M25 junction 10/A3 Wisley interchange TR010030
6.3 Environmental Statement Chapter 5: Air quality

Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6
June 2019

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

M25 junction 10/A3 Wisley interchange

The M25 junction 10/A3 Wisley interchange Development Consent Order 202[x]

6.3 ENVIRONMENTAL STATEMENT CHAPTER 5: AIR QUALITY

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010030
Application Document Reference	TR010030/APP/6.3
Author:	M25 junction 10/A3 Wisley interchange project team, Highways England

Version	Date	Status of Version
Rev 0	June 2019	Development Consent Order application

Table of contents

Chapter Pages

Tables

Figures

Executive summary

A review of baseline conditions shows that there are four Air Quality Management Areas (AQMAs) in the study area which could be affected by the Scheme. Air quality monitoring data shows that there are exceedances of the annual mean Air Quality Strategy (AQS) objective for NO_2 within the study area at roadside and kerbside sites, and within the AQMAs. PM_{10} concentrations are below the objectives.

During construction, there is the potential for increased emissions of dust, however, with the application of appropriate mitigation measures, significant adverse effects at nearby receptors would be unlikely. Additional traffic during construction was considered unlikely to significantly affect air quality, as there were not expected to be any receptors with an exceedance of the NO_2 annual mean AQS objective, and the changes were expected to be of small or imperceptible magnitude.

During operation, the assessment showed that overall there was not considered to be a significant adverse effect on air quality. Although exceedances of the NO_2 annual mean AQS objective were expected at three receptors both with and without the Scheme, and at one receptor with the Scheme but not with the Do-Minimum, the changes in concentrations with the Scheme were expected to be of imperceptible magnitude at three receptors, and of small magnitude at only one receptor. There was expected to be a low risk of non-compliance for meeting the EU Limit Values with the Scheme.

The ecological assessment showed that NO_x concentrations were estimated to exceed the critical level for vegetation at the majority of the designated ecological sites included in the assessment. There was expected to be an increase in NO_x concentrations at two of the designated sites sufficient to require changes in nitrogen deposition rates to be calculated. However, these changes were not considered to result in any adverse effects within the designated sites.

5. Air Quality

5.1 Introduction

5.1.1 This chapter provides the air quality assessment of the Scheme. It identifies and presents the existing baseline air quality conditions in the Scheme area, identifies the potential impacts on air quality associated with the Scheme on human health and ecosystems both during construction and operation, and discusses mitigation measures that may be applied to mitigate any potentially significant adverse effects.

5.2 Competent expert evidence

5.2.1 This air quality chapter has been undertaken by a Chartered Scientist (BSc, CSci) who holds full professional membership with the Institution of Environmental Sciences and Institute of Air Quality Management. They have over 20 years of knowledge and experience in air quality assessment and have used their knowledge and professional judgement to undertake this assessment.

5.3 Legislative and policy framework

Air Quality Criteria

5.3.1 There are two sets of ambient air quality criteria for the protection of public health: legally binding, mandatory limit values set by the EU; and objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)[1] which local authorities are required to work towards achieving. Both sets of criteria are implemented in Air Quality Regulations (The Air Quality Standards Regulations 2010 (SI 2010/1001)[2] for EU limit values and the Air Quality (England) Regulations (SI 2000/928)[3] as amended (2002/3043)[4] for AQS objectives).

5.3.2 Air quality criteria relevant to the air quality assessment are summarised in Table 5.1. For nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) the criteria are the same for both the EU limit values and the AQS objectives.

Table 5.1: Relevant human health air quality criteria

Pollutant	Criteria
NO_2	1-hour mean concentration should not exceed 200 µg/m^3 more than 18 times a year
	Annual mean concentration should not exceed 40 µg/m^3
PM_{10}	24-hour mean concentration should not exceed 50 µg/m^3 more than 35 times a year

[1] Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Retrieved 2019, from https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1
[2] The National Archives (2010) The Air Quality Standards Regulations 2010: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2010/1001/contents/made
[3] The National Archives (2000) The Air Quality (England) Regulations 2000: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2000/928/contents/made
[4] The National Archives (2002) The Air Quality (England) (Amended) Regulations 2002: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2002/3043/contents

Pollutant	Criteria
	Annual mean concentration should not exceed 40 µg/m^3
$PM_{2.5}$	Annual mean concentration should not exceed 25 µg/m^3

Ecological Criteria

5.3.3 The EU Directive sets a critical level for annual mean concentrations of nitrogen oxides (NO_x) to protect sensitive vegetation. This is included in the Air Quality Standards Regulations (SI 2010/1001). Assessment of compliance with this critical level is undertaken at locations more than 20 km from towns with more than 250,000 inhabitants or more than 5 km from other built-up areas, industrial installations or motorways or major roads with traffic counts of more than 50,000 vehicles per day. UK statutory nature conservation agencies' (Natural England) policy is to apply the criterion of 30 µg/m^3, on a precautionary basis, as a benchmark only in all designated conservation sites, including 'Ramsar' sites, SPAs, SACs and SSSIs.

5.3.4 Critical loads for nitrogen deposition have been set by the United Nations Economic Commission for Europe. A critical load is a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur, according to present knowledge. Critical loads vary by type of habitat and species. The critical load for deposition (eutrophication) is given as a range and is quoted in units of kg/ha/year.

Dust deposition

5.3.5 There are no national standards or guidelines for dust deposition currently set for the UK, nor by the European Union or any international organisation. This is mainly due to the difficulty in setting a standard that needs to relate to dust being a perceptual problem rather than being specifically related to health effects. Typically, assessments use an indicative threshold for the 'likelihood of complaint' for instance, in residential areas a dust deposition flux (as an average measured over a month using a passive deposition gauge) of 200 mg/m^2/day or greater.

Planning policy and framework

5.3.6 Table 5.2 below summarises the legislation, regulatory and policy framework applicable to air quality.

Table 5.2: Legislation, regulatory and policy framework for air quality

Legislation / Regulation	Summary of Requirements
National	
National Policy Statement for National Networks (NPSNN)[5]	The NPSNN provides policy and guidance relating to the development of NSIPs. It recognises (paragraph 5.3) that increased emissions of pollutants during construction or operation of projects on national networks can contribute to

[5] DfT (2014) National Policy Statement for National Networks. Retrieved 2019, from https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

Legislation / Regulation	Summary of Requirements
	adverse impacts on human health, on protected species and habitats. An Environmental Statement is required for projects that may have significant air quality effects and this should describe (paragraph 5.7): • Existing air quality levels; • Forecasts of air quality at the time of opening, assuming that the Scheme is not built (the future baseline) and taking account of the impact of the Scheme; and • Any significant air quality effects, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of the impact of road traffic generated by the project. Paragraphs 5.11, 5.12 and 5.13 of the NPSNN requires a judgement to be made as to the risk of a project affecting the UK's ability to comply with the Air Quality Directive. Paragraph 5.11: "Air quality considerations are likely to be particularly relevant where schemes are proposed: within or adjacent to AQMAs; roads identified as being above Limit Values or nature conservation sites; and where changes are sufficient to bring about the need for a new AQMA or change the size of an existing AQMA; or bring about changes to exceedances of the Limit Values, or where they may have the potential to impact on nature conservation sites." Paragraph 5.12: "The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and/or where they lead to a deterioration in air quality in a zone/agglomeration." Paragraph 5.13: "The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will: result in a zone/agglomeration which is currently reported as being compliant; or affect the ability of a non-compliant area to achieve compliance with the most recent timescales reported to the European Commission at the time of the decision."
National Planning Policy Framework (NPPF) 2019[6]	Paragraph 181 of the NPPF requires local planning authorities (LPAs) to take account of air quality in plan making. Paragraph 181: "Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

[6] MHCLG (2019) National Planning Policy Framework. Retrieved 2019, from https://www.gov.uk/government/publications/national-planning-policy-framework--2

Legislation / Regulation	Summary of Requirements
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) 2007	Sets out air quality standards and objectives, to protect people's health and the environment.
The Air Quality (Standards) Regulations 2010 (SI 2010/1001)	English legislation which sets legally binding limit values for human health and vegetation set in Directives 2008/50/EC and 2004/107/EC on ambient air quality.
The Air Quality (England) Regulations 2000 (SI 2000/928) and The Air Quality (England) (Amendments) Regulations (SI 2002/3043)	English legislation which sets the objectives given in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland, applicable to local air quality management.
Environment Act 1995 (Part IV)	Sets provisions for protecting air quality in the UK and for local air quality management. Local authorities are required to regularly review and assess local air quality and identify areas where Air Quality Strategy (AQS) objectives may be exceeded. Where the authority has declared an AQMA, it is required to prepare an Air Quality Action Plan (AQAP) describing the pollution reduction measures it will put in place. Further information on AQMAs in the air quality study area is provided in the Baseline Conditions section 5.7.
Road Investment Strategy (RIS) and Strategic Business Plan 2015[7]	By 2040 DfT aspires to a network that will be sustainable with "zero breaches of air quality regulations and major reductions in carbon emissions across the network". The Highways England Delivery Plan 2015-2020[8] identifies Highways England's commitment to investing £75m "in a range of projects to reduce pollution and ensure the air around the network is clean and healthy". The Highways England Delivery Plan 2017-2018[9] sets out indicators that will be used to measure performance, including, of relevance to air quality, the number of air quality pilot studies completed.
Highways England Air Quality Strategy[10]	Sets out Highways England's approach to improving air quality. As part of the strategy, Highways England has identified four priority action areas; policy, planning, monitoring and operational management, and has committed to "where appropriate, design out or mitigate poor air quality for our schemes"
National Air Quality Plan[11]	The UK government's plan for tackling roadside nitrogen dioxide concentrations in July 2017 which sets out the approach for meeting the statutory EU limit values for nitrogen dioxide in the shortest possible time.

[7] DfT and Highways Agency (2015) Road Investment Strategy: for the 2015/16 - 2019/20 Road Period, March 2015. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf

[8] Highways England (2015) Highways England Delivery Plan 2015 - 2020. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424467/DSP2036-184_Highways_England_Delivery_Plan_FINAL_low_res_280415.pdf

[9] Highways England (2017) Highways England Deliver Plan 2017-2018. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/642750/Highways_England_Delivery_Plan_Update_2017-2018.pdf

[10] Highways England (2017) Our strategy to improve air quality. Retrieved 2019, from https://www.gov.uk/government/publications/highways-england-air-quality-strategy

[11] Defra (2017) Air Quality Plan for nitrogen dioxide (NO2) in UK (2017). Retrieved 2019 from https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

Legislation / Regulation	Summary of Requirements
Clean Air Strategy 2019[12]	National strategy setting out the actions required across all parts of government and society to improve air quality. It includes new goals to reduce public exposure to $PM_{2.5}$ as recommended by the World Health Organisation.
Regional	
London Plan 2016[13]	The London Plan is the statutory Spatial Development Strategy for Greater London. Policy 7.14 Improving Air Quality sets out considerations for local authorities when making development planning decisions.
Draft New London Plan	The new London Plan is undergoing examination in public. Policy SI1 Improving Air Quality aims to ensure that new developments are designed and built, as far as is possible, to improve local air quality and reduce the extent to which the public are exposed to poor air quality.
Surrey Transport Plan, 2011-2026[14] Air Quality Strategy (2016)[15]	Surrey County Council has prepared an Air Quality Strategy with the aim of improving "air quality in AQMAs on the county road network such that Surrey's borough and districts are able to undeclare these areas as soon as possible, with regard to other strategies and funding constraints".
Local	
Elmbridge Core Strategy 2011[16]	Policy CS25 Travel and Accessibility within the Elmbridge Core Strategy 2011 states that the council "will seek to mitigate the detrimental environmental effects cause by transport, particularly with regards to heavy goods vehicles (HGVs), through a variety of measures, which may include…improving air quality [inter alia]. Support will be given to schemes that help to meet the commitments contained in the Elmbridge Air Quality Strategy".
Elmbridge Local Plan Development Management Plan 2015[17]	Policy DM5 Pollution states that "Within designated Air Quality Management Areas, the Council will promote measures to improve air quality and will expect development proposals to avoid introducing additional sources of pollution… Planning permission will not be granted for proposals where there is a significant adverse impact upon the status of the Air Quality Management Area or where air quality may have a harmful effect on the health of future occupiers of the development, taking into account their sensitivity to pollutants, unless the harm can be suitably mitigated".
Elmbridge Borough Council Air Quality Action Plan 2011[18]	The AQAP identifies road traffic as the primary source of air pollution within the borough and as such includes measures such as improved traffic control, as well as strategic measures including incorporating air quality into the planning regime. Progress on measures are additionally documented in EBC's

[12]Defra (2019) Clean Air Strategy 2019 Retrieved 2019 from https://www.gov.uk/government/publications/clean-air-strategy-2019
[13] Mayor of London (2016) The London Plan: The Spatial Development Strategy for London Consolidated with Alterations since 2011. Retrieved 2019 from https://www.london.gov.uk/sites/default/files/the_london_plan_2016_jan_2017_fix.pdf
[14] Surrey County Council (2018) Surrey Transport Plan (LTP3). Retrieved 2019 from https://www.surreycc.gov.uk/roads-and-transport/policies-plans-consultations/transport-plan
[15] Surrey County Council (2016) Surrey Transport Plan Air Quality Strategy January 2016. Retrieved 2019 from https://www.surreycc.gov.uk/__data/assets/pdf_file/0020/90254/Air-Quality-Strat-15th-Update-rebranded.pdf
[16] EBC (2011) Elmbridge Core Strategy.
[17] EBC (2015) Elmbridge Local Plan: Development Management Plan.
[18] EBC (2011) Air Quality Action Plan for Elmbridge Borough Council Retrieved 2019 from http://aqma.defra.gov.uk/action-plans/ElmBC%20AQAP%202011.pdf

Legislation / Regulation	Summary of Requirements
	annual status reports provision of electric vehicles for council use, and provision of electric charging points.
Guildford Borough Local Plan 2015-2034[19]	Policy ID3: Sustainable transport for new developments states that "New development will be required to provide mitigation to address otherwise adverse material impacts on communities and the environment including impacts on amenity and health, noise pollution and air pollution"
Woking Development Management Policies Development Plan Document 2016[20]	Policy DM5: Environmental Pollution applies a general principle that "When assessed individually or cumulatively, development proposals should ensure that there will be no unacceptable impacts on air quality [inter alia]". Policy DM6 Air and Water Quality states that "Development that has the potential, either individually or cumulatively, for significant emissions to the detriment of air quality, particularly in designated Air Quality Management Areas … or in areas at risk of becoming an Air Quality Management Area, should include an appropriate scheme of mitigation… Development in designated Air Quality Management Areas should take account of existing air pollution and include measures to mitigate its impact on future occupiers where possible…".
Mole Valley Local Plan 2000[21]	Policy MOV2 - The Movement Implications of Development states that "Development will normally only be permitted where it can be demonstrated that it is or can be made compatible with the transport infrastructure and the environmental character in the area…In particular, proposals for major developments will only be permitted where it can be demonstrated that in order to accommodate the traffic generated by that development appropriate measures are made to obviate the environmental impact…".
Reigate and Banstead Local Plan: Core Strategy Adopted 2014[22]	Policy CS10: Sustainable Development states that "Development will: …Be designed to minimise pollution, including air, noise and light [inter alia]."
Reigate and Banstead Borough Council Air Quality Action Plan for the M25 2004[23]	The main action within the AQAP is to monitor nitrogen dioxide concentrations near to the M25.
Runnymede Borough Council Air Quality Action Plan 2014[24]	The AQAP recognises road traffic as the major source of air pollution in the borough. The AQAP incorporates a number of measures for improving air quality both within the AQMAs and the wider local authority area from development control, implementation of mitigation, including redesign and compensation/offsetting measures, proposals for continued air quality monitoring, and identification of a number of infrastructure projects to tackle congestion and benefit air quality, supplemented with actions to promote sustainable

[19] GBC (2019) Guildford Borough Local Plan: Strategy and Sites 2015 – 2034. Adopted April 2019. Retrieved 2019 from https://www.guildford.gov.uk/newlocalplan/media/29891/The-Guildford-borough-Local-Plan-strategy-and-sites-2015-2034/pdf/Guildford_Borough_Local_Plan_(2015-2034)_(Web_Version)_(Reduced)1.pdf
[20] WBC (2016) Woking Local Development Documents: Development Management Policies October 2016. Retrieved 2019 from http://www.woking2027.info/developmentplan/management/dmpadp
[21] MVDC (2000) Local Plan. Retrieved 2019 from http://www.planvu.co.uk/mvdc/contents_written.htm
[22] RBC (2014) Reigate and Banstead Local Plan: Core Strategy Adopted July 2014. Retrieved 2019 from http://www.reigate-banstead.gov.uk/downloads/file/3073/adopted_core_strategy_july_2014
[23] RBC (2004) Air Quality Action Plan for the M25 within The Borough of Reigate and Banstead. Retrieved 2019 from http://www.reigate-banstead.gov.uk/downloads/file/1587/action_plan_for_the_m25_air_quality_management_area
[24] RBC (2014) Air Quality Action Plan for Runnymede Borough Council

Legislation / Regulation	Summary of Requirements
	transport. The AQAP also references local strategies and policies, including Runnymede's Local Transport Plan 3 and Local Development Framework (now termed Local Development Scheme[25]).
Air Quality Action Plan for the Royal Borough of Kingston upon Thames 2016[26]	The AQAP includes measures to reduce the pollution emitted from vehicles, promoting alternative more sustainable sources of transport.

Table Source: Various

5.3.7 There are no relevant policies within the Runnymede 2001 Local Plan, nor in the Surrey Heath 2012 Core Strategy or the Royal Borough of Kingston Upon Thames Core Strategy Adopted 2012.

5.3.8 It is noted that all local authorities with the exception of Guildford Borough Council (GBC) and Woking Borough Council (WBC) are in the process of updating their Local Plans.

5.3.9 Mole Valley District Council (MVDC) has not produced an Air Quality Action Plan (AQAP) as there are no AQMAs within their local authority area. Measures within the AQAP for GBC, WBC and Surrey Heath Borough Council (SHBC) are not considered at this stage as the AQMAs within their boroughs are not within the air quality study area.

5.4 Study area

5.4.1 The air quality assessment study area was defined in accordance with the DMRB Volume 11, Section 3, Part 1 HA 207/07 Air Quality[27].

5.4.2 The air quality study area for assessing the potential effects of construction dust during the construction phase is defined as the area within 200 m of the construction site, as set out in DMRB HA 207/07 (paragraph 3.45). The Scheme boundary includes the construction areas and has been used to define the study area for construction.

5.4.3 The air quality study area for assessment of construction traffic and during the operational phase is determined in accordance with traffic change criteria set out in the DMRB HA 207/07 which defines affected road networks (ARN) for local (paragraph 3.12) and regional (paragraph 3.20) air quality assessments. An assessment is required for local air quality where there are receptors identified within 200 m of the ARN.

5.4.4 The study area for local air quality during operation includes the area within 200 m of the Scheme extent, including the M25 junction 10, the M25 extending between junctions 8 and 13, the A3, the M3 between junctions 2 and 3, the A246 and other local roads. The Scheme is located primarily within the boundaries of Guildford Borough Council (GBC) and Elmbridge Borough Council (EBC), while the study area extends into the local authority areas of Woking Borough Council (WBC), Runnymede Borough Council (RBC), Surrey Heath Borough Council

[25] https://www.runnymede.gov.uk/CHttpHandler.ashx?id=16032&p=0
[26] Royal Borough of Kingston upon Thames (2016) Air Quality Action Plan For the Royal Borough of Kingston upon Thames. Retrieved 2019 from https://moderngov.kingston.gov.uk/documents/s59150/2_RevisedAirQualityActionPlanAnnex1draftAQAP.pdf
[27] DfT (2007). DMRB Volume 11, Section 3, Part 1 HA 207/07 'Air Quality'. Retrieved 2019, from http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf

(SHBC), Mole Valley District Council (MVDC), Reigate and Banstead Borough Council (RBBC) and the Royal Borough of Kingston upon Thames (RBK).

5.4.5 The study area for local air quality during operation is provided in Figure 5.1, which shows sensitive human health receptors and designated ecological sites within 200 m of the ARN. The study area for construction dust is provided in Figure 5.2. The study area for construction traffic is provided in Figure 5.9.

5.5 Assessment methodology

5.5.1 The air quality assessment for the Scheme has been undertaken principally following the guidance given in the DMRB HA207/07 and associated Interim Advice Note (IANs). It was discussed and agreed with Natural England and local authorities and has consisted of:

- Discussion of existing baseline conditions;
- Identification of sensitive receptors and AQMAs, and production of constraints maps;
- Qualitative assessment of the likely effect on local air quality from dust-raising activities during construction;
- Quantitative assessment of the likely effect on local air quality from changes in traffic during construction;
- Assessment of the likely changes in local air pollutant concentrations and nitrogen deposition rates during operation at selected receptors;
- Assessment of significance of the air quality effects including an assessment of compliance with the EU Air Quality Directive;
- Assessment of the likely changes in regional emissions during operation; and
- Identification of the need for mitigation measures where appropriate.

5.5.2 The Transport Analysis Guidance (TAG) assessment is reported separately. Quantitative outputs for reporting within the Appraisal Summary Table have been generated.

Existing Air Quality Information

5.5.3 A summary of existing air quality has been provided based on information collated for the PEIR and updated to include the additional information for the revised study area.

Constraints Map

5.5.4 A constraints map for the Scheme air quality study area has been produced based on the latest available information and is shown in Figure 5.1. The constraints map includes: affected roads, 200 m boundary from affected roads, sensitive receptors, AQMA boundaries, statutory designated ecological site boundaries, and exceedance areas of air quality criteria without and with the Scheme where known.

Effects on Air Quality During Construction

5.5.5 A qualitative assessment of impacts on air quality from construction has been undertaken in accordance with the DMRB. The assessment has taken into account the nature of any proposed construction activities that have the potential to generate dust and the location of sensitive receptors within 200 m of the Scheme construction works that could be at risk of being affected.

5.5.6 A quantitative assessment of vehicle emissions during construction has also been undertaken, given that there will be additional HDV movements of more than 200 per day, travelling to and from the construction site over a period in excess of six months. The assessment has followed the method for a local air quality assessment during operation as described below. The traffic data were provided for two scenarios in the year 2022, with and without construction traffic. In reality, construction will be taking place between 2020 and 2022, but the likely effects at receptors would be similar in all years. As the study area for construction traffic was different from that for the local air quality assessment during operation, additional receptors were required for assessment. These are provided in Appendix 5.2 and shown in Figure 5.9.

Effects on Air Quality During Operation

5.5.7 An air quality assessment has been undertaken principally following the guidance given in the DMRB HA207/07 and associated IANs.

5.5.8 Due to the complexity of the Scheme and the potential for significant effects, a detailed local air quality assessment has been undertaken to estimate NO_2 and PM_{10} concentrations at selected human health receptors, and NO_x concentrations and nitrogen deposition rates at designated ecological sites in the Scheme opening year. The local assessment is undertaken for the opening year, rather than the design year, as pollutant concentrations are likely to be higher in earlier years, due to continued expected improvements in emissions in future years.

5.5.9 A detailed level of assessment has been undertaken for regional emissions of NO_x, PM_{10} and carbon dioxide (CO_2) for the opening and design years, given that there were estimated to be changes in modelled peak hour speeds on the roads approaching junction 10.

5.5.10 $PM_{2.5}$ is not included in the assessment as there is not considered to be a risk of the annual mean air quality criteria being exceeded either with or without the Scheme. This is explained in more detail in Appendix 5.1. Measured concentrations at nearby monitoring sites are included in the baseline conditions section for supporting information.

5.5.11 The key scenarios included in the assessment were:

- Base year (2015) - for model verification;
- Projected base year (2022) - for long term trends assessment;
- Opening year (2022) for both the without (Do-Minimum (DM)) and with Scheme (Do-Something (DS)) - local and regional assessments; and
- Design year (2037) DM and DS - regional assessment only.

5.5.12 Traffic data were provided from the strategic SATURN traffic model (provided by Atkins transport planners) for the air quality assessment for the Scheme to enable the ARN for the local air quality assessment to be determined. The traffic data for the earlier design fix 2 (DF2) were used for the assessment. Analysis of the traffic data issued later for the design fix 3 (DF3) indicated that with DF3, the extent of the study area would be smaller, and the changes in traffic flows with the Scheme compared to the Do Minimum would generally be smaller. It was therefore considered unnecessary to revise the assessment, as the results presented in this ES are likely to be more conservative. A further refinement of the Scheme as a result of targeted consultation in November and December 2018 was made. This version of the Scheme (DF3.1) included the restriction of right turn movements from Byfleet Road into Seven Hills Road South and from Seven Hills Road North into Byfleet Road. Analysis of the traffic data issued for the design fix 3.1 (DF3.1) indicated that there would be additional traffic movements on the A245 Byfleet Road west of Painshill junction as a result of this change. Commentary on the likely effects on air quality is provided in Section 5.8.

5.5.13 An affected road for the purposes of a local air quality assessment is defined in DMRB HA 207/07 (paragraph 3.12) as a road that meets any of the following criteria:

- Road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 annual average daily traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV)[28] flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

5.5.14 The changes are applied to roads, rather than modelled links, and so where relevant are determined under two-way traffic conditions. The affected roads are provided in Figures 5.3 to 5.8.

Local Air Quality

5.5.15 The local air quality assessment was undertaken using the dispersion model Atmospheric Dispersion Modelling System (ADMS) Roads software (version 4.1.1.0).

5.5.16 Representative receptors were selected for the local air quality assessment and include those closest to the ARN, and therefore likely to be most affected, as well as those likely to experience the highest concentrations. The local authorities within the air quality study area were also contacted to discuss if there were any receptors they wished to be included within the air quality assessment. Receptors are provided in Appendix 5.2 and shown in Figure 5.10.

5.5.17 The hourly emissions data input to the dispersion model were estimated using Highways England speed band emission factors (based on EFT v8), hourly flows of Light Duty Vehicles (LDV) and HDV, during am, inter-peak, pm, and off peak periods, and speeds, input as a speed category, as determined in accordance with IAN 185/15 on speed banding. In addition, information on road alignment,

[28] Vehicles with a gross vehicle weight above 3.5 tonnes

road width, and local meteorological data (taken from Heathrow Airport for the base year 2015, windrose shown in section 5.8 below) were required to be input into the dispersion model.

Traffic Conditions

5.5.18 Traffic data were supplied in spreadsheet format in accordance with the Major Projects' Instructions (MPI)-29-082014 template. The ADMS-Roads model was set up with a unit emission rate entered into the model for each road link and a time varying emissions file created containing the estimated emissions for each hour, for both weekdays and weekends.

Background Concentrations

5.5.19 The output from the dispersion model provides estimates of the contribution from road traffic emissions to annual mean concentrations of NO_x and PM_{10} at discrete receptor locations. These concentrations must then be combined with estimates of background concentrations, to account for other sources of air pollution, to derive total annual mean concentrations for comparison with air quality criteria. Background concentrations have been derived from Defra's background maps (2015 reference year) and compared with monitored data at background sites in the area where available, to ensure the mapped estimates are appropriate. The comparison is shown in Appendix 5.3 and showed that at the majority of sites, except those within Surrey Heath, monitored concentrations were within 30% of those mapped, hence the Defra background concentrations were deemed suitable to use in the assessment. To avoid double counting the contribution from modelled emission sources, the in-square contributions from motorways, trunk roads, and primary A roads were removed from the total background concentration, using the Defra NO_2 Adjustment for NO_x sector removal tool v6.0, November 2017.

NO_x to NO_2 conversion

5.5.20 Concentrations of NO_2 have been derived from NO_x concentrations using the most up to date version of Defra's NO_x to NO_2 calculator (version 6.1, October 2017). The traffic mix and local authority data used for the conversion were selected according to the locations of the receptors.

Verification

5.5.21 The annual mean NO_2 concentrations were verified by means of comparison against available ratified monitoring data. The modelled road NO_x concentrations were adjusted where appropriate, with reference to the methodology set out in Defra's technical guidance LAQM.TG(16)[29]. Details of the verification process are provided in Appendix 5.4. Two adjustment factors were derived according to location within the air quality study area: in proximity to the M25, the M3 and the A3; and within Esher and other urban areas. Once adjusted, the total NO_2 concentrations were considered to have acceptable model performance in accordance with Defra's LAQM(TG(16)). The model performance statistics are presented in Appendix 5.4.

5.5.22 In the absence of monitored PM_{10} concentrations in the study area against which modelled concentrations could be verified, the model adjustment factor derived

[29] Defra (2018) Local Air Quality Management Technical Guidance (TG16) retrieved from: https://laqm.defra.gov.uk/technical-guidance/

for modelled road NO_x was also applied to modelled PM_{10} concentrations. This approach is suggested within Defra's LAQM.TG(16), and is considered likely to provide a conservative estimate of the contribution of modelled roads to ambient PM_{10} concentrations.

Long term trends

5.5.23 The assessment was undertaken in accordance with IAN 170/12 v3 on the assessment of future NO_x and NO_2 projections on long term trends (LTT), to account for future year uncertainties in emissions. Air quality assessments following the latest Defra emission factors have been considered to be overly optimistic in some cases. IAN 170/12 v3 requires that steps are taken to adjust the estimated total NO_2 concentrations from modelling, termed 'gap analysis' in order to better reflect future trends. An additional scenario (projected base year) is required to enable the gap analysis to be completed. The projected base year scenario is modelled using the base year traffic data with the opening year vehicle emission factors and background concentrations. The results for the opening year are then adjusted to represent the observed long-term trend profile.

5.5.24 Analysis of trends in annual mean NO_2 concentrations was undertaken using the Finnish Meteorological Institute MAKESENS (v1) spreadsheet using the annual mean time series data for relevant monitoring sites. The analysis identified where there is a statistically significant trend at sites with suitably robust data for use in the selection of suitable long-term trend factors. Further details are provided in Appendix 5.5. In this case the Highways England LTTE6 projection factors were deemed to be most appropriate and were used in the LTT analysis.

Compliance with EU limit values

5.5.25 Evaluation of compliance with EU limit values has been undertaken in accordance with IAN 175/13, using the baseline scenario from Defra's Pollution Climate Mapping (PCM) model.

Comparison with short term objectives

5.5.26 Commentary on potential exceedances of the 1-hour mean NO_2 AQS objective is possible with reference to Defra's LAQM.TG(16). The guidance suggests that if annual mean concentrations of NO_2 do not exceed 60 $\mu g/m^3$ then it is unlikely that hourly mean concentrations would exceed the objective for the 1-hour mean.

5.5.27 Defra's LAQM.TG(16) was also used to derive the number of exceedances of the 24-hour mean PM_{10} AQS objective, of which 35 are permitted. The method is based on the relationship between the number of 24-hour exceedances of 50 $\mu g/m^3$ and the annual mean concentration derived from UK Automatic Network Sites. This is described in the equation below:

Equation 5.1 – Calculation of PM_{10} 24-hour mean exceedances

Number of exceedances of 24-hour mean of 50 $\mu g/m^3 = -18.5 + 0.00145 * a^3 + (206/a)$

Where 'a' = total annual mean PM_{10} concentration

Ecological Assessment

5.5.28 Assessment of potential effects on NO_x concentrations and nitrogen deposition rates has been undertaken at identified sensitive ecological designations, in accordance with Annex F of the DMRB HA 207/07. The results are interpreted by the Project Ecologists in chapter 7 of this ES.

Magnitude of impact classification

5.5.29 Descriptors for magnitude of change in ambient concentrations of NO_2 and PM_{10} are provided in IAN 174/13. The changes in magnitude, which are based on an assumed measure of uncertainty (MoU) of 10%, may be described as imperceptible, small, medium or large, depending on the change in concentration relative to the air quality criterion as shown in Table 5.3.

Table 5.3: Magnitude of change criteria for local air quality

Magnitude of change in concentration	Value of change in annual mean NO_2 and PM_{10}
Large (>4 µg/m^3)	Greater than full MoU value of 10% of the air quality objective (4 µg/m^3)
Medium (>2 to 4 µg/m^3)	Greater than half of the MoU (2 µg/m^3), but less than the full MoU (4 µg/m^3) of 10% of the air quality objective
Small (>0.4 to 2 µg/m^3)	More than 1% of the objective (0.4 µg/m^3) and less than half of the MoU i.e. 5% (2 µg/m^3). The full MoU is 10% of the air quality objective (4 µg/m^3)
Imperceptible (≤0.4 µg/m^3)	Less than or equal to 1% of objective (0.4 µg/m^3)

Significance

5.5.30 Evaluation of the significance of the effect of the Scheme on local air quality has been undertaken in accordance with IAN 174/13. The number of receptors that fall within the 'small', 'medium' and 'large' magnitude of change categories is calculated and compared to the guidelines presented in Table 5.4. Significant air quality effects are only identified for receptors where AQS objectives are exceeded with or without the Scheme. Where the changes in concentrations are less than 1% of the AQS objective (i.e. less than 0.4 µg/m^3) then the change at these receptors is considered to be 'imperceptible' and can be scoped out of the judgement on significance.

Table 5.4: Number of Receptors Constituting a Significant Effect for Air Quality

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4 µg/m^3)	1 to 10	1 to 10
Medium (>2 to 4 µg/m^3)	10 to 30	10 to 30

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Small (>0.4 to 2 µg/m^3)	30 to 60	30 to 60

Regional Emissions

5.5.31 A detailed regional air quality assessment has been undertaken given that there are expected to be changes in peak hour speeds with the Scheme. Emissions of NO_x, PM_{10} and CO_2 were calculated for all the road links in the section of traffic model provided for the air quality assessment, considered to be in the traffic reliability area. The key scenarios for assessment are:

- Base year (2015);
- Opening year (2022), for both the DM and DS cases; and
- Design year (2037), for both the DM and DS cases.

5.6 Assumptions and limitations

5.6.1 Any air quality model has inherent areas of uncertainty, including:

- The traffic data used in the air quality model;
- The suitability of emissions data;
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere;
- The suitability of background concentrations; and
- The suitability of meteorological data.

5.6.2 Uncertainty associated with traffic data has been minimised by using a validated traffic model.

5.6.3 Uncertainties associated with emissions data have been minimised by using the most up to date speed-band emission factors available and by applying IAN 170/12 v3 for long term trends.

5.6.4 Uncertainties associated with model algorithms and empirical relationships have been minimised by using algorithms and relationships that have been independently validated and judged as fit for purpose.

5.6.5 Another uncertainty is with using historical meteorological data to estimate future concentrations. The key limiting assumption is that conditions in the future will be the same as in the past; however, in reality no two years are the same. In line with best practice, the same year of meteorological data (consistent with the base year as used in the model verification and adjustment process) has been used in future year modelling to allow any adjustments to be applied in future cases.

5.7 Baseline conditions

5.7.1 Information on existing ambient air quality i.e. baseline conditions, and identification of potential air quality constraints to the Scheme has been collated from the following sources:

- AQMA mapping[30];
- Defra's Pollution Climate Mapping (PCM) model data for 2015[31];
- Local Authority Local Air Quality Management Reports[32];
- Highways England NO_2 diffusion tube survey data[33];
- Ordnance Survey base mapping to identify locations of sensitive receptors (residential properties, schools, hospitals and elderly care homes); and
- Natural England Multi-Agency Geographic Information for the Countryside (MAGIC) website[34] to identify boundaries of designated ecological sites.

5.7.2 Figure 5.1 shows the air quality constraints within the air quality study area.

Pollutants

5.7.3 The air pollutants of concern in the context of the local air quality assessment for the Scheme are NO_2 and PM_{10}, as these pollutants are most likely to be present in ambient air at concentrations close to or above statutory limit values at receptors near to roads. In addition, the ecological assessment considers NO_x and nitrogen deposition. The regional assessment of vehicle emissions associated with the Scheme considers NO_x, CO_2 and PM_{10}. $PM_{2.5}$ is not required to be assessed as discussed in Appendix 5.1, however information on measured concentrations is provided in this section for information purposes. Further information on pollutants is provided below.

Nitrogen Dioxide/Oxides of Nitrogen

5.7.4 NO_2 is a secondary pollutant produced by the oxidation of nitric oxide (NO). NO and NO_2 are collectively termed NO_x. About a third of the UK NO_x emissions are from road transport[35]. The majority of NO_x emitted from vehicles is in the form of NO, which oxidises rapidly in the presence of ozone (O_3) to form NO_2. In high concentrations, NO_2 can affect the respiratory system and can also enhance the response to allergens in sensitive individuals. Additionally, there is increasing awareness of an association between long-term average concentrations (chronic exposure) of NO_2 and mortality. NO does not have any observable effect on human health at the range of concentrations found in ambient air. Elevated concentrations of NO_x can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from oxides of nitrogen emission contribute to acidification and/or eutrophication of sensitive habitats.

[30] http://uk-air.defra.gov.uk/aqma/maps, accessed 2018
[31] http://uk-air.defra.gov.uk/data/gis-mapping , accessed 2018
[32] Elmbridge Borough Council (2017) Air Quality Annual Status Report; Woking Borough Council (2018) Air Quality Annual Status Report; Guildford Borough Council (2018) Air Quality Annual Status Report, Mole Valley District Council (2018) Air Quality Annual Status Report, Runnymede Borough Council (January 2017) 2015 Air Quality Annual Status Report
[33] Connect Plus (2017) Air Quality Management Plan
[34] http://magic.defra.gov.uk/
[35] http://naei.beis.gov.uk/data/

Particulate Matter

5.7.5 The principal sources of 'primary' polluting particles are combustion processes, which include traffic and industry. Road transport produces 12% of primary PM_{10} emissions in the UK[36], of which the majority of emissions are from diesel engines. Finer fractions of particulate matter are associated with a range of symptoms of ill health including effects on the respiratory and cardiovascular systems, on asthma and on mortality.

Carbon Dioxide

5.7.6 CO_2 is a greenhouse gas and is used as an indicator of the wider scale, non-local effects of transport schemes. Exposure to CO_2 does not affect human health or ecology at ambient levels and so is not significant as a local air pollutant but is important for its national and international role in climate change.

Other Pollutants

5.7.7 National assessments have demonstrated that there is no risk of exceedance of the air quality objectives set for 1,3-butadiene, benzene, carbon monoxide, lead or sulphur dioxide due to emissions from traffic anywhere in the UK. These pollutants are therefore not considered further as there is not considered to be a potential for significant effects associated with these pollutants.

5.7.8 In addition to these air pollutants, dust may be generated during the construction phase in areas adjacent to the Scheme and associated works areas. Dust per se is not considered as a local air pollutant but may cause a perceived loss of amenity and can give rise to soiling (dust deposition).

Air Quality Management Areas

5.7.9 GBC has declared one AQMA for exceeding the annual mean AQS objective for NO_2: a section of the B300, The Street in Compton. This is not within 200 m of the ARN and unlikely to be affected.

5.7.10 EBC has declared six AQMAs for exceedances of the annual mean AQS objective for NO_2. Of these the Esher AQMA could potentially be affected by the Scheme as it is within 200 m of the ARN.

5.7.11 WBC has declared two AQMAs: Anchor Hill AQMA and Guildford Road AQMA. Neither are likely to be affected as they are not within 200 m of the ARN.

5.7.12 RBC has declared two AQMAs: one along the M25 corridor within the RBC administrative area; and one in Addlestone Town Centre. The M25 AQMA was declared for exceedances of both the annual and 24-hour mean AQS objectives for PM_{10} as well as the annual mean AQS objective for NO_2 and is within the air quality study area. The Addlestone Town Centre AQMA is not expected to be affected as it is not within 200 m of the ARN.

5.7.13 SHBC has declared one AQMA for a strip of land in Camberley along the M3 motorway, which is not within 200 m of the ARN.

5.7.14 RBBC has currently declared 9 AQMAs; one of which (AQMA No. 1 M25) is within 200 m of the ARN, and has been declared for exceeding the annual mean NO_2 AQS objective.

[36] http://naei.beis.gov.uk/data/

5.7.15 RBK has declared its entire borough an AQMA for exceeding the annual mean NO_2 AQS objective and the annual mean and 24-hour mean PM_{10} AQS objectives. This AQMA could potentially be affected as it is within 200 m of the ARN.

5.7.16 MVDC has not declared any AQMAs.

5.7.17 The four AQMAs within the air quality study area which could potentially be affected are described below in Table 5.5 and illustrated in Figure 5.1.

Table 5.5: Description of AQMAs within the Air Quality Study Area

Local Authority	Name	Air Quality Criteria Exceeded	Description
EBC	Esher AQMA	NO_2 annual mean	An area extending along the High Street, Church Street and including parts of Esher Green and Lammas Lane.
RBC	M25 AQMA	NO_2 annual mean PM_{10} annual and 24-hour mean	AQMA combining 2 areas: • Area 1 extending 70 m east and west of the centre line of the M25 between junction 11 and the southern boundary of the Borough at New Haw/Byfleet; and • Area 2 extending 55 m east and west of the centre line of the M25 between junctions 11 and 13.
RBBC	AQMA No. 1 M25	NO_2 annual mean	The length of the M25 near Walton to a distance 30 m either side of the carriageway between junction 7 and the point to the west of junction 8 where the motorway meets the borough boundary.
RBK	Kingston upon Thames AQMA	NO_2 annual mean PM_{10} annual and 24-hour mean	The whole borough

Defra Mapping

Pollution Climate Mapping

5.7.18 Defra's PCM model outputs are used in annual reporting to the EU regarding compliance with the limit values. This model provides estimates of roadside concentrations of pollutants, including annual mean NO_2 and PM_{10}. The modelled roadside concentration comprises a background component together with a roadside increment.

5.7.19 Not all roads are included within the PCM model. In the vicinity of the air quality study area, Defra's PCM model only includes parts of the A244, A245, A307 and A318. The PCM mapping shows that for the base year of the air quality assessment (2015), which is also the most recent reference year of the model, none of the roadside annual mean PM_{10} or NO_2 concentrations for the sections of roads which are within the study area exceeded the EU limit values of 40 $\mu g/m^3$.

5.7.20 Defra PCM links are illustrated in Figure 5.1.

Air Quality Monitoring

5.7.21 Air quality monitoring data from continuous monitoring stations (CMS) and passive diffusion tubes in and close to the air quality study area are presented in Table 5.2 to Table 5.7 below.

Highways England Monitoring

5.7.22 Connect Plus measure NO_2 concentrations using diffusion tubes at a number of sites around the M25 on behalf of Highways England. The survey started in September 2013, and results for three years are currently available. There are 11 sites in close proximity to the Scheme or ARN as shown in Figure 5.1. The annual mean NO_2 concentrations for these monitoring sites for the yearly periods between September 2013 and 2016 are presented in Table 5.6, below. The results show that there were recorded exceedances of the NO_2 annual mean AQS objective at two of the sites (CP28 and CP 29) over the three-year survey period. The highest measured concentration was 55.7 µg/m^3 in the September 2015-2016 period at CP28, located between junction 12 and 13 of the M25, while the lowest measured concentration was 15.8 µg/m^3 at site CP25, between junction 8 and 9 of the M25, during the September 2015-2016 period.

Table 5.6: Connect Plus Services -NO_2 Diffusion Tube Monitoring Data (µg/m^3)

Site ID	Site Type	X, Y	Sept 2013 - Sept 2014 annual mean	Sept 2014 - Sept 2015 annual mean	Sept 2015 - Sept 2016 annual mean
CP4	Roadside	506191,159955	32.8	33.4	28.6
CP5	Roadside	499041, 166285	25.9	30.7	37.8
CP8	Roadside	508378,159813	21.3	21.7	28.8
CP9	Roadside	510561,161143	25.1	28.6	27.3
CP10	Roadside	505578,161229	22.5	23.9	22.6
CP25	Roadside	520521, 155634	17.3	17.0	15.8
CP26	Roadside	516318, 158533	29.0	25.7	20.5
CP27	Roadside	509891,158070	18.5	20.9	20.5
CP28	Roadside	501606, 168831	46.3	48.3	55.7
CP29	Roadside	501849, 171742	47.1	40.7	37.5
CP34	Roadside	504272, 163938	23.9	23.1	22.0
Values in **bold** exceed the AQS objective of 40 µg/m^3					

5.7.23 Highways England has also conducted a diffusion tube survey for the purpose of informing the M25 junction 10 Improvements, for six months in 2016 between January and June, and has additionally undertaken surveys in the wider study area for other projects. The survey locations relevant to this Scheme are illustrated in Figure 5.1 and the results are provided below in Table 5.7. The results show that there were exceedances of the NO_2 annual mean air quality criterion at four sites in the Scheme base year, 2015, as adjusted. These sites (HE_5, HE_6, HE_7, HE_10) were located at roadside sites next to the A3 in Guildford.

Table 5.7: Highways England NO_2 Diffusion Tube Monitoring Data (µg/m^3)

Site ID	HE Site ID	Site Type	X, Y	Unadjusted 2016 average (Jan - Jun)	Adjusted, Annualised 2015
HE_1	A3Gui_004_1215	Roadside	496675,148632	35.9	28.1
HE_2	A3Gui_005_1215	Roadside	496950,148788	32.8	25.7
HE_3	A3Gui_006_1215	Roadside	497191,148945	34.1	26.6
HE_4	A3Gui_007_1215	Roadside	497731,149399	31.9	25.0
HE_5	A3Gui_008_1215	Roadside	497738,149591	112.3	87.7
HE_6	A3Gui_009_1215	Roadside	497884,150009	69.4	54.2
HE_7	A3Gui_010_1215	Roadside	497933,150108	70.2	54.8
HE_8	A3Gui_011_1215	Roadside	498058,150497	34.6	27.0
HE_9	A3Gui_012_1215	Roadside	498213,150665	37.1	29.0
HE_10	A3Gui_013_1215	Roadside	498113,150582	56.3	44.0
HE_11	A3Gui_014_1215	Roadside	498515,150826	31.7	24.8
HE_12	A3Gui_015_1215	Roadside	498670,150809	24.8	21.0
HE_13	A3Gui_017_1215	Roadside	499421,150831	42.0	32.8
HE_14	A3Gui_019_1215	Roadside	500805,151637	26.7	20.9
HE_15	A3Gui_020_1215	Roadside	501570,152712	34.0	26.6
HE_16	A3Gui_021_1215	Roadside	502002,152763	30.2	23.6
HE_17	A3Gui_022_1215	Roadside	504001,154442	38.0	29.7
HE_18	A3Gui_023_1215	Roadside	504053,154326	41.4	32.4
HE_19	A3Gui_024_1215	Roadside	502159,152868	37.1	29.0
HE_20	A3Gui_028_1215	Roadside	501244,152538	30.5	23.9
HE_21	M25J10A3_002_1215	Kerbside	507841,158598	37.9	35.1
HE_22	M25J10A3_006_1215	Kerbside	506271,160104	27.4	25.4
HE_23	M25J10A3_007_1215	Roadside	505870,160652	28.8	26.7
HE_24	M25J10A3_008_1215	Roadside	505552,161219	24.1	22.9
HE_25	M25J10A3_010_1215	Roadside	505442,161843	24.8	23.0
HE_26	M25J10A3_011_1215	Roadside	505452,162542	31.5	29.2

Site ID	HE Site ID	Site Type	X, Y	Unadjusted 2016 average (Jan - Jun)	Adjusted, Annualised 2015
HE_27	M25J10J16_001_1215	Roadside	504370,164047	34.9	32.3
HE_28	M25J10J16_002_1215	Kerbside	503688,165230	35.0	33.3
HE_29	M25J10J16_004_1215	Roadside	501797,168336	35.7	33.1
HE_30	M25J10J16_005_1215	Roadside	501432,170876	25.6	23.7
HE_31	M25J10J16_006_1215	Kerbside	501615,171664	39.9	37.0
HE_32	M25J10J16_028_1215	Kerbside	502386,167101	27.9	25.9
HE_26	M25J10A3_011_1215	Roadside	505452,162542	31.5	29.2
HE_33	CC_001_1215	Background	497031,164841	36.5	36.8
HE_34	CC_002_1215	Background	497027,164855	29.6	29.9
HE_35	CC_003_1215	Background	497022,164864	31.5	30.0
HE_36	CC_004_1215	Background	497018,164869	28.8	27.1
HE_37	CC_005_1215	Background	497017,164883	26.6	25.1

Local Authority Monitoring

5.7.24 All of the local authorities undertake air quality monitoring in the vicinity of the air quality study area for the Scheme.

Continuous Monitoring

5.7.25 None of the local authorities operate a CMS measuring concentrations of either NO_2 or PM_{10} within the air quality study area. The closest CMS to the study area which measure NO_2 are located at roadside sites in Weybridge and Hampton Court in EBC's area, at a kerbside site in Dorking in MVDC's area, which was in operation until 2014, and at the Tolworth Broadway roadside site in RBK's area from 2015. Concentrations at the Weybridge site exceeded the annual mean NO_2 AQS objective between 2012 and 2014, but have been below the AQS objective since. Concentrations at the Hampton Court and Tolworth Broadway sites exceeded the AQS objective in all years, while concentrations at the Dorking site were well below the AQS objective in all years. The annual mean NO_2 concentrations at these sites are provided in Table 5.8 below. The 1-hour mean AQS objective was met in all years at all sites.

Table 5.8: Annual Mean NO_2 Concentrations (µg/m^3) from CMS near the Scheme

Site ID	Local Authority	Site Type	X, Y	Distance from nearest affected road	2011	2012	2013	2014	2015	2016	2017
E1 (Weybridge)	EBC	Road side	507480, 164923	1.9 km NW	36	**43**	**43**	**40**	38	38	-

Site ID	Local Authority	Site Type	X, Y	Distance from nearest affected road	2011	2012	2013	2014	2015	2016	2017
E2 (Hampton Court)	EBC	Road side	515338, 168292	3.6 km NW	**51**	**41**	**47**	**47**	**40**	**44**	-
Dorking	MVDC	Kerb side	517034, 149803	5.4km SE	23	23	22	22	-	-	-
KT4 (Tolworth Broadway)	RBK	Road side	519706, 165885	1.6 km NE	-	-	-	-	**49**	**51**	**49**

- = data not available/monitoring not undertaken
Exceedances of annual mean NO_2 UK AQS objective are highlighted in bold
Data have been sourced from local authority reports

5.7.26 Measured PM_{10} concentrations at both the Dorking and Tolworth Broadway sites were well below both the annual mean and daily mean AQS objectives, as summarised in Table 5.9 and Table 5-10, below.

Table 5.9: Annual Mean PM_{10} Concentrations (µg/m^3) at CMS near the Scheme

Site ID	Local Authority	Site Type	X, Y	2011	2012	2013	2014	2015	2016	2017
Dorking	MVDC	Kerbside	517034, 149803	21	20	21	18	-	-	-
KT4 (Tolworth Broadway)	RBK	Roadside	519706, 165885	-	-	-	-	20	24	23

Table 5-10: Number of Exceedances of 24-hour Mean PM_{10} Standard at CMS near the Scheme

Site ID	Local Authority	Site Type	X, Y	2011	2012	2013	2014	2015	2016	2017
Dorking	Mole Valley	Kerbside	517034, 149803	11	10	2	2	-	-	-
KT4 (Tolworth Broadway)	RBK	Roadside	519706, 165885	-	-	-	-	1	9	6

5.7.27 The closest CMS which measures $PM_{2.5}$ is located at the London Teddington Bushy Park urban background site, approximately 15 km north of the Scheme. Annual mean concentrations at this site were below the AQS objective in all years.

Table 5.11: Annual Mean $PM_{2.5}$ Concentrations (µg/m^3) at CMS near the Scheme

Site ID	Local Authority	Site Type	X, Y	2011	2012	2013	2014	2015	2016	2017
London Teddington Bushy Park	London Borough of Richmond	Urban Background	515120, 170884	-	-	11*	14*	10	9	10
*Data capture rate <75%										

Passive Monitoring

5.7.28 Passive monitoring of NO_2 using diffusion tubes is undertaken by all the local authorities in the vicinity of the air quality study area. The locations are further described in Table A5.6.1 in Appendix 5.6, together with tabulated results for the period of 2010 to 2017, where available. Local authority monitoring locations are also illustrated in Figure 5.1, showing the comparison of annual mean measurements for 2015, the air quality base year, with the annual mean objective of 40 µg/m^3. Key areas and traffic corridors where exceedances of the annual mean AQS objective for NO_2 were measured in recent years include:

- Near M25 junction 10, adjacent to A3 northbound off-slip (G_6) (not representative of exposure);
- Near the A3 junction with Copsem Lane, north east of junction 10 (E_9) (not representative of exposure);
- At roadside/kerbside sites within the Esher AQMA (E_7, E_8, E_10, E_11);
- On the A245 Parvis Road over the M25 north west of junction 10 (Wk_3) (not representative of exposure);
- In Egham near the level crossing on the B388, east of the M25 (R_9); and
- Near the M3 near Brick Hill (SH7) (not representative of exposure).

5.8 Potential impacts

5.8.1 The Scheme has the potential to affect local air quality, both during construction and once in operation.

Construction

Dust Emissions

5.8.2 There is the potential for elevated dust deposition and soiling at properties within 200 m of the indicative construction site boundary as a consequence of the works, if dust raising activities are not effectively controlled and mitigated. The level and distribution of dust emissions would vary according to the duration and location of activity, weather conditions, and the effectiveness of suppression measures.

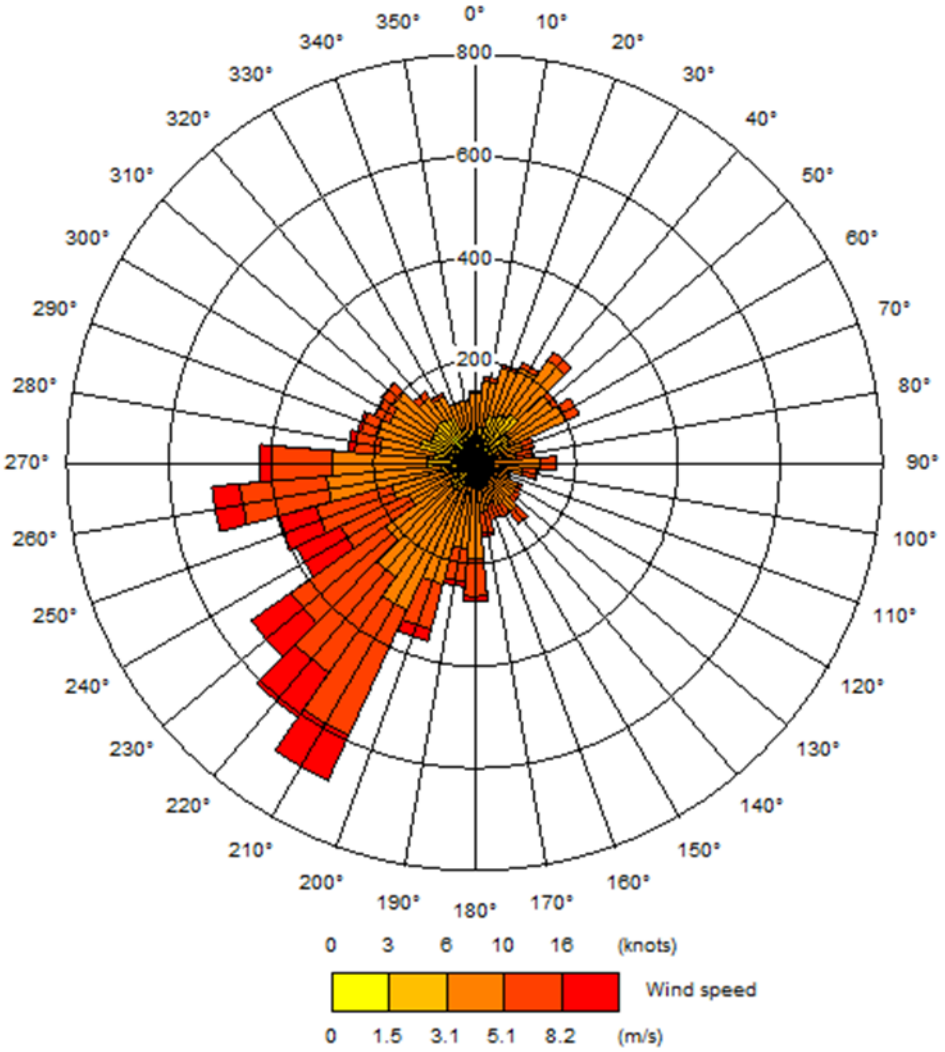
5.8.3 Receptors within 200 m of the indicative construction site boundary for the Scheme are shown in Figure 5.2. The Scheme has the potential for construction dust to affect up to approximately 50 properties. In addition, the Thames Basin

Heaths SPA which overlaps with the Ockham & Wisley Commons SSSI are both located within 200 m of junction 10, and there are four areas of ancient woodland within 200 m of the area likely to be affected during construction: south of the M25 junction 10 near the Ockham Park junction; north of junction 10 adjacent to the A3; and two areas east of the M25 junction 10.

5.8.4 The prevailing winds recorded at Heathrow Airport meteorological station (approximately 15 km north of the Scheme) are from the south west as shown in the windrose below (Figure 5.1). The highest wind speeds are also recorded from this direction. This suggests that the wind is more likely to transport the dust raised on site towards the north east of the construction works.

5.8.5 Receptors to the north east of the construction works include properties to the east of the A3 including at Elm Corner, within Painshill Park, and in Cobham.

Figure 5.1: Windrose for Heathrow Airport meteorological station (2015)



Construction Traffic

5.8.6 An increase in vehicle movements is expected to occur during the construction period, associated with the transport of materials, plant and labour to and from site. Concentrations were estimated at selected receptors following the IAN 170/12 v3 LTTE6 approach as noted below in the operation section. The

estimated concentrations at the receptors are presented in Appendix 5.7, and the changes in concentrations at the receptor points are shown in Figure 5.9.

5.8.7 There were not expected to be any exceedances of the annual mean NO_2 AQS objective at any receptors during the construction period. The highest concentration was estimated to be 37.4 µg/m^3 at receptor R19 with an imperceptible change during construction compared to the Do-Minimum.

5.8.8 The greatest increase in annual mean NO_2 concentrations is expected to be a 'small' increase of 1.6 µg/m^3 at R237, located in Woking close to the A320. This is due to an increase in HDVs of over 250 AADT on the A320 during construction. There are three other receptors with a 'small' increase in annual mean NO_2 concentrations with the Scheme at receptors R29, R234, and R236 respectively. This is as a result of an increase in approximately 100 HDVs AADT on the A3 north of junction 10 (near R29), and increases in HDVs of over 250 AADT on the A320 in Woking (near R234 and R236).

5.8.9 The remaining receptors were estimated to experience an imperceptible change in annual mean NO_2 concentrations with the Scheme.

5.8.10 In line with DEFRA's technical guidance LAQM.TG(16) there are not expected to be any exceedances of the 1-hour mean AQS objective given that annual mean NO_2 concentrations are all estimated to be less than 60 µg/m^3.

5.8.1 There are not expected to be any exceedances of the PM_{10} annual mean AQS objective, and all changes are expected to be imperceptible. In addition, there were no receptors where concentrations were expected to exceed the PM_{10} daily mean AQS objective.

5.8.2 At the ecological receptor points affected by construction traffic, nitrogen deposition rates were calculated for designated sites which had a change in NO_x concentrations of over 0.4 µg/m^3 and where the NO_x critical level for vegetation of 30 µg/m^3 was exceeded. These included transect points within Horsell Commons SSSI, which overlaps with the Thames Basin Heaths SPA, and Ockham and Wisley Commons SSSI, which also overlaps with the Thames Basin Heaths SPA to the south of junction 10. The results are provided in Appendix 5.7.

5.8.3 At the Ockham Wisley Commons SSSI / Thames Basin Heaths SPA transect west of the A3, approximately 1 km to the south of junction 10, the greatest increase was calculated to be 0.05 kg/ha/yr at 8 m from the edge of the A3. At the transect east of the A3, the greatest increase was calculated to be 0.06 kg/ha/yr at 10 m from the edge of the A3. The changes are due to an increase in traffic of around 2300 AADT along the A3 in this area.

5.8.4 At the Ockham Wisley Commons SSSI / Thames Basin Heaths SPA transect west of the A3, south of junction 10, the greatest increase was calculated to be 0.03 kg/ha/yr at 7 m from the edge of the A3. At the transect east of the A3, the greatest increase was calculated to be 0.04 kg/ha/yr at 5 m from the edge of the A3. The changes are due to an increase in traffic of around 2600 AADT along the A3 and slip roads in this area.

5.8.5 The change in nutrient nitrogen deposition with the Scheme at Horsell Commons SSSI transect west of the A320 was calculated to be a maximum of 0.1 kg/ha/yr at 5 m from the road edge. The change is due to the increase in HGVs of 250 AADT on the A320 at this location.

All of these changes in nitrogen deposition rates were 0.1 kg/ha/yr or less.

Operation

Local Air Quality

5.8.6 Concentrations were estimated for the opening year at 89 selected human health receptors, of which six receptors were selected for comparison with the short term air quality criteria. Both the NO_2 and PM_{10} concentrations were adjusted following verification, details of which are provided in Appendix 5.4. Concentrations of both NO_2 and PM_{10} were compared with relevant UK AQS objectives to determine whether there were likely to be any exceedances.

5.8.7 Modelling has been undertaken using two approaches to determine the future year concentrations: an approach following Defra LAQM.TG(16); and an approach in accordance with IAN 170/12 v3 LTTE6. The latter approach is considered the most realistic of the projections for estimating future concentrations, taking into account uncertainty in long term trends, and has therefore been used as the basis for determining the impact and significance of the changes and for determining compliance with the EU Air Quality Directive. Results for both approaches are presented in Appendix 5.7. Details of trend analysis in NO_2 annual mean concentrations are also provided in Appendix 5.5.

5.8.8 There are expected to be exceedances of the NO_2 annual mean AQS objective at three receptors (R1, R3 and R71) both with and without the Scheme. Receptor R72 is also expected to only exceed with the Scheme. The highest concentration with the Scheme is estimated to be 43.6 µg/m^3 at receptor R71, located near the A3 north of Guildford, although not within an AQMA. This is a robust estimate of future NO_2 concentrations that has used the LTT approach. With the Scheme, the change at this receptor is expected to be a decrease of 0.3 µg/m^3, which can be considered imperceptible. At receptor R1, located near the A308 in the Egham area, the estimated concentration with the Scheme is 40.8 µg/m^3, and the expected change with the Scheme is an increase of 0.1 µg/m^3, which can be considered imperceptible. At receptor R3, located in Egham to the east of the M25 north of junction 12, the estimated concentration with the Scheme is 40.4 µg/m^3, which is expected to be unchanged from the Do-Minimum.

5.8.9 The greatest increase in annual mean NO_2 concentrations is expected to be a 'small' increase of 1.8 µg/m^3 at receptor R72, located in Guildford, close to the A3. This is due to the increase in traffic on the A3 of the order of 1300 AADT and the change in speed band on the A3 southbound in the am peak from light to heavy congestion with the Scheme, which leads to an estimated concentration of 40.1 µg/m^3 with the Scheme.

5.8.10 There are four other receptors with a 'small' increase (0.6 to 1.2 µg/m^3) in annual mean NO_2 concentrations with the Scheme: receptors R26, R29, R63, and R83. In all cases the reason for the increase in concentrations is an increase in traffic with the Scheme: this includes the A3 north of junction 10 with an increase of 7900 AADT on the A3 near R26; 8000 AADT on the A3 and slip roads at Painshill junction near R29; an increase of 4300 AADT on the A3 north of Guildford (R63); and an increase of 1600 AADT on the B365 Seven Hills Road north of the A245 Byfleet Road(R83).

5.8.11 There are also expected to be improvements with the Scheme. The greatest decrease in annual mean NO_2 concentrations with the Scheme is expected to be

a 'small' decrease of 1.4 µg/m^3 at receptor R30 close to the Painshill junction on the A3 north of junction 10. Other receptors with a 'small' decrease in concentrations (-0.7 to -1.2 µg/m^3) include receptors R21, R22, R23, and R40. For all receptors except R40, the reason for the decrease in concentrations is due to a decrease in traffic flows on the road links in close proximity to the receptor including: a decrease of 2000 AADT on the A244 (R21 and R22); a decrease of 1400 AADT on the A244 Church Street in Esher (R23); and a change in traffic and speeds at Painshill junction (R30). The expected decrease in concentrations at R40 (Ockham Bites Café) is driven by the change in speeds from heavy congestion to light congestion on the A3 northbound off-slip.

5.8.12 The remaining receptors are estimated to experience an imperceptible change in annual mean NO_2 concentrations with the Scheme.

5.8.13 At the receptors within the AQMAs, all changes are expected to be imperceptible with the Scheme, with the exception of the Esher AQMA where receptors are estimated to have a small decrease in concentrations with the Scheme. Receptors R22 and R23 are within the Esher AQMA, and as noted above have a decrease in concentrations due to the decrease in traffic on the A244.

5.8.14 The Scheme is generally expected to have an imperceptible change at receptors near the M25 and M3, and a decrease at receptors along the A244 and in Esher. Along the A3 some receptors are expected to have a small increase and others to have a small decrease depending on their location.

5.8.15 In line with Defra's technical guidance LAQM.TG16 there are not expected to be any exceedances of the 1-hour mean AQS objective given that annual mean NO_2 concentrations are all estimated to be less than 60 µg/m^3.

5.8.16 There are not expected to be any exceedances of the PM_{10} annual mean AQS objective, and all changes are expected to be imperceptible. In addition, there were no receptors where concentrations were expected to exceed the PM_{10} daily mean AQS objective.

5.8.17 As a result of changes to the design with DF3.1 in the area of the B365 Seven Hills Road noted in paragraph 5.5.12 above, additional traffic movements are expected along the A245 Byfleet Road and at Painshill junction. As the changes in traffic are localised, a qualitative assessment of the effect of the change for this area alone was made, rather than a full quantitative assessment. Consequently, the results in Appendix 5.7 reflect the effects of the DF2/DF3 scheme with the changes as a result of DF3.1 reported here. It was found that the design changes would lead to an increase in pollutant concentrations at receptors near this area. The receptors most likely to be affected would be R28, R29, and R30, which have concentrations in the opening year of less than 25 µg/m^3 both with and without the Scheme. These receptors are expected to have changes in annual mean NO_2 concentrations of +0.4 µg/m^3, +0.7 µg/m^3 and -1.4 µg/m^3, representing an imperceptible change, a small increase, and a small decrease respectively. With DF3.1, any larger increase in annual mean NO_2 concentrations with the Scheme is still unlikely to lead to an exceedance of the annual mean NO_2 AQS objective at any of these receptors and would be unlikely to result in a significant adverse effect.

Compliance Risk Assessment

5.8.18 Compliance with the EU Air Quality Directive has been considered using the principles in IAN 175/13 where Defra PCM model links coincide with the modelled area to aid the assessment of significance of effect.

5.8.19 Defra's revised Air Quality Plan was published in 2017, which aids the consideration of compliance. The roads considered in the assessment are within Euro Zone 31 (South East) and Zone 1 (Greater London Urban Area). The maximum concentration across the roads considered within the study area is projected to be 36.8 µg/m^3 in 2022, on a section of the A3 west of Guildford.

5.8.20 The maximum increase in annual mean NO_2 concentration at a receptor included in the assessment is of small magnitude (maximum increase of 1.8 µg/m^3 at receptor R72 located in Guildford close to the A3, close to this PCM link). Hence the highest roadside NO_2 annual mean concentration within the air quality study area in 2022 with the Scheme (using the Defra PCM modelled output of roadside NO_2 concentrations for 2022) is calculated to be 38.6 µg/m^3. This is below the EU limit value of 40 µg/m^3 and therefore the Scheme is considered to be at low risk of not achieving compliance with the EU Air Quality Directive.

Ecological Assessment

5.8.21 The NO_x concentrations estimated at the ecological receptors are presented in Appendix 5. The changes in concentrations at the receptor transect points are shown in Figure 5.10.

5.8.22 The results indicate that in the 2015 base year, NO_x concentrations are estimated to exceed the critical level for vegetation of 30 µg/m^3 at the majority of the modelled receptor points (95 out of 127 points). In general, the critical level was met away from the edge of the road within each designated site, except within the Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA around junction 10 where exceedances were still estimated up to 200 metres from the edge of the road, as shown in Table 5.12.

5.8.23 In the opening year of 2022, there were still exceedances of the critical level both with and without the Scheme at the majority of sites, although the distance away from the edge of the road expected to exceed was expected to reduce, as shown in Table 5.12. The critical level was met at all receptor points within two transects, both with and without the Scheme: in the transect to the north of the A3 within the Esher Commons SSSI; and within the transect to the south of the A246 within the Sheepleas SSSI.

Table 5.12: Distance from road at which critical level for NO_x (30 µg/m^3) is met

Transect	2015	2022 DM	2022 DS
Colony Bog and Bagshot Heath SSSI/ Thursley, Ash, Pirbright & Chobham SAC/ Thames Basin Heaths SPA (south of M3)	150 m	75 m	75 m
Chobham Common SSSI (north of M3)	150 m	75 m	75 m
Chobham Common SSSI (south of M3)	200 m	100 m	100 m

Transect	2015	2022 DM	2022 DS
Esher Commons SSSI (north of A3)	50 m	Entire transect	Entire transect
Esher Commons SSSI (south of A3)	75 m	50 m	50 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (west of A3)	100 m	75 m	50 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (east of A3)	150 m	100 m	75 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (south of M25 (east of J10))	Not met at 200 m	100 m	100 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (east of A3 (south of J10))	Not met at 200 m	100 m	100 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (west of A3 (south of J10))	Not met at 200 m	75 m	75 m
Ockham & Wisley Commons SSSI/ Thames Basin Heaths SPA (south of M25 (west of J10))	Not met at 200 m	100 m	100 m
Ockham & Wisley Commons SSSI (north of M25 (west of J10))	200 m	100 m	100 m
Ockham & Wisley Commons SSSI (west of A3 (north of J10))	150 m	50 m	50 m
Ockham & Wisley Commons SSSI (east of A3 (north of J10))	Not met at 200 m	100 m	100 m
Ockham & Wisley Commons SSSI (north of M25 (east of J10))	Not met at 200 m	150 m	100 m
Sheepleas SSSI (south of A246)	Entire transect	Entire transect	Entire transect
Mole Gap to Reigate Escarpment SSSI (south of M25)	150 m	75 m	75 m

5.8.24 There are expected to be increases in annual mean NO_x concentrations of over 0.4 µg/m^3 at Esher Commons SSSI within 25 m of the south transect from the A3 (largest change of 0.8 µg/m^3 at 17 m from the road edge) and within the four sectors of the Ockham and Wisley Commons SSSI around junction 10, including the sections within the Thames Basin Heaths SPA south of junction 10. The increases are estimated to range from 0.1 µg/m^3 to 19.5 µg/m^3 depending on the location, with the largest changes occurring at the transect points north of the M25, to the west of junction 10. The increase in NO_x concentrations within Esher Commons SSSI is as a result of an increase in traffic of 3000 AADT on the A3 at this location. There is also expected to be an overall increase in traffic flows near the Ockham and Wisley Commons SSSI including: 4300 AADT on the A3 south of junction 10; 3700 AADT on the M25 and slip roads west of junction 10; 2500 AADT on the A3 north of junction 10; and 1500 AADT on the eastbound on-slip east of junction 10.

5.8.25 There are expected to be decreases in annual mean NO_x concentrations of over 0.4 µg/m^3 at Chobham Common SSSI within 5 m of the transect north of the M3 and within 10 m of the transect south of the M3, and at Sheepleas SSSI within 10 m of the transect south of the A246. In addition, there are expected to be

decreases in NO_x concentrations within the Thames Basin Heaths SPA 100 m south of junction 10, within both the transects to the west and east of the A3.

5.8.26 At the sites where there could potentially be a significant adverse effect, i.e. where NO_x concentrations are above 30 µg/m^3 and the increase with the Scheme is above 0.4 µg/m^3, (Esher Commons SSSI (South), and Ockham and Wisley Commons SSSI) the total nitrogen deposition rates and change in deposition were calculated. These results are provided in Appendix 5.7. The lower end of the relevant critical load range was taken to be 10 kg/ha/yr, which is representative of the heathland and woodland habitat types present at most sites, as shown in Appendix 5.7. In all cases the calculated total nitrogen deposition rates were above the lower end of the critical load in both the base year and opening year.

5.8.27 The greatest increase in the nitrogen deposition rate calculated with the Scheme at Esher Commons SSSI south of the A3 was 0.04 kg/ha/yr, at 17 m from the road edge, with a calculated total rate of 11.32 kg/ha/yr with the Scheme at this location.

5.8.28 At the Ockham and Wisley Commons SSSI / Thames Basin Heaths SPA transect west of the A3, the greatest increase in the nitrogen deposition rate calculated with the Scheme was 0.11 kg/ha/yr at 7 m from the edge of the A3, with an calculated total rate of 15.16 kg/ha/yr with the Scheme at this location. At the transect east of the A3, the highest increase was calculated to be 0.16 kg/ha/yr at 5 m from the road edge, with a calculated total of 16.22 kg/ha/yr with the Scheme at this location.

5.8.29 At the Ockham Wisley Commons SSSI / Thames Basin Heaths SPA transect south of the M25, to the west of junction 10, the greatest increase was calculated to be 0.05 kg/ha/yr at 25 m from the edge of the M25, with a calculated total nitrogen deposition rate of 14.40 kg/ha/yr with the Scheme at this location. At the transect north of the M25, to the west of junction 10, the greatest increase was calculated to be 0.87 kg/ha/yr at 5 m from the edge of the road, with a calculated total rate of 16.11 kg/ha/yr at this location.

5.8.30 At the transect west of the A3, to the north of junction 10, the largest increase in nitrogen deposition rate was calculated to be 0.07 kg/ha/yr 5m from the A3, with a calculated total rate of 14.52 at this location. At the transect east of the A3, the largest increase in nitrogen deposition rate was calculated to be 0.1 kg/ha/yr at 15 m from the A3, with a calculated total rate of 14.56 kg/ha/yr.

5.8.31 At the transect north of the M25, to the east of junction 10, the greatest increase was calculated to be 0.19 kg/ha/yr at 5 m from the M25, with a calculated total rate of 15.31 kg/ha/yr at this location.

5.8.32 The significance of the effect on nitrogen deposition rate within these designated sites is discussed in the biodiversity chapter, Chapter 7. At the Esher Commons SSSI, the largest change in nitrogen deposition is expected to be less than 0.1 kg/ha/yr at the edge of the road. At the Ockham and Wisley Commons SSSI, only one transect point at a location 5 m from the edge of the road was above 0.8 kg/ha/yr. It was considered overall that the changes in air quality were unlikely to adversely affect the sites.

Regional Air Quality

5.8.33 Estimated annual emissions of NO_x, PM_{10} and CO_2 are provided in Table 5.13.

5.8.34 Pollutant emissions in the opening year are expected to decrease with the Scheme by less than 1% compared to the Do Minimum, in line with the increase in vehicle kilometres travelled of 0.6%. In the 2037 design year, emissions are expected to decrease with the Scheme again by less than 1% compared to the Do Minimum, again in line with the expected increase in vehicle kilometres travelled of 0.7%.

5.8.35 Emissions of NO_x and PM_{10} are expected to decrease overall from the base year by both the 2022 opening year and 2037 design year, despite an increase in total vehicle kilometres travelled, because of improvements in vehicle technology.

5.8.36 Emissions of CO_2 are expected to increase overall from the base year by both the 2022 opening year and 2037 design year, in line with increases in vehicle kilometres travelled.

Table 5.13: Regional Emissions Results

Year	Scenario	NO_x (t/yr)	PM_{10} (t/yr)	CO_2 (t/yr)	Veh kms travelled/year
2015	Base	4,863	309	1,444,523	6,810,929,390
2022	DM	2,453	256	1,802,301	8,153,701,145
	DS	2,457	257	1,805,726	8,199,026, 006
	Change with DS	+4	+1	+3,425	+45,324,861
	% Change from DM	+0.2%	+0.3%	+0.2%	+0.6%
	% Change from Base	-49.5%	-16.9%	+25.0%	+20.4%
2037	DM	1,617	285	2,122,810	9,488,242,644
	DS	1,629	286	2,126,295	9,551,178,904
	Change with DS	+12	+0.44	+3,485	+62,936,260
	% Change from DM	+0.7%	+0.2%	+0.2%	+0.7%
	% Change from Base	-66.5%	-7.5%	+47.2%	+40.2%

5.9 Design, mitigation and enhancement measures

Construction

5.9.1 Mitigation measures to control dust during construction would be specified within contract documentation and incorporated into a CEMP. The precise measures would depend on the intended construction methods and the degree of dust generation at each site. Such measures may include but not necessarily be limited to:

- Regular water-spraying and sweeping of unpaved and paved roads to minimise dust and remove mud and debris;
- Using wheel washes, shaker bars or rotating bristles for vehicles leaving the site where appropriate to minimise the amount of mud and debris deposited on the roads;
- Sheeting vehicles carrying dusty materials to prevent materials being blown from the vehicles whilst travelling;

- Enforcing speed limits for vehicles on unmade surfaces to minimise dust entrainment and dispersion;
- Ensuring any temporary site roads are no wider than necessary to minimise their surface area;
- Damping down of surfaces prior to their being worked; and
- Storing dusty materials away from site boundaries and in appropriate containment (e.g. sheeting, sacks, barrels etc.).

5.9.2 If necessary monitoring parameters and a programme will be established.

Operation

5.9.3 The assessment indicated that there are not expected to be any significant adverse effects with the Scheme for the human health receptors. As such no mitigation measures have been proposed.

5.10 Assessment of effects

Significant effects

Construction

5.10.1 Any air quality effects due to construction dust will be temporary and can be suitably minimised by the application of standard and appropriate mitigation measures. On this basis, there is unlikely to be a significant effect on air quality due to the construction of the Scheme. The air quality effect due to construction traffic was also considered unlikely to be significant given that only one receptor was expected to have an exceedance of the annual mean NO_2 air quality objective, and the change at this receptor was expected to be imperceptible.

Operation

5.10.2 In accordance with the IAN 174/13, the number of human health receptors with an exceedance of an air quality objective and a large, medium or small change with the Scheme is provided in Table 5.12, while Table 5.13 outlines the evaluation of local air quality significance of the Scheme. Of the receptors estimated to exceed the annual mean NO_2 air quality objective, only one receptor (R72) is expected to have a small increase with the Scheme, and the exceedance is only estimated at this one receptor. The Scheme is therefore not expected to have a significant effect on human health receptors. As discussed in the biodiversity section, the Scheme is not expected to have a significant adverse effect on ecological receptors as a result of changes in air quality.

Table 5.14: Number of Receptors Exceeding the Annual Mean NO_2 Air Quality Objective and the Magnitude of Change in Concentration

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance

	Number of receptors with:	
Large (>4µg/m^3)	0	0
Medium (>2 to 4µg/m$^{3)}$	0	0
Small (>0.4 to 2µg/m^3	1	0

Table 5.15: Overall Evaluation of Local Air Quality Significance

Key Criteria Questions	Yes/No
Is there a risk that environmental standards will be breached?	Yes - Three receptors (R1, R3 and R71) are expected to exceed the annual mean NO_2 AQS objective both with and without the Scheme. One receptor (R72) is expected to exceed the objective with the Scheme only.
Will there be a large change in environmental conditions?	No – Three receptors (R1, R3 and R71) are expected to only have an imperceptible change. One receptor (R72) is expected to have a small change. No receptors are expected to have a large change.
Will the effect continue for a long time?	No. The largest change at any receptor is only expected to be small which would be reversible within approximately 2 to 6 years.
Will many people be affected?	No. The receptor with a small change is only representative of one property.
Is there a risk that designated sites, areas, or features will be affected?	Yes. Both the Esher Commons SSSI and the Ockham and Wisley Commons SSSI together with the overlap with Thames Basin Heaths SPA are expected to have an increase in NO_x concentrations, and to exceed the critical level with the Scheme. However the changes in nitrogen deposition rates are considered unlikely to have an adverse effect on designated features within these sites.
Will it be difficult to avoid or reduce or repair or compensate for the effect?	N/A
On balance is the overall effect significant?	On balance, the overall effect is not significant. Although there are human health receptors which are expected to exceed the annual mean NO_2 AQS objective both with and without the Scheme, the changes at these receptors with the Scheme are expected to be imperceptible. One receptor is expected to have a small increase in NO_2 concentrations with the Scheme such that there is an exceedance with the Scheme but not with the Do Minimum. In terms of the effect on designated ecological sites, it is anticipated that there is unlikely to be any adverse effect on the designated features within the Esher Commons SSSI and Ockham and Wisley Commons SSSI/Thames Basin Heaths SPA arising from changes in air quality.

Residual effects

Construction

5.10.3 With appropriate mitigation measures in place, any adverse effects resulting from dust emissions from the construction works would be minimised such that there

would not be any significant residual effect on the nearby receptors. There would not be any significant residual effect on receptors resulting from construction traffic emissions.

Operation

5.10.4 There would not be any significant residual effect at any receptor.

5.11 Cumulative effects

5.11.1 Committed developments in the area are provided in Chapter 17, Assessment of Cumulative Effects.

Construction

5.11.2 During construction seven of these proposals: the M25 junction 10 -16 Smart Motorway Programme; the former Wisley Airfield; two proposals for the Royal Horticultural Society Garden at Wisley; the former San Domenico Restaurant; Enfin, Painshill Farm; and a proposal at Feltonfleet School could potentially affect receptors within the air quality study area for construction, as it is expected that construction will be occurring over the same period. However, with appropriate mitigation measures in place, any adverse effects resulting from construction dust would be minimised such that there would not be any significant residual effect on the receptors affected by these proposals.

Operation

5.11.3 Additional traffic from specific committed developments were taken into account within the traffic modelling, meaning that the air quality assessment during operation already takes into consideration cumulative effects.

5.12 NPSNN compliance

5.12.1 In line with the national guidance described in section 5.3, the NPSNN requires a judgement to be made as to the risk of a project affecting the UK's ability to comply with the Air Quality Directive. The assessment has shown that the changes in local air quality at the selected human health receptors are all small or imperceptible. The Scheme is not expected to result in a significant adverse effect on air quality. There is not expected to be a compliance risk as regards the UK's ability to comply with the Air Quality Directive. The Scheme is therefore expected to be compliant with the NPSNN.

5.13 Monitoring

5.13.1 Given that the Scheme is not expected to have any significant adverse effects on air quality, no monitoring is required.

5.14 Summary

5.14.1 An air quality assessment has been undertaken for the Scheme.

5.14.2 A review of baseline conditions shows that there are four AQMAs which could be affected by the Scheme. These AQMAs are located within the administrative

boundaries of EBC (Esher AQMA), RBC (M25 AQMA), RBBC (AQMA N°1 M25) and KBC (Kingston upon Thames AQMA).

5.14.3 Air quality monitoring data shows that there are exceedances of the annual mean AQS objective for NO_2 within the study area at roadside and kerbside sites, and within the AQMAs at present. PM_{10} concentrations are below the objectives.

5.14.4 During construction, there is the potential for increased emissions of dust, however, with the application of appropriate mitigation significant effects at nearby receptors would be unlikely. Additional traffic during construction is considered unlikely to significantly affect air quality, as there were not expected to be any receptors with an exceedance of the NO_2 annual mean AQS objective, and the changes were expected to be of small or imperceptible magnitude.

5.14.5 The assessment showed that during operation, exceedances of the NO_2 annual mean AQS objective were expected at three receptors (R1, R3 and R71) both with and without the Scheme, and at one receptor (R72) with the Scheme but not without the Scheme. The change in concentrations with the Scheme at three of these receptors (R1, R3 and R71) was expected to be of imperceptible magnitude, and the change at one receptor (R72) to be of small magnitude.

5.14.6 Five receptors were expected to have small increase in NO_2 annual mean concentrations with the Scheme due to an increase in traffic on roads in close proximity to each receptor. However, concentrations were expected to decrease with the Scheme at five receptors due to decreases in traffic flows on the road links in close proximity to the receptors. All remaining receptors were expected to have imperceptible change in NO_2 concentrations.

5.14.7 There are not expected to be any exceedances of the annual mean or daily mean PM_{10} AQS objectives. All changes are expected to be imperceptible.

5.14.8 There are not expected to be any Defra PCM links in the air quality study area that would exceed the annual mean NO_2 EU limit value in 2022 and changes in concentrations would not result in exceedances in 2023 or beyond. There is not expected to be a compliance risk due to the Scheme.

5.14.9 NO_x concentrations were estimated to exceed the critical level for vegetation of 30 $\mu g/m^3$ at the majority of the modelled receptor points within the designated ecological sites included in the assessment. There was expected to be an increase in NO_x concentrations of over 0.4 $\mu g/m^3$ at two of the designated sites assessed: Esher Commons SSSI; and Ockham and Wisley Commons SSSI, including within the overlap with Thames Basin Heaths SPA. However, the changes in nitrogen deposition rates were considered unlikely to have an adverse effect on the sites.

5.14.10 During operation, the assessment has shown that overall there is not considered to be a significant adverse effect on air quality.

References

Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Retrieved 2019, from https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1

The National Archives (2010) The Air Quality Standards Regulations 2010: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2010/1001/contents/made

The National Archives (2000) The Air Quality (England) Regulations 2000: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2000/928/contents/made

The National Archives (2002) The Air Quality (England) (Amended) Regulations 2002: Retrieved 2019, from http://www.legislation.gov.uk/uksi/2002/3043/contents

DfT (2014) National Policy Statement for National Networks. Retrieved 2019, from https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

MHCLG (2019) National Planning Policy Framework. Retrieved 2019, from https://www.gov.uk/government/publications/national-planning-policy-framework--2

DfT and Highways Agency (2015) Road Investment Strategy: for the 2015/16 - 2019/20 Road Period, March 2015. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf
Highways England (2015) Highways England Delivery Plan 2015 - 2020. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424467/DSP2036-184_Highways_England_Delivery_Plan_FINAL_low_res_280415.pdf

Highways England (2017) Highways England Deliver Plan 2017-2018. Retrieved 2019, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/642750/Highways_England_Delivery_Plan_Update_2017-2018.pdf

Highways England (2017) Our strategy to improve air quality. Retrieved 2019, from https://www.gov.uk/government/publications/highways-england-air-quality-strategy

Defra (2017) Air Quality Plan for nitrogen dioxide (NO2) in UK (2017). Retrieved 2019 from https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

Defra (2019) Clean Air Strategy 2019 Retrieved 2019 from https://www.gov.uk/government/publications/clean-air-strategy-2019

Mayor of London (2016) The London Plan: The Spatial Development Strategy for London Consolidated with Alterations since 2011. Retrieved 2019 from https://www.london.gov.uk/sites/default/files/the_london_plan_2016_jan_2017_fix.pdf

Surrey County Council (2018) Surrey Transport Plan (LTP3). Retrieved 2019 from https://www.surreycc.gov.uk/roads-and-transport/policies-plans-consultations/transport-plan

Surrey County Council (2016) Surrey Transport Plan Air Quality Strategy January 2016. Retrieved 2019 from https://www.surreycc.gov.uk/__data/assets/pdf_file/0020/90254/Air-Quality-Strat-15th-Update-rebranded.pdf

Elmbridge Borough Council (2011) Elmbridge Core Strategy.

Elmbridge Borough Council (2015) Elmbridge Local Plan: Development Management Plan.

Elmbridge Borough Council (2011) Air Quality Action Plan for Elmbridge Borough Council Retrieved 2019 from http://aqma.defra.gov.uk/action-plans/ElmBC%20AQAP%202011.pdf

Guildford Borough Council (2019) Guildford Borough Local Plan: Strategy and Sites 2015 – 2034. Adopted April 2019. Retrieved 2019 from https://www.guildford.gov.uk/newlocalplan/media/29891/The-Guildford-borough-Local-Plan-strategy-and-sites-2015-2034/pdf/Guildford_Borough_Local_Plan_(2015-2034)_(Web_Version)_(Reduced)1.pdf

Woking Borough Council (2016) Woking Local Development Documents: Development Management Policies October 2016. Retrieved 2019 from http://www.woking2027.info/developmentplan/management/dmpadp

Mole Valley District Council (2000) Local Plan. Retrieved 2019 from http://www.planvu.co.uk/mvdc/contents_written.htm

Reigate and Banstead Borough Council (2014) Reigate and Banstead Local Plan: Core Strategy Adopted July 2014. Retrieved 2019 from http://www.reigate-banstead.gov.uk/downloads/file/3073/adopted_core_strategy_july_2014

Reigate and Banstead Borough Council (2004) Air Quality Action Plan for the M25 within The Borough of Reigate and Banstead. Retrieved 2019 from http://www.reigate-banstead.gov.uk/downloads/file/1587/action_plan_for_the_m25_air_quality_management_area

Runnymede Borough Council (2014) Air Quality Action Plan for Runnymede Borough Council

Royal Borough of Kingston upon Thames (2016) Air Quality Action Plan For the Royal Borough of Kingston upon Thames. Retrieved 2019 from https://moderngov.kingston.gov.uk/documents/s59150/2_RevisedAirQualityActionPlanAnnex1draftAQAP.pdf

DfT (2007). DMRB Volume 11, Section 3, Part 1 HA 207/07 'Air Quality'. Retrieved 2019, from http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf

Highways England (2013) Interim Advice Note 170/12 v3 Updated advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality, retrieved from http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian170v3.pdf

Highways England (2013) Interim Advice Note 174/13 Updated advice for evaluating significant local effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality, retrieved from http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian174.pdf

Highways England (2013) Interim Advice Note 175/13 Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 'Air Quality

Highways England (2015) Interim Advice Note 185/15 Updated traffic, air quality, and noise advice on the assessment of link speeds and generation of traffic data into speed-bands for users of DMRB Volume 11, Section 3, Part 1 'Air Quality, retrieved from http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian185.pdf

Defra (2018) Local Air Quality Management Technical Guidance (TG16) retrieved from: https://laqm.defra.gov.uk/technical-guidance

Defra's UK AIR Air Information Resource Air Quality Management Areas http://uk-air.defra.gov.uk/aqma/maps

Defra's UK AIR Air Information Resource UK Air Quality Interactive Map http://uk-air.defra.gov.uk/data/gis-mapping

Elmbridge Borough Council (2017) Air Quality Annual Status Report

Woking Borough Council (2018) Air Quality Annual Status Report

Guildford Borough Council (2018) Air Quality Annual Status Report

Mole Valley District Council (2018) Air Quality Annual Status Report

Runnymede Borough Council (January 2017) 2015 Air Quality Annual Status Report

Connect Plus (2017) Air Quality Management Plan

MAGIC website http://magic.defra.gov.uk/

National Atmospheric Emissions Inventory http://naei.beis.gov.uk/data/

Printed on paper from well-managed forests and other controlled sources.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363