Heathrow Expansion DCO Consultation Response

Air quality

September 2019

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1. Overview

1.1 This paper sets out the response of TfL on air quality to the statutory consultation by Heathrow Airport Limited (HAL) on its expansion proposals.

1.2 HAL's air quality assessments (despite already showing an exceedence that would result in refusal of a DCO application) are inadequate and risk seriously understating the impacts of the expansion proposals as they are based on a flawed approach to surface access, an abnormal and optimistic model verification process and a distinct lack of detail around the model inputs.

1.3 The NPS found that if a third runway opens at Heathrow before 2030 as planned, there would be a high risk of non-compliance with legal limits for air pollution, HAL's own preliminary assessment shows not only that there would be widespread worsening of air quality but also that there will be at least one exceedence of legal limits caused by traffic associated Heathrow expansion.

1.4 TfL's review of the material presented suggest that the air quality impacts of an expanded Heathrow are likely to be significantly under predicted, which could result in a corresponding additional detrimental impact on Londoners' health, and risks misleading those whose role it is to scrutinise and evaluate the proposals.

1.5 The Mayor and TfL are implementing a range of measures to reduce London's toxic air, including ULEZ and the T-charge, It is not acceptable for HAL to seek to bank these reduction in air pollution – designed to improve the health of Londoners – and instead use the headroom to enable its expansion and a widespread increase in emissions.

1.6 It is important to recognise that the air quality impacts arising from the proposals are to a large extent dependent on the road traffic impacts modelled by the applicant. These are used to estimate pollutant emissions from road traffic, which are then used in the air pollution dispersion model. There are a number of concerns over the robustness of this modelling, including the lack of evidence underpinning key assumptions and the quality of the road traffic modelling which, at this stage, is not fit for purpose nor compliant with DfT WebTAG criteria. This means that the air quality impacts presented by the applicant could be underestimated.

1.7 There is also concern that the model verification process is insufficiently robust. This

process entails comparing modelled pollutant concentrations due to road traffic emissions against the available monitoring data for the current baseline scenario - and adjusting model outputs where necessary. The adjustment factor for NO_x is unusually high, whilst, for PM_{10}, no adjustment has been applied to modelled concentrations (despite substantial variations at some sites). Furthermore, we also have concerns about the way background pollutant concentrations have been taken into account. This casts doubt on the validity of forecast NO_2 and PM_{10} concentrations and the air quality impacts of the proposals.

1.8 There is a lack of clarity around other key dispersion model input data, such as reduced vehicle speeds near junctions, the use of diurnal profiles for traffic flows and sensitivity tests using amended vehicle exhaust NO_x emissions. This raises further concerns about the validity of the presented air quality impacts.

1.9 The presentation of the results is deficient and prevents us fully reviewing the impacts of the scheme on air quality. It is not possible to understand the overall "quantum of impact" and the extent to which HAL is expecting to include others' improvements to air quality from initiatives to reduce air pollution and improve public health across London.

1.10 There are a number of other important issues around the years of assessment, the construction impacts, health impacts, and the way compliance with the NO_2 annual mean limit value has been assessed, that will need to be addressed.

1.11 As a result of the above, TfL does not consider that HAL has complied with its duty to provide information which is reasonably required to develop an informed view of the likely significant environmental effects (as per Regulation 12 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017). TfL would, therefore, expect HAL to formally consult on adequate air quality assessments once these are produced.

2. Scale of air quality issues around Heathrow

2.1 It will be paramount to address the concerns mentioned above given the state of air quality around the airport and the main access roads. As mentioned in the Preliminary Environmental Information Report (PEIR), the road network affected by the proposals includes many roads within Air Quality Management Areas (AQMAs) declared by local authorities over the years, due to continuous breaches of the NO_2 annual mean air quality objective of 40µg/m^3. The airport itself lies within the Hillingdon AQMA, whilst key access roads are part of AQMAs surrounding the airport, such as those declared by Slough (M4 motorway, A4 London Road), Runnymede (M25), Hounslow and Spelthorne (the whole borough).

2.2 As part of the London Local Air Quality Management system, the GLA also identified Air Quality Focus Areas to better target air pollution hotspots within London

boroughs and support their air quality action plans, based on detailed dispersion modelling and areas of high population exposure. A number of these Focus Areas lie within the area affected by the proposals, including the Heathrow Area, part of the M4, Feltham High Street (A244), key junctions along the Great West Road (A4), West Drayton/Yiewsley and Hayes North Hyde Road (A437).

2.3 The NO_2 annual mean EU limit value of 40µg/m^3 is still currently exceeded on most of the key airport access corridors within these AQMAs and/or Focus Areas, as illustrated by London-wide dispersion modelling carried out by the GLA as part of the latest London Atmospheric Emissions Inventory (LAEI 2016). Moreover, projections modelled for the London Environment Strategy published in 2018 show that the NO_2 annual mean limit value is still likely to be exceeded along a number of these roads by 2025, such as the M25, the M4, and A30 Great South-West Road.

2.4 This illustrates the extent of the air quality issues around the airport, and shows that much more needs to be done even with the Mayor's bold initiatives to tackle air pollution across London.

2.5 Indeed, the High Court judgment on the challenge to the Airports NPS affirmed that the legal obligations on air quality "drew the reddest of red lines"[1].

3. Surface access underpinning

3.1 Inherent to the air quality impact assessment is the underlying surface access and specifically the highway modelling. These are reviewed in TfL's Surface access response, which raises multiple concerns about how the highway modelling has been undertaken and the assumptions that have been made, in particular about the volume of road traffic.

3.2 Any significant changes to the highway model outputs will have a direct impact on the air quality assessment along the main access roads and around the airport and could also affect the area over which impacts are assessed. This is because estimates of road transport emissions are directly linked to key transport model outputs, such as the total vehicle flows and average vehicle speeds on each modelled road.

3.3 Moreover, the screening of roads, used to determine the "affected road network" where air quality impacts are more likely, is based on a strict comparison of transport scenario model outputs - i.e. with and without expansion. Any change to these outputs could lead to additional roads (currently not included in the air quality assessment) needing to be considered in the air quality modelling as well. It is therefore important that any final air quality impacts assessment is based on an agreed and credible set of surface access proposals and resulting traffic scenarios – which we remain some way away from.

[1] [2019] EWHC 1070 (Admin), Judgment, 265

3.4 Beyond these critical surface access issues, the rest of this document sets out our other main concerns with regard to the assessment of the air quality impacts.

4. Model performance issues

Nitrogen Oxides (NO_x) modelling

4.1 It is recognised that a detailed model has been built to enable the dispersion of future emissions from both airport and road traffic sources to be modelled, in order to estimate the impacts of the scheme on air quality. However, when bringing this information together and then comparing the results of the model predictions against local air pollution monitoring data, a large and systematic model under-prediction has been determined for road transport sources. As a result, for the dispersion modelling of road traffic emissions, model outputs (ground level air pollutant concentrations, in $\mu g/m^3$) have been adjusted to be in line with existing monitoring data. Whilst this model verification and subsequent adjustment is common place in air quality assessments – due to the uncertainty associated to model input data, such as road traffic flows, vehicle fleet compositions, average speeds, emissions factors or meteorological conditions affecting the dispersion of pollutants – the dispersion model outputs in this instance were corrected by a factor of nearly 4. This means that the road traffic NO_x contribution predicted by the model has been multiplied by this correction factor, before then being used to estimate the total ground level concentration of NO_2. The adjustment factor used would be considered improperly high for a credible assessment of a proposal of this magnitude.

4.2 In order to derive this factor, the measured road-NO_x has been derived from total monitored NO_x concentrations by subtracting various non-transport related components. However, these components are based on modelled contributions, namely aircraft, car parks and the Lakeside Waste Management facility emissions, alongside an estimate of other background contributions. This means that this estimate of the measured road-NO_x is in fact dependent on unverified modelled outputs. As a result, the comparison of modelled and monitored road-NO_x contribution is partly dependent on other modelled outputs, which could affect the overall road-NO_x adjustment factor. Again, whilst the generally professional approach taken by the technical modellers is recognised, the inputs that they have used suffer from several major limitations that are likely to mean, collectively, that there is a large uncertainty associated with the current forecasts. Given the absolute criticality of limit value thresholds to the ability of the proposals to meet legal air quality requirements, it is important that these shortcomings are addressed if there is to be sufficient certainty around the air quality impacts of the proposals.

4.3 Moreover, the dispersion model does not include all emission sources through direct input. For example, emissions of NO_x from domestic heating plant or use of non-road mobile machinery are not estimated through specific activity data but via the Defra background air pollution maps (provided at a $1 km^2$ resolution). The method involves

the removal of specific emission contributions (which have not been modelled) from these background maps. So, for example, within the core model area, the air quality consultants have modelled the dispersion of airport-related activity and road traffic emissions – based on their surface access model, which, it must be noted, is not the same as the model used by Defra to determine its background concentration maps. HAL has therefore subtracted the contribution that the Defra background maps estimate to be from airport and road traffic, to get the contribution from all remaining, non-explicitly modelled emission sources. However, no verification of this component has been undertaken and it is not known how it compares to potential monitored background air pollutant concentrations across the modelled area.

4.4 Given that a high adjustment factor has been required for road-NO_x, the performance of the dispersion model at background monitoring sites should be explicitly demonstrated, in order to confirm that the background concentrations used in the model are not being underestimated. The relative impacts of the scheme will change depending both on background pollutant concentrations (this could lead to overall higher predicted pollutant concentrations) and on the adjustment of road traffic emission contributions. In addition, the relative contributions of airport-related emissions may change, which means the impacts of the airport may be somewhat different than those presented, depending on the proximity of sensitive receptors to the airport.

4.5 Information in the Preliminary Environment Information Report (PEIR) suggests that model performance may vary for different road types, such as motorways, compared to more local roads. However, a single adjustment factor across the whole model area has been applied. Justification for using a single factor should be provided, as opposed to using zonal (i.e. multiple) adjustment factors depending on the road type/environment, and the likely impact of this approach on the reliability of the forecast road concentrations assessed.

4.6 Further detailed information should be provided to support the model verification. It is essential that source apportionment data is provided for each verification point in order to understand the relative contributions, and the effect that model adjustment has on these. This could include the contribution of emissions due to aircraft Landing and Take-Off (LTO) cycles, airside vehicles and equipment (Auxiliary Power Units - APU/Ground Support Equipment - GSE), and landside road traffic (split to airport, non-airport, and construction-related traffic). It would be helpful if these data were tabulated in full both pre and post adjustment.

Particulate matter (PM_{10}) modelling

4.7 As opposed to NO_x modelled output, PM_{10} modelled concentrations have not been adjusted, despite a comparison with 12 PM_{10} monitoring sites. The reason stated is that it was not deemed necessary, since there seemed to be a good agreement between modelled and monitored concentrations at a number of these monitoring

sites. However, this conclusion was reached after having discarded nearly half of the monitoring sites (5 exactly) where the model significantly under-predicted concentrations, by nearly a factor of 2. Although the PEIR attempts to explain the reasons for such results at each of these monitoring sites (including some sites which are largely under-predicting by a factor of about 15), it looks like the reasons stated are speculative (e.g. unknown local sources that cannot be included in the model). As a result, there is a significant concern about a potential lack of robustness and high uncertainty in modelled PM_{10} concentrations and associated impacts.

4.8 Uncertainty and robustness in relation to PM_{10} would also have a potential impact on $PM_{2.5}$ modelling. Whilst a limited number of monitoring sites for $PM_{2.5}$ are available, the lack of verification for PM_{10} raises concerns for the $PM_{2.5}$ modelling, with a risk that $PM_{2.5}$ concentrations could be significantly under-predicted, which could then underestimate the results of the air quality impacts on health.

Model performance overall

4.9 For such a large-scale proposal having extensive and detailed air quality impacts, the nature of which are acknowledged as being absolutely critical to the UK's legal requirement to meet air quality limit values at the earliest possible time, and based on our review presented above, much more needs to be done to improve the model performance and the robustness of the assessed impacts.

5. Air pollutant dispersion model input data

5.1 There is concern on a number of points associated with the model input data for the dispersion modelling of road traffic emissions[2]. Emissions factors from road traffic are a function of average vehicle speed and incorrect speeds can lead to significant changes in road transport emissions. To account for road traffic congestion in the dispersion model, we note that the average vehicle speeds have been reduced near "junctions or other features that will slow traffic". This speed correction is common in road traffic air quality assessments. However, no information nor justification is given on how these reduced speeds have been estimated, which areas or road links these have been applied to, and what distance from junctions has been considered. We understand that all these assumptions have been based on "professional judgment". Further information must be provided to allow for a full review of traffic input data and understanding of their impact on vehicle emissions.

5.2 Highways England's recommendation to use observed vehicle speeds, and speed band categories as per IAN (Interim Advice Note) 185/15 guidance, have not been utilised either. This guidance acknowledges the issues around using vehicle speeds in air quality assessments based on route journey times, as these do not reflect speeds accurately on individual road links.

[2] PEIR Volume 3, Chapter 7, Section 4.2

5.3 Although the PEIR states that diurnal profiles have been used to account for changes in road traffic emissions across the day, and in particular around AM/PM/inter-peak hours, no information is given in relation to assumptions. It is unclear how diurnal profiles were derived (for example from which roads). It is likely that diurnal profiles were only provided for a small portion of the affected road network considered in the air quality assessment, and therefore, somehow, those roads for which no diurnal profile was available have been allocated a profile from another nearby or similar road. This information should have been provided, in particular the methodology to allocate diurnal profiles to road links where no such information was available.

5.4 There has been no sensitivity test carried out to determine the potential impact of vehicle speed diurnal pattern on road traffic emissions, as it looks like speeds have been assumed constant across the day.

5.5 It is acknowledged that sensitivity tests on road traffic emissions have been done using the CURED (Calculator Using Realistic Emissions for Diesels) model. However, using this model is less precautionary than Highways England's Interim Advice Note IAN 170/12 published approach. The potential for significant effects could therefore be underestimated. Moreover, although it is suggested that the CURED model has been peer reviewed, it is not clear whether it has been approved for use by Defra and/or Defra's consultants who manage the Emissions Factors Toolkit (EFT).

Based on all points raised above and without further, more detailed information being presented, there are concerns that road traffic emissions used in the dispersion model are not robust on parts of the affected road network, which would have an impact on modelled NO_x and PM concentration, and could affect the results of the air quality impact assessment. It is also not clear that where such outputs are used for the purposes of the environmental assessments, how HAL has shown that it has considered a reasonable worst case scenario as it is required to do.

6. Assessment years

6.1 Assessment has been undertaken for the years 2022, 2027 and 2035. However, the PEIR states that all years between 2022 and 2035 will be modelled. This is essential for both the air quality impacts at receptors, and in relation to Defra's Pollution Climate Mapping (PCM) model links (which is one element of assessing the air quality obligations) as it will important to be able to understand where and what the impacts are in each year particularly in relation to phasing of the scheme (both in terms of construction and operation).

6.2 As stated previously, the surface access modelling including road traffic is an essential input to the air quality modelling. However, it is unclear as to how the traffic data, including construction traffic, is to be represented each year, especially as the surface access chapters seems to indicate that traffic data is to be interpolated between 2022 and 2030 – but this is unlikely to represent the maximum phasing

impacts around 2024/2025 and 2026. Again, therefore, HAL has not provided any evidence they have undertaken a worst case scenario assessment.

6.3 The air quality assessment used three base year models (2015, 2016 and 2017) but it is unclear if the traffic models for each of these years are validated or are forecasts from another year.

6.4 TfL would note that the requirement for bringing nitrogen dioxide air pollution within statutory limits is a requirement to do so in the shortest possible time. The years of assessment are, therefore, important in the context of demonstrating air quality obligations, particularly because Defra has determined that London will become compliant with air quality limit values in 2025, but also to understand how compliance at different receptors changes.

6.5 The PEIR states that beyond 2030, emissions and modelling of road traffic and background concentrations remains the same, as projections for beyond these years are not available. This raises concerns that Defra has not provided suitable tools for the air quality assessment and this should be addressed.

7. Construction impacts

7.1 The dispersion modelling for year 2022 included additional construction road traffic forecast on the affected road network. However, for other years, such additional traffic has not been included, although it is stated that the Environmental Statement will include it as well. It will be important to be able to separate the impact of construction road traffic from other additional traffic due to the airport expansion on the affected road network, to fully be able to separate the impacts of construction from those from the operation of the scheme. Without this, it is clear TfL and other parties have not been provided with information reasonably required to understand the likely significant impacts of the expansion proposals.

7.2 In the draft Code of Construction Practice (CoCP), it is stated that the trigger level for automatic PM_{10} monitoring will be 250µg/m^3. However, the latest IAQM monitoring guidance recommends a lower Site Action Level of 190µg/m^3, measured as a 1-hour mean, which is based on the latest research. This lower trigger level should be considered and added to the final CoCP.

8. Description of results

8.1 Air quality results are provided for a few selected receptors in different areas. The results figures show that there are multiple receptors where concentrations have not been predicted including in areas where the scheme worsens air quality, but these do not appear to be accounted for even though there are potentially significant effects due to the scheme.

8.2 This is perhaps partly a function of the very large areas of impacts of the scheme

which is acknowledged to affect hundreds of thousands of Londoners, but more detailed maps of results should be provided for better clarity.

8.3 Receptor locations are acknowledged to reflect only the general location of a building and that distance from the road is not representative. Air quality impacts vary considerably with distance, being greatest closest to roads. We are therefore concerned that the air pollutant concentrations at the façade of properties along the affected road network may be under-predicted.

8.4 As currently reported, we are unable to fully review the impacts of the scheme on air quality. A major omission is a simple table comparing both emissions and concentrations across the whole of the Greater London area with and without expansion for a selection of future dates. This would allow the overall "quantum of impact" of the proposals to be appreciated, and the extent to which they negate improvements to air quality from initiatives such as the Mayor's Ultra Low Emission Zone proposals. These other improvements are not there to facilitate the expansion of Heathrow in terms of giving it headroom to meet air quality limit values – they are there to improve the health of Londoners. Any proposals that add to this burden – irrespective of the legal limit values – will therefore frustrate and delay this wider objective. Such transparency for the "total impact of the proposals" is therefore vital if they are to be properly judged in the wider policy and public health context.

8.5 Aside from results in terms of ground level concentrations, no emissions from different sources have been provided. These should be provided for the different modelled sources of pollution, and should cover all years of the assessment, through to 2050. This is required as NO_x and PM emissions are important contributors to regional air quality and climate change impacts.

8.6 Due to the vast amount of information that local people and experts will be expected to scrutinise, including multiple document links and cross-cutting themes, which in some cases affect the same sensitive receptors (for example, populations affected by both noise and air quality impacts), a results portal should be provided by HAL to facilitate future reviews.

9. Assessment of compliance with NO_2 EU limit value

9.1 Although we understand the need to follow Defra's methodology to assess compliance with the NO_2 annual mean EU limit value of 40µg/m^3, it is stated that the conversion method used in that assessment to estimate NO_2 concentration from modelled NO_x concentrations is not the same as the one used to assess the scheme against the Air Quality Strategy objectives on the whole affected road network. There is a concern in relation to how the difference in methodology to estimate NO_2 concentration from NO_x concentrations can affect overall conclusions with regards to NO_2 impacts. For example, if the NO_x/NO_2 conversion method used in the assessment of compliance with EU limit values produces higher annual mean NO_2

concentrations, this method could have been used in the rest of the assessment to be conservative. This is not discussed in the PEIR.

9.2 Based on the impact on the PCM road links in accordance with Highways England's IAN 175/13, this would trigger the need for an Air Quality Action Plan, given that the project results in an overall increase in concentrations on roads that exceed 40µg/m^3. It is unclear what the justification is for not trying to mitigate the impacts.

9.1 It would be helpful if Figure 7.2 (Volume 2 PEIR Chapter 7) could include the full PCM road links considered in the assessment, not just point locations, to enable a better understanding of the geographical area assessed as part of the assessment of compliance with NO_2 EU limit values.

9.2 All years between 2022 and 2030 should be assessed in terms of compliance with the NO_2 annual mean EU limit value. This will enable detailed consideration of impacts in and around 2025, in addition to understanding the impacts of airport expansion on local compliance issues, such as delays in achieving compliance within the core area.

10. Health Impacts

10.1 It is not clear why the Greater London local authorities outside of the extent of the air quality model have been assessed in the health impact assessment, as there would be no modelled air quality effects in these areas. Including these areas in the health impact assessment would be expected to reduce the population weighted change in concentrations, as impacts would be diluted across a greater population by including areas outside of the air quality model where no air quality impacts have been determined. Using such an approach is likely to have underestimated the health-associated air quality effects.

10.2 The risk coefficients used are in line with Defra's "Impact Pathways Approach" guidance (2019), although it is noted that the NO_2 coefficient has not been reduced to account for confounding effects of PM. Furthermore, PM mortality coefficients are likely to be overestimated, as they do not account for potential confounding effects of other associated pollutants, as per Defra's guidance. Defra's (2019) advice is that "Analysts should clearly acknowledge this limitation and examine its potential effect on results through sensitivity analysis." It is, however, noted that the mortality calculations from air pollution have been based on NO_2 coefficient alone in order to account for confounding effects associated with mortality.

10.3 Data corresponding with total hospital admissions per resident have been used for the health impact assessment. Hospital admissions data should be specific to respiratory admissions and cardiovascular admissions when applying the risk coefficients associated with those effects. If this is not the case then this should be clearly stated as a limitation to the assessment, along with the potential implications

of this assumption.

10.4 The health outcome results table presents the DCO Project-related change as a percentage increase. It is not known what these values represent in terms of additional number of deaths or cardiovascular/respiratory hospital admissions due to the Project. It is also noted that the change in life years lost associated with the Project is not quantified or presented.

10.5 It is unclear what criterion has been used to define the significance of the health effects. Paragraph 12.10.526 states that the vulnerable group effects range between not significant and significant.