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Gatwick Northern Runway Project: Air Quality Written Representation Deadline 4

Client: CAGNE

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Contents

1. Introduction

1.1. Air Pollution Services (APS) has been commissioned by CAGNE (the 'Client') to review the air quality assessment undertaken by the Applicant for the Gatwick Northern Runway Project (herein the 'Proposed Development').

1.2. APS previously produced a "*Technical Note: Gatwick Northern Runway Project: Critical Review of Air Quality Assessment*" and attended virtually the Issue Specific Hearing (ISH) on Air Quality held on 1 May 2024.

1.3. This note provides clarification on the issues raised at the ISH and provides further representations on other air quality issues.

1.4. The following documents have been reviewed:

1. 5.1 Environmental Statement (ES) Chapter 13 Air Quality, version 1;
2. 5.2 Environmental Statement Air Quality Figures (Parts 1 to 5);
3. 5.3 Appendices to the ES Chapter (13.2.1, 13.3.1, 13.3.2, 13.4.1, 13.6.1, 13.8.1, 13.9.1 (Parts 1 to 6), 13.9.2;
4. 5.1 Environmental Statement (ES) Air Quality, version 2 (tracked); and
5. REP3-083 Gatwick Airport Limited Deadline 3 Submission - 10.16 The Applicant's Response to the ExA's Written Questions (ExQ1) - Air Quality.

1.5. In addition, the Applicants' ADMS-Urban model files (limited to those provided) have been reviewed to understand what appears, from the written evidence provided by the Applicant, to be a poorly performing model, in particular the road transport dispersion modelling study.

1.6. It is useful to understand the *context* of the Applicant's assessment of likely significant effects. In reaching their professional judgement, the Applicant has relied on the impact descriptors set out in Table 6.3 of the Environmental Protection UK/Institute of Air Quality Management (EPUK/IAQM) guidance (EPUK/IAQM, 2017). This requires:

- Dispersion modelling to predict pollutant concentrations; and
- Air quality assessment levels (AQALs).

1.7. Therefore, consideration needs to be given to both the confidence in predicting the pollutant concentrations (this is discussed in Section 2 of this report) and the appropriateness of the AQALs in Table 6.3 of the guidance (this is discussed in Section 3 of this report).

1.8. The other issues addressed in this report are:

- the health assessment; and
- the ultra-fine particles (UFP) assessment.

1.9. Questions for the Applicant, which we believe would be beneficial for the Examining Authority (ExA) to have a response to are in red text.

1.10. The assumption is the reader has a reasonable understanding of the terms and abbreviations used in the air quality assessment to avoid the need to detail them all here.

1.11. This document has been produced by Kieran Laxen and Dr Claire Holman. Claire has over 40 years' experience of working across the air quality spectrum including on major developments such as for airports, ports and industry. Claire is currently the honorary President of the IAQM.

1.12. Kieran has about 16 years' experience. He is a recognised expert on air quality and meteorological modelling. He is leading the production of professional guidance on dispersion modelling and he is responsible for APS's meteorological services including the production of numerical weather prediction (NWP) data which is increasingly being used in dispersion models due to the sparse network of observational stations.

Proportionality in Air Quality Assessments

1.13. With regards to the air quality assessment, the Applicant has made reference to proportionality on a number of occasions and in places used it to justify the modelling approaches taken. Therefore, it is important to confirm what proportional means in this context. For avoidance of doubt, proportionality is not a justification for not following good modelling and assessment practice. Proportionality in Environmental Impact Assessments (EIAs) and for air quality assessments is discussed below.

1.14. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') are derived from Directive 2014/52/EU of the European Parliament and of the Council dated 16 April 2014. This requires an environmental assessment to be proportionate and this remains relevant to EIAs conducted post Brexit.

1.15. The principle of proportionality is laid down in Article 5(4) of the Treaty on European Union. It seeks to set actions taken by European Union (EU) institutions within specified bounds. Under this principle, EU measures:

- must be suitable to achieve the desired end;
- must be necessary to achieve the desired end; and
- must not impose a burden on the individual that is excessive in relation to the objective sought to be achieved (proportionality in the narrow sense).

1.16. When determining the 'proportionality' of an air quality assessment (AQA) consideration needs to be given to a range of factors such as the extent of the study area, the spatial and temporal resolution of any models used and the degree of complexity of the models used.

1.17. Air pollutant concentrations depend, primarily, on the rate of emission, physical processes that affect the dilution of the emissions once in the atmosphere, and chemical process which form new pollutants. The meteorological conditions influence both types of process.

1.18. Most AQAs, which rely on dispersion modelling for road or air emissions, use the Atmospheric Dispersion Modelling System (ADMS). The ADMS-Urban and ADMS-Airports used to assess the air quality impacts of the Proposed Development are short distance models (i.e. local models) that are useful for providing high spatial resolution of concentrations. Following good modelling practice ADMS can be effective at predicting annual mean concentrations.

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1.19. There are more complex models such as regional chemical transport models (RCTMs) which take a fuller account of atmospheric chemistry than local models. The chemistry, particularly the formation of pollutants such as $PM_{2.5}$, becomes more important over longer distances.

1.20. A local model can be nested within a RCTM. This approach would be recommended for a study spanning a large area which considers multiple pollutants. However, it is accepted that the use of a local scale model such as ADMS is likely to be proportionate for the magnitude of the scheme and has been used on developments at other airports in the UK.

1.21. The need for an assessment to be proportional should not, however, be confused with poor modelling approaches.

1.22. The Proposed Development is a major national infrastructure project with the study area extending 10s of km's from the airport. This is not a small project. We consider the use of a local model such as ADMS and good modelling practice is proportionate to the scale of the project. We are concerned that good modelling practice has not been used. This is discussed further in Section 2.

Summary

1.23. In summary:

- Consideration needs to be given to *both* the confidence in predicting the pollutant concentrations, which we consider to be in question based on the evidence provided (see Section 2), and the appropriateness of the Air Quality Assessment Levels (AQALs) used in Table 6.3 of the EPUK/IAQM guidance (see Section 3);
- The need for an assessment to be proportional should not be used as an excuse for poor modelling approaches (see Section 2); and
- If the Applicant had used relevant AQALs in the assessment, the outcome of the assessment is likely to, either:
  - change from insignificant to significant, with risks of an unacceptable burden on the local population; or
  - remain insignificant but correctly define the magnitude of risk and facilitate the appropriate level of mitigation (more than currently proposed) and the appropriate level of monitoring (more than currently proposed) to be specified.

1.24. One key implication of the Applicant's model underperforming is that the ExA cannot be sure that the mitigation provided is appropriate. The current assessment does not provide the ExA with evidence to determine whether the proposed mitigation and monitoring is sufficient.

2. Reliability of the Air Quality Modelling

Modelling Guidance

2.1. There is no official guidance on dispersion modelling (particularly modelling future scenarios) to support the planning system. The UK operates an open approach, expecting applicants to justify the use of the selected model and to document the implications of the approach adopted including its limitations.

2.2. There are, however, a series of useful document/guides which provide relevant recommendations including, but not limited to, Defra's Local Air Quality Management (LAQM) Technical Guidance 2022 (TG22), CERC's (the ADMS model developer) user guides and FAQs, recommendations presented at User Group meetings (e.g. CERC's User Groups and IAQM's DMUG conferences), Environment Agency recommendations and the Atmospheric Dispersion Modelling Liaison Committee's (ADMLC's) guidelines.

2.3. For airport emission sources, the International Civil Aviation Organisation's (ICAO's) Air Quality Manual provides approaches and recommendations, although again there is limited reference to modelling future air quality. The Department for Transport (DfT's) Project for the Sustainable Development of Heathrow (PSDH) report also provides a series of approaches to modelling which were considered good practice at the time of the reports (2006). IAQM are publishing good practice modelling guidance in the summer of 2024 and it is noted that this is not yet available.

2.4. The Applicant's reports suggest the guidance in TG22 has been used in the most part, particularly in relation to road traffic emissions.

2.5. TG22 is designed to support local authorities to undertake their duties under the Environment Act 1995 as amended by the Environment Act 2021, and subsequent regulations. It states that:

"The primary users will be technical officers within local authorities charged with air quality duties under the regulations cited above in England, Scotland, Wales and Northern Ireland. Secondary users will include transport, planning and policy officials."

2.6. TG22 is not designed to be a manual for modelling studies for planning applications but it does provide useful information for undertaking modelling studies. It should be used as a good indicator of the baseline expectations for modelling studies but not justification for not following more recent good practice.

2.7. TG22 includes guidance on regarding 'Model Validation, Verification, Adjustment and Uncertainty'. It states:

"7.549 Model validation refers to the general comparison of modelled results against monitoring data carried out by model developers. The model used should have some form of published validation assessment available and/or should be recognised as being fit for purpose by the regulatory authorities.

7.550 However, in most cases, the validation studies performed by model developers are unlikely to have been undertaken in the area being considered. Therefore, it is necessary to perform a comparison of the modelled results versus monitoring results at relevant locations. The results of this comparison should be included in Review and Assessment reports, and is referred to here as model verification."

CERC's ADMS-Urban Model

2.8. CERC developed ADMS-Urban (also ADMS-Roads) to model dispersion of pollutants from road traffic emissions sources. The road sources approach was validated for open highways without obstructions/barriers etc. along the sides of the carriageways. It has been well validated for these situations and is considered appropriate for use. In recognition that obstructions such as buildings, walls, barriers can restrict dispersion and result in recirculation in the street area (known in general as the ‘street canyon’ effect), CERC developed a canyon module. This model was updated to the ‘Advanced canyon’ module which provides better estimates of concentrations where there are buildings or other obstructions to air flow near a road, including one sided canyons and porous canyons (i.e. not solid walls).

Modelling

2.9. We have received modelling files from the Applicant, which we requested some months ago. Given Deadline 4 is soon after the ISH on air quality we have had limited time to review the files and have focused on the ADMS-Urban files (the road traffic modelling). This is because the model performance statistics suggest the model is performing poorly in many areas.

Missing Files

2.10. The modelling files received excluded several of the modelling scenarios such as the baseline 2018 scenario, which means not all scenarios can be checked and in particular the basis for the verification factors cannot be reviewed. Any variations in different scenarios have therefore not been reviewed. This is a concern because it is not uncommon for detailed modelling studies to include mistakes such as missing road links in different model scenarios. This was the case when APS reviewed the road modelling for the London City Airport application on behalf of Newham Council in 2023 and the Applicant had accidently missed out a road in a future year scenario.

File Labelling

2.11. The files which are linked to the model are not labelled the same as the file path, for example, the receptor file provided has one name (‘Receptors.asp’) and the receptor file linked to the model has a different name (‘_Master_v2.asp’). It is not clear if they are the same files or what the version 2 changes were.

Airport Emissions

2.12. The approach to the aircraft and airside emissions source modelling is reasonably well documented There are some elements, however, which appear to be out of date. The Applicant relies heavily on the 2006 PSDH report in the methodology for airport emissions inventories. We note, for example, the PSDH work recommended adjustment factors to account for engine deterioration. However, the ICAO Air Quality Manual more recently recommends not making such adjustments.

2.13. It would be useful to understand which approaches (e.g. sophisticated, advanced, simple A, simple B etc.) for each element set out in the ICAO Air Quality Manual have been adopted, particularly in relation to future projections.

2.14. In addition, the ICAO databank version used for the assessment should be documented.

2.15. The ICAO Air Quality Manual provides recommendations on approaches for modelling the current situation but not for future scenarios. It is important to document what has been done to provide confidence regarding the model results.

2.16. To be confident that the approach adopted is based on current knowledge and understanding, it would be useful for the Applicant to confirm with respect to the estimation of aircraft emissions that:

- There have been no changes in understanding since 2006 when the PSDH report was published;
- Whether more recent approaches (for example, as set out in the ICAO Air Quality Manual) have been adopted in the assessment, and if not, an explanation of why they were not included; and
- Whether any more recent approaches would change the modelled emissions.

Road Traffic Modelling

2.17. Details of the rapid review undertaken are presented in Appendix A1. A brief summary of some of the key findings is set out below.

- The ADMS canyon module was not used. There is no discussion on the implication of this on the model results. Excluding the canyon model is likely to be one of the main contributors to the poor model performance. This is discussed in more detail later.
- Of the small proportion of the total road links reviewed, in numerous locations, the road widths used in the model are not representative of the actual road widths. There is an expectation many roads are not modelled at the correct width. These issues are likely to result in the predicted concentrations at receptors to be wrong and it is not possible to state that this would result in uniformly under- or over predicting concentrations therefore this has introduced random error due to poor road model setup.
- A small number of distances between receptors and roads have been reviewed, however, there is an expectation many of the receptors are not modelled at the correct distance from the road which will mean significant random error will be introduced.
- A constant surface roughness was used in the ADMS model across the whole study area. While an explanation has been provided by the Applicant, it relies on anecdotal evidence from a single 3rd party report and discussion with the model developer. On this basis it has been argued that a low roughness is worst-case, however, whether this is true and applicable to the modelling study carried out or not the assessment has relied on 0.2 m being worst-case constantly but with the large study area it will conceivable be anything from 0.01 m to 1 m (i.e. both above and below the single used value) so it can't always be 'worst-case' for all locations. The effort required to use variable surface roughness in ADMS is minimal for a competent modeller and therefore not restrictive, that is, it does not require a disproportionate time to include, and by excluding it adds unnecessary uncertainty when the modelling domain is large.
- Meteorological data from Gatwick airport has been used for the modelling study, but no consideration has been given to whether this is appropriate for the entire modelling study area. Given the size of the study area the conditions will change. ADMS is a Gaussian plume model, and wind direction is a key variable influencing the predicted concentrations. No discussion is presented on the Implications of this.
- No information is provided regarding the processing of key input data. For example, the removal of the contribution from certain sources (i.e. the airport and road transport) should be removed from the background concentrations to avoid double counting. It has not been possible to determine what has been done and whether it is appropriate or not and what any implications would be on the assessment. Another example is whether road traffic emissions have taken account of road gradient, a standard option in the emission factor toolkit used by the Applicant. If gradients were accounted for, how?
- No information provided on road speeds, emission calculations from traffic flows, time varying emissions. Not clear what was done and how reliable it is.

2.18. Overall the modelling approach taken introduced significant random error.

2.19. As noted in paragraph 7.558 of TG22 (text in square brackets added to provide relevant context):

"…model adjustment is not the first step in improving the performance of a dispersion model. Before adjustment of a model is applied, local authorities [the modeller] should check their model setup parameters and input data in order reduce the uncertainties."

2.20. Paragraph 7.558 of TG22 then states:

"Once reasonable efforts have been made to reduce the uncertainties of input data for a model, further comparison of modelled and monitored results can be undertaken.

2.21. TG22 states in paragraph 7.558 that:

"Common improvements that can be made to a "base" model include:

- *Checks on traffic data;*
- *Checks on road widths;*
- *Checks on distance between sources and monitoring as represented in the model;*
- *Consideration of speed estimates on roads in particular at junctions where speed limits are unlikely to be appropriate;*
- *Consideration of source type, such as roads and street canyons;*
- *Checks on estimates of background concentrations; and*
- *Checks on the monitoring data".*

2.22. It is clear from our review of the modelling files that there could have been simple improvements to the base model (and assessment models) and that good practice was not followed resulting in poor model performance. As an example, the influence of 'street canyons' should have been included. It is considered standard practice for detailed air quality modelling studies to model the street canyon influence.

2.23. Defra's Joint Air Quality Unit (JAQU) was responsible for reviewing the air quality modelling undertaken for the development of Clean Air Zones (CAZs). JAQU's expectation was that the street canyon influence on concentrations would be accounted for in the modelling work (note, even where alternative models were used, the canyon effect was expected to be accounted for).

2.24. Document 5.3 Appendix 13.6.1 paragraph 3.1.2 provides generic reasons why modelling and measured data may differ. The list of reasons includes model setup (including street canyons, road widths and receptor locations), and model limitations (treatment of roughness and meteorological data). It states: "*The above factors were investigated as part of the model verification process to minimise the uncertainties as far as possible*". Our rapid review would suggest that reasonable efforts to reduce uncertainties have not been made largely because of the short cuts used in the modelling.

2.25. The ExA should not be confident that the roads modelling carried out accurately predicts concentrations across the full study area, this is reiterated in the next sections.

Model Performance

Pollutants

2.26. Defra's estimates of background NO_2 concentrations were compared with background measurement data and found to compare well. However, no similar comparison was undertaken for PM_{10} or $PM_{2.5}$.

2.27. What confidence does the Applicant have in the background PM_{10}, and $PM_{2.5}$ concentrations used?

2.28. A model performance evaluation for NO_2 was carried out by the Applicant (discussed later). However, no model performance for PM_{10}, $PM_{2.5}$ or NH_3 has been carried out.

2.29. What confidence does the Applicant have in the PM_{10}, $PM_{2.5}$ and NH_3 concentrations predicted?

2.30. The ExA should not be confident that the modelling of PM_{10}, $PM_{2.5}$ or NH_3 is reliable without a model performance evaluation for these pollutants.

Exclusion of Monitoring Sites

2.31. The Applicant has excluded from the model verification monitoring sites due to the presence of vegetation and other local characteristics. These measurements represent real world conditions, which local receptors also experience. It is unclear how receptors with similar characteristics to the excluded monitoring sites have been assessed given that the Applicant states that the modelling does not perform well at those locations. The characteristics described can, however, be accounted for in the modelling if the model had been setup appropriately.

2.32. Monitoring sites excluded based on the factors set out in Paragraph 3.2.1 of Appendix 13.6.1 include:

- Monitoring sites obstructed by vegetation (e.g. RB40. RB39, MSAQ24, CR94, MSAQ25, RB209) and therefore "*concentrations would not be accurately represented in the model*"; and
- Monitoring sites (CR86, H3, DT36, Storrington 1, ST40, Storrington 19n, M25) influenced by local characteristics which were not explicitly modelled.

2.33. This suggests that at all sites which were not removed, the modelling accounted for the local characteristics which influence the dispersion of pollutants which is known not to be the case.

2.34. Whilst there is evidence that the Applicant reviewed all the monitoring sites, it is unclear whether a similar review was undertaken of the modelled receptors. It is likely that a proportion of these also have characteristics "*which were not explicitly modelled*" or "*would not be accurately represented in the model*", as an example, bus/taxi lanes and bus stops were not modelled nor were varying degrees of restricted dispersion due to obstructions/barriers adjacent to roads (the canyon effect). Concentrations in these locations could be under-estimated. The Applicant has not provided information on how the assessment has considered these locations.

2.35. It is worth noting that this also implies that other monitoring sites which are not excluded were not obstructed by vegetation or affected by local characteristics. So why did the model struggle and need zonal verification (see later discussion on this)?

Comparison of Modelled verses Measured Concentrations

2.36. All models include error, the errors are typically categorised into systematic error (consistent error attributable to variable(s)) and random error. Adjustment to model outputs should be focused on accounting for the systematic error. Random error should be reduced through investigation of the parameters that influence variables and are much harder to take account of.

2.37. Document 5.3 Appendix 6.1 paragraph 3.1.1 states:

"Model verification refers to the comparison of modelled pollutant concentrations with measured concentrations at the same points to assess the performance of the model and determine an adjustment factor if one is required. Defra's Technical Guidance (TG22) (Defra, 2022) provides advice on model verification, which is used for modelling of road networks in isolation, highways assessments, local air quality management and other local modelling of roads (Defra, 2022). Should the model results for NO2 be largely within ±25 % of the measured values and there is no systematic over or under-prediction of concentrations, then the Defra guidance (TG22) (Defra, 2022) advises that no adjustment is necessary. If this is not the case, then the modelled values are adjusted based on the observed relationship between modelled and measured NOx concentrations to provide better agreement."

2.38. This misquotes TG22. Instead of 'modelling of road networks in isolation' it refers to 'verifying models from which roads are the primary emissions source' (TG22 heading above paragraph 7.558). In the vast majority of the locations, because the monitoring is located near to the road network, the road emission sources are the primary emission source.

2.39. Furthermore, TG22 Box 7-17 (referred to in Box 7018) recommends adjustment even within ±25 % of the measured values (our emphasis):

"In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%".

2.40. It goes on to state:

"…you may consider model adjustment as this can lead to further improvements in the results obtained, for example where all results move to within 10% of monitored concentrations."; otherwise "… consider altering the model inputs and rerunning in order to improve the results of the comparison and verification".

2.41. This implies that results should ideally be within ±10% of the measured values but greater uncertainty may be acceptable up to ±25% providing the cause of the error is determined (systematic verses random). The Applicants results are not all within ±25% and many are not within ±10%.

2.42. A comparison of the modelled total NO_2 versus measured NO_2 in 2018 was presented in Appendix 13.6.1. The Applicant states this was based on the TG22 approach. Verifying the model using NO_2 is not applicable (see caveats to Box 7-17 in TG22) as the NO_2 concentrations were not predicted directly by the modelling (NOx was predicted and converted to NO_2 outside the model).

2.43. Instead, the approach set out in TG22 Box 7-18 and data in TG22 Box 7-19 – Worked Example of Verification should have been provided.

2.44. The Applicant should provide all the data shown in the Worked Example (TG22 Box 7—19) for all verification sites.

2.45. Can the Applicant confirm that the model setup was adjusted to improve the model before being finalised?

2.46. Can the Applicant confirm which adjustments were required and whether the adjustments were made following a wholistic approach i.e. the entire model domain and road network updated where amendments were made near to monitoring locations?

2.47. Does the Applicant consider that the need for 12 verification zones is due to the lack of detail in the model? If not, what is the cause?

2.48. Paragraph 3.2.1 makes references to monitoring data from 2019, whereas the verification was undertaken for 2018 modelled data. The Applicant is asked to confirm that the monitoring sites with 2018 data were used, and that reference to 2019 is a typo.

2.49. When modelling different source types, it is useful to undertake a full model review, i.e. is any error applicable to all locations consistently or is it different. Uncertainty in modelling of different source types can vary. For example, does comparison with monitoring near to road sources and away from major road sources behave in the same way?

2.50. There remain locations where the modelled verses measured values are more than 25% different. No discussion related to why this may be the case and which receptors may experience similar conditions has been presented.

2.51. It is also important to note that where the error is random (i.e. cannot be accounted for) and the measured values are more than ±10 % the model is considered to be performing poorly (i.e. it is not representing the real world because there are variables which have not been accounted for in the modelling).

2.52. Was an analysis carried out to determine systematic verses random error? If so, can the Applicant please provide the analysis.

Zonal verification

2.53. It is acknowledged that TG22 paragraph 7.564 provides the following advice for local authorities:

> *"In addition to the consideration of roadside and background sites during model verification, local authorities should also consider separating different types of locations when comparing modelling and monitoring. For example, modelling undertaken for roadside sites in urban areas may require a different adjustment to modelling undertaken for roadside sites near motorways or trunk roads in open settings. In some cases, local authorities may also identify some urban sites such as street canyons, which perform differently to more typical urban locations. Where large differences in an adjustment factor are determined for different types of location, local authorities should consider undertaking separate adjustments within a model area in order to avoid over or under-predicting at the different types of location. For example, adjusting modelling results close to a motorway*

based on verification and adjustment at street canyon sites could lead to a large over-prediction of results."

2.54. Whilst this provides justification for a zonal adjustment, as discussed previously, adjustment is secondary to the primary aim of improving the model first. Using the model's full capabilities, which is not a disproportionate task, will remove many of the errors in the first instance. It will also provide confidence in the model performance where there is no monitoring. The relevance of zonal factors can be considered after this.

2.55. Document 5.3 ES Appendix 13.6.1 concludes in paragraph 3.3.5 that:

"The model is performing well, provides a conservative approach and is proportionate in terms of being able to identify significant effects for the ES. The ES assessment model verification results have improved from the PEIR. This is shown by a reduction in the number of verification zones from 18 to 12 and an improvement in the majority of factors. Additionally, some zones have been reduced in size. The zones with their corresponding factors that have been applied to the road contribution of the modelled concentrations in the study area are presented in Table 3.3.1."

2.56. However, what is unclear is why the study area had to be divided into different verification zones. A single verification factor could have been applicable to the whole study area. The fact that it is divided into 12 zones suggests that the model has not been set up to properly to take account of the differences across the study area. It is difficult to understand why some model verification sites on the same stretch of road are in different zones.

2.57. A review of the verification zone approach has been carried out (see Appendix A1). There are numerous occasions where receptors along the same road have been categorised differently with no justification. In these examples, the streetscape has not changed between the receptor locations, nor has the gradient. It is also highly unlikely that the traffic flows would have significant (if at all) changed in these locations and thus the use of different verification zones is inappropriate. There is no explanation in the report about how these zones were categorised.

2.58. We believe that verification zones should be an exception in modelling and, if essential, justification for the source of the systematic error driving the need for different verification zones should be reported.

2.59. Does the Applicant consider that the need for 12 verification zone is due to the lack of detail in the model? If not, what is the cause? Can the applicant explain why the model required different verification zones?

Conservative Assessment?

2.60. Document 5.3 ES Appendix 6.2 Table 3.1.1. shows that the verification zone named 'Gatwick' has a calculated adjustment factor of 1 and Brighton Road (airport) an adjustment factor of 1.3.

2.61. The approach set out in the modelling of the airport sources implies that conservative assumptions regarding airport associated emissions have been made. Ignoring the point that the road traffic model does not account for all the factors affecting concentrations, it is reasonable to assume that the model is broadly performing similarly (under-estimating) in the zones near to the airport as in the other zones with higher adjustment factors. The under-estimation of the road contribution to concentrations by the model is masked by the over-estimated contribution from the airport (i.e.

the road traffic modelling is underestimating by more than presented but the over-estimations from the airport modelling mask this). No discussion related to this is presented.

2.62. For predictions for future years the use of conservative estimates is appropriate but not for the base year where the aim is to assess the model performance. Using 'conservative assumptions' for the airport emissions risks under-estimating the road traffic impacts. This under-estimate may follow through to the future scenarios.

Statistical evaluation

2.63. There are various statistics that can be used to determine model performance for air quality modelling studies, however, we have focused on those presented in TG22 which are:

- Root mean square error (RMSE);
- Fractional Bias; and
- Correlation coefficient.

2.64. These parameters estimate how the model results agree or diverge from the measured data.

RMSE

2.65. The model performance, based on the verification statistics presented, is not consistent and in some cases is poor.

2.66. Document 5.3 Appendix 5.6.1 paragraph 3.3.5 states that the assessment is (our emphasis) *"… **proportionate in terms of being able to identify significant effects for the ES**"* yet, as an example, the variation (RMSE) is greater than 9 µg/m^3. That means an estimate of 32µg/m^3 could be anywhere between 24 and 41 µg/m^3. This is then compared to an air quality objective (AQO) of 40 µg/m^3. The ideal RMSE is 0.0 µg/m^3, i.e. there is no deviation, although in any model, a small error is considered acceptable providing the implications of the error is considered in the assessment of the results (which has not been done, see section 3). RMSE is used to identify if the model shows a systematic tendency to over or under predict i.e. the smaller the RMSE the closer the relationship between modelled and measured values.

2.67. Can the Applicant explain how an average error of +/- 9 µg/m^3 is acceptable when comparing the predicted concentrations against a fixed value or threshold?

Correlation Coefficient

2.68. There is a negative correlation between the model and measured data in two of the verification zones (see correlation coefficients in 5.3 ES Appendix 13.6.1 Table 3.3.1), which for concentrations derived from the same road traffic emissions in the real world is impossible. This negative correlation means that as the model concentration increases the measured concentration decrease as illustrated in Figure 1. The ideal value is +1.0 which means a linear relationship between the modelled and measured data, i.e., as one goes up so does the other by the same amount.

Figure 1: Negative and positive correlations between modelled and measured concentrations

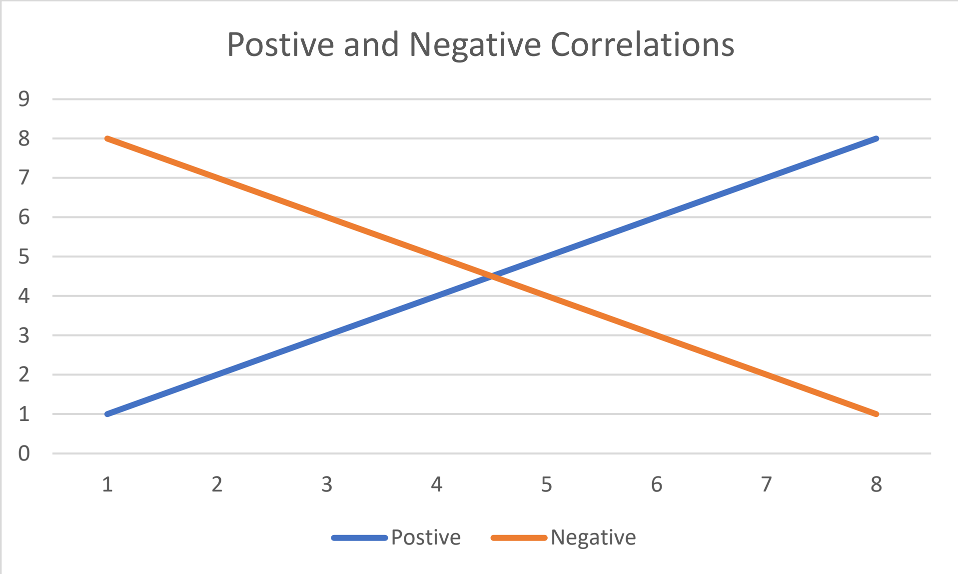

Figure notes: Positive corelation both axis increase; negative correlation one axis increases the other decreases.

2.69. Can the Applicant explain how there can be a negative correlation between the model and measured data and the model be considered to be performing well?

Overall

2.70. In paragraph 3.1.1 of the document 5.3 Appendix 13. 6.1, the Applicant suggests they have taken account of systematic error by applying a verification factor.

2.71. The applicant needs to state the source of the systematic error and why it varies between the zones.

2.72. It is unclear how each receptor was allocated into a zone, for example, some receptors on the same road which experience the same traffic impacts which the same street characteristics have been allocated different zonal factors (examples of this are presented in Appendix A1).

2.73. Can you please point to where in the air quality documents there is a discussion of the random error in the model and the resulting implications for the assessment.

2.74. Document 5.3 Appendix 13.6.1 paragraph 3.1.4 states "*…The key points of feedback were all addressed and the model verification for the ES is improved compared with the PEIR with fewer zones, improved correlation between modelled and monitored results*."

2.75. It is clear that not all issues were addressed and that the model is still not performing well, particularly in the road traffic emissions modelling. Based on the evidence made available by the Applicant, the ExA should not be confident that the modelling of concentrations is reliable across the full study area. Without confidence in the concentrations from the modelling study, the assessment of effects needs to be carried out with caution and should very clearly set out how the uncertainty in the modelling has been accounted for, which has not been done.

3. Assessment of significance

3.1. Due to time constraints, this section focuses on the assessment of effects on human receptors rather than effects on ecological receptors. We have provided context from guidance on the assessment of significance to show that the Applicant has not provided sufficient evidence to the ExA to make a judgement of likely non-significant effects or to be able to determine whether proposed mitigation and monitoring is sufficient.

EIA Framework

3.2. The likely significant effects on the environment must be considered in relation to the impact of the development on factors specified in Regulation 4(2) of the EIA Regulations. A review of the EIA requirements in relation to air quality is set out in Appendix A2. The key points to note are:

- The evolution of the baseline must be presented.
- The latest scientific evidence must be considered.
- The likely significant effect must be reported.

EPUK/IAQM Guidance

3.3. The EPUK/IAQM guidance (2017) provides industry accepted and standard practice approaches to determining the significance. It is relevant to human exposure only (IAQM provides separate guidance on assessing the effects on ecological sites).

3.4. The guidance requires professional judgement to be used in determining the overall significance of a project. Although uncertainty is not explicitly mentioned as a consideration there are several references to uncertainty in the guidance, for example the footnotes of Table 6.3 mention the "inherent uncertainty".

3.5. Dispersion modelling is a tool used to support the judgement of whether there is likely to be a significant effect as a result of a project and facilitates the use of the impact descriptor matrix set out in Table 6.3 of the EPUK/IAQM guidance. While not a requirement to use the table it does provide useful information in a recognisable format for EIAs.

3.6. To use the EPUK/IAQM impact descriptor matrix (Table 6.3) requires the following information: the change in concentration, the absolute concentrations with the project, and a relevant assessment threshold or AQAL.

DMRB Guidance

3.7. We acknowledged this guidance but have not considered it in this review due to the lack of time.

Relevant Assessment Threshold or AQAL

3.8. The Applicant's assessment discusses limit values which it states will be referred to as 'standards' in the assessment.

3.9. The Defra definition of an air quality standard is set out below (available from UK AIR (Defra, n.d.):

"Air Quality Standards are concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment."

3.10. Document 5.1 ES Chapter 13 paragraph 13.2.2 states that Table 13.2.2 sets out the air quality standards of most relevance to the assessment, obtained from the Air Quality Standards

Regulations. These Regulations implement the Ambient Air Quality Directive (2008/50/EC on Ambient Air Quality and Cleaner Air for Europe). The Table 13.2.2 includes standards which are not derived from the Directive. They are from Regulations under the 1995 Environment Act and the 2021 Environment Act.

3.11. The AQOs are not set out or defined in the Air Quality Chapter of the ES. However, in the assessment section the applicant frequently refers to objectives such as in paragraphs: 13.10.27, 13.10.28, 13.10.51, 13.10.72, 13.10.82, 13.10.83, 13.10.84, 13.10.107, 13.10.108, 13.10.140, 13.10.141.

3.12. The EPUK/IAQM guidance uses the term 'Air Quality Assessment levels' and in the footnote to Table 6.3 defines them as:

"AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)"

3.13. At present there are the following thresholds which should be considered in determining the relevant AQAL for each assessment year:

- The national air quality objectives;
- The UK limit values (derived from the EU);
- The Government's 2040 $PM_{2.5}$ targets (and 2028 interim targets);
- Evidence review carried out by WHO published in 2021;
- The EU limit values; and
- Environmental Assessment Levels and approach for determining them as defined by the EA.

3.14. The air quality objectives have not been reviewed recently and are not considered to represent what is "*scientifically known about the effects of each pollutant on health…"*. It has been well recognised by Government for many years that health effects occur at levels below the air quality objectives and EU limit values. For example, Public Health England (now the UK Health Security Agency) stated in 2018 that "*...there is no clear evidence of a safe level of exposure below which there is no risk of adverse health effects*" (Public Health England, 2018).

3.15. The World Health Organization's (WHO's) Air Quality Guidelines, published in 2021, is the most recent review of the scientific evidence compiled at an international level. It provides recommendations for developed nations to work towards lower thresholds to protect people's health.

3.16. There is widespread recognition that the current limit values and objectives are not sufficiently protective of human health. Recently the European Council and Parliament made a political agreement on revisions to the Ambient Air Quality Directive, in recognition of the increasing evidence of health effects at lower levels. For example, the annual mean NO_2 limit value will be 20 $\mu g/m^3$ to be achieved by 2030 replacing the current limit value of 40 $\mu g/m^3$ (meant to have been achieved by 2010). The new directive will include provisions to delay compliance with the threshold by 10 years providing certain requirements are met.

3.17. In February 2024, the United States Environmental Protection Agency (EPA) announced the Agency's proposed rule change reducing the primary annual $PM_{2.5}$ US National Ambient Air Quality Standard (NAAQS) from 12 $\mu g/m^3$ to 9 $\mu g/m^3$.

3.18. The UK Government has also set $PM_{2.5}$ targets recently (The Environmental Targets (Fine Particulate Matter, (England) Regulations 2023). These Regulations include an annual mean concentration target (AMCT), which is half of the current limit value for $PM_{2.5}$ to be achieved by 2040.

3.19. The Institute of Environmental Management and Assessment (IEMA) guidance published in 2022 on health impact assessments in EIA makes clear that it is important that the public have confidence in the levels set for health protection. The Health and Wellbeing assessment (document 5.1 ES Chapter 18) includes consideration of the effects at levels below the current standards adding weight that the AQAL in the Air Quality Chapter should not exclusively use the current standards.

3.20. Policy change takes time and requires appraisal of the supporting evidence. It is, however, reasonable to be confident that the UK will lower the regulatory levels for NO_2 and potentially other pollutants over the next 25 years (the period the Applicant's assessment covers).

3.21. The Office for Environmental Protection's (OEP's) remit includes ensuring that the Government's commitment to environmental improvement post Brexit is delivered and the 'Progress in improving the natural environment in England 2022/2023' report published in January 2024 (Office for Environmental Protection, 2024) stated on Page 54:

"Government should consider reviewing all ambient air quality standards in the Air Quality Standards Regulations to bring them more in line with WHO guidelines. This review would complement the significant improvement made to the target for annual mean concentration for $PM_{2.5}$ (although, given the potential benefits to public health, government should continue to influence the international agenda to reduce transboundary pollution and bring the WHO $PM_{2.5}$ standard within reach). The targets review should be coupled to horizon scanning exercises to ensure that emerging pollutants such as microplastics and ultra-fine particulates are considered, as the group of pollutants considered in regulations has been largely static over the past 50 years."

3.22. The OEP have then make a specific recommendation ('Clean air recommendation 4') on Page 55:

"Government should review all limit and target values for pollutants in ambient air and consider bringing them more in line with World Health Organization standards."

3.23. Other chapters in the ES, and assumptions within the Air Quality Chapter, are based on policy direction, such as the net zero target, uptake in electric vehicles, and passenger demand growth. It would be consistent to also consider policy direction and expectation with respect to the AQALs. It is very likely that within the timeframe of the assessment of the Proposed Development that the NO_2 AQAL will become more stringent.

3.24. Reasonable AQALs that should be included in the assessment (as a minimum as sensitivity tests) for NO_2 and $PM_{2.5}$ are presented in Table 1. Increasing weight should be given to more stringent AQALs in future years.

Table 1: Recommended AQALs for Assessing the Likely Significant Effects of NO_2, $PM_{2.5}$ and PM_{10}

Years	NO_2	$PM_{2.5}$	Comment
2026	40 µg/m³	20 µg/m³ and 12 µg/m³	$PM_{2.5}$ target if 12 µg/m³ is the interim target for 2028. The other $PM_{2.5}$ and the NO_2 AQALs are the current values.

Table 1: Recommended AQALs for Assessing the Likely Significant Effects of NO_2, $PM_{2.5}$ and PM_{10}

Years	NO_2	$PM_{2.5}$	Comment
2032	40 µg/m³and 20 µg/m³	11.3 µg/m³	NO_2 level of 20 µg/m³ applicable in EU from 2030 with some extensions up to 2040 at the latest. $PM_{2.5}$ target is derived from the linear interpolation between the interim 2028 target and the 2040 target.
2038	40 µg/m³ and 20 µg/m³	10.3 µg/m³	NO_2 level of 20 µg/m³ applicable in EU from 2030 with some extensions up to 2040 at the latest. $PM_{2.5}$ target is derived from the linear interpolation between the interim 2028 target and the 2040 target.
2047	20 µg/m³	10 µg/m³	NO_2 level of 20 µg/m³ applicable in EU from 2030 with some extensions up to 2040 at the latest. $PM_{2.5}$ target is the 2040 target.

3.25. Using AQALs that are more stringent will provide better protection for the public. It should be noted that the AQALs in Table 1 are not as stringent as the WHO air quality guidelines which are based solely on the medical evidence. The annual mean WHO guideline values for NO_2, PM_{10} and $PM_{2.5}$ are 10 µg/m³, 15 µg/m³ and 5 µg/m³ respectively.

3.26. The Environment Agency uses its Environmental Assessment Levels (EALs) for the assessment of air quality impacts when deciding environmental permits. The EALs are derived using a hierarchy of sources of information as set out in '*Derivation of New Environmental Assessment Levels (EALs) to Air Consultation*' (2012). The first source in the hierarchy is the UK Expert Air Quality Standards and guidelines. The second are WHO Air Quality Guidelines. It states:

"In many cases EU Limit Values for air pollutant concentrations and associated UK Air Quality Objectives have been derived using a cost benefit analysis and subject to political negotiation. As such they may not be entirely health-based and therefore have been excluded from the hierarchy."

Uncertainty

3.27. It is acknowledged that there are broad statements that aim to demonstrate that conservative approaches have been adopted (such as holding background concentrations far into the future at a constant level). However, there is no evidence that the model uncertainty has been accounted for in the assessment of the likely significant effects. This should be done. An example would be discussion of the uncertainty in the future traffic modelling and the implications on the predicted concentrations relied upon to define the effects.

Alternative approaches

3.28. The approach set out in the EPUK/IAQM guidance (2017) is considered standard in the industry. Consideration of other assessment approaches would be beneficial to further inform the judgement of likely significant effects. Given the scale and the lifespan of the project, in our professional opinion this should be carried out to provide useful information in decision making and to be able to specify relevant mitigation and monitoring.

3.29. These could include:

- Framing the impacts in terms of the percentage change relative to the baseline concentration. Then using the Impact descriptor matrix with the newly determined percentage change.
- Consider how long the project would delay compliance, for example with the $PM_{2.5}$ AMCT or the interim target and judge whether that is significant or not.
- Account for uncertainty in the modelling, for example, removing the RMSE value calculated as part of the model performance evaluation from the relevant AQAL to use an assessment threshold which is adjusted for the model performance. Given the high RMSE values this is recommended.

3.30. None of these approaches have been presented and would add supporting evidence to the professional judgement carried out in the determination of the overall significant likely effect.

Overall

3.31. The Applicant's approach to determining significance does not provide the ExA with the information to make a determination based on the latest scientific evidence and appropriate approaches. The effect of the project on human health is deferred to the Health and Wellbeing Chapter and the assessment of the effect on the quality of the air due to the project should be carried out considering appropriate future baseline conditions (i.e. more stringent AQALs than are currently defined, such as 20 µg/m^3 for NO_2 in future years). Additional methods of presenting and determining the effect should be included given the non-threshold nature of air quality.

4. Health and Exposure Assessment

4.1. As a legally binding air quality target, the Air Quality Chapter should include discussion in relation to the population exposure reduction target (PERT) for $PM_{2.5}$. While there is no official guidance on assessing compliance with the target, the Applicant should provide information regarding how much the Proposed Development will delay exposure reduction. Without this the ExA will not have the information on the effect of the project on the Government's ability to achieve its exposure reduction target. The Health and Wellbeing assessment considers population weighted exposure and is part way there (although some concerns are raised below). The trajectory of the population weighted concentration for each year in the baseline should be plotted on a graph along with the population weighted concentration for each year for the with Project scenario. This can be used to determine the impact the scheme will have on complying with the PERT. This should be set out in the Air Quality Chapter for determination of significance based on compliance before the Health and Wellbeing Chapter of the ES determines the significance in relation to health and wellbeing.

4.2. More generally, the Health and Wellbeing assessment relies on information from the air quality assessment, specifically concentrations. Any assessment based on the information from the air quality assessment needs to account for the uncertainties and confidence in the modelling, particularly when the non-threshold effects are considered. This review has raised questions on the confidence in the modelling leading to concerns with the Health and Wellbeing assessment conclusions.

4.3. 5.3 ES – Appendix 13.4.1, section 6 sets out the Health Impact Assessment Methodology. It states that concentrations at each receptor (identified from AddressBase Plus data) have been interpolated from modelling and that:

“The air quality modelling was undertaken at a 100m resolution grid across the wider study area…”

4.4. The use of a 100 m spaced grid will miss the localised impacts near to roads or other emission sources, for example, due to the steep gradient in concentration with proximity to road traffic emissions. To overcome this well-known issue, a source oriented grid is common practice which includes receptors parallel to the roads along with a coarser regular grid. Furthermore, the height at which the 100 m spacing grid was modelled at is not clear. It could be at 0 m or 1.5 m or another height which is not representative of human exposure. This could lead to the predictions used in the Health and Wellbeing assessment being incorrect.

4.5. Can the applicant provide clarification on the modelling for the exposure assessment and confirm that the interpolated values represent exposure near to road sources.

4.6. The Health and Wellbeing assessment focuses on general population exposure rather than local health effects. In the Statement of Common Ground (SoCG) between the Applicant and Reigate and Bansted Council, the Applicant has stated:

“The health assessment has considered the potential for localised impacts within the relevant study areas.”

4.7. This statement suggests the health assessment has considered the health effects at a local hotspot level. It is not clear what has been done, how these localised impacts have been considered and how they impact any judgement of significance.

5. Ultra-fine Particles (UFP)

5.1. Document 5.1 ES Chapter 13 Air Quality states in paragraph 13.2.5 that “*$PM_{2.5}$ is considered to be a good indicator of general risk associated with exposure to fine and ultrafine particulate matter, and this has been quantitatively assessed in this ES, to allow an evaluation of effects and to respond to stakeholder queries*.”

5.2. This is the approach taken in the recent planning applications for airport expansion at Bristol, Stanstead, London City and Gatwick. This is not scientifically valid as ultrafine particles (UFP) are extremely small and are measured based on the number of particles whereas $PM_{2.5}$ is measured using its mass. UFPs have very little mass.

5.3. In the SoCG between the Applicant and Reigate and Bansted Council (page 17 Document 10.1.7 dated March 2024) the Applicant has accepted that *“It is agreed that $PM_{2.5}$ is not a direct proxy for UFP. It is also agreed that UFP particle numbers would be expected to be much higher than those for $PM_{2.5}$ and have different dispersion characteristics. This is taken into account”.*

5.4. It is unclear how the different dispersion characteristics of UFPs and $PM_{2.5}$ could have been taken into account, as only $PM_{2.5}$ has been quantified.

5.5. Can the Applicant confirm how the ‘*different dispersion characteristics’* between $PM_{2.5}$ and UFP have been taken into account.

5.6. The SoCG states that UFPs and $PM_{2.5}$ have common sources related to the combustion engine operation. However, there are significant differences between internal combustion engines and jet engines and their emissions, although the technologies are converging to meet emission requirements. In addition, the sulphur content of automotive and aviation fuels is very different. Sulphur in the fuel is considered by ICAO to be responsible for much of the non-volatile UFP emissions. Due to these technology and fuel differences, it is unlikely that there will be a linear relationship between changes on $PM_{2.5}$ and the number of UFPs, which appears to be the basis on which the assessment of the impact on UFP has been undertaken.

5.7. Chapter 13 Air Quality, paragraph 13.2.5 also states *"There is no established modelling methodology for UFPs and although there is evidence of health impacts, there is limited data due to the lack of long-term exposure studies. There is currently no legislated standard for UFPs."* The same argument has been used in other ESs for recent airport expansion.

5.8. The EIA Regulations do not require air quality modelling to be undertaken. Many other disciplines use qualitative assessment methods. It is not difficult to develop a qualitative method to give an indication of whether the emissions of UFP are likely to increase or decrease in the future and the magnitude of change compared to the baseline (for example, are the UFP emissions likely to increase by 10%, 50%, more than 100% when compared to the baseline).

5.9. The ICAO Airport Air Quality Manual was used to calculate the emissions from the aircraft that are likely to use Gatwick Airport. ICAO provides a database of non-volatile particle mass and number emissions (i.e., UFPs) by aircraft type. Using this database would provide an indication of how these emissions will change as a consequence of the changing aircraft fleet using the airport as a result of the proposals. The non-volatile UFPs from the aircraft can be quantified. These can be used to consider the magnitude of change in non-volatile to provide context for the discussion of the health effects.

5.10. It is unlikely that ICAO would have collected this data if it saw no benefit for airports to include non-volatile particles in their emission inventories and dispersion modelling.

5.11. The Manual does not currently provide a method for estimating the volatile particle number, but does include a method for estimating the mass of volatile PM. It is clear from the Manual, that the emission of volatile particles is considered to be sulphur dependent. Whilst it is not currently possible to estimate the number of volatile UFPs emitted from engines and formed downwind, reducing the sulphur content of future fuels is considered likely to reduce the emissions of UFP. This has already been shown to be effective for reducing UFP emissions from road transport.

5.12. Quantification of the volatile UFP is more difficult. These are largely related to the sulphur content of jet fuel. To meet net zero the Government is committed to the introduction of sustainable aviation fuel which is expected have very low sulphur content.

5.13. There is already a move towards the use of Sustainable Aviation Fuels (SAFs) to meet net zero carbon emissions in the aviation industry. The UK Government confirmed in July 2022 that it would introduce a SAF mandate in 2025 requiring at least 10% of jet fuel to be made from sustainable feedstocks by 2030. SAFs are low sulphur fuels that are likely to reduce the volatile UFPs. However, to meet the government's net zero commitments these and other ultra-low sulphur fuels including electricity and hydrogen will be used in the future.

5.14. Is the Applicant committed to the introduction of sustainable aviation fuel and if so over what timescale?

5.15. In the absence of such a commitment on SAFs a semi qualitative approach based on the quantity of fuel consumed in the future assessment years would also provide a useful proxy for magnitude of change in volatile UFP emissions.

5.16. Local communities are concerned about the health effects of UFPs, and it is important that this pollutant is properly considered in the Air Quality Chapter of the ES. The arguments set out by the Applicant on the complexity of considering UFP are acknowledged, but this does not mean an assessment cannot be done within the scope of EIA. This should be considered in detail in the Air Quality Chapter of the ES (i.e. by air quality specialists) before consideration in the Health and Wellbeing Chapter.

5.17. The Health and Wellbeing Chapter of the ES has relied on the small magnitude of change in $PM_{2.5}$ mass concentration to derive a small magnitude of change in UFP number. However, there is no direct 1 to 1 relationship and the magnitude of change in UPF could be several orders of magnitude greater than for the $PM_{2.5}$ mass. The Health and Wellbeing Chapter therefore should not rely on the $PM_{2.5}$ change to derive a magnitude of change in UFPs.

5.18. Finally, it is worth noting that Schedule 4 of the EIA Regulations sets out the information required for inclusion in Environmental Statements. It includes an estimate, by type and quantity, of air emissions produced during the construction and operation phases. Therefore, an estimate of emissions of UFP should be presented in the Air Quality Chapter.

5.19. The effects of UFPs have not been considered appropriately in the Air Quality Chapter. A judgement of no significant effects on the air quality (in regards to UFPs) cannot be reached based on the information in the Air Quality Chapter. As such, the ExA are not able to determine the likely significant effect nor, the appropriate level of mitigation or monitoring where proposed.

6. Other

6.1. There are several other considerations which have been identified, these include:

- Per- and Polyfluorinated Substances (PFAS) emissions have not been considered in the Air Quality Chapter. While it is an emerging issue, it has been known about for some time. No consideration or assessment has been carried out and the likely significant effects have not been scoped out or discussed. Airport activities can be a source of PFAS emissions;
- Ecological assessments which have not been explicitly reviewed due to available time, rely on modelling which has not undergone any model performance evaluation of the relevant pollutants and therefore cannot be confidently relied upon. Therefore, any determination based on this is questionable without clarity of the modelling confidence; and
- Where is the assessment of the increased exposure caused by bringing more people to the airport as the capacity increases?

7. Conclusion

7.1. In conclusion, we have identified a number of issues and concerns related to the air quality assessment and assessments based on the information in the air quality assessment.

7.2. We believe clarification on the issues should be provided and the assessment updated where necessary. Once updated, proportional mitigation and monitoring can be defined, hence the importance of a good assessment. The monitoring requirements are expected to be greater than those currently proposed.

8. Glossary

ADMLC	Atmospheric Dispersion Modelling Liaison Committee
ADMS	Atmospheric Dispersion Modelling System
AMCT	Annual mean concentration target
APS	Air Pollution Services
AQAL	Air quality assessment level
AQO	Air quality objective
CAZ	Clean air zone
DFT	Department for Transport
EAL	Environmental Assessment Level
EIA	Environmental Impact Assessment
EPA	US Environmental Protection Agency
EPUK	Environmental Protection UK
ES	Environmental Statement
EU	European Union
ExA	Examining Authority
ExQ1	ExA's Written Questions
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
ICAO	International Civil Aviation Organisation
IEMA	Institute of Environmental Management and Assessment
ISH	Issue Specific Hearing
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
NAAQS	US National Ambient Air Quality Standard
NO_2	Nitrogen dioxide
NOx	Nitrogen Oxides
NWP	Numerical weather prediction

OEP	Office for Environmental Protection
PERT	Population Exposure Reduction Target
PFAS	Per- and Polyfluorinated Substances
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles, more specifically particulate matter less than 2.5 micrometres in aerodynamic diameter
PSDH	Project for the Sustainable Development of Heathrow
RCTM	Regional Chemical Transport Model
RMSE	Root mean squared error
SAF	Sustainable Aviation Fuel
SoCG	Statement of Common Ground
TG22	LAQM Target 22
UFP	Ultra-fine particles
WHO	World Health Organization

9. References

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A1. Road Modelling Review

A rapid review of the roads modelling has been carried out. This is largely based on the information in document: APP-158 ES_Appendix 13. 4.1 Air Quality Assessment Methodology and relevant Figures along with the limited modelling files provided by the Applicant which, in relation to the roads modelling, included:

- 'Construction DS 2029' ADMS '.upl' files;
- 'Operational DS 2029' ADMS '.upl' files; and
- Spatial files including: 'Base 2018_MasterRoads.shp', 'Roads_Op_Con.shp' and 'Receptors.asp'.

A1.1. Assessment methodology in paragraph 3.10.13 states: "The geometry of the road network for the baseline, construction and operational traffic scenarios is presented in ES Appendix 13.4.1: Air Quality Assessment Methodology Figure 4.1.1.". These figures are not sufficient to review modelling although in the absence of high resolution figures, these have had to be used in places in this review.

A1.2. In general there appears to be an inconsistent modelling approach across the study area which risks a greater level of uncertainty in the modelling.

A1.3. Section 3.1.2 of the Air Quality ES Chapter, Appendix 12.6.1: Air Quality Data and Model Verification details a list of reasons why modelled results may not compare as well as some locations and includes the following:

- *"Uncertainties in estimated traffic flow and speed data;*
- *Model set up (including street canyons, road widths, receptor locations; and*
- *Model limitations (treatment of roughness and meteorological data)."*

A1.4. Table 2 along with the accompanying Figures referenced, provides a very brief summary of the rapid modelling review. There is some brief explanatory text in the footnote of each Figure. This is a small snapshot of the review and should not be considered complete, but highlights issues quickly identified.

A1.5. A review of the verification zone approach has been carried out with reference to Figure 18 to Figure 26. There is some brief explanatory text in the footnote of each Figure. There are numerous occasions where receptors along the same road have been categorised differently with no justification. The streetscape has not changed between the receptor locations, nor has the gradient. It is also highly unlikely that the traffic flows would have significant (if at all) changed in these locations and thus the use of different verification zones is inappropriate. There is no explanation in the report about how these zones were categorised. It is not considered appropriate to use the verification approach adopted by the Applicant and the there is a high risk of underpredicting concentrations.

Table 2: Modelling Review

Parameter	Example	In model	Comments
Road 'canyon like features'	Figure 2	Not used	The modelling has not included the influence of street canyon like features on dispersion of pollutants from road traffic in the study area. This is a major weakness of the modelling used. Exclusion of street canyons will result in underprediction and given the streetscape varies from receptor location to receptor location there is no practical way to account for these in any model verification (i.e. it is not systematic error, it is random error introduced by poor model setup).
Road widths	Figure 3 to Figure 4	Inconsistent	Of the small proportion of the total road links reviewed, in numerous locations, the road widths used in the model are not representative of the actual road widths. There is an expectation many roads are not modelled at the correct width. These issues are likely to result in the predicted concentrations at receptors to be wrong and it is not possible to state that this would result in uniformly under- or over predicting concentrations therefore this has introduced random error due to poor road model setup.
Receptor Distances from kerbside	Figure 5	-	A small number of distances between receptors and roads have been reviewed, however, there is an expectation many of the receptors are not modelled at the correct distance from the road which will mean significant random error will be introduced.
Road speeds	Figure 6 to Figure 9	Not provided	The road speeds used in the model were not detailed in the documentation or provided with the modelling files. It is therefore unknown which speeds were used. The methodology states the speeds were taken from the traffic model and reduced to 20 kph near junctions. However, average speeds can be slower than 20 kph in locations where congestion occurs. It is believed (but not clear) the peak, interpeak and off-peak traffic flows were used to derive emissions and during peak time along roads with high congestion 5 kph is likely to be more representative. Speeds should account for deceleration/acceleration at junctions, roundabouts, crossings etc. Speeds should also consider congestion. Typical speeds from online datasets such as Google Maps traffic flows show where congestion is likely to occur for different periods of the day and days of the week. There is, therefore, information on locations suspectable to congestion which should be accounted for in the modelling. It is not possible to review the speeds used because they have not been reported and the speeds can have a significant impact on the predicted concentration at a local level which is critical to the assessment.
Road gradients	Figure 10	Not used	There is no mention of how road gradients and their impact on emissions were accounted for in the documentation and thus it cannot be concluded that they were included in the model. Gradients can influence the emissions from road transport and therefore the concentrations near to roads with gradients. If the gradients were not included in the model, then the effect of slope on emissions and concentrations will not have been accounted for. Because not all roads have a constant gradient this could introduce random error which cannot be accounted for by a model verification adjustment.

Bus stops	Figure 11	Not accounted for	The model does not include bus lanes or bus stops. Many receptors are located in proximity or adjacent to bus lanes and / or bus stops. Buses utilising bus stops will slow down / idle at these locations. Elevated pollutant concentrations at locations where bus stops are evident in the real world but not accounted for in the modelling.
Wake	Figure 12		The ADMS model did not consider the variation in vehicle induced turbulence across the study area. There is no discussion of the implications of this on the model results. The model uses default values which assumes 5% HDVs on all roads which is not correct over a large study area. Vehicle induced turbulence changes the dispersion of pollutants.
Time varying emissions	Figure 13		A .fac file (the time varying emissions files) was referenced in the modelling files. The .fac file containing the time varying emissions was not provided. No details were provided in the documentation.
Emission Rates	Figure 14	Inconsistent	Examination of some of the UPL files used in the modelling showed some roads to have an emission rate of 0, this was the case for both airport and non-airport traffic.
Meteorological data	Figure 15 to Figure 16	Gatwick airport observational site used for whole domain	Dispersion modelling requires the use of meteorological data. A single annual dataset has been used to represent the local meteorological across the entire domain. This is not representative of the real world conditions. It is worth noting that the Gatwick Airport meteorological data is subtly different to the Charlwood Met Office meteorological data located several hundred meters away, so even at locations near the airport the use of Gatwick Airport meteorological data may not be correct in all locations. When distances are greater there are clear differences in dominate wind direction again this means emission sources (e.g. roads) located 10s of km from the airport should have used locally representative meteorological data.
Meteorological and surface parameters	Figure 17	Default settings used	The modelled domain is large, the lack of differentiating parameter values does not account for variation in land use across the domain. Minimum MO length was 20 for the whole domain, in reality it would vary across the modelled domain, particularly in urban area. This would likely impact dispersion and concentrations. Surface roughness value is 0.2, in the ADMS User Guide this equates to agricultural areas (min). This is not an accurate representation of the whole model domain. The explanation by the Applicant notes that concentrations will vary depending on the chosen surface roughness highlighting the importance of a representative surface roughness value. Given the large domain area and the varying land cover over that area a variable surface roughness would be good practice and would likely have an impact on the model performance evaluation outcome. The response from the applicant states *"The 2005/6 study acknowledged that an 'an approximate representative value of roughness length for modelling the dispersion of sources on, or close to the airport is expected to lie in the range 0.2 m to 0.5m: in the 2002/3 modelling study a value of 0.2 m was chosen."* It does not discuss the suitability of a surface roughness value for the wider study area which is up to 10s of km from the airport. The use of a single surface roughness value for the whole modelling domain is not considered appropriate and will introduce random error in the modelling.

Figure 2: Street Canyons

Figure notes: Imagery © 2024 Google, map data © 2024.

The images on the left show receptors (yellow dots, follow red arrows) which are located along the roads in the images on the right. The streetscape clearly demonstrates street canyon properties and the restrictions on dispersion of pollutants has not been accounted for. The predicted concentration by the Applicant is likely to be under-statement in this situation.

Figure 3: Road Widths – Modelled Roads Wider

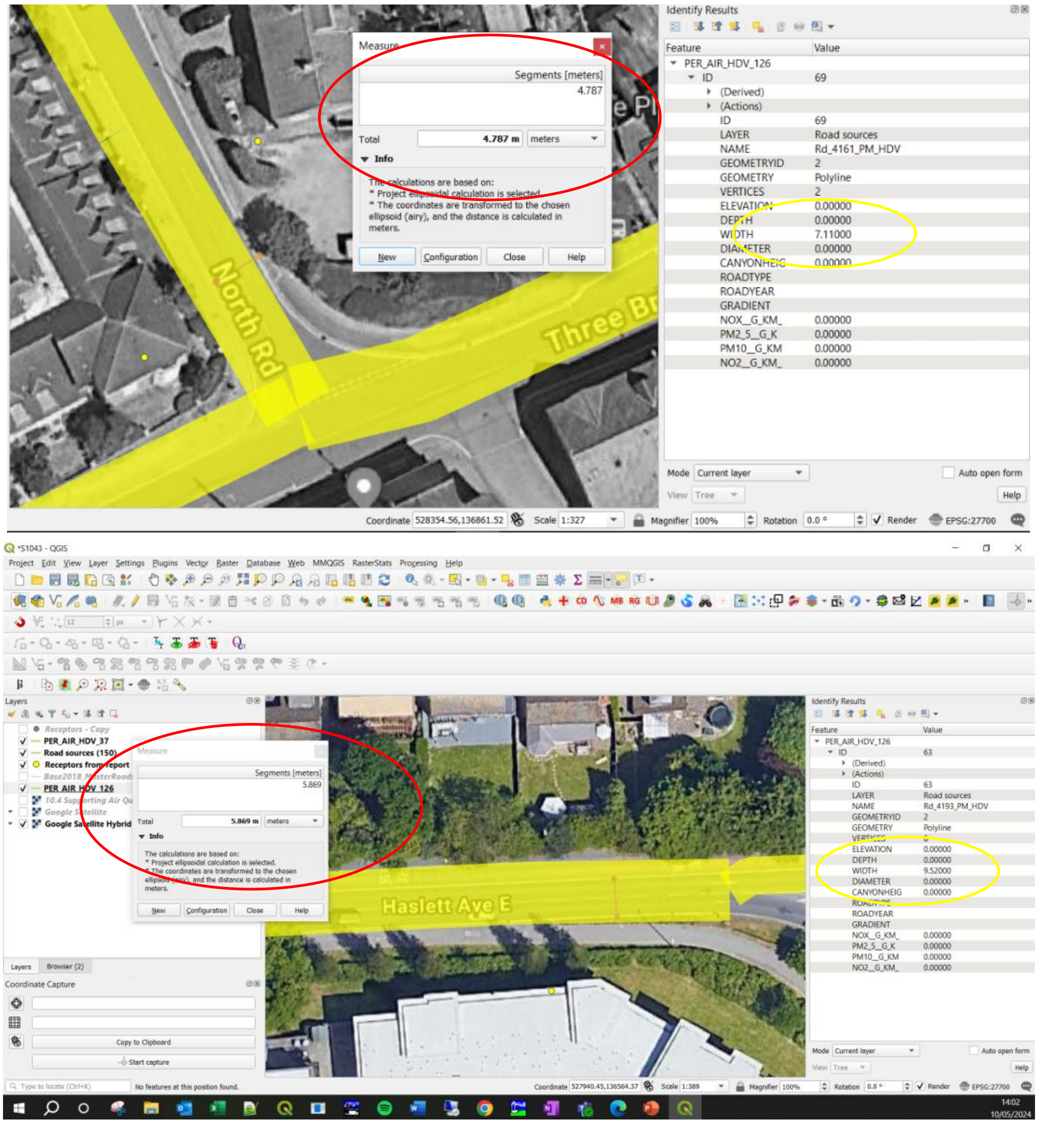


Figure notes: Imagery © 2024 Google, map data © 2024.

North Road: The measured road with here (see red circle) is ~4.79 m, the width used in the model (see yellow circle) is ~7.1 m. The distance between the receptors and the road may be incorrect which would influence the concentrations experienced at these receptors. Moreover, an increased road width could lead to increased dispersion and lower concentrations at the receptor. It is therefore possible that receptors in this location would experience higher concentrations than those predicted by the model.

Haslett Ave E: The measured road with of this section of Haslett Ave E is ~5.9 m (see red circle), the width used in the model is ~9.5 m (see yellow circle). The distance between the receptors and the road may be incorrect which would influence the concentrations experienced at these receptors. Moreover, an increased road width could lead to increased dispersion and lower concentrations at the receptor. It is therefore possible that receptors in this location would experience higher concentrations than those predicted by the model.

A small number of roads have been reviewed, however, there is an expectation many roads are not modelled at the correct width which will mean random error will be introduced.

Figure 4: Road Widths – Modelled Roads Narrower

Figure notes: Imagery © 2024 Google, map data © 2024. Map projection used result in underlaying satellite being out of line but scales (distances) are corrects.

First mage (no visible road name): The measured width of this road (red circle) is ~ 8.1 m, the modelled road with (yellow circle) is 7.6 m. The distance between the receptors and the road may be incorrect which would influence the concentrations experienced at these receptors. Moreover, an increased road width could lead to increased dispersion and lower concentrations at the receptor. It is therefore possible that receptors in this location would experience higher concentrations than those predicted by the model.

Hazelwick Ave: The measured width of Hazelwick Ave is ~ 6.67 m (red circle), the width used in the model is 9.35 m (yellow circle). The distance between the receptors and the road may be incorrect which would influence the concentrations experienced at these receptors. Moreover, an increased road width could lead to increased dispersion and lower concentrations at the receptor. It is therefore possible that receptors in this location would experience higher concentrations than those predicted by the model.

A small number of roads have been reviewed, however, there is an expectation many roads are not modelled at the correct width which will mean random error will be introduced.

Figure 5: Receptor distance from kerbside

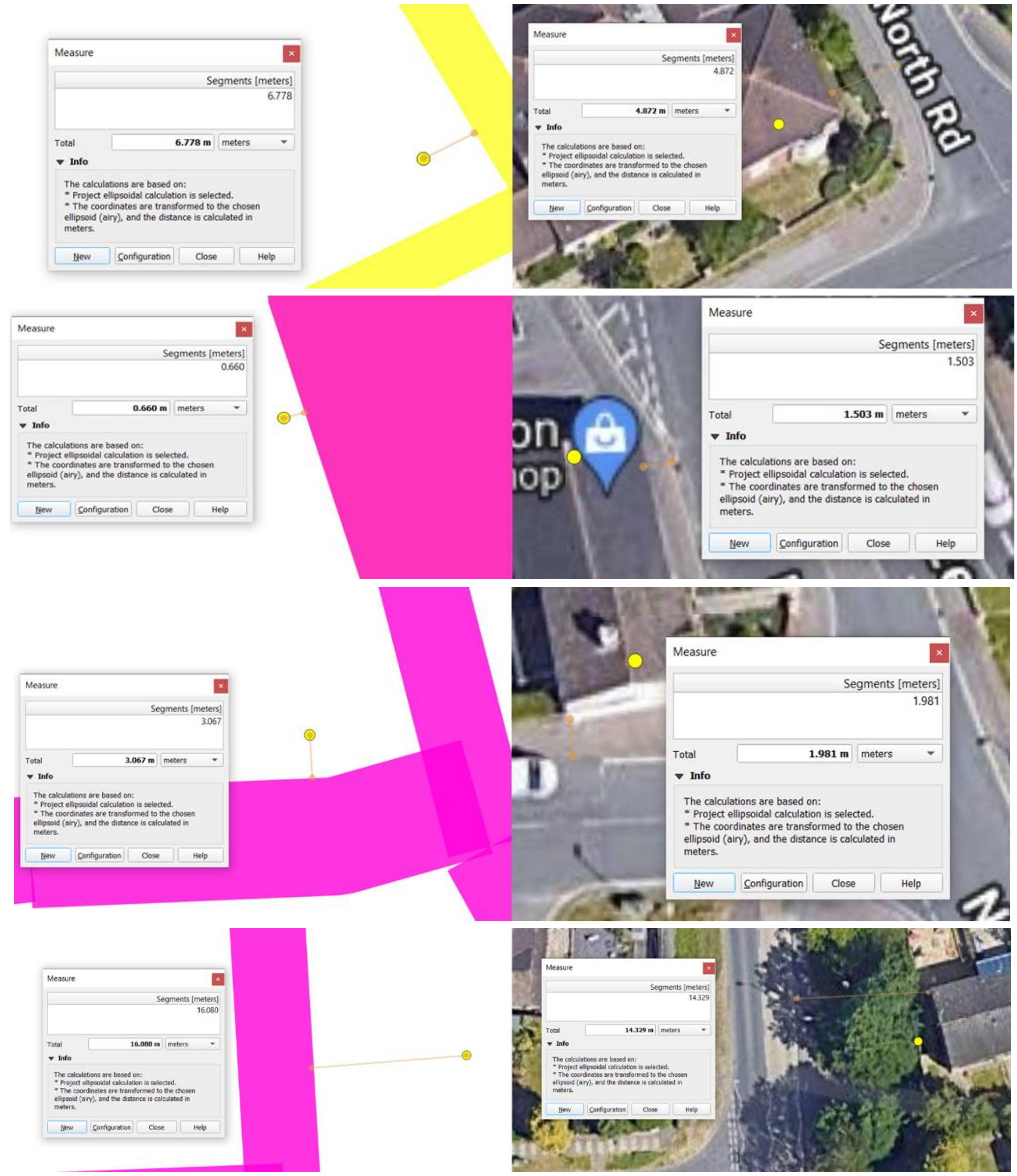


Figure notes: Imagery © 2024 Google, map data © 2024.

The images on the left show the distance between the road (yellow or pink line) and receptor (yellow dot) used in the model. The images on the right show the measured distance between the receptor and the road. The difference between the modelled receptor locations, relative to the roads and the real location is significant. This will have a significant impact on the predict concentrations. A small number of distances between receptors and roads have been reviewed, however, there is an expectation many of the receptors are not modelled at the correct distance from the road which will mean significant random error will be introduced.

Figure 6: Road Speeds – Typically AM and PM peak speeds from Google maps shows locations of likely congestion

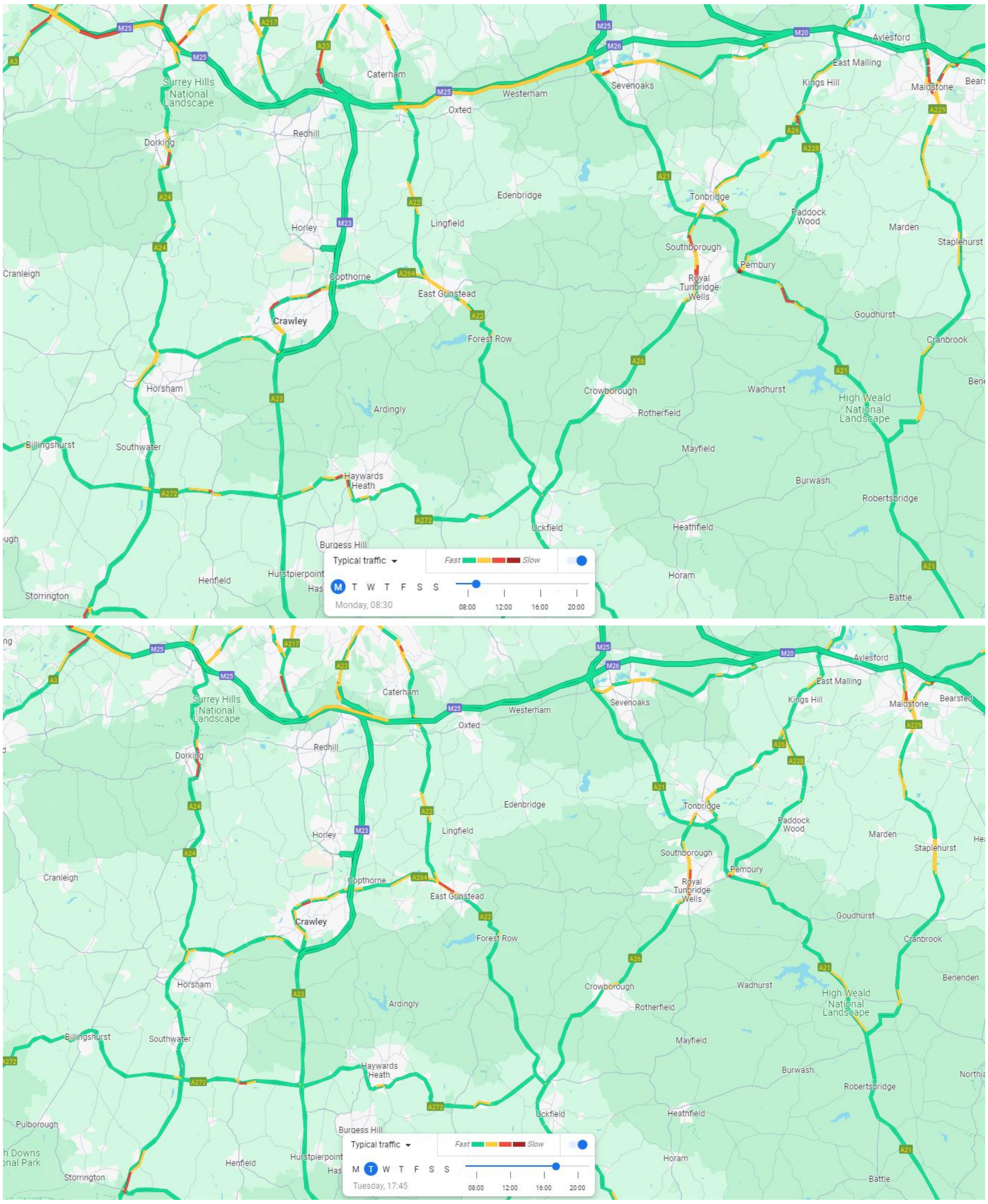


Figure notes: Screenshot from Google Maps with Traffic View

The traffic speeds used in the model were not included in the documentation or modelling files provided. It is therefore unknown whether they were accounted for. The screenshots show typical traffic speeds at 08:45 on a Monday, there are areas of congestion.

Figure 7: Road Speeds – Typical off peak speeds from Google maps shows

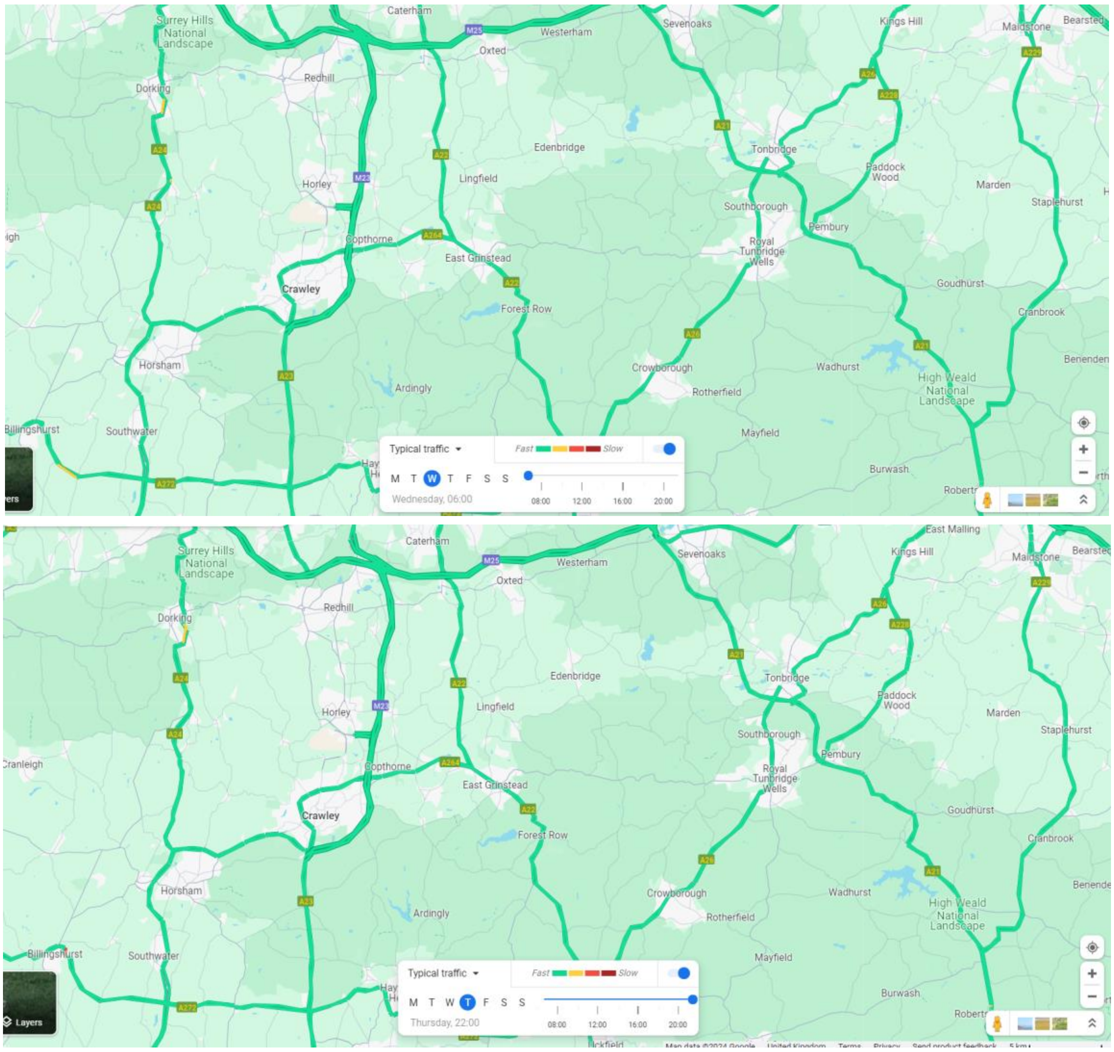


Figure notes: Screenshot from Google Maps with Traffic View

The traffic speeds used in the model were not included in the documentation or modelling files provided. It is therefore unknown whether they were accounted for. The screenshots show typical traffic flows for 06:00 on Wednesday (top) and 22:00 on Thursday (bottom), these are off peak times, little congestion is shown.

Figure 8: Road Speeds – Typical inter-peak speeds from Google maps shows

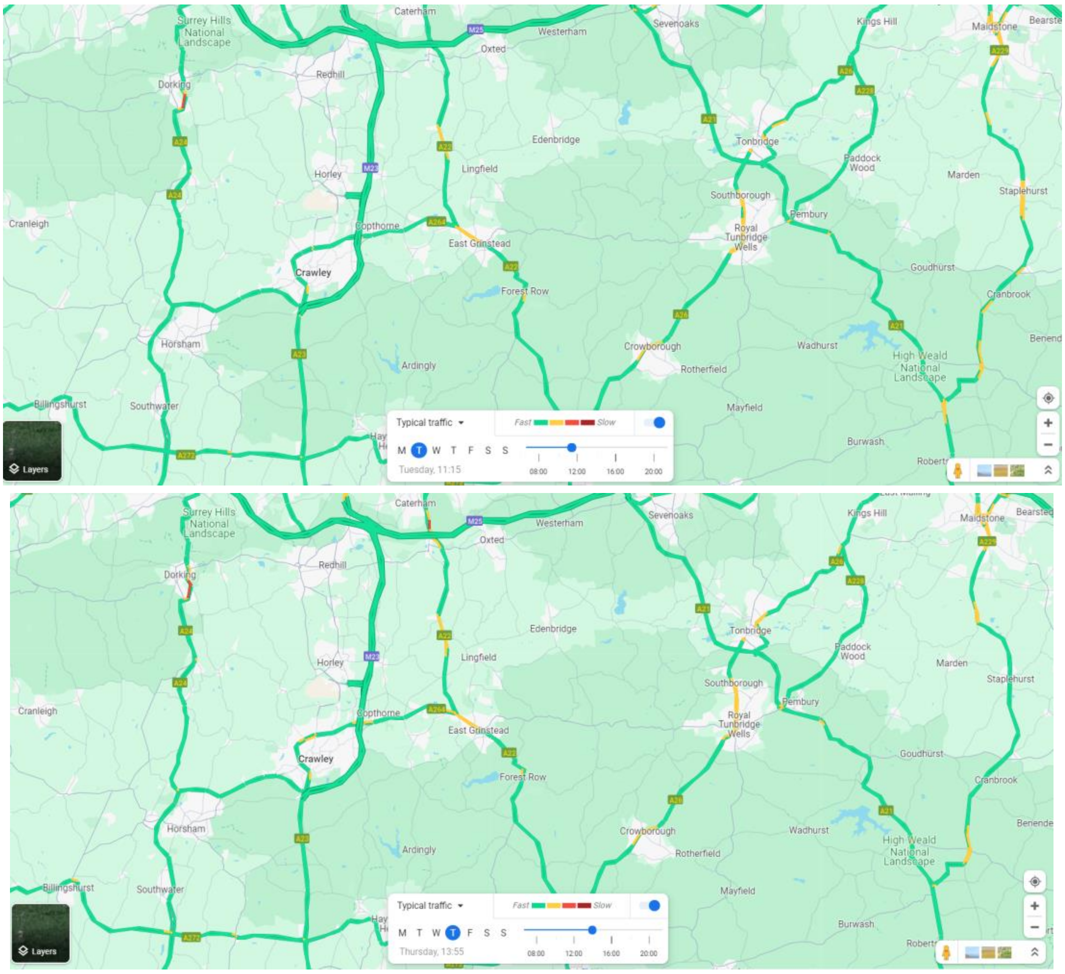


Figure notes: Screenshot from Google Maps with Traffic View

The traffic speeds used in the model were not included in the documentation or modelling files provided. It is therefore unknown whether they were accounted for. The screenshots show typical traffic flows for 11:15 on Tuesday (top) and 13:55 on Thursday (bottom), these are inter-peak times. There are areas of congestion, especially around Royal Tunbridge Wells and East Grinstead.

Figure 9: Road Speeds – Typical speeds from Google maps shows locations of likely congestion lengths in East Grinstead

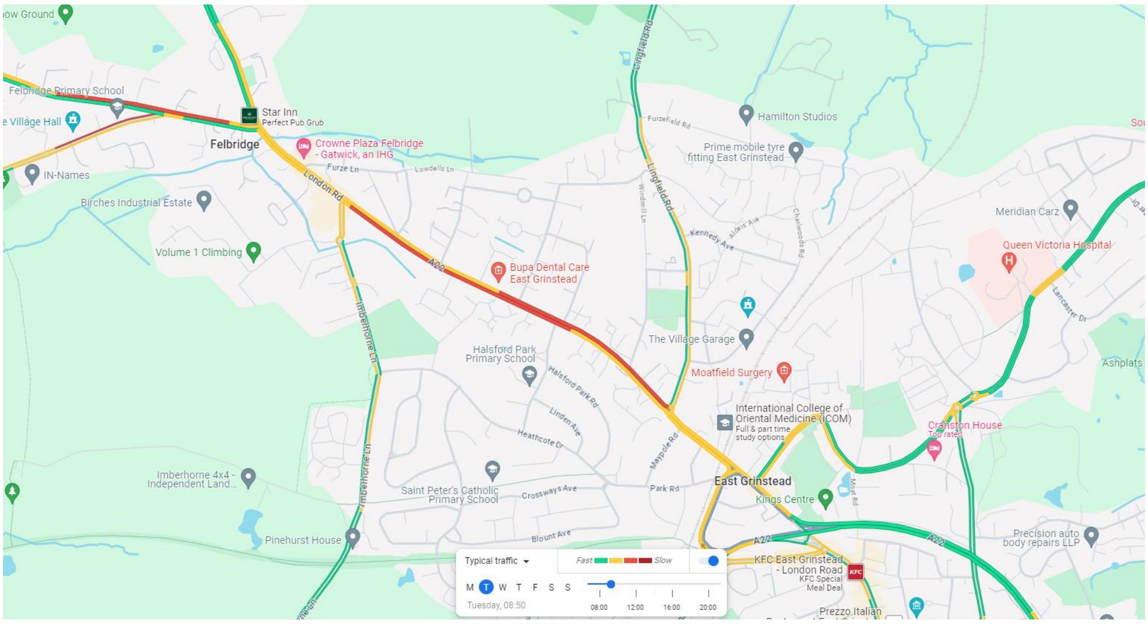


Figure notes: Screenshot from Google Maps with Traffic View

The traffic speeds used in the model were not included in the documentation or modelling files provided. It is therefore unknown whether they were accounted for. The screenshots show typical traffic speeds at 08:45 on a Monday, there are areas of congestion including at locations more than 50 m from junctions.

Figure 10: Road Gradients

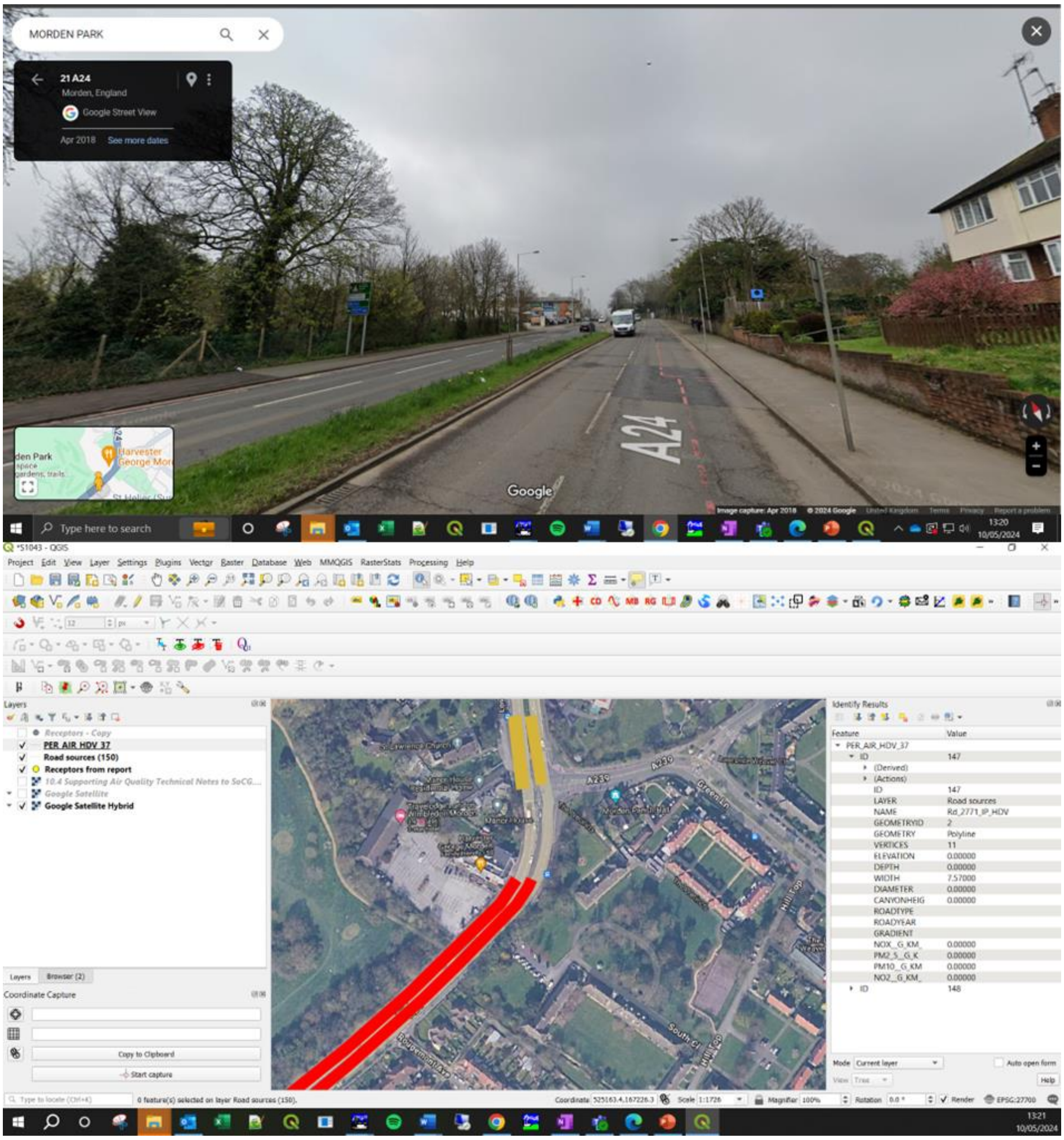


Figure notes: Imagery © 2024 Google, map data © 2024

The A24 shown in the Google StreetView screenshot has is a significant gradient. It is unknown whether gradients were used in the model. This figure illustrates an incline along the A24 where emissions from road traffic would be greater.

Figure 11: Bus Stops / Lanes

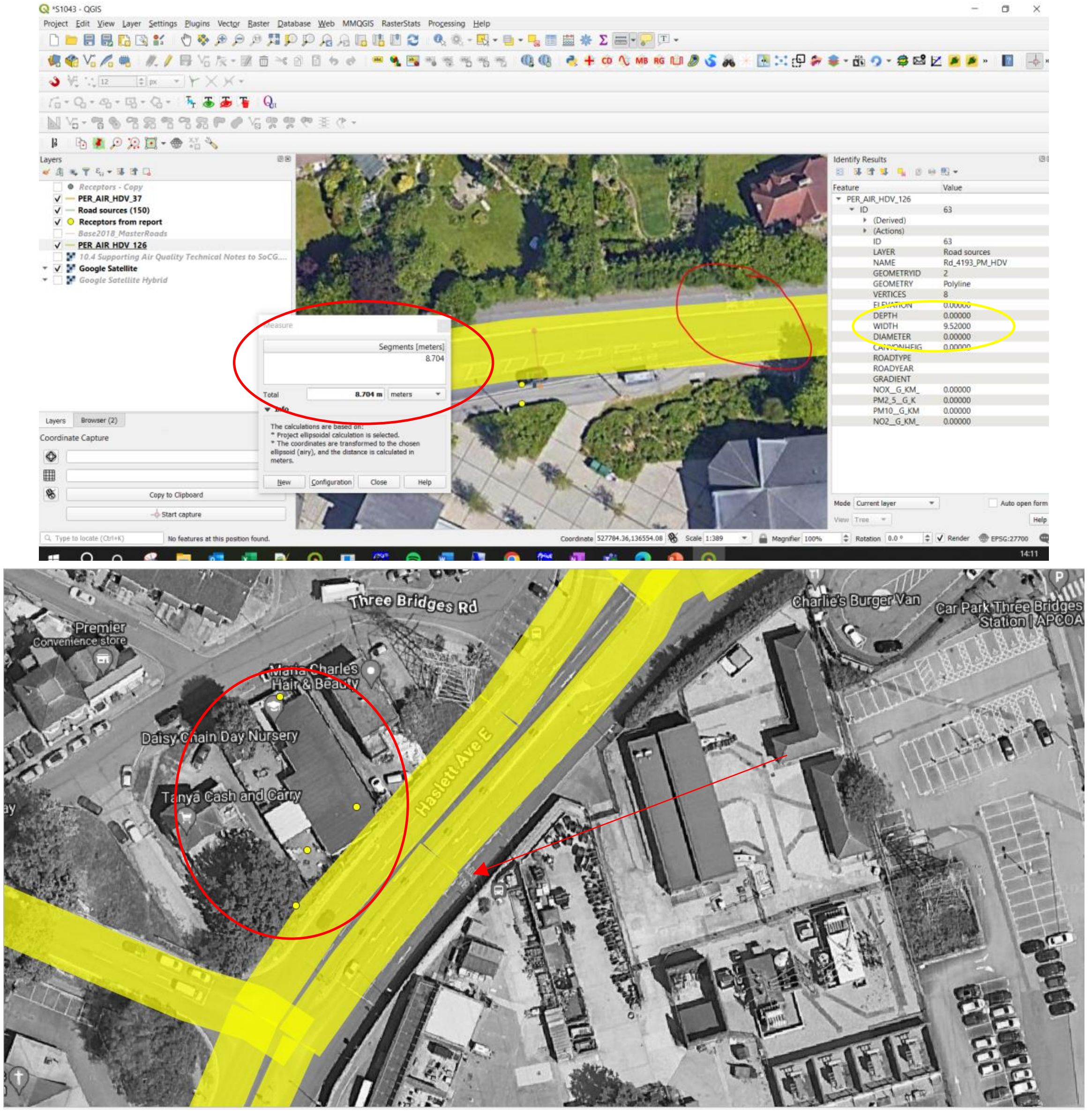


Figure notes: Imagery © 2024 Google, map data © 2024.

First image: The bus lane (see red outline) has not been accounted for here. The measured road with (red circle on left) is ~8.7 m, the width included in the model (yellow circle) is ~9.5 m. The distance between the receptor and the road could therefore be incorrect and thus the concentration at the receptor could be incorrect. A wider road could lead to increased dispersion which would also influence the concentration predicted at the receptor.

Second image: The bus stop along Haslett Avenue (red arrow) has not been accounted for. The receptors (red circle) might be experiencing increased concentrations due to idling / slow moving buses utilising this bus stop; this will not be accounted for in the model.

Figure 12: Wake

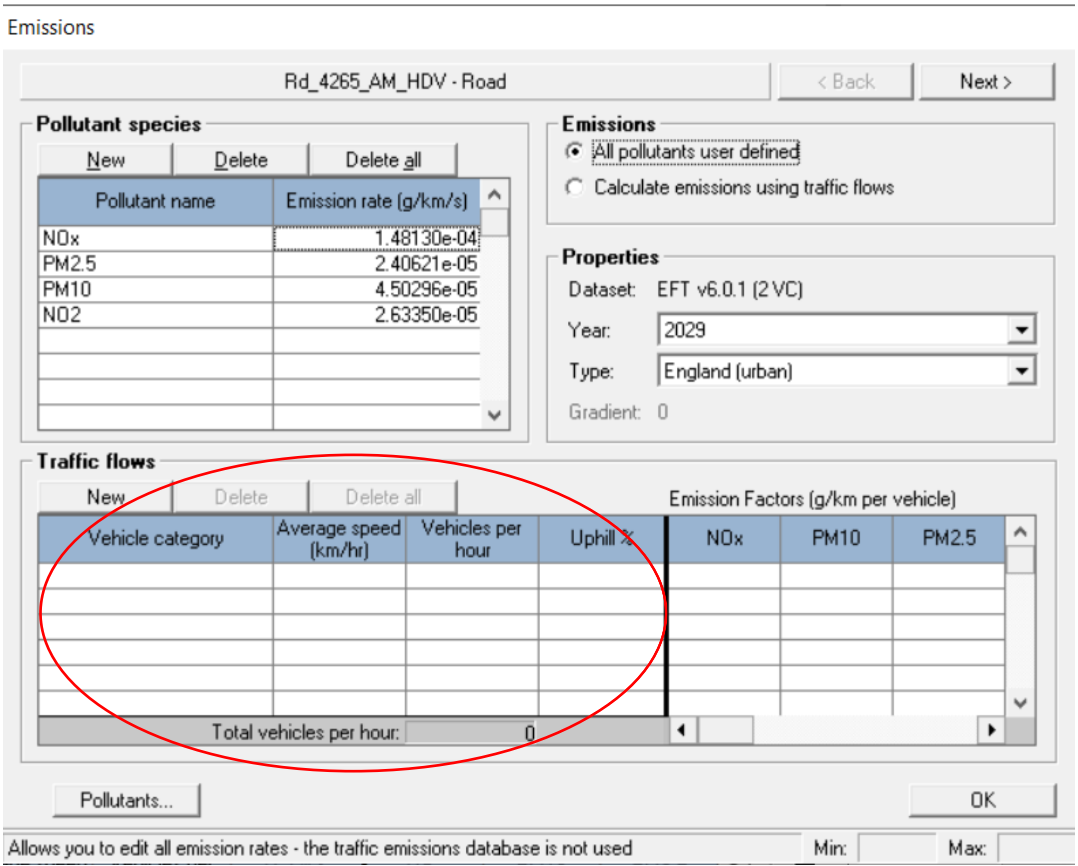


Figure notes:

The ADMS graphical user interface shows the emission rates for Rd_4265_AM_HDV but does not include any traffic flows and only externally calculated emissions have been entered. As a result of excluding traffic flows the default 5% HDVs will have been used for defining the vehicle induced turbulence (wake).

Figure 13: Time Varying Emissions

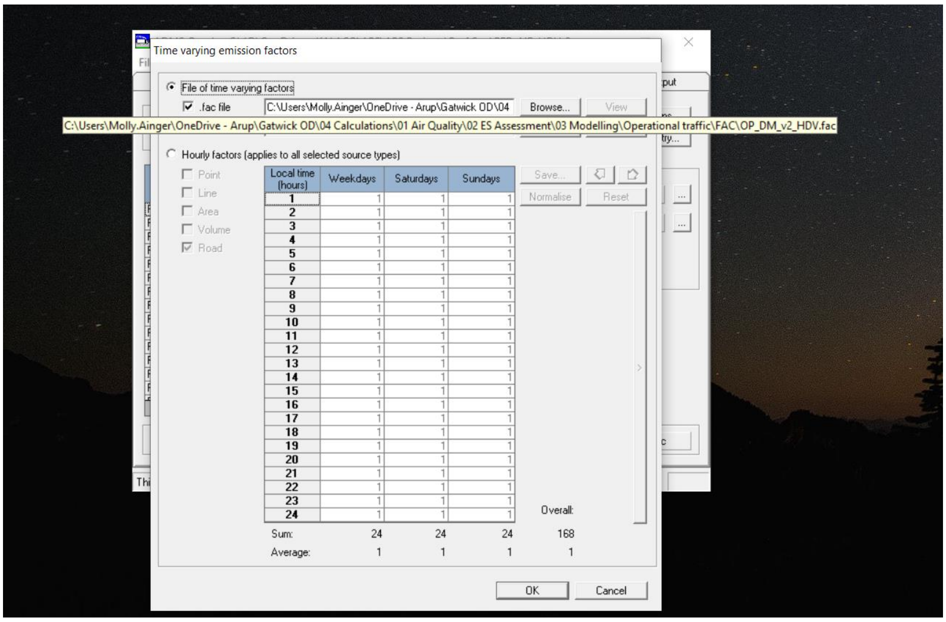


Figure notes:

The ADMS graphical user interface shows a .fac file (the time varying emissions file) has been linked to but this file has not been provided and not presented in the supporting documents submitted by the Applicant.

Figure 14: Emission Rates

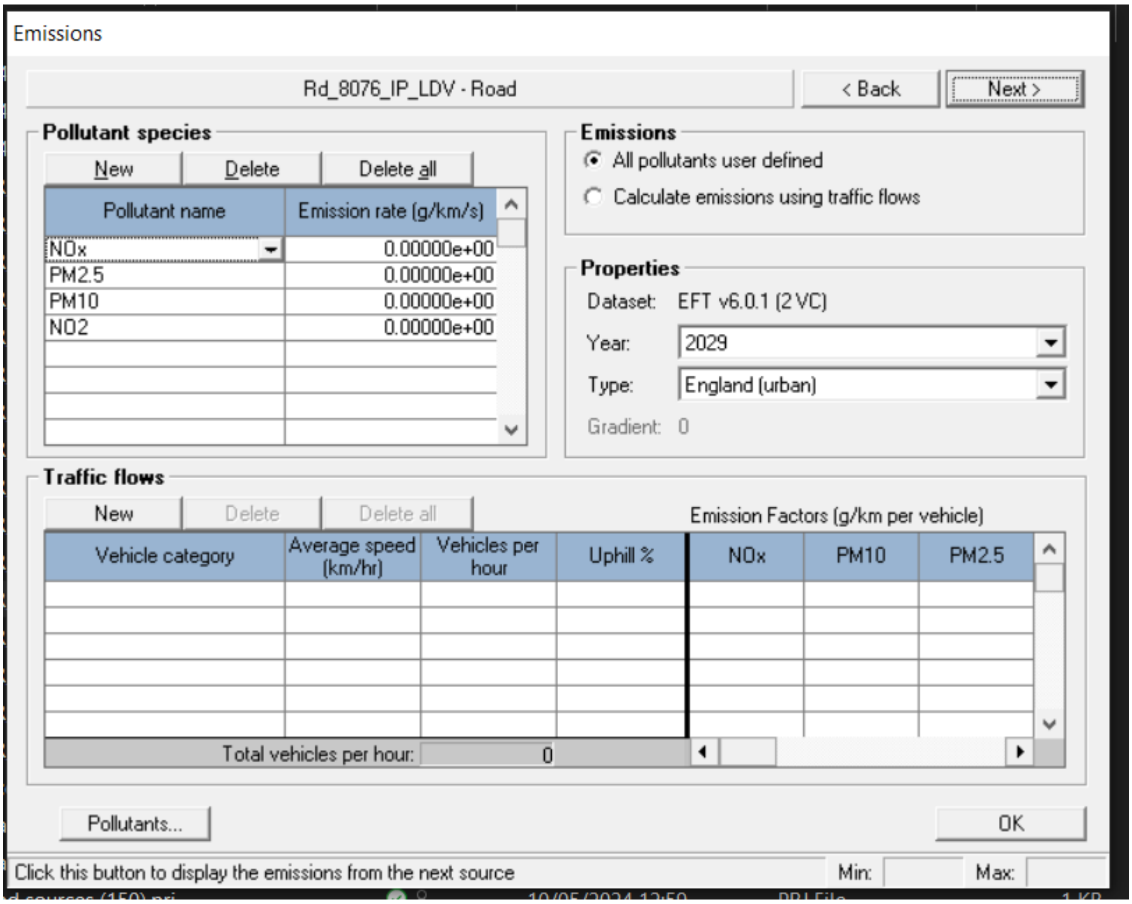


Figure notes: Screenshot from ADMS-Urban

The emission rates for this road are 0, this is the case for other roads. It is unclear as to why these roads do not have emissions.

Figure 15: Meteorological data – Wind roses

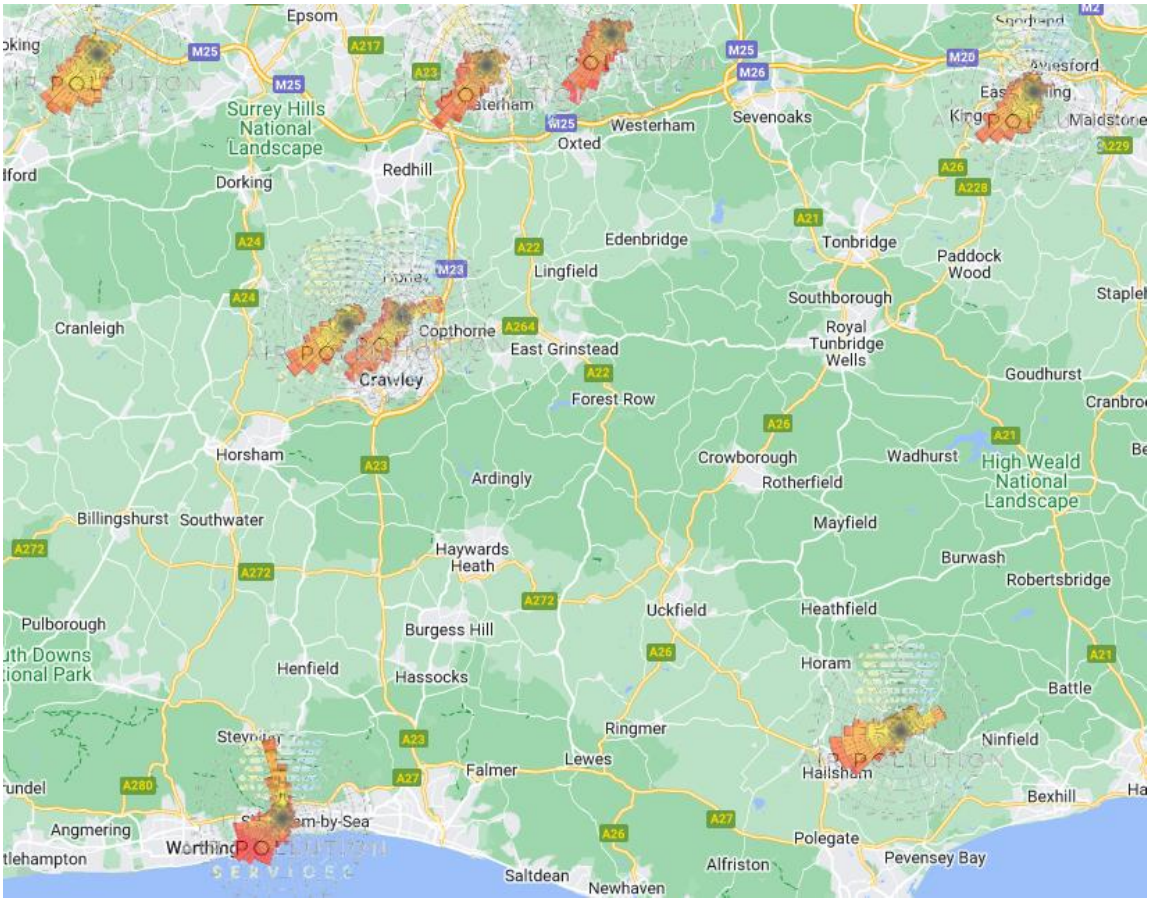


Figure notes: Screenshot from APS' website. Imagery © 2024 Google, map data © 2024.

The model used Gatwick Airport observational meteorological (derived from the METAR) for the whole model domain. Charlwood Met Office site (left of Gatwick) demonstrates winds from the southwest, whereas Gatwick also experiences winds from the east. Wind direction and speed vary across the modelled domain. The use of a single meteorological dataset to represent the local meteorological in all locations of the modelling domain will introduce error.

Figure 16: Meteorological data

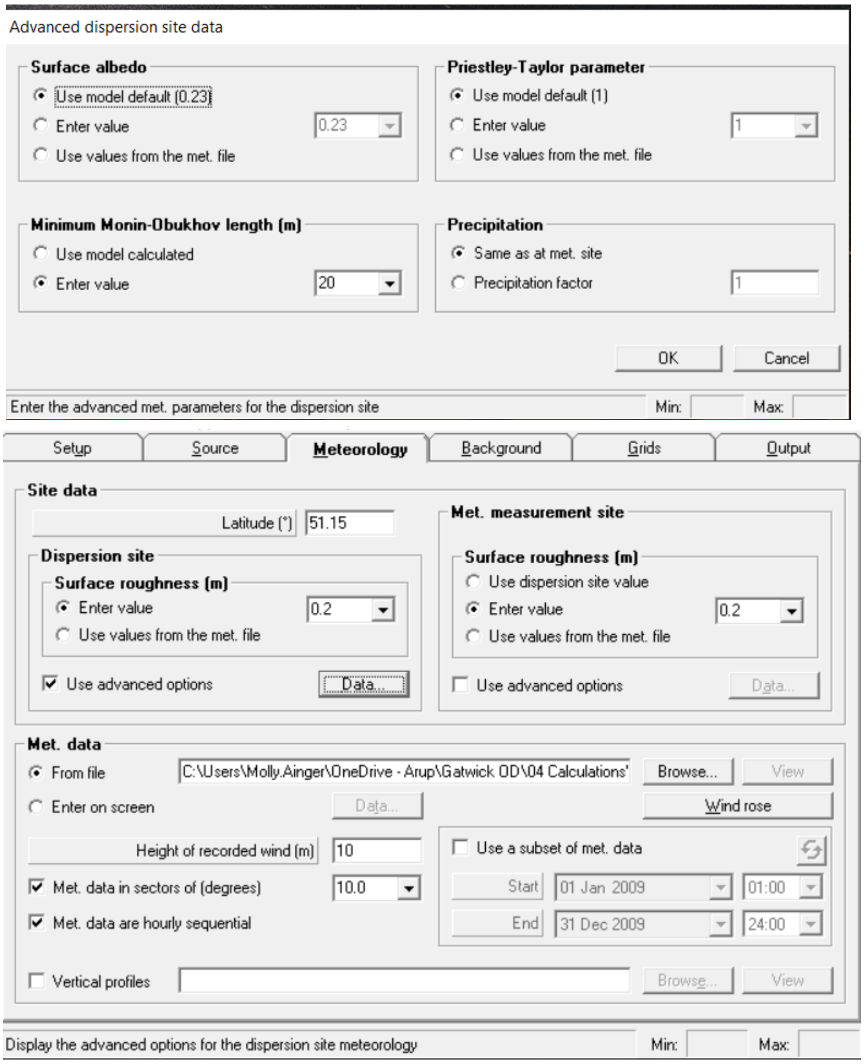


Figure notes: Screenshot from ADMS-Roads.

The input file demonstrates the meteorological parameters used in the model where default values have been used for surface albedo, precipitation and the Priestly-Taylor parameter, and 20 has been used for the minimum Monin-Obukhov length for the whole model domain. The influence of varying surface parameters has therefore not been accounted for and could lead to under- or over-predictions in different areas of the study area. The input file also shows the meteorological parameters used in the model, where 0.2 m has been used for surface roughness throughout the entire model domain.

Figure 17: Met Parameters – Surface Roughness

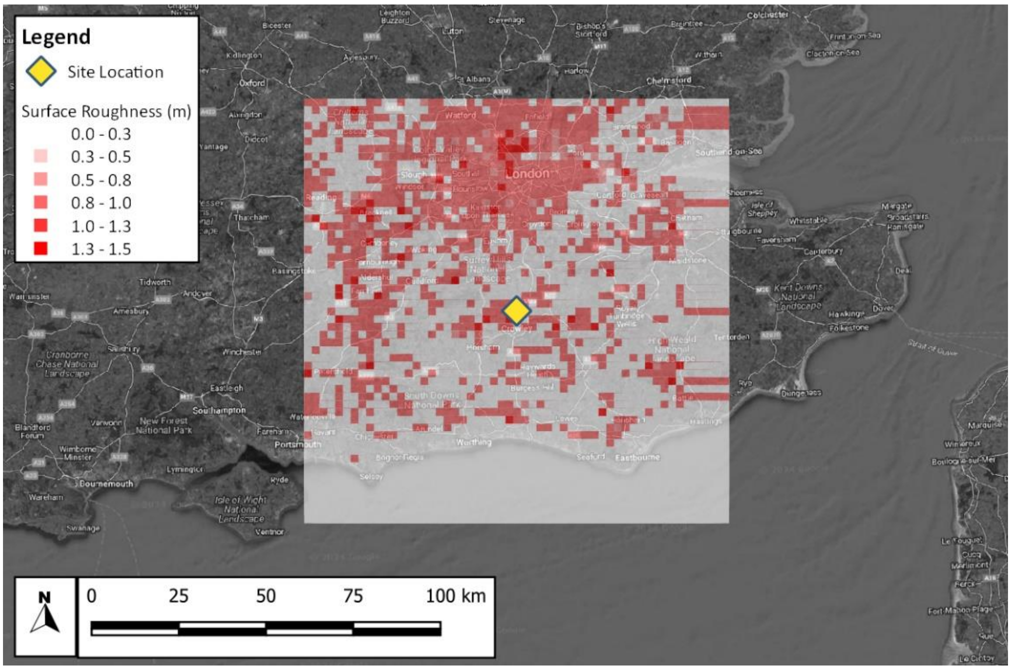


Figure notes: Imagery © 2024 Google, map data © 2024.

The model used a default surface roughness value of 0.2 m. The figure shows a variation in surface roughness from 0 – 1.5 m. The model has therefore under-estimated surface roughness in some locations and overestimated surface roughness in other locations. Justification that 0.2 m is conservative and acceptable to use across the entire domain, as the Applicant has done, is therefore not true in all locations.

Figure 18: Verification Adjustment Factor

Table 3.3.1: 12 Zonal Adjustment Factors

Zone	Number of Sites	Modelled Road Adjustment Factor	Correlation Coefficient	RMSE ($\mu g/m^3$)	Fractional Bias
Generic	58	1.3	0.8	4.3	0.01
Brighton Road (airport)	23	1.3	0.3	6.1	0.01
Cowfold	6	1.6	0.7	2.9	-0.03
Crawley	3	1.7	-1.0	4.3	0.05
Croydon, Park Lane	3	1.6	-1.0	9.7	-0.01
Gatwick	42	1	0.6	3.6	0.03
Hassocks	5	2	0.7	3.7	0.02
Hazelwick Roundabout	16	1.2	0.9	5.0	-0.07
London	61	1.2	0.5	5.7	0.02
M23 and M25	21	0.8*	0.6	5.0	-0.06
Merstham	3	1	-0.9	3.1	0.00
Storrington	5	1.7	1.0	6.2	-0.05

*A factor of 1 was used to process the results as a conservative assumption.

Figure notes: Source: Gatwick Airport Northern Runway Project. Environmental Statement, Appendix 13.5.1: Air Quality Data and Model Verification.

The report includes this table of the different verification factors used in the model. It does not provide an explanation as to how these zones were selected or how zones were allocated to receptors.

Figure 19: Verification Zones

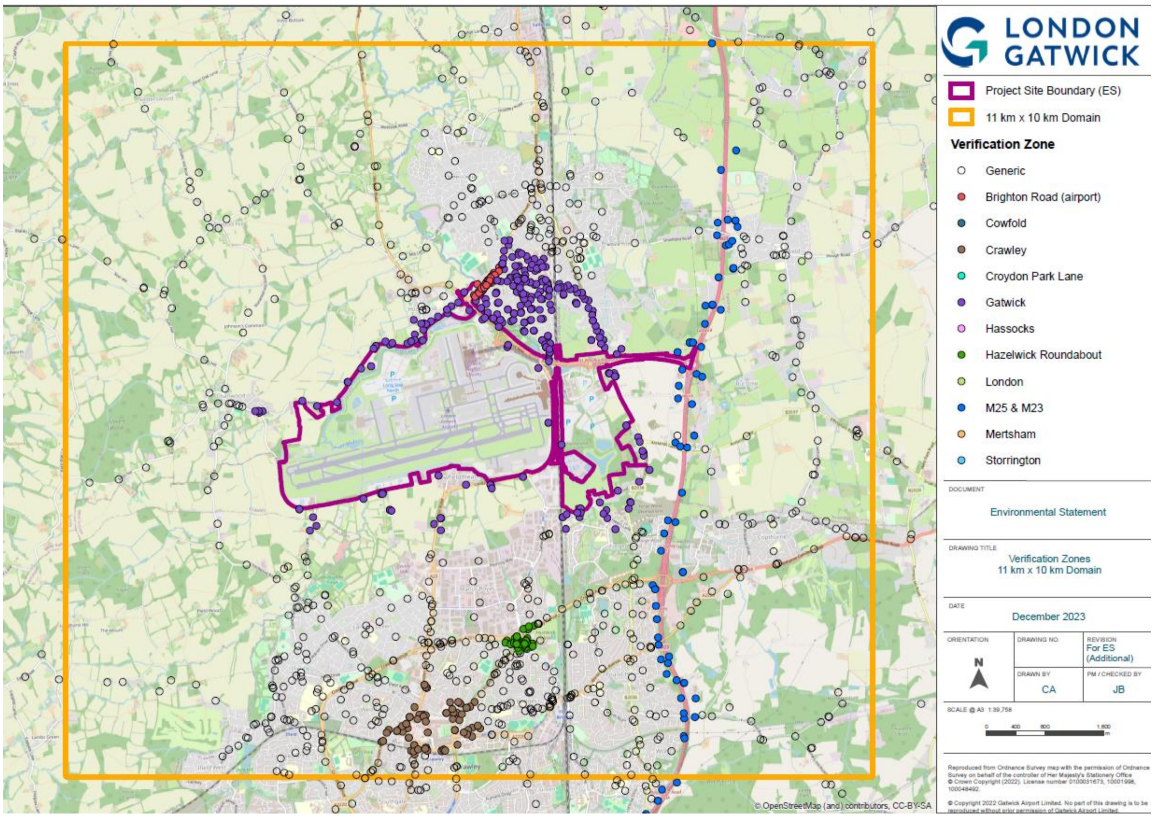


Figure notes: Source: Gatwick Airport Northern Runway Project. Environmental Statement, Appendix 13.5.1: Air Quality Data and Model Verification.

The receptors in the model have been categorised into different verification zones, with differing verification adjustment factors. No justification for allocation has been made.

Figure 20: Verification Adjustment Factor Zones – M23 / B2037

Figure notes: Imagery © 2024 Google, map data © 2024.

There are two verification zones shown here, M23 & M25 in blue, and generic in white. The blue zone has an adjustment factor of 1, and the generic has an adjustment factor of 1.3, meaning that there is a 30% difference in the road concentration contribution between the two zones. The receptor in the white zone (red arrow) is closer to the motorway than the one in the blue zone (yellow arrow). There is no clear reasoning for the use of two different verification zones here.

Figure 21: Verification Adjustment Factor Zones – Turners Hill Rd

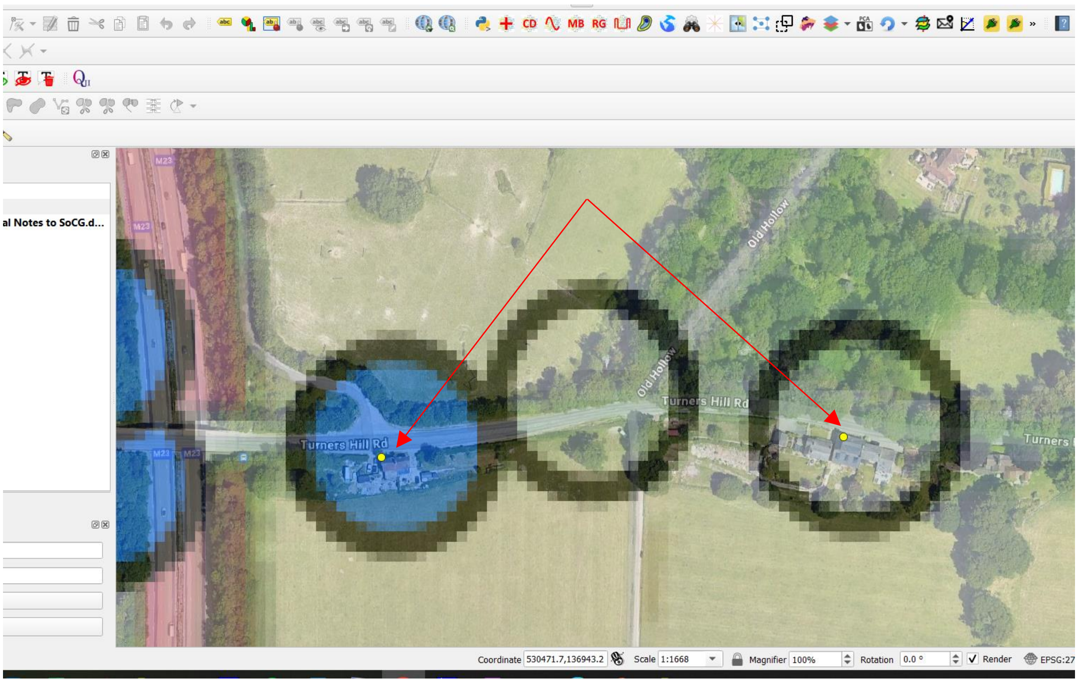


Figure notes: Imagery © 2024 Google, map data © 2024.

This section of Turners Hill Road has two verification factors used, M25 & M23 in blue and generic in white. The blue zone has an adjustment factor of 1, and the generic has an adjustment factor of 1.3, meaning that there is a 30% difference in the road concentration contribution between the two zones. However, there is no significant difference in streetscape or gradient, and it is unlikely that traffic flows and / or speeds would change significantly between the two zones. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

Figure 22: Verification Adjustment Factor – Three Bridges Rd

Figure notes: Imagery © 2024 Google, map data © 2024.

This section of Three Bridges Road has two verification factors used, Crawley in brown and generic in white. The brown zone has an adjustment factor of 1.7 and the generic zone has an adjustment factor of 1.3, meaning that there is a 40% difference in the road concentration contribution between the two zones. However, the streetscape along the road does not change, there is not a significant change in gradient, and it is unlikely that traffic flows would differ greatly between the two zones. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

Figure 23: Verification Adjustment Factor – A2004

Figure notes: Imagery © 2024 Google, map data © 2024.

This section of the A2004 has two verification factors used, Crawley in brown and generic in white. The brown zone has an adjustment factor of 1.7 and the generic zone has an adjustment factor of 1.3, meaning that there is a 40% difference in the road concentration contribution between the two zones. However, the streetscape along the road does not change, there is not a significant change in gradient, and it is unlikely that traffic flows and / or would differ greatly between the two zones. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

Figure 24: Verification Adjustment Factor – The Street

Figure notes: Imagery © 2024 Google, map data © 2024.

This section of The Street/Horley Road has two verification factors used, Gatwick in purple and generic in white. Gatwick has an adjustment factor of 1 and generic has an adjustment factor of 1.3, meaning there is a 30% difference in the road concentration contribution between the two zones. However, the streetscape along the road does not change, there is not a significant change in gradient, and it is unlikely that traffic flows and / or speeds would differ greatly between the two receptors. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

Figure 25: Verification Adjustment Factor – A23

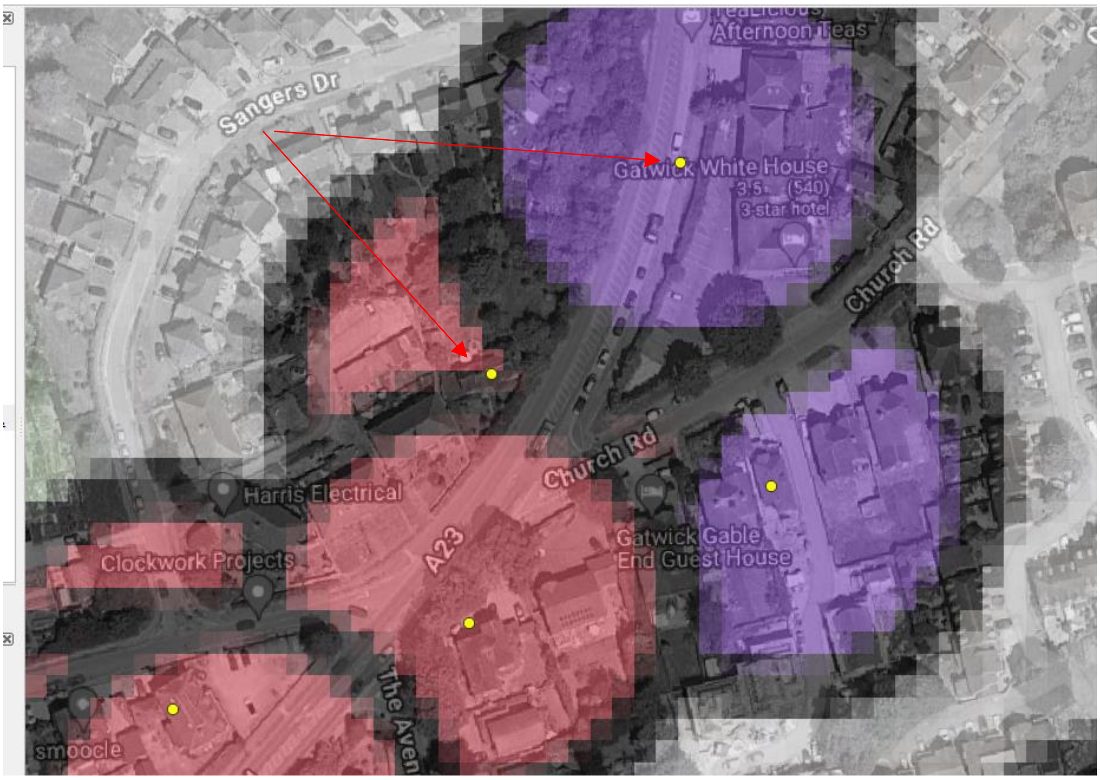


Figure notes: Imagery © 2024 Google, map data © 2024.

This section of the A23 has two verification factors used, Brighton Road (airport) in red, and Gatwick in purple. Brighton Road (airport) has an adjustment factor of 1.3 and Gatwick has an adjustment factor of 1, meaning there is a 30% difference in the road concentration contribution. However, there is no significant difference in streetscape or gradient, and it is unlikely that traffic flows and / or speeds would change significantly between the two zones. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

Figure 26: Verification Adjustment Factor – Crawley Ave

Figure notes: Imagery © 2024 Google, map data © 2024.

This section Crawley Avenue has two verification factors used, Hazelwick Roundabout in green and general in white. Hazelwick Roundabout has an adjustment factor of 1.2 and generic has an adjustment factor of 1.3, meaning that there is a 10% difference in the road concentration contribution between the two zones. However, there are receptors in the green zone which are not situated at the roundabout and are close to receptors in the white zone. Moreover, there is no significant difference in streetscape or gradient, and it is unlikely that traffic flows and / or speeds would change significantly between the two zones. Therefore there is no justification for two different zones to be used and the Applicant has not stated why this is done. It is not clear which zonal adjustment factor should be applied to both of these (as they are exposure to the same situation). This will impact the predicted concentrations.

A2. EIA Framework

A2.1. The EIA Regulations 2017 require EIAs to identify, describe and assess in an appropriate manner, the direct and indirect significant effects of development on a number of factors including human health, biodiversity and air.

A2.2. Regulation 18 (4) sets out what must be in an Environmental Statement. It should include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment; and be prepared, taking into account the results of any relevant UK environmental assessment, which are reasonably available to the person preparing the environmental statement, with a view to avoiding duplication of assessment.

A2.3. Schedule 3 sets out the criteria for screening whether development requires and EIA or not. It also states that the likely significant effects of development must be considered in relation to the magnitude and spatial extent of the impact, the nature of the impact, the intensity and complexity of the impact, the probability of impact, the expected onset, duration, frequency and reversibility of the impact, the cumulative impact and the possibly of effectively reducing the impact.

A2.4. It requires consideration of the risks to human health (for example due to air pollution).

A2.5. Schedule 4 sets out the information required for inclusion in Environmental Statements. It includes an estimate, by type and quantity, of air emissions produced during the construction and operation phases.

A2.6. Schedule 4 also requires (our emphasis)

- a description of the current state of the environment (i.e. the baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge (i.e. future baseline(s)).
- A description of the factors likely to be significantly affected by the development which includes human health, biodiversity, and air.
- A description of the likely significant effects of the development resulting from:
    a. the construction and existence of the development, including, where relevant, demolition works;
    b. the use of natural resources, in particular land, soil;
    c. the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;
    d. the risks to human health, cultural heritage or the environment (for example due to accidents or disasters); and
    e. the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources.

f. the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change; and

g. the technologies and the substances used;

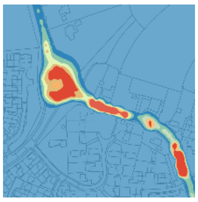
A2.7. The description of the likely significant effects should cover the direct and indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project.

A2.8. Schedule 4 also requires a description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.

AIR POLLUTION
SERVICES

Experts in Air Quality, Odour and Climate Change

- Air Quality Assessments for Planning Applications
- Air Quality Neutral
- Pre-application Feasibility



- LAQM Support
- Feasibility Studies
- Local Plan Modelling

- Construction Dust
- Mineral Dust
- Dust Management

- Odour Risks
- Odour Modelling
- Odour Management

- Transport Schemes
- Industrial and Energy
- Agriculture and Waste

- EIA Air Quality Chapters
- Greenhouse Gas Assessments
- Climate Vulnerability

- Air Risk Assessments
- MCPD Permits
- Specified Generator Permits

- Litigation Services
- Quality Assurance
- Monitoring Services
- Policy Development

[redacted]