 30** (Considers that in addition to there being no proper consideration of the long-term effects of the operational road on bats, there is considerable scientific uncertainty about the likely success of the short-term construction mitigation plan, and as such the plan does not meet the requirements of European law which demands that the success of the mitigation must be “beyond reasonable scientific doubt”):

1. Long-term operational effects are assessed in the SIAA and Chapter 10 of the ES (Document 2.3.2) Section 10.9. With regard to European law – I refer to my response to Point 4.

2.2.27. I confirm that the statement of truth and professional obligations to the inquiry from my main proof still applies.