Appendix 1: Hillingdon's High Speed Rail Appraisal of Carbon Impacts

High Speed Rail

Appraisal of Carbon Impacts

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1. Executive Summary

1.1. Executive Summary

1.1.1. HS2 LTD claim that the multi billion pound HS2 will be broadly carbon neutral. In a letter dated 9 February to a colleague, Phillip Hammond reiterates the claim, but goes one stage further and says that the first phase of HS2 will be broadly carbon neutral.

1.1.2. HS2 Ltd claims that HS2 will instigate a significant shift away from more carbon intensive flights and in turn helping to reduce the transport sector's 25% of the UK emissions. Unfortunately, these claims are based on an inaccurate set of assumptions and a highly inadequate report.

1.1.3. In reality HS2 is likely to result in an increase in the UK emissions. HS2 Ltd is relying on an increase in domestic aviation to justify bold carbon claims. However, a significant modal shift from domestic flights to rail has already begun. HS2 will reduce the amount of domestic flights, but by the time this happens, the modal shift will be vastly less than HS2 Ltd has claimed. Furthermore, HS2 will attract customers from far less carbon intensive existing lines on to a brand new network. This new network will have a considerable carbon deficit long before any impacts on domestic aviation are realised. This makes HS2 a highly expensive transport intervention that will only have a negative impact on UK transport emissions.

1.1.4. This paper provides an appraisal of the HS2 Greenhouse Gas Report as part of the 51M consultation response it shows that the assumptions of both HS2 and Phillip Hammond are wildly inaccurate and misleading. It also demonstrates that based on the information provided, HS2 will not even be broadly carbon neutral, but is likely to increase the UK's carbon emissions.

London to Birmingham Cannot Possibly be Carbon Neutral

1.1.5. Firstly, the HS2 Report is far from clear as to what is being assessed. The report is called London to West Midlands, but has provided limited assessment of impacts beyond the Phase 1 route. All the other environmental assessments have only considered the impacts of

London to Birmingham. However, as any benefits on carbon emissions come later in the project, HS2 Ltd has seemingly considered impacts of a wider network. This is particularly prevalent where HS2 Ltd is relying on the benefits of the Scotland links to deliver a modal shift from air to rail.

1.1.6. Phillip Hammond has claimed that Phase 1 of HS2 will be broadly carbon neutral (appendix 1). This is an enormously misleading statement and completely misinterprets the HS2 Report. Phase 1 cannot possibly be even close to carbon neutral as the high construction and operational carbon impacts will not be offset by a reduction in domestic aviation. There is currently no modal share for aviation for journeys from Birmingham to London. This means that Phase 1 has no aviation competition. Phillip Hammond's statement is fundamentally wrong. No one at HS2 Ltd has seemingly set out the impacts for Phase 1 alone.

1.1.7. This interpretation of what is being assessed comes mainly from Table 4 of the greenhouse gas report. One of the scenarios in this table suggests that a reasonable best case for the 'proposed route' would be that all domestic aviation switches to rail. This cannot be likely for just Phase 1. It is highly illogical to suggest that a 30minute quicker journey between London and Birmingham is going to reduce domestic flights between London to Scotland and London to Manchester/Leeds to zero. Furthermore, this conclusion would be in complete contrast to previous studies that all set out likely increases in carbon emissions for a high speed rail network from London to Manchester.

1.1.8. The second scenario in Table 4 suggests that the 'proposed route' would increase emissions by 16.9MtCO2 (with 1.2MtCO2 from construction) if there was no impact on domestic aviation. In reality, this is more likely to be the scenario for Phase 1. There are no flights between London and Birmingham and rail already has an 80% share of the market for journeys from Manchester. The 30 minute saving between London and Birmingham is unlikely to result in a reduction in those wishing to fly from Scotland to London. HS2 Ltd's own report therefore sets out a more likely scenario of HS2 being substantially carbon negative.

1.1.9. Phase 1 cannot be Carbon Neutral and will add to the UK's carbon emissions.

1.1.10. The HS2 Report also provides an illogical assumption of the air to rail modal shift. HS2 Ltd has provided no modeling or flight information making it difficult to assess their appraisal. However, previous reports have set out more comprehensive assessments and concluded that the only aviation competition for high speed rail is the London to Scotland links. There are currently no flights between Birmingham and London, and rail already has a 79% market share for journeys between Manchester and London (ATOC, 2010). Therefore any benefits of HS2 can only have noticeable effects when the Scottish links are made. Furthermore, there is no acknowledgement of 'interlining'. Even with a direct high speed rail link to Scotland, there would still be a 38% (SDG, 2009) aviation share of the London to Edinburgh route. There are no current plans to provide a direct high speed link to Scotland which further undermines the competitiveness of HS2 with domestic aviation.

Freed up domestic slots will be used for International Flights

1.1.11. The report fails to give any credence to what may happen to freed up domestic flight slots as people flying from Scotland switch to HS2. The basis for the carbon neutral claims is made on the assumption that any freed up domestic slots lost to HS2 would <u>not</u> then be taken up by greater emitting long haul flights. The evidence from the aviation industry suggests they would jump at the chance to remove domestic flights in favour of more lucrative long haul flights.

1.1.12. In this instance, HS2 LTD is relying on the untried and untested EU Emissions Trading Scheme (ETS) to control the switch from domestic to international slots. This is a naïve and hopeful policy stance and one which is unlikely to come to fruition. The EU ETS only includes aviation emissions from 2012, and therefore its impacts are not yet known. It has been criticised by academics (House of Commons Library, 2011) for not being strong enough and therefore is not likely to provide the control that HS2 Ltd hopes it will.

1.1.13. HS2 has not done any further work on the EU ETS and therefore cannot possible know what the impacts it would have on the freed up domestic slots to international flights. Again, the evidence from industry suggests that they would welcome the switch to more

international flights regardless of the EU ETS. This means HS2 will free up flight slots for greater emitting long haul journeys. In doing so it has a detrimental impact on the UK's carbon emissions. To not even include an assessment of the likely impacts of the EU ETS in the Report is deeply concerning.

1.1.14. In reality the extensive carbon outputs of the construction and operation of HS2 will be added to the carbon outputs of increased international flights.

What is high speed rail?

1.1.15. The trains proposed by HS2 Ltd will travel at speeds far greater than European high speed trains. HS2 Ltd's high speed (340kmh) trains have a 90% higher electricity demand than regular (200kmh) trains. In recent months, Chinese high speed rail operators have reduced their high speed trains (340kmh+) to reduce the cost of energy. The UK's energy market is neither stable nor self reliant. With reliance on overseas supplies and the decommissioning of several domestic power stations without any permitted replaces, there is no agreed strategy in place to provide a more stable energy market in the UK to date. Consequently HS2's substantial consumption (up to 18 high speed trains per hour for Phase 2) is highly vulnerable to an energy market that has seen dramatic price hikes over the last decade.

1.1.16. Furthermore, HS2 relies on generating a latent demand in travel to and from Birmingham, i.e. people who are only making the journey because of HS2. The report makes no acknowledgement of the amount of additional HS2 passengers and the associated emissions compared with the fewer passengers using domestic aviation. It is likely that the increased demand of energy intensive rail (HS2) will outweigh any reduction in domestic aviation.

HS2 Will have Substantial Carbon Fiscal Cost

1.1.17. Due to the lack of data shown, it is not possible to critically appraise the cost of carbon. Nevertheless, HS2 LTD has costed it at somewhere between +£1.37billion and -£4.6billion. However, they acknowledge this could be worse if freed up domestic slots become international flights, which is the more likely option. Again, no figures have been provided or a proper assessment been made. Combined with the

unsubstantiated conclusions it is not possible to accurately cost the financial value of the carbon impacts. However, using logical assumptions and more accurate data gathered in other reports, it is more likely that HS2 would be nearer the -£4.6billion than the +£1.37. If the aspirations of the aviation industry are realised, and freed domestic slots are switched to long haul flights, then the fiscal cost could rise further. A multi billion pound transport investment should not have such a high environmental and fiscal cost; costs which will eventually be met by the public in one way or another.

1.1.18. In addition, the few details on carbon costing available suggests that the Department for Energy and Climate Change's 2009 Carbon Valuation has been used. This was updated in July 2010 which would have made it more appropriate for a consultation launched in February 2011. Subsequent to this, further changes have been made regarding the cost of carbon which would also be expected to be accounted for given the potential impacts on the scheme.

How long will it take for HS2 to become Carbon Neutral?

1.1.19. The report fails to provide an adequate timeline of emissions. A modal shift from domestic air to rail is only likely to occur when links to Scotland are made. HS2 acknowledge that there is no competition with car users, and relies on a switch from air to rail to provide carbon benefits. However, rail to air balance is 100/0 for London – Birmingham and 80/20 for London to Manchester (ATOC,2010). In recent years the amount of domestic air journeys has continued to fall as costs increase, and flight operators switch their attention to more lucrative long haul flights (BMI cancelled their Glasgow to Heathrow service in March 2011). Therefore, there is no domestic aviation competition until HS2 trains link to Scotland. Even then, without a direct high speed link there will only be a 30minute saving over existing rail services as the East Coast Mainline run a morning service that takes 4hours compared with the proposed 3.5hours for HS2.

1.1.20. Furthermore, flight operators will still maintain 'interlining' flights to allow domestic travelers to continue journeys overseas with relative ease as shown in High Speed rail examples across Europe. The construction and operation of Phase 1 will be highly carbon negative. Only when the 'Y' network is constructed and operated will there be any

competition with limited air travel. HS2 then has to provide links to Scotland before any noticeable impact on aviation is made.

1.1.21. Therefore HS2 will rack up considerable carbon deficits prior to any noticeable impacts on domestic aviation. It is misleading to portray the carbon impacts of a fully operational 'Y' network with links to Scotland without considering the 10+ years of carbon deficit.

Inadequate Report on which to base a Multi Billion Pound Transport Decision

1.1.22. The HS2 report lacks a proper appraisal of the impacts of this expensive rail scheme. It is not clear what is meant by the Proposed Route, and not clear whether the 'Y' network is being assessed or just Phase 1. If it is referring to the 'Y' network then the assessment of construction emissions is considerably less (1.2mtCO2) than a previous Booz Allen report (5mtCO2) which investigated a much shorter line. If it does refer to just Phase 1, then all the negative impacts of the shorter route are being assessed against the benefits that can only occur from the completed network. This is misleading and would result in any subsequent support for the project to be fundamentally flawed.

1.1.23. There is a considerable amount of missing data and evidence to support the conclusions. There is no mention of the construction of brand new stations, no assessment of the loss of important carbon sinks; no presentation of any flight data; no acknowledgement of a Heathrow Spur at all and the HS2 Report even acknowledges important demand forecasting was unavailable. The HS2 Report is therefore not a suitable evidence base on which to make a decision on a £34billion 'green' infrastructure project.

2. Introduction

2.1. Background

2.1.1. HS2 Ltd claims that HS2 will be broadly carbon neutral. The vagueness of the statement is commensurate with the standard of the green house gas report ('HS2 Report) presented by HS2 Ltd. This paper sets out the vast amount of holes and inaccuracies within the HS2 Report.

2.1.2. HS2 will be the single largest public transport intervention in modern times. It will cost the public in the region of £17billion for phase 1 alone at a time when available public finances are under pressure like at no other time.

2.1.3. In perpetuity, the UK has set itself some of the most ambitious carbon reduction targets in the world. The UK has history of not meeting its rhetoric, and the new Government has claimed this must end. Their first Transport White Paper is called 'Creating Growth, Cutting Carbon' giving an indication of the importance of carbon reductions. Furthermore, the well publicised Stern report puts a fiscal cost on climate change, which further encourages carbon reductions for those less concerned with the environment.

2.1.4. The UK has a very fragile and declining energy industry that is highly vulnerable to due to its reliance on overseas supplies. The cost of energy is continually growing as energy companies raise prices to cover the growing cost of carbon and emissions amongst other factors. Given the potential impacts on the environment and economy, the public has every right to know the true impacts of HS2.

2.1.5. HS2 is therefore a hugely important scheme, as it has the potential to impact on carbon emissions as well as energy consumption. Both of these have significant environmental costs, but also fiscal costs.

2.2. Purpose of this Paper

2.2.1. This paper sets out to demonstrate that the evidence and information provided by HS2 LTD is far from satisfactory. It is impossible to make an accurate analysis of HS2's impact on carbon emissions based on the accompanying report. However, this paper uses logical assumptions,

previous publications and HS2's own report to provide a vastly different conclusion than that provided by HS2 LTD.

3. Assessment of Report

3.1. Report Deficiencies

3.1.1. The first matter to note about the carbon impacts of HS2 is that they have been given very little consideration. The HS2 Report accompanying the consultation document is wholly inadequate to support a multi billion pound transport decision. The following provides a summary of the list of failings of the report:

No supporting information

3.1.2. The 30 page report is not supported by any evidence. Instead only the outputs from whatever modeling has been done are included. It also means that conclusions are highly difficult to scrutinise by the public and experts, or for HS2 LTD to verify their conclusions.

The Report doesn't know what to Assess

3.1.3. The HS2 Report gets confused by what needs to be assessed. It is primarily looking at the impacts of Phase 1 (London to Birmingham) as the report is titled, but the wider network was also considered. However, Paragraph 1.1.4 clearly sets out that the operational impacts of the proposed route have been assessed. However, it is not clear whether the report refers to the 'Y' Network or Phase 1 London to Birmingham. The Consultation Document provides no other Phase 2 information and focuses solely on Phase 1. If the report does mean to assess Phase 2 then it is difficult to understand how operational carbon impacts have been assessed. For example, how many trains between London and Glasgow are being considered.

3.1.4. However, it is clear that the positive impacts of a modal shift in air to rail have been used to offset the operational impacts. Unfortunately, as the report concludes, these benefits will only occur once the final links to Scotland are made. Therefore, the benefits of a complete network are being assessed against the negative impacts of operating and constructing just the London – Birmingham network. Therefore the report provides an extremely misleading conclusion.

No presentation of flight information

3.1.5. The report lacks any information on flight or existing passenger journeys along the route. A report of this importance should set out how conclusions have been reached. Yet there is no presentation of key data which undermines the conclusions given.

No presentation of phasing information

3.1.6. The report only provides a brief assessment of the impacts of the London – Birmingham route. Yet no assessment has been made of the wider impacts of the network. More importantly, it provides no timeline for impacts. For example, the construction impacts will be realised first and benefits will only be realised when the Scotland links are constructed. It would be prudent to make an assessment of how long it takes for HS2 to become carbon positive, if in fact this is the case.

No clear analysis of EU Emissions Trading Scheme

3.1.7. HS2 and the Government are relying on the EU Emissions Trading Scheme to control freed up domestic flight slots from going international. However, no appraisal has been made or included within the HS2 Report. This fundamentally undermines any attempt to claim that the EU ETS will be of any impact. Instead HS2 LTD is relying on 'hope' that the EU ETS will have an impact. It would not be prudent to base a major transport decision such as this one purely on 'hope' particularly with the cost of carbon increasing rapidly and environmental impacts becoming more prevalent. HS2 Ltd has included an assessment of the impacts of the EU ETS, therefore their conclusions on switches from domestic to international slots is unsubstantiated. Given the significant impacts that an increase in long haul flights would have on carbon cost (possibly over £4billion) and carbon emissions (possibly over 25mtCO2) (Table 7, HS2 Ltd AoS). It would be advisable to provide a proper and rigorous assessment. The Public has a right to know what the true carbon impacts are on the UK.

Inadequate Presentation of Data

3.1.8. The Steer Davies Gleave (SDG) report (Potential for modal shift from air to rail for UK aviation, 2009) for the Committee on Climate Change

provides a much more comprehensive assessment of impacts of high speed rail on air. This was not completed for specific proposals although it sets out clearly the arguments for and against and these are presented in an open and transparent way. The HS2 Report uses none of the presentational aids as the SDG Report and would therefore more likely be describe as unsubstantial and evasive.

Inadequate Assessment of Carbon Assessment of Grid Electricity

3.1.9. Table 4 of the HS2 Report makes an assumption of the carbon intensity of the grid. However, no figures are given, and no clear appraisal of the likely sources of grid electricity is made. The current UK energy supplies are predominantly from carbon intensive sources. As yet there is no clear strategy regarding less carbon intensive energy production sources. Therefore, HS2 Ltd needs to make it more obvious what the impacts would be on carbon emissions over time, if grid electricity is not decarbonised to the extent they assume.

Lack of Impacts Considered

3.1.10. Information that is presented for the London - Birmingham is minimal. However, there is almost no information on the impacts of the rest of the network. Yet the benefits of full network are considered. The report should provide a much more robust methodology that assesses the likely impacts of the whole scheme including operational and construction impacts. Any subsequent environmental appraisal will look at the specifics of the proposed route in more detail. It is unlikely that these will consider more carbon impacts, this means this HS2 Report is the only opportunity to investigate the full networks impact. This is a missed opportunity given the way it has been presented. This is the only time co2 gets considered.

No acknowledgement of a 7000 space car park at new Birmingham Interchange

3.1.11. The HS2 Report fails to acknowledge that as part of the scheme a large scale new park and ride system is being proposed just outside Birmingham. This will invariably have a significant impact on carbon emissions, both in terms of construction and increased road transportation that the HS2 Report misses completely. Phase 2 is also likely to accommodate one or more interchanges. Parkways in the

East Midlands, South Yorkshire and Lancashire are also likely to be on the same scale. ,

No clear acknowledgement of carbon impacts associated with new stations

3.1.12. The report also fails to acknowledge that a number of new stations and depots are going to be constructed further adding to the carbon emissions.

Acknowledged lack of inadequate demand modeling

3.1.13. Chapter 5 of the HS2 Report sets out a myriad of limitations regarding the carbon assessment work. This includes the lack of demand forecasting available as well limitations with the modeling. Again, a decision of this nature should not be based on an incomplete and lightweight appraisal.

No construction impact emissions for Heathrow Link

3.1.14. The report makes no reference to a Heathrow link at all. This will have significant impacts on carbon emissions, and one of the main reasons for it is to enhance 'International Connectivity' and in turn more long haul flights. This would surely have an impact on carbon emissions yet there is no mention of the link at all. In fact, there is no mention of 'Heathrow' throughout the report. This is particularly concerning given HS2 Ltd's main reason for selecting the proposed route is to establish a link with Heathrow. By their own admittance, this link is to provide 'international connectivity'. In other words, HS2 are keen to assist overseas travel. This is particularly concerning as HS2 Ltd assumes that domestic flight slots will be restricted by the EU ETS from moving to long haul flights. Yet, by their own admission, HS2 Ltd are providing a link to Heathrow to ensure that more people can travel overseas.

No mention of Edinburgh, Glasgow or Heathrow in word search

3.1.15. The omission of Edinburgh, Glasgow and Heathrow is indicative of the lack of a comprehensive assessment of HS2's impacts on carbon emissions. These are all key destinations, particularly in consideration of impacts on aviation, yet are not mentioned once. This highlights the level of report that is being presented to the public and to the Government on which a multi billion pound scheme is being considered.

No mention about the loss of Carbon Sinks

3.1.16. HS2 will include a vast landtake including the loss of trees, natural landscape and other areas that currently operate as carbon sinks, i.e. areas of land that absorb CO2. A properly undertaken and comprehensive report will allocate a section to making an assessment of these impacts.

No Conclusion

3.1.17. HS2 Ltd has offered up no formal conclusion on the assessment of carbon impacts of HS2. Instead, a vague assumption of 'broadly carbon neutral' has been made with no proper justification of the results provided. The lack of a conclusion is deeply concerning as it implies HS2 Ltd are attempting to not acknowledge the analysis of their own report.

3.1.18. The Government has reiterated the need to ensure carbon emissions are factored into all major transport decisions. The Coalition Government's first transport white paper is entitled 'Creating Growth, Cutting Carbon'. There is no doubt that the Government claims that carbon should be treated seriously and as a matter of urgency. However, the HS2 Report does not implement these intentions. It is contrary to the ambitions of the Government and the report itself undermines the need to properly assess carbon impacts. It would be inappropriate to make a decision on the carbon credentials of HS2 based on the report presented by HS2 Ltd.

4. What is the Report Assessing?

4.1. Introduction

4.1.1. The HS2 Report is highly unclear as to what is being assessed. It is therefore a misleading report and not fit for the purpose of understanding the carbon impacts of a multi billion pound transport investment.

4.1.2. One of the main areas of uncertainty relates to what is meant by the 'proposed route' in the context of the Greenhouse Gas Report (the 'HS2 Ltd Report'). In all other parts of the Appraisal of Sustainability (AoS), the proposed route refers to Phase 1, London to Birmingham. However, the HS2 Ltd Report implies the Proposed Route is the 'Y' Network. Even then, there is some uncertainty whether the Report refers to Phase 1 or the 'Y' Network.

4.1.3. HS2's business case is solely based on Phase 1, which means demand forecasting, costs of tunnels, route design, impacts on business and environment are only considered for the London to Birmingham route. Yet the carbon report seems to go beyond what is assessed elsewhere. Paragraph 1.1.2 of the report states:

> *A full appraisal of the scheme between London and Manchester and Leeds would be undertaken during the course of 2011 to take account of the more detailed scheme proposals to Manchester and Leeds, as well as any policy revisions with respect to energy, carbon and transport that may have emerged by this stage. For this report, we have considered what the wider network might be in the longer term, up to and beyond Manchester and Leeds, in order to gain an understanding of what the full long term effects might be.*

4.1.4. This implies that the proposed route within the carbon report is actually different from the meaning used elsewhere in the Consultation documents. This implies that the HS2 Ltd Report assesses the 'Y' network (although no specific reference is made to the 'Y' network - there is also no mention of the Heathrow Link)

4.1.5. However, the report is titled HS2: London to West Midlands which suggests that only the impacts on the London to Birmingham (the actual Proposed Route) are being assessed. This is supported by a relatively hidden statement in the supporting text providing conclusions on embedded carbon impacts. Paragraph 6.2.8 states:

> *Total embedded carbon emissions for the proposed scheme are reported as +1.2MtCO2e (within the range +0.29 to +2.12 MtCO2e). In comparison, the Booz and Temple 2007 study reported a figure of approximately +10MtCO2e of embedded carbon for a route between London and Scotland (approximately 8-10 times the length).*

4.1.6. Attention is drawn to the description of the London to Scotland being 8-10 times the length of the carbon report's 'proposed scheme'. It is not 8-10 times the length of track to Scotland from the 'Y' network. It therefore implies that the carbon report's 'Proposed Scheme' being referred to in the embedded impacts assessment is the same route referred to as the 'Proposed Route' elsewhere in the AoS, i.e. London to Birmingham.

4.1.7. This is further supported by the conclusions of the assessment of construction impacts. In 2007 Booz Hamilton (authors of the Greenhouse Gas Report for HS2 Ltd) did another study on the impacts of a north-south rail route. This found that the construction impacts for a London to Manchester (no 'Y' link to Leeds) amounted to approximately 5mtCO2. The HS2 report concludes the Proposed Scheme would have construction impacts of 1.2mtCO2. It is unlikely that Booz Hamilton's findings have gone from 5mtCO2 for a London to Manchester link only, to a reduced 1.2mtCO2 for a London to Manchester and Leeds. This further implies that the assessment within the HS2 Ltd report is based solely on the London to Birmingham route.

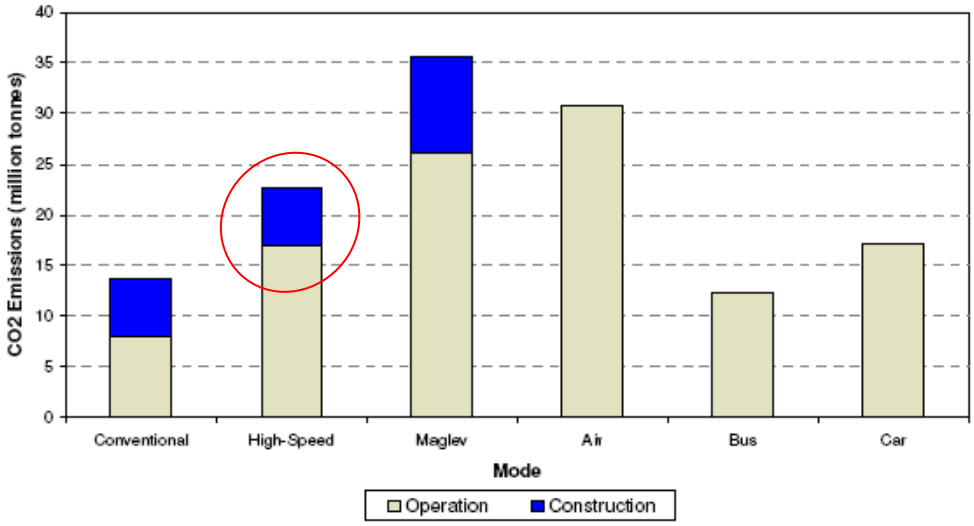

Figure 1: Construction impacts of London to Manchester (taken from figure 1.1a of Booz Allen Hamilton report 2007: Estimate Carbon Impact of a New North South Line)

4.1.8. This lack of clarity if further highlighted in paragraphs 1.1.4 and 5.1.2 of the HS2 Ltd Report:

> *Operational emissions were calculated using initial outputs from the HS2 Demand Model for the proposed route with reference to appropriate emission factors. (1.1.4, AoS Appendix 2)*
>
> *No comparison can be made at this time of the proposed scheme with either the Reference Case (do-minimum) or the three alternative scenarios. Preliminary results from the Demand Model were available only for the proposed scheme. (5.1.2, AoS Appendix 2)*

It is understood that no detailed modeling work has been done for the 'Y' network and it is therefore not possible to determine the operational impacts. This makes it difficult to understand what information is being used to determine the operational impacts within the HS2 Ltd Report if it is meant to relate to the 'Y' network.

4.1.9. Aside from the inconsistency within the AoS, the lack of clarity as to what is being assessed raises some serious concerns.

4.2. If Proposed Route/Scheme = London to Birmingham

4.2.1. It is acknowledged elsewhere in this route that the only aviation competition for HS2 comes when links into Scotland are made. If reference to the Proposed Route in the HS2 Ltd Report refers to London to Birmingham then it is worrying that the operational and construction impacts of Phase 1 are being compared with the benefits of a complete network. This is highly misleading. The report should clearly set out what the impacts are for Phase 1 alone which is in line with the assessments elsewhere in the AoS.

4.2.2. Table 4 of the greenhouse gas report claims that the proposed route could result in a reduction of 23.2MtCO2 if it takes the complete share of travel away from domestic aviation. This would mean that 30 minute time saving on HS2 from London to Birmingham route would have huge impact on the London to Manchester and London to Scotland aviation markets. A 30 minute saving between London and Birmingham is not going to dramatically decrease the amount of people flying from Scotland to London.

4.2.3. Furthermore, Scenario A in table 4 sets out a reasonable best case for HS2. It suggests that it will have help to reduce emissions by a total of -7.4MtCO2 (-6.2 when construction impacts are included). However, this relies on the 23.2MtCO2 reduction as set out above.

4.2.4. Scenario B of the same table sets out a total increase of 15.7MtCO2 (16.9 with construction impacts) if the proposed route has no impact domestic aviation.

The key point therefore is to determine whether or not a 30 minute saving between London and Birmingham would have sufficient impacts on the aviation markets in Manchester (currently only 20%) and in Scotland. Logic dictates that only a limited amount of Scottish passengers would be won over by a 30 minute saving on a rail journey. Therefore, Scenario B is more likely and by HS2 Ltd's own admission, HS2 would therefore increase carbon emissions.

4.2.5. It is clear that HS2 Ltd is keen to avoid an assessment solely of Phase 1. This would clearly demonstrate a net increase in carbon emissions. However, this needs to be done to determine a fair understanding of the impacts of HS2.

4.3. If Proposed Route/Scheme = London to Manchester and Leeds

4.3.1. If the Proposed Route does mean the 'Y' Network, then it would be appropriate to properly set out the assumptions made to calculate the operational and construction impacts for the extended route. As no detailed route study has been provided for the 'Y' network, it is not clear what assumptions HS2 Ltd have been made regarding:

- Length of Route
- Amount of Tunnels
- Amount of New Stations
- Amount of Train Journeys
- Times of Train Journeys and Destinations
- Passenger Numbers on those Train Journeys.

4.3.2. Furthermore, if the 1.2mtCO2 does relate to the construction of the 'Y' network, then it is highly concerning to see such a change from the previous Booz Allen report from 2007. This showed that the construction impacts of a London to Manchester route alone would be in the region of 5mtCO2. It is therefore difficult to understand how developing a separate link to Leeds and a Heathrow Spur reduces this impact to 1.2mtCO2.

5. Unlikely HS2 Report Conclusions

5.1. Modal Shift from Air to Rail

5.1.1. HS2 Ltd acknowledges that the major competitor with High Speed Rail is air travel. This is the sector they claim will deliver the majority of the carbon benefits which will ultimately outweigh all the emissions associated with other impacts. Again, the lack of any detailed assessment and supporting information makes the conclusions inaccurate and difficult to substantiate.

5.1.2. The most comprehensive background data to help support a proper assessment of carbon emissions of HS2 is a September 2009 report by Steer Davies Gleave for the independent Committee on Climate Change (set up by the 2008 Climate Change Act). This report, titled 'Potential for modal shift from air to rail for UK aviation' (the 'SDG Report'), includes an analysis on the impacts of high speed rail on aviation. Despite not being tailored to a specific project it provides much more information that the HS2 Report; it includes actual flight and passenger data and provides modeling results to help support conclusions.

5.1.3. The SDG Report states that there were 22million domestic passengers throughout the UK in 2008. However, the SDG Report notes:

> *It is unlikely that rail could offer a competitive service for all of these journeys. For example, 40% of domestic passengers in 2008 used flights which involved a sea crossing (to/from Northern Ireland, the Channel Islands or the Isle of Mann); these passengers are unlikely to switch to rail. (Potential for modal shift from air to rail for UK aviation, Steer, September 2009).*

Furthermore, HS2 will provide direct benefits to cities on the routes, with possible indirect benefits to routes not serviced by a dedicated high speed line, Edinburgh and Newcastle for example. The SDG Report concludes that:

> *The development of a high speed line would cause a much greater switch from air to rail particularly on Anglo-Scottish routes (Figure 1.4). The impact is limited on the London-*

Manchester route as most London-Manchester passengers (other than those using the route in order to connect onto other flights in London) already travel by rail. (Potential for modal shift from air to rail for UK aviation, Steer, September 2009)

5.1.4. Therefore the main transfer of domestic flights to HS2 would be felt between London – Glasgow, and London – Edinburgh. Although with no direct high speed connection to Edinburgh and Glasgow, the benefits are not easy to quantify. The graph shows that there are possible additional benefits on the Birmingham to Edinburgh and Glasgow routes, but it should be noted that they only cover a fraction of the domestic air market. The graph below shows the previous assessment contained within the SDG Report:

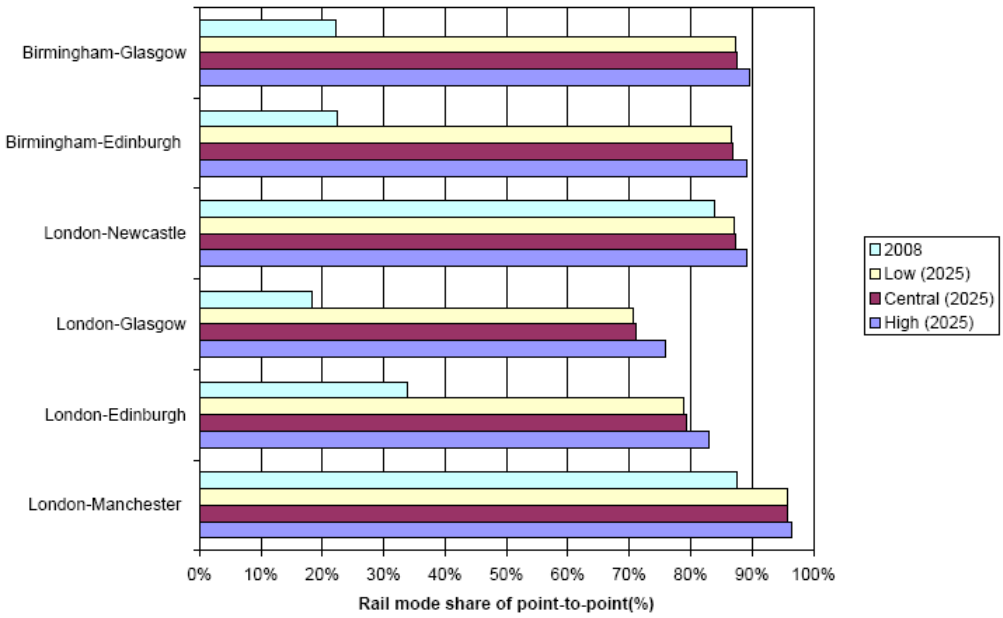

Figure 2: Rail modal share before and after HS2. (Potential for modal shift from air to rail for UK aviation, Steer, September 2009)

5.1.5. It is worth noting that the SDG report is basing its assumptions on a direct link to Scotland, whereas HS2 Ltd are not suggesting such a link at this stage of the strategy.

5.1.6. The HS2 Report (para 3.1.2) supports the assessment on modal shift:

Proposed routes from London to Birmingham and London to Manchester were found to make a potential net contribution to carbon emissions, as the operational carbon savings achieved

through modal shift did not compensate for the construction related carbon emissions.

5.1.7. HS2 Ltd acknowledges that the construction and operation of Phase 1 will have negative impacts. However they are relying on benefits from a shift in domestic aviation to rail to outweigh the negative impacts. These benefits cannot occur to any significant extent in Phase 1 because it cannot compete with the domestic aviation market in Scotland and will only have a minimal impact on the Manchester and Leeds markets where rail already dominates.

Inaccurate Assessment of modal shift of Air to Rail

5.1.8. The HS2 Report does not adequately include specific London to Edinburgh or Glasgow passenger information. In fact, the report makes no reference to the cities of Edinburgh or Glasgow at all. However, the SDG Report does provide more detailed information on the destination of those flying from Glasgow and Edinburgh to London.

5.1.9. Figure 3 shows that passengers flying to Edinburgh (49%), Glasgow (41%) and Manchester (74%) all do so with the intention of transferring from Heathrow. This 'interlining' reduces the likelihood of direct competition with rail

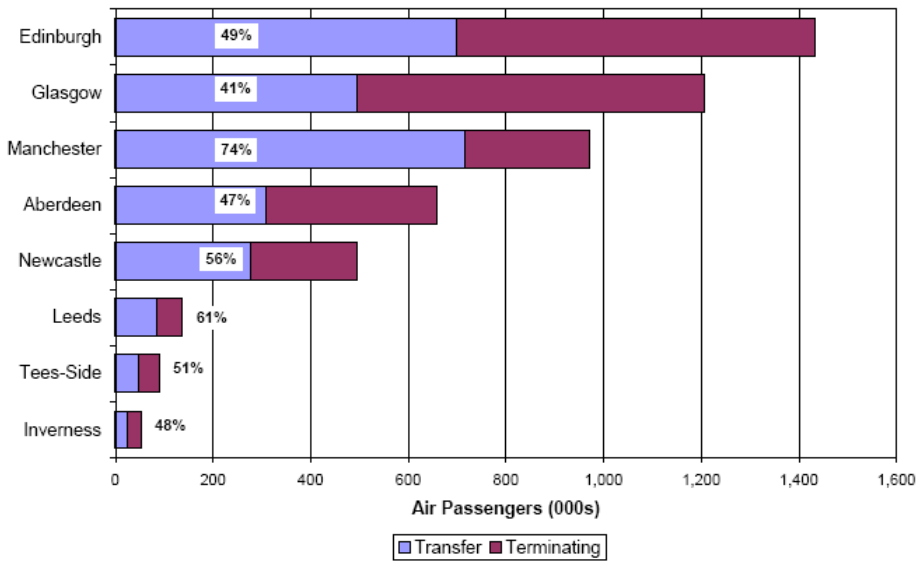

Figure 3: Reason for passenger travel to London Heathrow (Taken from Potential for modal shift from air to rail for UK aviation, Steer, September 2009)

5.1.10. Figure 4 below shows more accurately the impact of high speed rail on the Edinburgh modal shift. Even with high speed rail, air travel still accounts for 38% of the modal share. A similar figure would be expected for Glasgow.

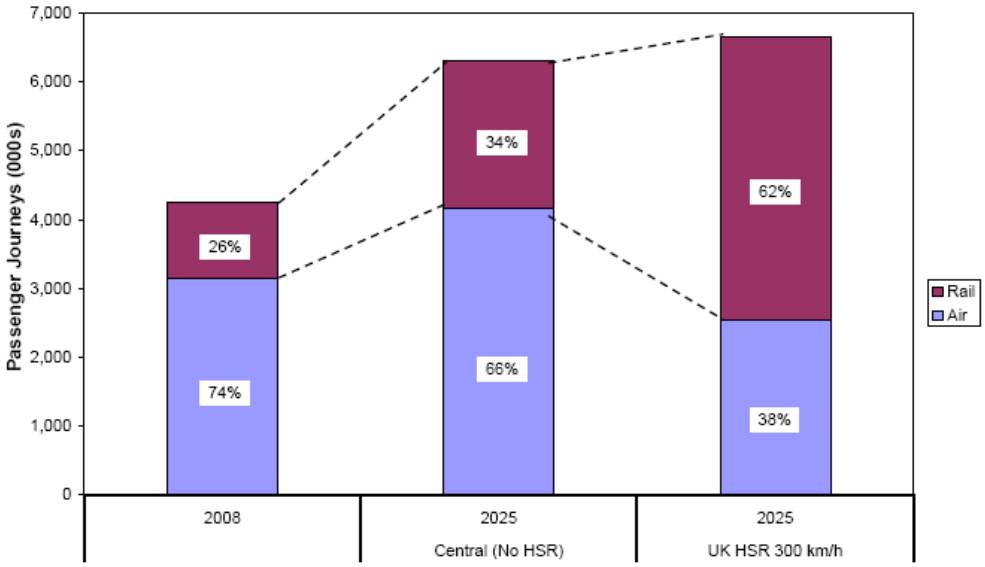

Figure 4: London to Edinburgh modal share with and without High Speed

5.1.11. Another more detailed study by Booz Allen Hamilton's produced a report for DfT in 2007 which also assessed the carbon impacts of a possible new North-South rail line. The analysis included CO2 emissions from construction and operations over a period of 60 years. The 2007 report showed that carbon emissions parity could not be achieved for the London-Manchester route. The rail mode share required to offset additional emissions would exceed 100%, i.e. the entire carbon emissions generated by domestic flights is less than the increase in emissions from high speed rail.

5.1.12. It is unlikely HS2 will have positive carbon impacts even when links to Scotland are provided and it starts to be truly competitive with air travel. There will always be a demand for interlining, and the previous SDG Report provides the most appropriate appraisal as HS2 Ltd has not provided any with their report. The SDG Report demonstrates that there could still be as much as 40% interlining to Heathrow from Edinburgh with the intention of moving internationally. It seems inconceivable that HS2 would see enough benefits from a modal shift

from air to rail to outweigh the operational and construction impacts of a completed high speed network.

Recent Domestic Flight Trends

5.1.13. Since 2004 there has been a steady modal shift to rail from air. By 2008 the rail market share in the London-Scotland and London-North East market was higher than in 2001. The main drivers of this improvement since 2004 are likely to be:

- Improved rail punctuality and reliability after recovery from the post-Hatfield disruption;
- Improvement in rail journey time from infrastructure upgrades;
- Increased security checks at UK airports from August 2006;
- Higher air passenger duty; and
- Increased use of yield management techniques by rail operators.

5.1.14. The HS2 Report does not seem to make any acknowledgement of the declining domestic aviation market. HS2 Ltd has used DfT's aviation forecasting figures up to 2043. This sets out a 128% increase in domestic aviation and it is assumed this is how HS2 Ltd has worked out the significant modal shift from air to rail. However, this completely ignores recent trends in domestic aviation and the flight industry's desire to switch to more lucrative long haul flights.

In particular:

> *CAA figures show that between 2006 and 2010, passenger journeys by air between Glasgow and London airports went down by 22.4%, while ATOC information confirms a remarkable 85.8% increase in rail passenger journeys between the cities. (28 March 2011, www.rail.co)*

A later article on www.rail.co provided a simple analysis of ATOC statistics on domestic aviation trends:

Between 2006 and 2010, total journeys by rail on these routes rose by 42%, increasing by 2m to just over 7m journeys. Over the same period, the total number of domestic air journeys on those domestic routes fell by 27%, or 3.25m, to around 9m in 2010. Over the last two years, there has been a particular surge in rail travel on these routes [10 most popular routes], with train journeys rising by 25%. (5 April 2011, www.rail.co)

5.1.15. Domestic air travel has reduced considerably in the last 5 years. However, HS2 Ltd is relying on a significant increase in domestic flights to provide the modal shift to rail and justify a reduction in CO2 emissions. The 128% increase is highly unlikely. There is no appetite within the aviation industry (see section 5.2) to see a rise in less lucrative domestic flights, and rail has continued to compete well without a high speed line. The EU Emissions Trading Scheme will place a further burden on airline operators, which is likely to increase their reliance on more lucrative long haul flights.

5.1.16. HS2 Ltd would not be able to make a strong case for having such a positive impact on domestic aviation if a more realistic assessment was made on recent trends. This would undermine the one area where HS2 Ltd thinks the benefits of HS2 will come from.

Timeline of Carbon Emissions

5.1.17. HS2 Ltd are relying on the modal shift from air to rail to deliver carbon benefits, but these will only be delivered once positive links to Edinburgh and Glasgow are delivered. However, the evidence above suggests that even with a direct connection there is still a considerable amount of domestic flight journeys as result of needing to transfer out of Heathrow.

5.1.18. Nearly all assessments of the carbon associated with 'green' schemes are accompanied by a determination of a 'payback' period. HS2 Ltd acknowledge that there will be considerable carbon impacts from construction and more so from the ongoing operation. A scheme of this magnitude should be accompanied by a realistic interpretation of when and how the scheme will become carbon positive.

5.1.19. As discussed elsewhere, the London to Birmingham route is not likely to have any impact on domestic aviation. The HS2 Report is not

thorough enough to quantify or qualify the emissions impacts as it provides no timeline to the carbon emissions. There is likely to be years of deficit before any potential benefits are felt, and even then it is not likely that these would offset the construction costs or ongoing operational impacts of the whole network. HS2 has not properly assessed this so cannot produce the evidence to refute this more likely conclusion.

5.2. Shift from Domestic to International Flights

5.2.1. Table 4 in Chapter 6 of the HS2 Report sets out the impacts on carbon emissions as a result of a switch in domestic flights to HS2. The first methodology provides a theoretical best case reduction of 23.2 MtCO2, although this relies on a complete switch of domestic flights to HS2 and no reuse of these slots. The reasonable best case scenario suggests no change in emissions based on no change in domestic flights. Both of these are highly unlikely, the second more so, since HS2 is being promoted as an alternative to domestic flights.

5.2.2. The second methodology, Scenario B, sets out a reasonable worst case that freed up domestic flight slots would then switch to international flights. However, it does not quantify and provides a footnote as to why:

> *The upper range of net changes in air travel is unknown as the international destination of flights using take-off slots freed up by HS2 diverting domestic flights is not known at this stage. As an illustration, flights from London to either New York or Shanghai would be one order of magnitude greater than typical UK domestic flights. The value of the upper range is expected to be large and positive resulting in a net increase in carbon emissions and aggregated carbon costs from HS2.*

5.2.3. HS2 Ltd has therefore not even made an assumption of the impacts. Instead they have suggested it could be a highly negative impact but it is too difficult to work out. This reasonable worse case scenario, is in fact the most likely. Freed up domestic flight slots will become long haul flights. It is therefore wholly inappropriate not to even make a broad assessment.

5.2.4. It is widely accepted in the aviation industry that international slots are more favourable to domestic. Airline operator BMI recently suspended its Glasgow – Heathrow flights due to the increasing costs placed on each passenger by BAA at Heathrow. In making the decision BMI operators describe the decision to increase costs by BAA as:

> *Unfair discrimination against domestic and short-haul operators and said the airports' operator BAA was favouring long-haul carriers. (BBC Website, 31 January 2011)*

5.2.5. International flights are more commercially viable for airport operators and Heathrow's domestic flights have continued to reduce in recent years. Furthermore, DFT has publicly claimed that the HS2 Heathrow spur is about enhancing international connectivity. DFT claim the Heathrow Link will:

> *Bring Manchester and Leeds city centres within 70 and 75 minutes respectively of the country's main hub airport and transforming its accessibility from the Midlands and the North release runway capacity so that Heathrow could enhance its operational resilience and potentially develop its route network (DFT Exhibition Banner, The case for high speed rail)*

5.2.6. However, in order to enhance international connectivity more use has to be made of the constrained capacity at Heathrow. Colin Matthews, BAA's Chief Executive is quoted as saying:

> *…BAA would like more passengers to arrive [at Heathrow] by train. High Speed rail would attract people who currently arrive by short-haul flights, freeing slots for more long-haul flights*

5.2.7. And Nigel Milton, Director of Policy and Political Relations at Heathrow told the ENDS Report (an environmental website):

> *No sensible, well-informed person still seriously pretends HS2 is a green alternative to a third runway. The question now is given no third runway, how we can maximise the effectiveness of our limited capacity at Heathrow. That means more long-haul flights…every time BMI or British Airways have cancelled a domestic route in the past, they've replaced it with a more*

profitable medium- or long- haul route. That's exactly what will happen when HS2 comes and more domestic routes get cut.

5.2.8. Oxera's report for the Transport Select Committee offered the same conclusions on the likely aviation impacts of HS2:

> *The extent of modal shift is a key factor in determining the level of carbon emissions. A shift in passengers from domestic aviation to high-speed rail would lower aviation emissions if the aviation services were reduced as a result (or smaller or more efficient planes used for the remaining passengers). Therefore, the AoS considers a number of scenarios related to the impact on aviation services from high-speed rail. One scenario considered is that there would be no change to aviation emissions if the reduction in passenger numbers on any one flight were not enough to discontinue the service. Another scenario proposed in the AoS is that slots previously used by the flights predicted to be displaced by HS2 remain vacant. However, this is unlikely to occur due to the excess demand for capacity at the main airports in the South East (Heathrow and Gatwick).*

5.2.9. Oxera proposed the following question to be considered at the Transport Select Committee:

> *Q: Is it correct that there may be a net increase in carbon emissions because there is no reduction in the number of flights and additional HS2 services?*

5.2.10. It is concerning that HS2 Ltd are portraying HS2 as a green scheme with 'broadly carbon neutral' credentials. The evidence above suggests that HS2 Ltd's carbon report is weak, lacking evidence and based on assumptions of unlikely events.

Over reliance on EU Emissions Trading Scheme

5.2.11. DFT is relying solely on the EU Emissions Trading Scheme (EU ETS) to control the likelihood of domestic slots going international, and therefore reduce HS2 impacts on carbon. No assessment of this has been carried out and HS2 Ltd would appear to be 'hoping' this has the desired effect. However, the aviation industry led by BAA would

suggest that this control is highly unlikely to be effective. This assumption is supported by an academic study by Dr Elena Ares for the House of Commons Library, Science and Environment section which concludes:

> *According to the Commission's estimates the theoretical impact of inclusion is that emissions reductions of 183 millions tonnes of CO2, a 46% reduction compared to business as usual will be achieved by aviation as they will be capped at 2004-06 levels. However as the Commission points out the option of purchasing credits from within the EU ETS and the Kyoto schemes mean that other options are available to the aviation industry and actual cuts are not likely to be anything as significant. (Dr Elena Ares, 27 April 2011, House of Commons Library, Science and Environment Section)*

5.2.12. HS2 Ltd has not done the work to enable a proper assessment of what the EU ETS would have on the freed up domestic slots switching to international. It is obvious HS2 Ltd did not want to claim HS2 as having adverse impacts so have made a broad conclusion that is not based on any firm assessment. There is no intention within the aviation industry, particularly at BAA to freeze domestic slots for the good of the environment and the EU ETS is untried, untested and is currently considered to be relatively ineffective.

5.2.13. HS2's conclusions on Carbon Neutrality are based on an assumption that any freed up domestic slots would not switch to long haul flights. This is clearly not the case. This means HS2 is likely to facilitate an increase in emissions purely by encouraging more long haul flights.

5.3. Emissions from Extra HS2 Journeys may outweigh the Modal Shift

5.3.1. The HS2 Report also fails to properly assess the impacts of its induced demand for travel. HS2 Ltd claims that HS2 would increase passenger demand by 100% over normal rail services due to its high speed. This means that HS2 will carry considerably more passengers to London than air ever did. HS2 Ltd does not include any supporting data for their calculations which means alternative reports and papers have to be considered.

5.3.2. DFTs Delivering a Sustainable Railway (White Paper, July 2007) states:

> *The argument that high-speed rail travel is a 'green option' does not stand up to close inspection on the basis of the present electricity generation mix. The Government estimates that carbon emissions per passenger for a journey between London and Edinburgh will be approximately 7 kg of carbon for conventional-speed rail, 14 kg for high-speed rail, and 26 kg for aviation. Passenger carbon emissions are likely to be similar between Glasgow and London.*

5.3.3. HS2's business case relies on a latent demand for travel to London. HS2 Ltd claims that the new rail scheme will increase the amount of passengers traveling to London; passengers that would otherwise not intend to make that journey. It is therefore possible that by realising the latent demand the amount of emissions associated with HS2 could outstrip those of domestic flights. However, as no information or assessment has been provided by HS2 it is not possible to determine a conclusion either way.

5.4. Lack of Consideration of Additional Impacts

Road Transportation

5.4.1. Rail is normally considered to be a cleaner more efficient alternative to road transportation. However, HS2 acknowledge that this multi billion pound rail scheme will have minimal impact on road. Only 6% of the users of HS2 have left their cars at home or the Birmingham Interchange (HS2 Demand for Long Distance Travel April, 2011). This has almost a negligible impact on road emissions as set out in HS2 Ltd's report.

5.4.2. Table 4 of the HS2 Ltd report states the scheme will achieve a reduction of between 0.8MtCO2 and 2.2 MtCO2 as a result of removing cars from the road. The report uses a reasonable best case estimate of 1MtCO2 reduction in road emissions over 60years as a result of HS2. In 2009 the DfT reported that the UK's road transport emissions were 113MtCO2.

5.4.3. There is no reason to doubt the figures presented by HS2 Ltd, but there is a more important issue to be considered. The single largest public

transport intervention for the foreseeable future will have no noticeable impact on the UK's transport emissions. This is highly concerning given that road transportation provides a quarter of the UK's emissions which should make this a prime target for helping to meet the overall 2050 reduction goal of 80%.

5.4.4. There is a further omission within the carbon report related to the impacts on road transportation. The report fails to acknowledge any effect the opening of a new interchange near the Birmingham NEC would have on road trips.

5.4.5. Paragraph 3.10.1 of the Appraisal of Sustainability (Main Report 1) states:

> *A new HS2 station would be constructed adjacent to the NEC and just to the east of the M42. And It is likely that some 7,000 car parking spaces also would be required and that this would be provided in multi-storey accommodation.*

5.4.6. The size of this car park would suggest considerable new road journeys. It may be possible that some of these spaces are a result of reduced car journeys to London which would reduce carbon emissions; however, it is more likely that these spaces will be used by those would otherwise have traveled to satellite stations, or those not able to journey into Birmingham. This has not been obviously factored into the report and there is no mention of any additional road trips as a result of the new interchange at Birmingham. For example, the Chiltern and West Coast Main Lines have access from 11 stations in the Midlands; HS2 will have access from only 2.

5.4.7. The loss of classic line services, particularly in Leicester will also force people to make road journeys.

Construction Impacts

5.4.8. An assessment of the Report's attempts to consider construction impacts is included within Chapter 4 and in particular 4.3.2. This shows a worrying difference between the HS2 Ltd Report (prepared by Booz Allen) and Booz Allen's 2007 report for the DfT. The reports contain vastly different findings, although the HS2 Ltd Report is unclear about what it is trying to assess. As a consequence the construction impacts

assessment is not fit for purpose and it is not possible to determine the extent of the construction impacts with such a confusing report.

5.4.9. It is difficult to scrutinise the construction impacts based on the minimal information provided and the selected methodology. It is possible to draw comparisons with other recent rail projects to highlight yet another concern with the assessment of carbon impacts. The recently 'approved' Crossrail scheme was accompanied by a full assessment and the Crossrail website (www.crossrail.co.uk) includes a factsheet on the carbon impacts. The summary states:

> *Crossrail's Carbon Footprint model predicts net carbon dioxide emissions (measured in tonnes of CO2) resulting from the construction and operation of the railway. Total emissions of carbon dioxide from the construction phase of the Crossrail project are estimated to be in the order of 1.7 million tonnes of CO2. Once the railway is operational, there will be annual savings in the order of 70,000 to 225,000 tonnes of CO2, largely due to the displacement of car journeys and replacement of diesel trains on the existing network. The "payback" period is therefore between 7 and 26 years after opening, beyond which there will be net savings in CO2.*

5.4.10. The table below sets out the comparisons between the two schemes:

	Crossrail	***HS2***
Overall Length (approx)	*118km*	*180km*
Length of Tunnels (approx)	*20km*	*20km*
Type of construction	*New and reuse of existing lines*	*New line*
Emissions associated with construction	*1.7MtCO2*	*1.2MtCO2*

It seems highly unrealistic for Crossrail (35% shorter) to have 30% higher emissions associated with construction. The failure to provide sufficient supporting evidence by HS2 Ltd does not allow for an easy

comparison. However, on the broad facts, the figures presented by HS2 Ltd are highly optimistic.

5.4.11. Furthermore, table 6 of the HS2 Report does not include measurements related:

- new stations even though HS2 will provide overhauls of Euston, a new station at Old Oak Common, an improved Birmingham Interchange and a new station in the centre of Birmingham
- personnel travel which has been assessed as having zero impacts which is highly unlikely
- Associated rail infrastructure such as electricity feeder stations, depots, maintenance bays, or transformers
- to the loss of carbon sinks, such as open space, trees, CO2 absorbing plants.

5.4.12. It is not clear if the construction impacts in the HS2 Ltd report are supposed to consider the impacts of the 'Y' network. If so, then all the impacts listed above that have been ignored for Phase 1, will only increase over the length of the 'Y' network.

5.4.13. HS2 Ltd cannot make accurate claims of construction impacts based on the information provided. By not even considering the 'Y' network or inaccurately representing it, and not accounting for some major construction impacts that will increase emissions, HS2 has provided a misleading conclusion.

5.5. Conclusions on Impacts on Emissions

5.5.1. In reality HS2 will have far more carbon impacts than presented in the report. The construction and operation of a complete 'Y' network will put HS2 in considerable carbon deficit before links to Scotland allow for competition with domestic aviation. The lack of consideration of a number of factors, including a 7000 park and ride in Birmingham and associated road journeys, combined with the lack of information on the construction of new stations and depots, means the HS2 Report is not portraying the real impacts.

5.5.2. The allowance for the benefits from a modal shift from aviation is also being overstated. In reality a completed network with Scottish links is likely to realise a reduction in domestic aviation. However, there will be such a significant carbon deficit that it is unlikely that HS2 will ever reach a positive credit.

5.5.3. Furthermore, not all domestic slots will switch to HS2. Interlining is vital to passengers and even with a Heathrow spur people will still fly to Heathrow from Edinburgh and Glasgow with a view to continuing overseas.

5.5.4. Most importantly though, any domestic slot removed from the timetables will not become vacant, instead it will be taken up by an international flight. This is the most serious element of HS2's impact on carbon that should not be overlooked. HS2 has far more impacts than HS2 Ltd claim, and far less benefits.

6. No Consideration of Carbon Costs

6.1. Carbon Costs Assessment

6.1.1. HS2 Ltd has failed immeasurably to consider the carbon impacts which make their very vague assessment of the monetary costs also flawed.

6.1.2. The assessment of the carbon costs is completed within 1 page and is based on the scenario modeling that fails to adequately consider carbon impacts as outlined in the previous chapter. As a consequence of the vague carbon assessment, the broad range of costs for scenario A (Table 7, HSR Report) and Scenario B (Table 8) is given as somewhere between +£1.37billion and -£4.6billion. Although it should be noted that the worst case scenario presented in Scenario B cannot be quantified as this is dependent on what happens to domestic flight slots.

6.1.3. It has been demonstrated above that HS2 assumptions over carbon impacts are wholly inaccurate. HS2 is likely to have a detrimental impact on the UK's carbon emissions and as the most likely scenario is that freed domestic slots will be switched to long haul flights, then the worse cases of scenarios A and B are more realistic.

6.1.4. This means HS2 will cost upwards of £4billion. This cost rises further if the more recent carbon floor price is considered. The Transport Select Committee commissioned Oxera to carry out an independent study of HS2. With regards to Carbon they concluded:

> *The case for high-speed rail is affected by the impacts on carbon emissions that are quantified, although these do not appear to be included in the BCR. Given the very limited anticipated substitution from air to rail (6%) and car (7%), the substantial volume of new trips (22%) suggested for HS2, and the lower rates of emission from slower trains, the classic rail options could well involve lower overall emissions. This would bring the comparison of BCRs closer together for the Y network and generate an advantage for the classic rail options to Birmingham. (Para 3.44, Oxera Report, Review of the*

Government's case for a High Speed Rail Programme, June 2011)

6.1.5. The simple truth is that it is not possible to assess the carbon cost based on the information provided. This multi billion pound transport scheme could have significant additional carbon monetary costs that should be assessed comprehensively.

6.1.6. There are further costs that need to be factored in. HS2 will increase the energy demand considerably as high speed trains (350kmh) require 90% more energy than standard (200kmh) trains. All this extra energy consumption and associated carbon will further place strain on already declining energy sector. The increase in carbon prices will mean any additional costs to energy suppliers will offset this by raising energy prices which will affect everyone. As any benefits (if any) will be realised when the Scotland links are provided, the first decades of HS2 will result in a much greater cost, likely to be absorbed by the public. This is particularly unfair given that most people across the UK will not see the benefits of HS2.

6.1.7. 51M believes that the cost of carbon can be assessed in more detail to provide much greater certainty regarding the monetary costs. The Oxera report concluded:

> *The overall balance of non-monetised impacts—which include landscape, carbon and changes in land use—is difficult to ascertain, but is likely to become more apparent as the understanding of the impacts improves over time, and as HS2 Ltd adjusts the appraisal to reflect the DfT's revised approach to such assessments. (Para 5.2, Oxera Report, Review of the Government's case for a High Speed Rail Programme, June 2011)*

6.1.8. 51M believes it would be highly irresponsible to go beyond the initial decision making stage prior to understanding the impacts on carbon. Oxera, has clearly identified a hole in the appraisal by HS2 Ltd, yet it would not make sense to plug these holes after HS2 was given approval for later design stages.

7. Phillip Hammond Letter

7.1. Critical Appraisal

7.1.1. On 9 February 2011 Phillip Hammond wrote a letter (appendix 1) to a colleague to 'set the record straight' regarding a number of 'incorrect statements' made by the Stop HS2 Campaign.

7.1.2. In this letter, Mr Hammond attempts to refute claims that high speed rail would not be carbon efficient. He states:

> *In fact, our proposed London – West Midlands line is expected to be broadly carbon neutral, even allowing for the significant increase in demand that it would cater for, and its consequential economic benefits. No other option for increasing rail capacity can offer a similar balance of economic and environmental benefits.*

7.1.3. It is assumed that Mr Hammond is basing this on the HS2 Report, and in particular, Table 4. This shows that HS2 (London to Birmingham) will have an operational ouput of 18.5MtCO2 (realistic case), yet this will be offset by a 23.2MtCO2 reduction in CO2 as passengers switch from air to rail.

7.1.4. Ignoring the inaccuracies of the assessment on air to rail shift, or the complete lack of supporting information, Table 4 is highly misleading. It either assumes that a 30 minute saving between London and Birmingham will completely remove domestic flights from London to Manchester and London to Scotland; or more realistically it is being assessed against the wider 'Y' network.

7.1.5. Mr Hammond's interpretation of the impacts is based on one of two scenarios:

7.1.6. Scenario 1: Mr Hammond is comparing the benefits from a complete HS2 network against the negative impacts of only Phase 1;

7.1.7. Scenario 2: Mr Hammond is assuming HS2 London to Birmingham provides vast improvements to those travelling from Scotland and Manchester to London. I.e. all those who would normally have flown from Manchester to London and Scotland to London would switch to

travel on classic rail routes to Birmingham to realise a 30minute saving on HS2.

The first of these scenarios means that Mr Hammond is completely misleading the public as to the impacts of Phase 1 which will have significant construction and operational impacts with minimal benefits. Scenario two means that Mr Hammond is basing his views on a situation that is highly unfeasible not supported by evidence and is in complete contrast to previous assessments of high speed rail.

7.1.8. Booz Allen Hamilton's 2007 study for the DFT concluded:

> *The construction (embedded) carbon element was expected to be substantial, and only where significant modal shift (from air to rail) was possible, was a net carbon reduction (embedded carbon less operational carbon) achieved. Proposed routes from London to Birmingham and London to Manchester were found to make a potential net contribution to carbon emissions, as the operational carbon savings achieved through modal shift did not compensate for the construction related carbon emissions. (Paragraph 3.1.2 of HS2 Report)*

7.1.9. This is further supported by a 2007 the Department for Transport published a white paper entitled Delivering a Sustainable Railway. This concluded that high speed rail:

> *Significantly dilutes the carbon saving available, given the cost of infrastructure and the further carbon and wider environmental impacts of construction. It serves to raise serious questions about whether this is the most effective way to maximise environmental benefits from any available public investment. (Delivering a Sustainable Future, DFT, 2007)*

7.1.10. It would appear that Mr Hammond has not been able to 'set the record straight', instead he has provided more misleading information and a further misrepresentation of HS2's Report and the carbon impacts of the scheme.

8. Conclusions

8.1. Conclusions

8.1.1. The Government has made bold claims about its carbon reduction ambitions. The launch of the first transport white paper is called 'Creating Growth, Cutting Carbon'. DFT's own five year Transport Plan states they will drive smarter investment to encourage low carbon transport.

8.1.2. Cutting carbon emissions should therefore be as much at the heart of HS2 as fiscal growth. Unfortunately, the evidence presented suggests that those promoting HS2 have very little concern for carbon emissions. The information provided is littered with illogical assumptions, missing evidence, inaccurate conclusions and is presented in a highly unprofessional and lightweight manner.

8.1.3. In 2007 the Department for Transport published a white paper entitled Delivering a Sustainable Railway. This concluded that high speed rail:

> *Significantly dilutes the carbon saving available, given the cost of infrastructure and the further carbon and wider environmental impacts of construction. It serves to raise serious questions about whether this is the most effective way to maximise environmental benefits from any available public investment. (Delivering a Sustainable Future, DFT, 2007)*

8.1.4. HS2 LTD has acknowledged the scheme is not aimed at providing a road to rail modal shift. Instead, it is in direct competition with aviation. At present, there are no flights from Birmingham to London, the route of Phase 1 of HS2. There are very minimal flights relative to rail journeys from Manchester, and those that travel to Heathrow do so to transfer to other destinations. Therefore HS2 phase 1 has no aviation industry to compete with, meaning there will be a negligible modal air to rail shift. Yet HS2 has enormous operational and construction impacts. To claim HS2 Phase 1 is carbon neutral is a blatant misrepresentation and undermines any attempts to deliver a low carbon transport infrastructure.

8.1.5. The Transport Minister Phillip Hammond provides a more honest appraisal of the Government's carbon intentions in a speech at the IBM Start Conference on 10 September 2010:

> *Sustainable solutions have, of course, first and foremost to be environmentally sustainable. But they must also be fiscally and economically sustainable - affordable to the taxpayer in the long-term and compatible with an economic growth agenda. (www.dft.gov.uk)*

And,

> *Cutting carbon - as important as it is - is relatively simple. Doing it in a way which supports economic growth, is fiscally sustainable and promotes social mobility and sustainable development is a far tougher challenge. (www.dft.gov.uk)*

It is clear that HS2 has become an economic project for the Government, and in fact cutting carbon has been placed far below fiscal growth. Unfortunately, this is an extremely myopic view. The Stern report highlights the fiscal cost of not tackling climate change, which has clearly been ignored in the assessment of HS2.

8.1.6. The Government cannot possible make an informed decision on the carbon impacts of HS2 based on the report provided. Furthermore, the Public and Local Authorities who are coming under increasing pressure to reduce their own carbon footprints, and will be hit by rising bills as a result, should have complete access to the carbon modeling for this scheme. If this multi billion pound scheme results in further carbon emissions in the UK then it will fall on other sectors to work harder to reduce emissions. The cost of carbon is continuing to rise which means any commercial sector increased costs will fall on the public to meet.

8.1.7. All sectors across the UK are under financial pressure to reduce their energy consumption and carbon footprint. The Government has made it a priority. Yet the HS2 Report matches none of the requirements the Government has placed on other sectors, for example through the Carbon Reduction Commitment. This is a consultation document which should demonstrate to the public and other sectors how carbon is being considered in this major transport

scheme. Sadly it fails and completely undermines the Governments rhetoric and the encouragement it is making of other sectors to consider carbon impacts more seriously.

9. Appendix 1: Phillip Hammond Letter

From the Secretary of State

Department for Transport

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9 February 2011

Dear Colleague,

You may have received an email from the Stop HS2 Campaign inviting you to attend their national convention in Stoneleigh on 19 February. It contains a number of incorrect statements regarding the Government's plans for high speed rail and I thought it would be helpful to set the record straight.

First, the costings for high speed rail given in the email are incorrect, stating the cost for the first phase of the project to be £34.7 billion. In fact, the cost of the first phase of the project is estimated to be between £15.8 billion and £17.4 billion. Phases I and II together, including the network from London to Manchester and Leeds, is estimated at around £33 billion. These figures are calculated factoring in construction risk and optimism bias in accordance with Treasury methodology. While the costs of a new high speed line are clearly significant, they would be spread out over the next 15 years, with the overwhelming majority being spent during the next Parliament and the subsequent one, after the public finances are scheduled to be back in balance. We expect high speed rail to deliver benefits for the country well in excess of its costs. A revised business case will be published with the forthcoming consultation documents.

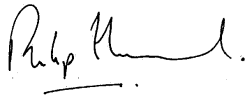
Secondly, the email from the Stop HS2 campaign states that high speed rail will not be carbon efficient. In fact, our proposed London-West Midlands line is expected to be broadly carbon neutral, even allowing for the significant increase in demand that it would cater for, and its consequential economic benefits. No other option for increasing rail capacity can offer a similar balance of economic and environmental benefits. Our wider high speed network to Manchester and Leeds, with through-running services to Scotland, could also provide an attractive alternative for many journeys which would otherwise be made by short-haul aviation. The proposed connections to Heathrow airport and to HS1 and the Channel Tunnel will further increase the attraction of rail for short-haul European destinations.

The Stop HS2 campaign also claim that householders and business owners affected by the route have had no form of formal communication from the Government telling them that their property has been included in the plans. In fact the proposed route has been very well publicised, including adverts in local and regional media. We will be writing to all property owners potentially affected by the proposed new line at the launch of the forthcoming consultation. To avoid spreading blight, it would only be following consultation and subject to the Government taking a final decision that we would identify who exactly would be affected. The Government is determined to protect the legitimate interests of private property owners affected by the route, and we have already launched a scheme to support those affected who have a pressing need to sell their property.

In summary, it is the Government's strong belief that high speed rail will be one of the crucial elements to ensuring the economic success of our country in the decades ahead. Britain cannot afford to be left behind as our competitors develop modern infrastructure. A national high speed rail network from London to Birmingham, with onward legs to Leeds and Manchester, will help us secure the growth, the jobs, and the investment that will drive our prosperity in the future. It provides an opportunity to tackle the longstanding North-South divide, ensuring that every part of the country contributes to, and benefits from, future growth and prosperity. With a high speed rail line, the Midlands and the North will be much better able to access and benefit from the magnet effect of London's economy, transforming the way Britain works and competes in the 21st century.

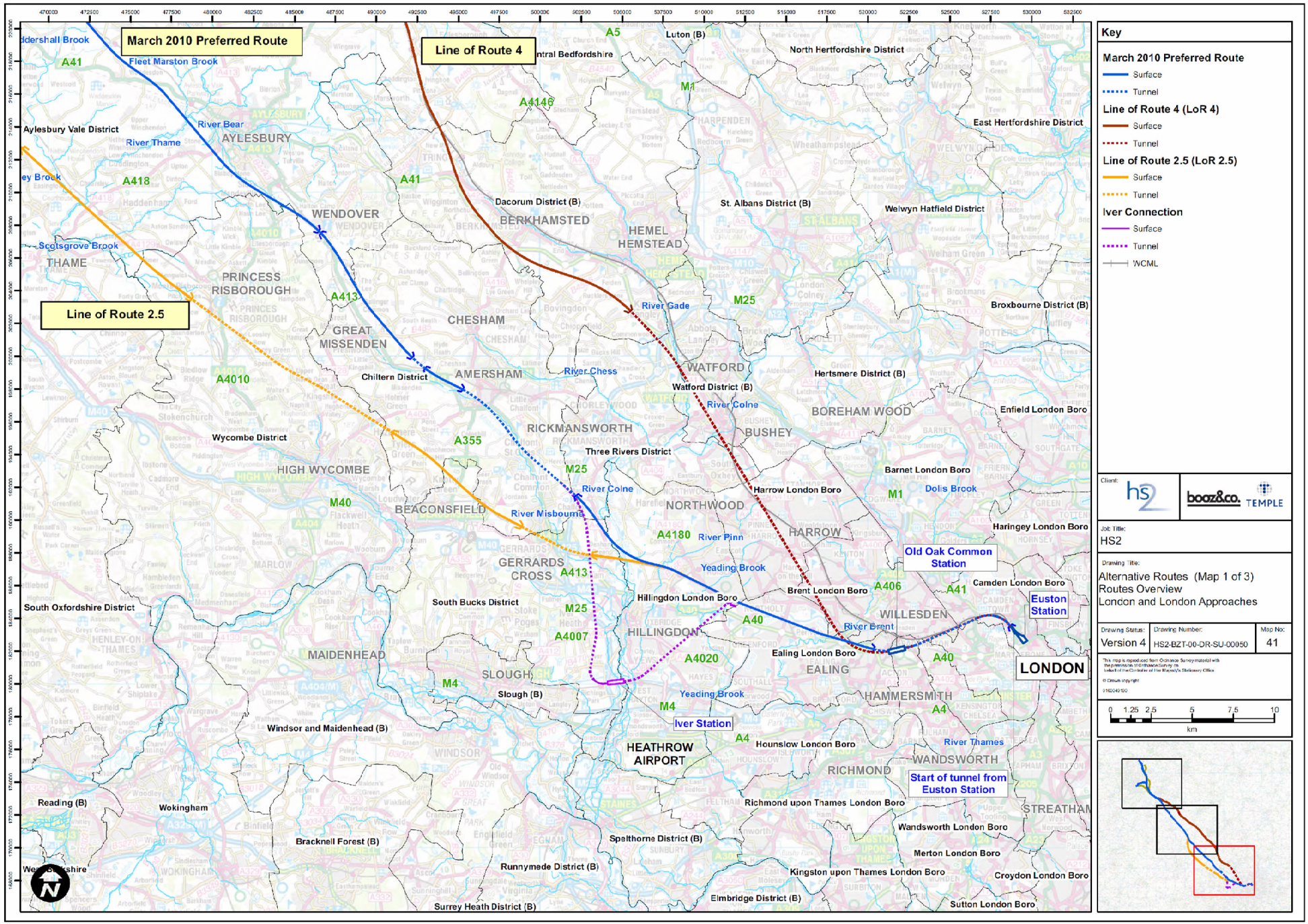
The consultation we are launching in the next few weeks will be a comprehensive undertaking to ensure that everyone potentially affected, positively or negatively, will be able to have their say and fully engage in the project. An updated business case will be published alongside the consultation, which will encompass not only the detailed line of route that has been outlined for the initial London to West Midlands phase, but also the Government's overall strategy for a national high speed rail network. As part of the process, roadshows will be held along the length of the preferred route from London to the West Midlands to ensure that local people have the opportunity to discuss specific concerns.

Yours ever

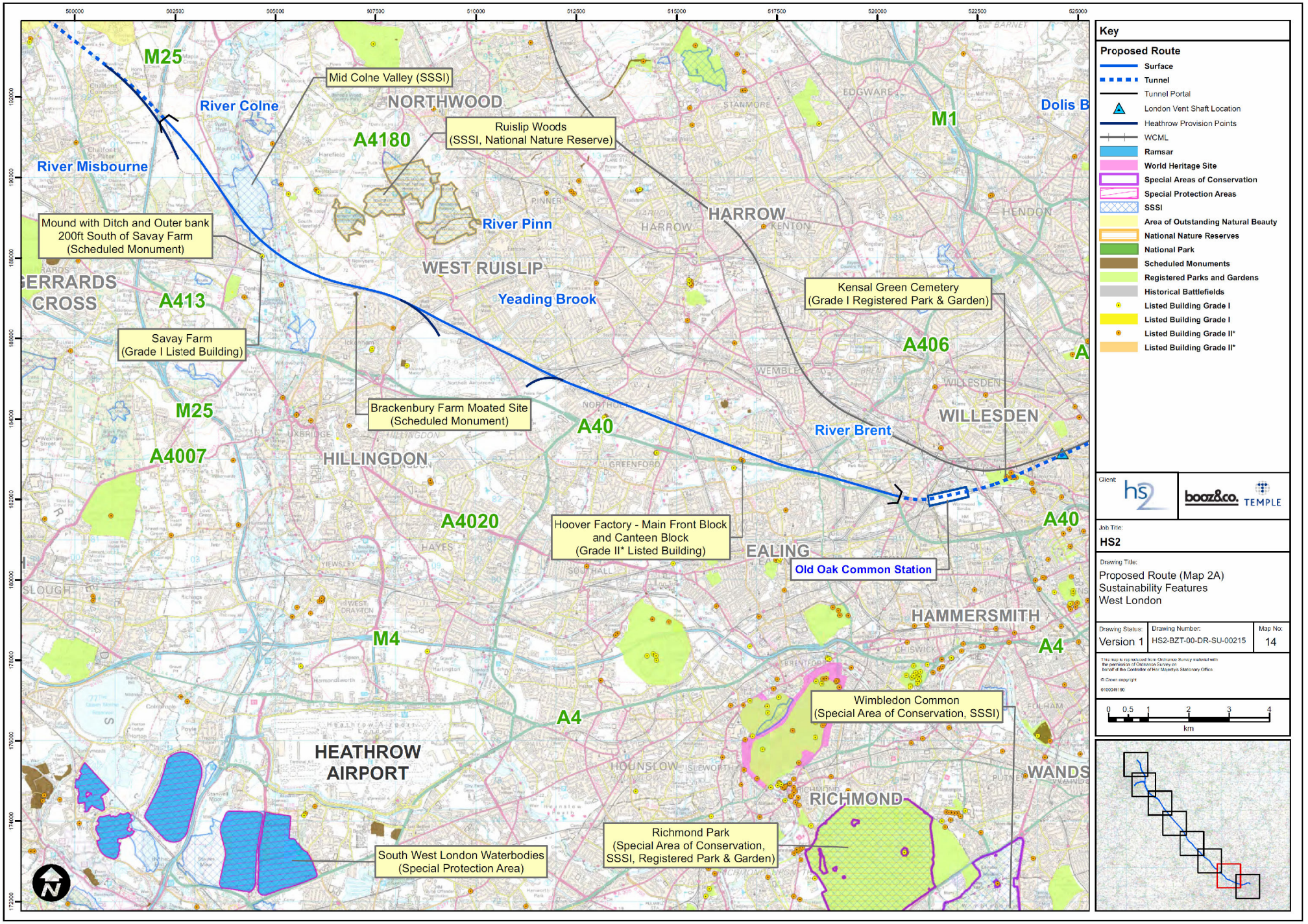


PHILIP HAMMOND

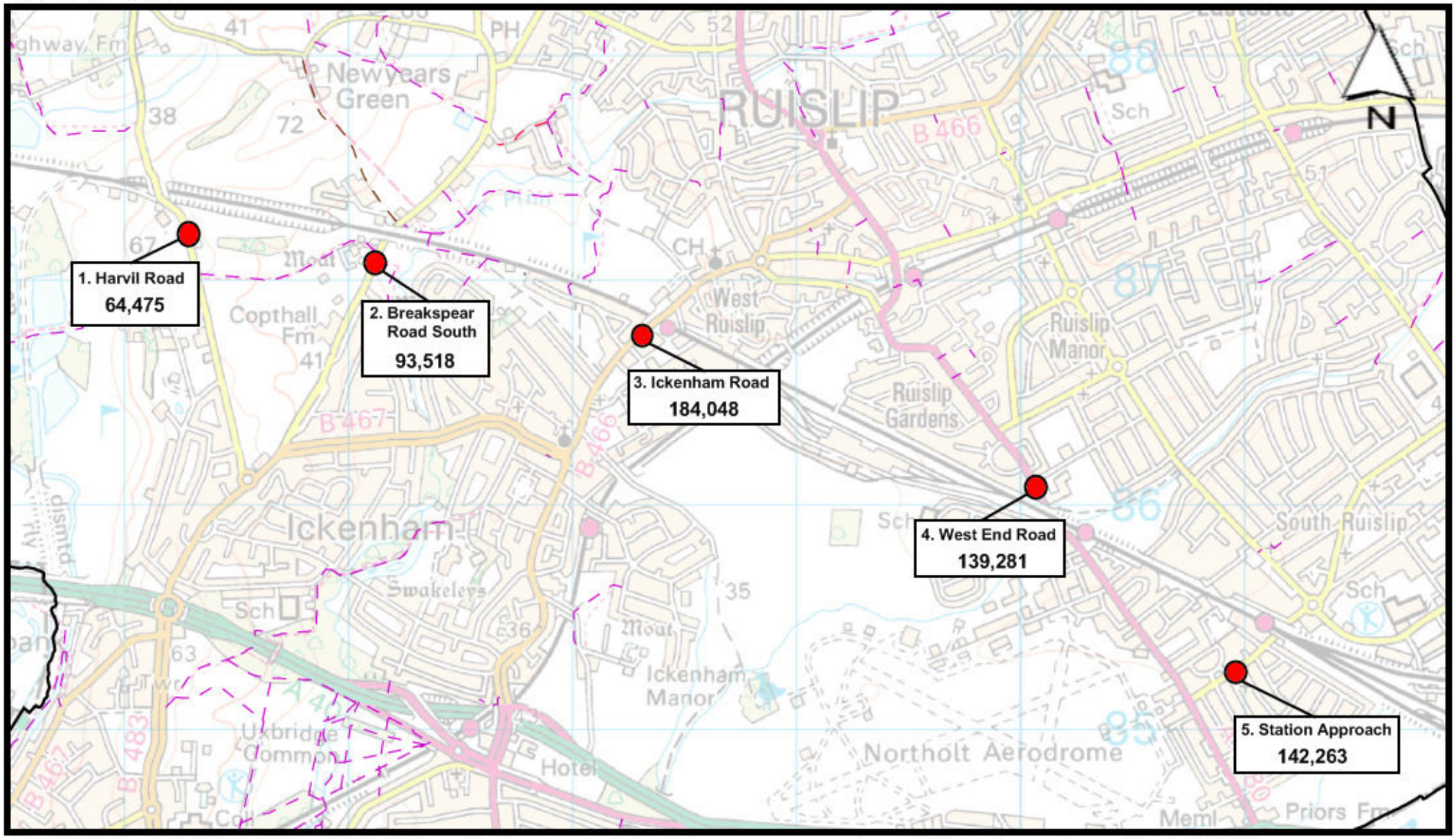
Appendix 2: HS2 Ltd's alternative routes


March 2010 Preferred Route
Line of Route 4
Line of Route 2.5
Key
March 2010 Preferred Route
Surface
Tunnel
Line of Route 4 (LoR 4)
Surface
Tunnel
Line of Route 2.5 (LoR 2.5)
Surface
Tunnel
Iver Connection
Surface
Tunnel
WCML
Client:
hs2
booz&co.
TEMPLE
Job Title:
HS2
Drawing Title:
Alternative Routes (Map 1 of 3)
Routes Overview
London and London Approaches
Drawing Status:
Version 4
Drawing Number:
HS2-BZT-00-DR-SU-00050
Map No:
41
0 1.25 2.5 5 7.5 10
km
Old Oak Common Station
Euston Station
Start of tunnel from Euston Station
Iver Station
LONDON
Aylesbury Vale District
Chiltern District
Wycombe District
South Bucks District
South Oxfordshire District
Three Rivers District
Watford District (B)
Hertsmere District (B)
Dacorum District (B)
St. Albans District (B)
Welwyn Hatfield District
East Hertfordshire District
North Hertfordshire District
Luton (B)
Broxbourne District (B)
Enfield London Boro
Barnet London Boro
Harrow London Boro
Haringey London Boro
Camden London Boro
Brent London Boro
Hillingdon London Boro
Ealing London Boro
Hounslow London Boro
Richmond upon Thames London Boro
Wandsworth London Boro
Merton London Boro
Kingston upon Thames London Boro
Croydon London Boro
Sutton London Boro
Elmbridge District (B)
Spelthorne District (B)
Runnymede District (B)
Surrey Heath District (B)
Bracknell Forest (B)
Windsor and Maidenhead (B)
Slough (B)
Reading (B)
Wokingham
AYLESBURY
WENDOVER
BERKHAMSTED
HEMEL HEMSTEAD
CHESHAM
GREAT MISSENDEN
PRINCESS RISBOROUGH
THAME
AMERSHAM
BEACONSFIELD
HIGH WYCOMBE
RICKMANSWORTH
WATFORD
BUSHEY
BOREHAM WOOD
NORTHWOOD
HARROW
WILLESDEN
GERRARDS CROSS
MAIDENHEAD
SLOUGH
HILLINGDON
EALING
HAMMERSMITH
HEATHROW AIRPORT
RICHMOND
WANDSWORTH
STREATHAM
River Bear
River Thame
Fleet Marston Brook
Scotsgrove Brook
River Gade
River Chess
River Colne
River Misbourne
River Pinn
Yeading Brook
River Brent
River Thames
Dollis Brook
A41
A418
A413
A4010
A355
M25
M40
M4
M1
A4
A40
A406
A4180
A4007
A4020
A5
A4146

Appendix 3: HS2 Ltd's Outline of route and impacts in West London


M25
Mid Colne Valley (SSSI)
River Colne
NORTHWOOD
Ruislip Woods
(SSSI, National Nature Reserve)
A4180
River Misbourne
M1
Dolis B
Mound with Ditch and Outer bank
200ft South of Savay Farm
(Scheduled Monument)
River Pinn
HARROW
WEST RUISLIP
GERRARDS
CROSS
A413
Yeading Brook
Kensal Green Cemetery
(Grade I Registered Park & Garden)
Savay Farm
(Grade I Listed Building)
A406
M25
Brackenbury Farm Moated Site
(Scheduled Monument)
A40
River Brent
WILLESDEN
A4007
HILLINGDON
A4020
Hoover Factory - Main Front Block
and Canteen Block
(Grade II* Listed Building)
EALING
Old Oak Common Station
HAMMERSMITH
M4
A4
HEATHROW
AIRPORT
Wimbledon Common
(Special Area of Conservation, SSSI)
RICHMOND
Richmond Park
(Special Area of Conservation,
SSSI, Registered Park & Garden)
South West London Waterbodies
(Special Protection Area)
Key
Proposed Route
Surface
Tunnel
Tunnel Portal
London Vent Shaft Location
Heathrow Provision Points
WCML
Ramsar
World Heritage Site
Special Areas of Conservation
Special Protection Areas
SSSI
Area of Outstanding Natural Beauty
National Nature Reserves
National Park
Scheduled Monuments
Registered Parks and Gardens
Historical Battlefields
Listed Building Grade I
Listed Building Grade I
Listed Building Grade II*
Listed Building Grade II*
Client:
hs2
booz&co.
TEMPLE
Job Title:
HS2
Drawing Title:
Proposed Route (Map 2A)
Sustainability Features
West London
Drawing Status:
Version 1
Drawing Number:
HS2-BZT-00-DR-SU-00215
Map No:
14
0 0.5 1 2 3 4
km

Appendix 4: Roads in Hillingdon affected by HS2 proposal



ROADS AFFECTED BY HS2 - Volumes of traffic movements, Hillingdon June/July 2011

HILLINGDON
LONDON

KEY

Road name & volume of traffic movement in the week between 25th June - 1st July 2011

Traffic survey locations

N.B. Total volume of traffic movement in the week between 25th June - 1st July 2011 on the five roads is 623,585

Appendix 5: Landscape at Hillingdon Outdoor Activity Centre

Fig. 1: View across the lake to Hillingdon Outdoor Activities Centre (HOAC)

Fig. 2: HS2 Ltd image of viaduct over Colne Valley

Appendix 6: Hillingdon's Appraisal of HS2 Ltd's Noise Assessment

1. Introduction

This section considers the noise and vibration impacts of the proposed HS2 railway line. It makes frequent reference to Appendix 5.4 "Noise and Vibration" of the "Appraisal of Sustainability, Appendix 5 – AoS Technical Reports". For brevity, that Appendix 5.4 is generally referred to in this section as the "AoS". This section also makes reference to the residential airborne noise appraisal maps presented in the "Appraisal of Sustainability, Main Report, Volume 2, Plans and Appraisal Framework".

In this section, use is made of two reports prepared by Southdowns Environmental Consultants Ltd (SEC). One of these reports is "HS2 Appraisal of Sustainability: Acoustics Review" commissioned by the 51m consortium. The other report is "HS2 Noise Appraisal Maps: Acoustics Review" commissioned by the London Borough of Hillingdon.

2. AoS noise criteria

Reliance on $L_{Aeq18hr}$

The justification given in the AoS for reliance on a single noise indicator $L_{Aeq,18hr}$ (the 18-hour $L_{Aeq,T}$ noise level between 06:00 and 24:00 hours) is that it is used in the assessment of eligibility for sound insulation for new railways under the Noise Insulation (Railways and other Guided Transport Systems) Regulations 1996, it is one of the noise indices that forms the basis for noise action planning under the Environmental Noise (England) Regulations 2006 (as amended), and its use is set out in DfT WebTAG guidance for the assessment of different transport proposals. However, the principal noise indicators set out in the Environmental Noise Regulations for the assessment of community response to environmental noise, including railway noise, during the day, evening and night-time hours are L_{den} (with 5 and 10 dB penalties for evening and night periods) and L_{night}, with other indicators such as $L_{Aeq,18hr}$ only being included as supplementary noise indicators.

The Environmental Noise Regulations transpose European Directive 2002/49/EC into UK law. The requirement for noise assessment to be based on a consideration of the noise indicators L_{den} and L_{night} originated in the directive. The directive states that L_{den} is the noise indicator to be used for assessing overall annoyance, while L_{night} is the noise indicator to be used for assessing sleep disturbance. The absence of any consideration of noise impact using the noise indicators L_{den} and L_{night} represents a shortcoming of the AoS noise assessment.
Notwithstanding the limited use and applicability of HS2's single noise indicator, the three noise criteria adopted by HS2 for the 18-hour $L_{Aeq,18hr}$ noise level between 06:00 and 24:00 hrs are discussed below.

High noise levels

The AoS defines a free-field noise level greater than or equal to 73 dB $L_{Aeq,18hr}$ as a "high noise level". The justification presented in the AoS for the adoption of this criterion is that it is the level used by Defra to identify First Priority Locations for the Noise Action Plan (NAP) required by the Environmental Noise (England) Regulations 2006. However, the following quotation from Defra's Noise Action Plan for the London agglomeration dated March 2010 defines the intended use and context of the 73 dB $L_{Aeq,18hr}$ noise

threshold in relation to railway noise: *"This threshold value should only be used for the purposes of identifying First Priority Locations for investigation in the context of this Noise Action Plan and should not be used for any other purpose or in any other policy context."*
It can readily be seen that the threshold level set out in the noise action planning document has a specific use to define a priority area of study within the NAP. It has no authority elsewhere and consequently no value as a criterion level. Its use in the AoS adds no worthwhile information to the assessment. It certainly does not suggest that a railway noise exposure is in any way acceptable if lower than 73 dB $L_{Aeq,18hr}$.
Application of the NAP First Priority Location criterion level of 73 dB $L_{Aeq,18hr}$ to the HS2 project breaches Defra's explicit preclusion of its use outside the context of Noise Action Plans for the initial prioritisation of the management of noise from existing noise sources. It is considered that this noise level represents an extreme and very high noise level for the assessment of noise impacts outside existing dwellings. Furthermore, a free-field noise criterion level of 73 dB $L_{Aeq,18hr}$ corresponds to a façade noise level of 76 dB $L_{Aeq,18hr}$ and is thus 8 dB higher than the daytime noise criterion level for the offer of sound insulation under the Noise Insulation Regulations.

Noise insulation levels

The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996 require that the promoter of new, additional or altered works to a railway system offers noise insulation and alternative ventilation for the habitable rooms of dwellings, subject to exceeding specific noise criteria. The criteria are the same as used in the AoS, with qualification for insulation requiring a daytime façade noise level of 68 dB $L_{Aeq,18hr}$ (06:00 to 24:00 hrs). However, the regulations also provide for insulation against railway noise at night, requiring a night-time façade noise level of 63 dB $L_{Aeq,6hr}$ (24:00 to 06:00 hrs). There is no consideration in the AoS of the number of properties qualifying for night-time noise insulation. It is also important to note that mitigation of noise in outdoor residential areas such as gardens and balconies falls outside the scope of these regulations.

Noticeable noise increases

A "noticeable noise increase" is defined in the AoS as a total railway noise level of greater than or equal to 50 dB $L_{Aeq,18hr}$ with an increase in rail noise level of at least 3 dB. The stated justification for use of a criterion based on 50 dB $L_{Aeq,18hr}$ relies on the document "Guidelines for Community Noise" published in 1999 by the World Health Organisation (WHO). That document states that an outdoor noise level of 50 dB $L_{Aeq,16hr}$ should not be exceeded in order to protect the majority of people from being moderately annoyed.

It is important to note that the executive summary of the WHO document states that the guideline value for annoyance relates to "steady, continuous noise". This would apply, for example, to steady continuous road traffic noise from a distant busy road. However, noise which is intermittent or otherwise varies significantly with time cannot be described as "steady, continuous". Intermittent noise from passing high speed rail trains clearly cannot be described as "steady, continuous". It is therefore likely that use of the threshold of 50 dB $L_{Aeq,18hr}$ would tend to underestimate annoyance for railway noise which is intermittent and composed of a number of discrete noise events. Furthermore, the unpleasant low frequency "rumble" noise heard during pass-by of the individual HS2

trains is likely to increase annoyance at any given noise level. Further discussion of noise increases is given below.

3. AoS noise prediction uncertainties

Train noise sources

According to the AoS, sources of direct airborne train noise include: mechanical noise from the motors, fans and ancillary equipment on the train, which tends to be the dominant source at low speeds; "rolling" noise from wheels passing along the rails, which usually dominates between low speed and higher speeds up to 300 km/h; and aerodynamic noise from general air flow around the train body, pantograph and bogie areas that starts to become predominant at the highest speeds (over 300 km/h).

Noise mitigation

The AoS presents noise levels assuming indicative additional noise mitigation. However, the main Consultation Document "High Speed Rail: Investing in Britain's Future" is unclear as to what this noise mitigation would be in reality. It states in paragraph 5.85 that "*mitigation options cannot be identified in full or committed to at this stage, since they rely on design detail that has not yet been developed. For example, to design the provision of noise barriers alongside the route would first require assessments of noise impacts."*

The additional noise mitigation scenario set out in the AoS assumes a 3 dB reduction in future train emissions, based on unspecified improvements in the next generation of high speed rolling stock. There is no guarantee that the claimed reduction in noise emission noise limits will be delivered. Also, noise levels achieved under reference conditions may not be achieved in everyday use, when the effects of wear begin to show on wheel and rail surface quality.
The additional noise mitigation scenario set out in the AoS also assumes noise reduction equivalent to that of a 3m high noise barrier at the preliminary candidate areas for mitigation. At viaducts, the noise mitigation is based on what would be achieved if 2m high barriers are installed. It is not clear, however, whether these barrier heights relate to height above ground or to height above rail head.

The acoustic performance of any noise barriers actually provided will be limited where aerodynamic noise is prevalent at higher speeds, and at lower speeds it will depend on the respective contributions of individual train noise sources. It is acknowledged in the AoS that aerodynamic noise needs to be controlled through advances in rolling stock design. If substantial reductions in aerodynamic noise are not achieved, then higher noise barriers and/or reductions in train speeds will be required if it is not practicable to install higher noise barriers.
The AoS identifies that the noise calculation methodology was modified to take account of the acoustic benefits of 3m or higher noise barriers for train speeds above 300 km/h. This modification involved reducing the actual noise barrier height by 1m for calculation purposes, and assuming a single train noise source located at 1m above the tracks. This methodology would appear to be unproven and inevitably introduces uncertainty into the calculations.
The proposed HS2 line includes a 3.6 km viaduct over the Grand Union canal and River Colne. The viaduct would extend from near Harvil Road in Hillingdon borough to near

Tilehouse Lane in Hertfordshire. Throughout the viaduct length, train noise would only be screened by a 2m noise barrier. Furthermore, HS2 train speeds increase over the viaduct to 300 km/h and 360 km/h. Train source noise levels would be higher at these increased speeds. Also, there are doubts about the acoustic performance of noise barriers at such high speeds because of the increase proportion of aerodynamic noise. No actual predicted noise levels are given in the AoS for this area. Noise from HS2 trains travelling over the viaduct is a concern for Hillingdon in view of the possible noise impacts at residential areas of Harefield and South Harefield, and the outdoor amenity areas around the Colne Valley lakes, such as Hillingdon Outdoor Activities Centre.

For the more built-up areas of the borough, there may be insufficient space to accommodate the proposed noise barriers, given that the proposed HS2 line is so close to residential properties. Much of the HS2 line through the borough would run to the north of and generally alongside existing rail lines used by Chiltern Line trains and London Underground trains. The AoS does not make it clear whether the noise barrier proposed to the south of the HS2 tracks would be between the HS2 tracks and the existing rail tracks, or to the south of both HS2 tracks and existing rail tracks. This is an important omission because the location of the noise barrier would have a significant effect on noise attenuation achieved at receivers to both the north and south of the HS2 line. While a noise barrier between the existing tracks and the HS2 tracks would be most effective at screening HS2 train noise, there may be problems with access for maintenance if the barrier is located on land belonging to Chiltern lines or London Underground.
HS2 consultation material indicates that an allowance of at least £215m has been provided for additional noise mitigation measures. Details of the derivation of this figure are not provided and it is not possible, in the absence of further and more detailed studies of potential impacts and mitigation options at this stage of project development, to identify the eventual costs of mitigation.

4. AoS omissions

Magnitude of noise increases

The AoS noise appraisal criterion for “noticeable noise increase” includes a minimum noise increase of 3 dB in ambient noise levels. We believe that changes in a noise index less than 3 dB can be perceptible depending on the cause of the change. For example, increases in a noise index $L_{Aeq,T}$ of less than 3 dB can be perceptible if caused by an increase in numbers of noise events such as would occur with an increase in the number of passing trains.

Also, the AoS criterion does not distinguish between the range of noise impacts that would be encountered along the proposed route. A predicted future train noise level of 64 dB $L_{Aeq,18hr}$, for example, would represent a noise change of 19 dB at receptors where the pre-existing noise level is 45 dB $L_{Aeq,18hr}$. Nevertheless, this would not qualify for insulation since the façade noise level would be only 67 dB $L_{Aeq,18hr}$. This would represent a “severe” noise impact based on the semantic descriptors given in the draft guidelines produced by the Institute of Environmental Management and Assessment. The magnitude of the noise impact should be a key factor in any consideration of the requirement for additional noise mitigation. This failure to distinguish between noticeable noise increases between 3 dB and 19 dB or more represents a significant omission in the AoS approach to noise appraisal.

An indication of the magnitude of the $L_{Aeq,18hr}$ noise increases which could result from the HS2 proposal is given by the noise predictions carried out by Southdowns Environmental Consultants. These noise increases are discussed below under the section headed “Noise and vibration impacts”.

Peak noise levels

The noise assessment contained in the AoS is based on a consideration of the noise indicator $L_{Aeq,18hr}$, which averages noise levels over the 18 hours 06:00 to 24:00 hrs. In consequence, there is no consideration in the AoS of the impacts on individuals of the higher peak noise levels during each noise event as a train passes.
The WHO document “Guidelines for Community Noise” gives advice on the use of noise indicators based on $L_{Aeq,T}$. The executive summary of that document states that *“$L_{Aeq,T}$ should be used to measure continuing sounds, such as road traffic noise or types of more-or-less continuous industrial noises. However, when there are distinct events to the noise, as with aircraft or railway noise, measures of individual events such as the maximum noise level (L_{Amax}) …. should also be obtained in addition to $L_{Aeq,T}$”,* and *“For intermittent noise, it is emphasised that it is necessary to take into account both the maximum sound pressure level and the number of events.”*

The guidance offered by the WHO cannot be lightly dismissed or ignored. The recommendation that individual events should be considered in the noise assessment has not been accepted by HS2. Reliance on $L_{Aeq,18hr}$ means that there is no assessment of peak noise levels during a train pass-by, and this is a major shortcoming of the AoS noise assessment. The noise indicator normally used to measure peak noise levels for assessing effects on people is L_{Amax} (specifying Fast or Slow time weighting).

Using information contained in AoS Figure 4, and the document referred to in AoS Footnote 11, we estimate that $L_{Aeq,Tp}$ noise levels will be around 13 dB higher than $L_{Aeq,18hr}$ noise levels at 250 km/h with 432 trains over 18 hours. Also, we have been informally advised by HS2 that $L_{Amax,S}$ noise levels are likely to be similar to $L_{Aeq,Tp}$ noise levels, but that $L_{Amax,F}$ noise levels would be slightly higher. We therefore estimate that $L_{Amax,S}$ from a HS2 train passing by at 250 km/h would be around 13 dB higher than $L_{Aeq,18hr}$ with 432 trains over 18 hours.
Using the above empirical relationship, we have estimated free-field $L_{Amax,S}$ noise levels by adding 13 dB to the $L_{Aeq,18hr}$ noise levels predicted by SEC for the “without mitigation” scenario. We estimate that free-field $L_{Amax,S}$ noise levels at worst-affected dwellings could be up to around 86 dB in the red “high noise level” (as defined in AoS) areas identified in AoS map 1A, up to around 84 dB in the orange noise insulation areas identified in AoS map 1A, and up to around 76 dB in the grey “noticeable noise increase” (as defined in AoS) areas identified in AoS map 1A.

We have not predicted $L_{Amax,S}$ noise levels for the “with mitigation” scenario. This is because we consider that the empirical relationship between $L_{Amax,S}$ and $L_{Aeq,18hr}$ assumed above may not apply with the intervention of a noise barrier between the noise source and the noise receiver.
AoS Table 1 gives predicted numbers of HS2 two-way train movements. HS2 assumed train movements for Phase 1 of the scheme, without the northern extension, are 22 and 28 per standard hour and peak hour respectively. HS2 assumed train movements for Phase 2, with the northern extension, are 30 and 36 per standard hour and peak hour

respectively. This suggests HS2 trains could pass by at an average rate of one every 2 or 3 minutes.
We believe that pass-by noise, as measured by peak noise level $L_{Amax,S}$, from passing HS2 trains for the "without mitigation" scenario are likely to have an adverse noise impact at a large number of residential properties along the HS2 route corridor in Hillingdon borough. Pass-by noise from passing HS2 trains could disturb residents' use of their gardens during the day. In addition, such pass-by noise could cause sleep disturbance to residents at night. This is considered further below.

Night noise

The noise assessment carried out in the AoS is based the noise indicator $L_{Aeq,18hr}$, which is the average noise level over the period 06:00 to 24:00 hours. During this time, there is no subdivision into the peak traffic hours or for the activities that take place during early morning or the late evening. Traffic at these times receives the same consideration as traffic at less sensitive times of the day. Not only does the use of $L_{Aeq,18hr}$ remove consideration of discrete events it also ignores the possible additional noise effects of exposure at noise sensitive times.
In addition, whilst HS2 define the proposed operation as a "predominantly daytime operation" (AoS paragraph 1.5.1), the hours of 06:00 to 07:00 and 23:00 to 24:00 are hours which are normally considered to be part of the night time period 23:00 to 07:00 hours. Thus, there is no specific consideration of noise impacts that occur during the more noise sensitive evening and night periods.

Stated railway operational hours are 05:00 hrs to 24:00 hrs Monday to Saturday, and 08:00 to 24:00 hrs on Sunday. These stated operational hours show that the line will operate for 3 out of 8 hours during the conventional defined night between 23:00 and 07:00 hrs. AoS Table 1 gives predicted numbers of train movements. HS2 assumed train movements for Phase 1 of the scheme, without the northern extension, are 22 and 28 per standard and peak hour respectively. Peak hours are defined as 07:00 to 10:00 hrs, and 16:00 to 19:00 hrs. This corresponds to an average of one train movement every 2 to 3 minutes during peak and standard hours. For Phase 2, with the northern extension, the respective figures for standard and peak hour train movements are 30 and 36.

This suggests that, without the northern extension, 22 trains could operate during each of the night-time hours 23:00 to 24:00 hrs, 05:00 to 06:00 hrs, and 06:00 to 07:00 hrs. Subsequent operation with the northern extension would increase this to 30 trains per hour over each of these 3 night-time hours.

The WHO document "Guidelines for Community Noise" recommends that peak noise levels outside bedrooms should not exceed 60 dB $L_{Amax,F}$ so that people may sleep at night with windows open. We are concerned that passing HS2 trains could cause sleep disturbance to residents in the night period, and to children in the evening period. The estimates of peak noise $L_{Amax,S}$ levels for train pass-by events as given above support this concern. As noted, peak noise $L_{Amax,F}$ levels would be slightly higher than the estimated peak noise $L_{Amax,S}$ levels. Also, the estimated peak noise levels are "free-field" noise levels which would have to be increased by 3 dB for comparison with the WHO external criterion since the latter is considered to be a façade noise level.

Night-time noise criteria and impacts have not been defined in the AoS on the basis that properties eligible for noise insulation under the night-time noise criterion level of 63 dB $L_{Aeq,6hr}$ (24:00 to 06:00 hrs) specified in the Noise Insulation Regulations would have already been identified under the daytime noise criterion of those regulations. However, the Noise Insulation Regulations pre-date more contemporary guidelines for noise limits published in the document "Night Noise Guidelines for Europe" published by the World Health Organisation in 2009. These guidelines recommend an external Interim Target Level of 55 dB L_{night}, and this can be used for the evaluation of night noise impacts. The night noise guidelines also define an external Interim Target Level of 40 dB L_{night} as a threshold value for the health impact assessment of new projects. Furthermore, the Environmental Noise Regulations require assessment of night noise using the L_{night} noise indicator in order to assess sleep disturbance effects.
The absence of any proper consideration of night noise impacts represents a serious shortcoming of the AoS noise assessment.

Ground-borne noise and vibration

Potential ground-borne noise and vibration impacts of HS2 trains are addressed only at commentary level in the AoS. However, the AoS paragraph 2.4.2 acknowledges by reference to AoS Figure 3 that ground-borne noise and vibration can be an issue with trains running at surface level, and is not a problem restricted to trains running in tunnels. AoS paragraph 9.3.1 acknowledges that more detailed assessments will have to consider ground-borne noise and vibration impacts for "all sections" of the HS2 line. The absence of a proper consideration of ground-borne noise and vibration impacts in the AoS is of particular concern to Hillingdon. This is because the proposed HS2 line would pass very close to many residential properties in the borough.

Tunnel boom noise

The AoS recognises that pressure waves created as a high speed train enters a tunnel portal can result in micro-pressure waves that cause a boom noise at the exit of long tunnels. It also recognises that noise barriers outside the tunnel portal are not effective. Although ways of mitigating tunnel boom noise are mentioned in the AoS, there is no quantitative assessment of this form of noise and no guarantee that it can be adequately mitigated. The proposed HS2 line includes a tunnel portal where the HS2 line enters a tunnel near the M25 motorway. Tunnel boom noise associated with this tunnel portal is a concern for Hillingdon in view of the possible noise impacts at residential areas of Harefield, and outdoor amenity areas around the Colne Valley lakes.

Non-residential noise receivers

AoS paragraph 3.1.4 acknowledges that no detailed noise impact assessment has been carried out for the noise impact of railway operational noise on non-residential noise-sensitive receivers. These receivers include community, education, healthcare and outdoor recreation facilities such as Hillingdon Outdoor Activities Centre situated off Harvil Road. Other outdoor facilities requiring consideration include the golf course at West Ruislip, and the recreation ground adjacent to Ruislip Gardens station. Schools close to the proposed HS2 line include those situated at Herlwyn Avenue and Sidmouth Drive. The failure of the AoS to consider noise impact at these non-residential facilities is a concern to Hillingdon.

Construction noise and vibration

The AoS does not contain any assessment of noise and vibration impacts resulting from construction of the proposed HS2 railway. This is a concern for Hillingdon because the proposed line of the railway passes through a heavily populated urban residential area.

5. Other AoS criticisms

Train speeds

The consultation leaflet on HS2 trains states that the HS2 trains would initially travel at speeds up to 360 km/h, but that train speeds could reach 400 km/h in the future *"on the condition that there would be no unacceptable increase in noise levels*." Furthermore, statements made in the consultation document suggest that the presentation of noise impacts presented in the AoS would provide the benchmark against which noise impacts associated with future train speeds of 400 km/h would be judged. The possibility that HS2 train speeds could be higher than those currently modelled is of great concern in view of the potential implications for noise and vibration impacts.

Quiet or tranquil areas

The Environmental Noise (England) Regulations 2006 require identification of Quiet Areas as defined in European Directive 2002/49/EC. The regulations require the competent authority to prepare a Noise Action Plan including provisions that aim to protect any formally identified Quiet Areas in the London agglomeration area. The proposed HS2 line passes through part of Hillingdon borough that falls within the defined London agglomeration area. We are concerned that the HS2 proposal has not taken into account noise implications for any Quiet Areas which may be formally identified in the borough. Similar concerns arise regarding existing tranquil areas outside the London agglomeration, such as the area around the Colne valley lakes which could be affected by noise from HS2 trains travelling over the proposed Colne valley viaduct.

Noise insulation entitlement

The AoS gives the number of HS2 trains passing through the borough over the 18 hours period 06:00 to 24:00 hrs as 432 for Phase 1 (without the northern Y-extension), and 576 for Phase 2 (with the northern Y-extension). In the AoS, residential properties qualifying for sound insulation seem to have been assessed on the basis of the lower noise levels with 432 trains over the 18 hours day. The Noise Insulation Regulations do not cover "intensified use" of an existing rail line. This suggests that some residential properties may miss out on noise insulation when the HS2 line is extended to Leeds and Manchester in the proposed Phase 2. Unless this is taken into account, residential properties that will be subject to 68 dB $L_{Aeq,18hr}$ only when the line is extended to Manchester and Leeds may fail to qualify for noise insulation when the line is extended.

Strategic noise assessment

The AoS contains a high level strategic noise assessment for the whole of Phase 1 of the proposed HS2 route. It gives estimated numbers of dwellings that might be eligible

for sound insulation. Entitlement to such insulation would, in fact, be a statutory requirement under the Noise Insulation Regulations. Otherwise, the quantitative assessment of noise and vibration presented in the AoS is limited to the identification of numbers of dwellings in route corridors which are predicted to experience noise levels exceeding AoS definitions of “high noise levels” and “noticeable noise increases”.

The AoS noise assessment is not a detailed noise assessment. There have been no detailed baseline noise surveys, and the AoS results are not at a level that enables the identification of noise levels at individual properties. Accurate baseline noise levels are necessary for determining the significance of noise levels from the HS2 line. Future baseline noise levels may differ from current levels due to changes in train rolling stock, and contributions from other environmental noise sources. The AoS acknowledges in paragraph 6.2.2 that candidate areas for additional mitigation are preliminary due to the strategic nature of the noise assessment.
The AoS has been produced to accompany and form the basis of the consultation phase of the HS2 project. As a result of this consultation, the decision will be made as to whether to proceed with the project or not. It is the only stage in the overall project where direct responses from the public can be made. It is therefore essential that the information given out at this stage is both well founded and complete.

The AoS and the consultation documents are the results of a strategic study and HS2 Ltd have repeated on a number of occasions that it will be changed as the project proceeds. Within the AoS, there are important areas where matters of noise and vibration are only considered at a commentary level. Accordingly, the AoS is not of sufficient stature to be the basis of a decision to proceed on such a major infrastructure project. Such a decision can only be taken with the knowledge and information that a full and exhaustive Environmental Impact Assessment would provide. We believe that the AoS does not form an adequate basis for making a decision on the noise and vibration impacts for a major infrastructure project of this magnitude.

6. Noise and vibration impacts

<u>AoS residential airborne noise appraisal</u>

The AoS proposed route airborne noise appraisal is presented in section 7.2 of the AoS. The results are given in terms of the numbers of dwellings that exceed the three HS2 chosen 18-hour daytime noise criteria. Results are given for the HS2 proposal for Phase 1 (without northern Y-extension) and Phase 2 (with northern Y-extension). The results are presented in Tables 3 and 4 of the AOS, and summarised in Tables 1 and 2 below, relating to the respective scenarios without and with additional mitigation. The results are expressed in terms of total affected properties over the whole of the route from London to Birmingham, rather than being specific to Hillingdon borough. Results for Phase 1 only for the individual route sections covering Hillingdon borough are given in Table 3.

Table 1: AoS residential airborne noise impacts without additional mitigation

Project phase	“high noise levels” *	Noise Insulation Regulations	“Noticeable noise increase” *
Phase 1 (without Y-extension)	~ 70	~ 1,400	~ 24,300
Phase 2 (with Y-extension)	< 210	< 1,650	~ 33,600

* as defined in AoS

Table 2: AoS residential airborne noise impacts with additional mitigation

Project phase	"high noise levels" *	Noise Insulation Regulations	"Noticeable noise increase" *
Phase 1 (without Y-extension)	~ 10	~ 150	~ 4,700
Phase 2 (with Y-extension)	< 20	< 200	~ 6,600

* as defined in AoS

Table 3: AoS residential airborne noise impacts for individual route sections Phase 1

	"high noise levels" *		Noise Insulation Regulations		"noticeable noise increase" *	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Old Oak Common to West Ruislip	< 50	< 5	~ 1,300	~ 80	~ 6,700	~ 650
West Ruislip to Aylesbury	< 5	< 5	< 30	< 20	~ 8,700	~ 1,450

* as defined in AoS

Comparison of Tables 1 and 2 shows the apparent large reductions in properties affected resulting from the additional noise mitigation. For example, numbers of properties qualifying for noise insulation with Phase 1 are reduced from around 1,400 to around 150 by the additional noise mitigation. Similarly, numbers of properties with a "noticeable noise increase" (as defined in AoS) with Phase 2 are reduced from around 33,600 to around 6,600 by the additional noise mitigation.

As mentioned, HS2 train numbers over the 18 hour daytime period would be 432 for Phase 1 (without Y-extension) and 576 with Phase 2 (with Y-extension). This represents a 33% increase in train movements, corresponding to an increase in average $L_{Aeq,18hr}$ of 1.25 dB. Relatively small noise increases, such as 1.25 dB, can result in significant increases in numbers of properties affected. This indicates the sensitivity of the overall results to noise modelling assumptions and accuracy.

It is apparent from Table 3 that the results in the AoS are given for individual route sections, so it is not possible to give numbers of affected properties in Hillingdon borough alone. This is another demonstration of the limited detail provided in the AoS.

<u>AoS residential airborne noise appraisal maps for Hillingdon area</u>

The Appraisal of Sustainability Main Report Volume 2 – "Plans and Appraisal Framework" contains drawings illustrating the AoS residential airborne noise appraisal. Map No. 1A (Drawing HS2-BZT-00-DR-SU-00303) illustrates noise for route section Old Oak Common to West Ruislip without additional mitigation. Map No. 2A (Drawing HST-BZT-00-DR-SU-00307) illustrates noise for route section West Ruislip to Amersham without additional mitigation. Map No. 1A-M (Drawing HS2-BZT-00-DR-SU-00304) illustrates noise for route section Old Oak Common to West Ruislip including additional mitigation. Map No. 2A-M (Drawing HST-BZT-00-DR-SU-00308) illustrates noise for route section West Ruislip to Amersham with additional mitigation.

The results shown by these maps for the Hillingdon borough area are discussed below.

AoS results for Hillingdon area without mitigation

Map 1A shows the AoS residential noise appraisal without mitigation for the HS2 route section from the eastern boundary of Hillingdon borough to West Ruislip. Map 2A shows the corresponding AoS noise appraisal for the HS2 route section from West Ruislip to the western boundary of Hillingdon borough.

Map 1A identifies a preliminary candidate area for noise mitigation extending the whole of the HS2 route corridor from the eastern side of Hillingdon borough to just to the west of Breakspear Road South. Three areas are shown in red in map 1A to represent areas in which dwellings will potentially experience “high noise levels” (as defined in AoS). These red areas are situated adjacent to West Ruislip station, Blenheim Crescent, and Bridgewater Road. A series of areas are shown in orange in map 1A to represent areas in which dwellings will potentially be eligible for noise insulation. These orange areas extend over most of the route length between Great Central Avenue in South Ruislip to Breakspear Road South. Map 1A also shows a large number of areas marked in grey to represent areas in which dwellings will potentially experience a “noticeable noise increase” (as defined in AoS).

Map 2A identifies a preliminary candidate area for noise mitigation extending the whole of the HS2 route corridor from the western side of Hillingdon borough to Harvil Road. Map 2A shows a large number of grey areas marked in grey to represent areas in which dwellings will potentially experience a “noticeable noise increase” (as defined in AoS). These grey areas are situated at areas in which dwellings are located in South Harefield, where existing rail noise may be absent, in the region of Broadwater Lane, Moorhall Road and Harvil Road. In addition, a grey area is shown at Dewes Farm situated off Harvil Road adjacent to Hillingdon Outdoor Activities Centre.

As mentioned, Hillingdon has commissioned Southdowns Environmental Consultants (SEC) to carry out noise predictions. The SEC noise predictions covered the HS2 route section from the eastern boundary of Hillingdon borough to the western end of the Greenway in Ruislip. The SEC noise predictions did not cover the HS2 route section west of the western end of the Greenway, and consequently did not cover the HS2 route section containing the Colne valley viaduct. The SEC noise predictions are discussed below.

SEC have carried out $L_{Aeq,18hr}$ noise predictions (without mitigation) for the red “high noise level” (as defined in AoS) area shown in AoS map 1A adjacent to West Ruislip station (where Blenheim Care Home is situated). The SEC noise predictions suggest that the red area shown in AoS map 1A adjacent to West Ruislip station could be in error. Conversely, the SEC noise predictions suggest that there may be a red “high noise level” (as defined in AoS) area missing in AoS map 1A at the western end of Herlwyn Avenue. The absence of a red “high noise level” area at the western end of Herlwyn Avenue in AoS map 1A seems surprising since that area is one of three areas identified in map 1A-M relating to noise levels with additional indicative mitigation as an area in which dwellings are potentially eligible for noise insulation.

The SEC noise predictions (without mitigation) show large $L_{Aeq,18hr}$ noise increases at the red “high noise level” (as defined in AoS) areas identified in AoS map 1A at

Blenheim Crescent and Bridgewater Road. Thus, the SEC noise predictions show $L_{Aeq,18hr}$ noise increases of 15 dB at a dwelling in Blenheim Crescent, and 14 dB at a dwelling in Bridgewater Road. These noise increases would represent a “severe” noise impact based on the semantic descriptors given in the draft guidelines produced by the Institute of Environmental Management and Assessment (IEMA).

The SEC noise predictions (without mitigation) show large $L_{Aeq,18hr}$ noise increases at some of the orange “noise insulation” areas identified in AoS map 1A. For example, the SEC noise predictions show $L_{Aeq,18hr}$ noise increases at worst-affected dwellings of 15 dB in Herlwyn Avenue, 12 dB in Lawn Close, 13 dB in Almond Close and 10 dB in Roundways. These noise increases would represent a “severe” noise impact based on the IEMA draft guidelines.

The SEC noise predictions (without mitigation) show large $L_{Aeq,18hr}$ noise increases at some of the grey “noticeable noise increase” (as defined in AoS) areas identified in AoS map 1A. Thus, the SEC noise predictions show $L_{Aeq,18hr}$ noise increases at worst-affected dwellings of 7 dB in Herlwyn Avenue, 5 dB in Crosier Way, 6 dB in Roxburn Way, and 7 dB in Tedder Close. These noise increases would represent a “substantial” noise impact based on the IEMA draft guidelines. The SEC $L_{Aeq,18hr}$ noise predictions show noise increases at worst-affected dwellings of 10 dB in Berkeley Close, 13 dB in Dartmouth Road, 12 dB in Portal Close, 11 dB in West End Road, and 11 dB in Trenchard Avenue. These noise increases would represent a “severe” noise impact based on the IEMA draft guidelines.

We regard the above noise increases (without mitigation) for HS2 Phase 1 as representing significant adverse noise impacts because they are caused by an increased number of train pass-by noise events resulting from the introduction of HS2 trains. Many of the noise increases would represent “substantial” or “severe” noise impacts based on the draft guidelines produced by the Institute of Environmental Management and Assessment.

<u>AoS results for Hillingdon area with mitigation</u>

Map 1A-M shows the AoS noise appraisal with mitigation for the HS2 route section from the eastern boundary of Hillingdon borough to West Ruislip. Map 2A-M shows the AoS noise appraisal with mitigation for the HS2 route section from West Ruislip to the western boundary of Hillingdon borough.

Map 1A-M shows three areas marked in orange as identified for noise insulation. These are situated in the region of Blenheim Crescent, Herlwyn Avenue and Bridgewater Road. All red and grey areas identified in map 1A in these areas have disappeared following the application of the noise mitigation. Map 2A-M shows a reduced number of grey areas compared with map 2A as a result of application of the noise mitigation.

The SEC noise predictions have been carried out with indicative mitigation in relation to the above mentioned HS2 route section from the eastern boundary of the borough to the western end of The Greenway. The SEC noise predictions have been carried out for Phase 1 (without northern Y-extension) and for Phase 2 (with northern Y-extension), whereas the corresponding residential noise appraisal presented in AoS map 1A-M relates only to Phase 1.

The SEC noise predictions for HS2 Phase 1 (with mitigation) identify a large number of dwellings with a “noticeable noise increase” (as defined in AoS) in grey areas not shown in map 1A-M. These dwellings are generally situated in the area around and between Ruislip Gardens station and South Ruislip station. The SEC noise predictions at these dwellings give noise increases (with mitigation) in the range 3 to 7 dB $L_{Aeq,18hr}$ with Phase 1. The SEC noise predictions give the corresponding $L_{Aeq,18hr}$ noise increases (with mitigation) at these same dwellings as being in the range 4 to 8 dB for Phase 2. These larger noise increases are caused by the higher $L_{Aeq,18hr}$ noise levels with Phase 2 than with Phase 1 resulting from the increased number of HS2 trains passing through Hillingdon borough.

The higher $L_{Aeq,18hr}$ noise levels associated with HS2 Phase 2 (with mitigation) also result in a “noticeable noise increase” (as defined in AoS) compared with existing noise levels at dwellings which would not experience noticeable noise increases with HS2 Phase 1. As a consequence, the SEC noise predictions for Phase 2 (with mitigation) identify a large number of dwellings experiencing a “noticeable noise increase” (as defined in AoS) additional to those mentioned above. These dwellings are generally situated in the area around and between West Ruislip station and South Ruislip station. The SEC noise predictions at these dwellings give $L_{Aeq,18hr}$ noise increases (with mitigation) in the range 3 to 5 dB with Phase 2.

We regard the above noise increases (with mitigation) for Phase 1 and for Phase 2 as representing significant adverse noise impacts because they are caused by an increased number of train pass-by noise events resulting from the introduction of HS2 trains. Many of the noise increases would represent “moderate” or “substantial” noise impacts based on the draft guidelines produced by the Institute of Environmental Management and Assessment.

7. Noise policy

Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published by Defra in March 2010. It sets out the Government’s long term vision on noise policy, and is stated to apply to all forms of environmental noise including transportation noise. The stated vision is to *“Promote good health and a quality of life through the effective management of noise within the context of Government policy on sustainable development.”* The stated aims are *“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: avoid significant adverse impacts on health and quality of life; mitigate and minimise adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life”.*
The statement explicitly recognises that noise exposure can cause annoyance and sleep disturbance both of which impact on quality of life. It also notes that many experts agree that annoyance and sleep disturbance can give rise to adverse health effects. We are doubtful that the vision and aims of the NPSE have been fully considered in relation to the proposed HS2 railway.

Environmental Noise Directive

The Environmental Noise (England) Regulations 2006 (as amended) transpose into UK law European Directive 2002/49/EC. The directive relates to the Assessment and Management of Environmental Noise, and is commonly referred to as the Environmental Noise Directive. The stated aim of the Directive is to "*avoid, prevent and reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise."* The term "environmental noise" is defined as including noise emitted by transport, such as rail traffic. Under the directive, Member States are required to adopt noise action plans based on noise-mapping results with a view to *"preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserve environmental noise quality where it is good."*

There is a general obligation under the directive to prevent and reduce environmental noise, and to protect environmental noise quality where it is good. We are doubtful that the proposed HS2 railway can be considered to further this aim because of the increases in railway noise that it will cause.

8. Conclusions

The quantitative assessment of noise and vibration impacts contained in the AoS is limited to the calculation of train operational noise levels as expressed using the $L_{Aeq,18hr}$ noise indicator. The assessment is restricted to determining the number of dwellings which may experience an exceedance of three thresholds defined in the AoS for "high noise levels", noise insulation and "noticeable noise increase" during the 18 hours daytime period 06:00 to 24:00 hrs. The noise assessment is strategic and not sufficiently detailed.

Notable omissions in the AoS and hence in the identification of noise impacts include the absence of any quantitative assessment of: the magnitude of railway noise increases; peak noise levels during pass-by of trains; night-time noise impacts at dwellings (during the conventional 8-hours night period 23:00 to 07:00 hrs when 66 to 90 train movements will run between 23:00 and 24:00 hrs, and 05:00 to 07:00 hrs); and train airborne noise impacts at non-residential receptors such as community, education, healthcare and outdoor recreational facilities. Other omissions concern other potential sources of adverse noise and vibration impacts at both residential and non-residential receptors: ground-borne noise and vibration from surface running of HS2 trains; tunnel portal boom effects; noise from line-side and other fixed plant and equipment; and construction noise and vibration.

There are a number of uncertainties in the predictions of $L_{Aeq,18hr}$ noise levels used in the AoS noise assessment, and no detailed assessment has been made of baseline noise levels. Other uncertainties in the AoS noise predictions include: the assumed reduction of 3 dB in future HS2 train noise source levels; actual railway track quality which affects noise levels; line-side noise barrier performance and source heights of train mechanical equipment and aerodynamic noise; and practicality of installing noise barriers of the required height and at the required locations. The noise criteria and assumptions incorporated into the AoS noise prediction model represent a significant project risk in the event that significant noise effects have been underestimated and engineering alignment options are constrained to the published alignment. Options for

additional mitigation would then be limited to the installation of higher noise barriers, or long term speed restrictions.

Notwithstanding the above limitations, a high number of daytime noise impacts at dwellings in terms of noticeable noise increases (as defined in AoS) is presented in the AoS with additional mitigation (6,600 and 4,700 for with/without northern Y-extension). The scenario with additional mitigation is based on an anticipated 3 dB reduction in future high-speed train source noise levels, which may or may or not materialise. The predicted number of dwellings given in the AoS with noticeable noise increases (as defined in AoS) with additional mitigation represents an approximate 5-fold decrease compared with the scenario without additional mitigation (33,600/24,300 for with/without northern extension).

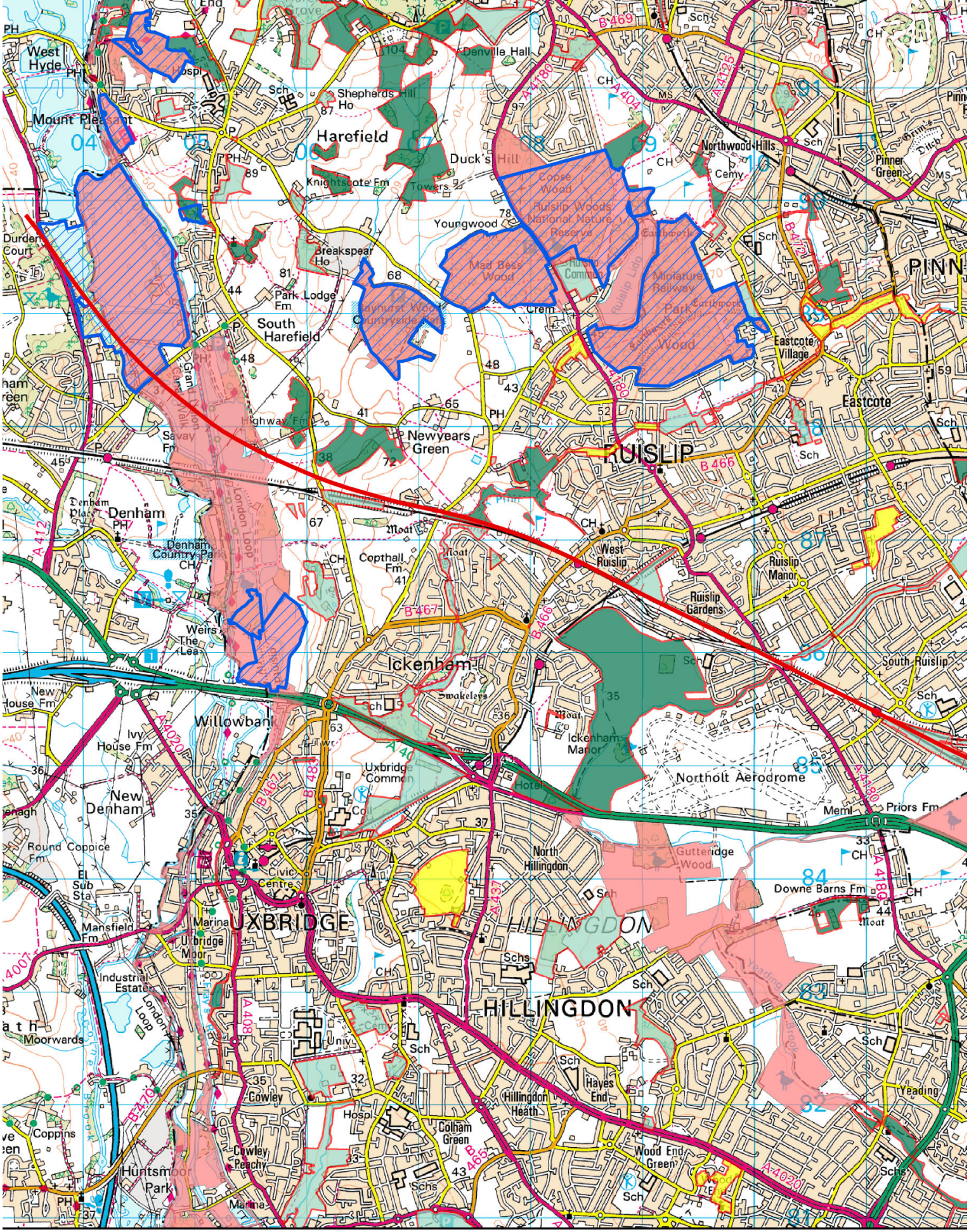
However, the residual magnitudes of noise impact have not been defined with respect to any noise changes above 3 dB, i.e. the difference in ambient noise levels with and without HS2 railway. The AoS presentation of noise impacts based on a noise change of 3 dB or more makes no distinction between noise impacts if higher noise level increases above this threshold of noise change. Substantial noise increases of 10 dB or more, which could occur at levels below the absolute threshold for insulation, cannot therefore be differentiated in the AoS. It is thus not possible to determine the significance of the numbers of noise impacts presented in the AoS and hence whether these represent a tolerable level of impact in the context of major infrastructure projects and sustainability.

In a project of this importance, it would not be unreasonable to expect that all noise and vibration issues would be examined in great detail. The reason for this is that the consultation stage is a primary decision point. It is at this stage that the decision will be made to progress this project and to expect this to be done without all required information would be remiss. Equally it is at this stage that the only effective consultation with potentially affected people will take place. Such a consultation cannot be informed if all information is not available. We believe that the AoS does not form an adequate basis for making a decision on the noise and vibration impacts for a major infrastructure project of this importance.

Appendix 7: Photograph of Mid Colne Valley Landscape


Horse And Barge
Moorhall Rd
Patrons Way E
N Orbital Rd
Beech Close
Bosch Way
Link Way
Savay Ln
Moorfield Rd
Savay Close
Denham Green
Denham Rail
Denham Garden Village
Denham Country Park
The Swan Inn
Village Rd
Harvil Rd
New Years Green Ln
Hillingdon Outdoor Activities Centre
Skip Ln

Appendix 8: Hillingdon Sites of Important Nature Conservation



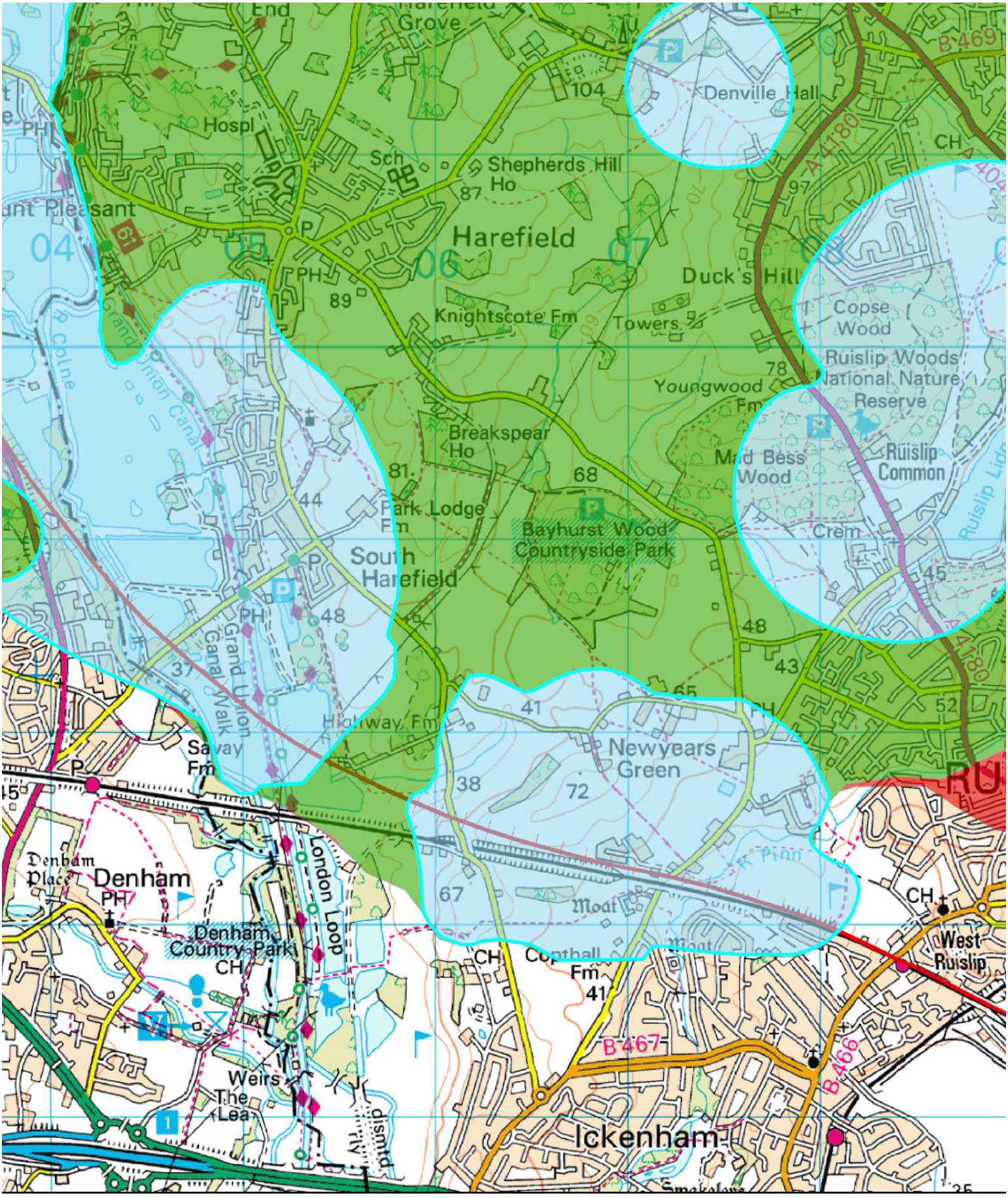
Legend

- HS2 Proposed Route
- Site of Special Scientific Interest
- SINCS Metropolitan
- SINCS Grade 1
- SINCS Grade 2
- SINCS Local

Sites of Important Nature Conservation

Appendix 9: Flood Risk in Hillingdon

Appendix 10: Groundwater Protection Areas in Hillingdon



Legend

Source Protection Zones

All

Reference

- Spz 1
- Spz 2
- Spz 3
- HS2 Proposed Route