Note:
Modelling Nitrogen along Transect 4 Alongside the A3, South of J10 on M25

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Experts in air quality
management & assessment

Document Control

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1 Introduction

1.1 This Note has been prepared on behalf of the Royal Horticultural Society (RHS). It sets out the results of modelling of nitrogen oxides concentrations on a transect of receptors running east of the A3 just to the south of J10 of the M25 (Transect 4). The aim is to test the results presented by Highways England (HE) to the DCO Examination for the improvements to J10, in particular, the in-combination change in nitrogen deposition along Transect 4 between the 2022 Do Nothing (DN) and Do Something (DS), as set out in REP10-007 for distances to 100 m from the road, with results for 150 m and 200 m from Appendix B to REP8-022.

1.2 This Note sets out the modelling carried out by Air Quality Consultants Ltd (AQC) and then presents the results derived to represent the in-combination impacts on nitrogen deposition along Transect 4. The qualifications of those involved in carrying out the work are set out in Appendix A1.

2 Modelling

Model setup

2.1 The traffic flows and speeds are those provided by Vicki Sykes of Atkins to AQC in an email dated 11 June 2020 at 17:22. The modelling has included the seven links on the A3 that will dominate the traffic contribution to the receptors on the transects into the SPA (receptors R149-R156 represent Transect 4), as illustrated in Figure 1.

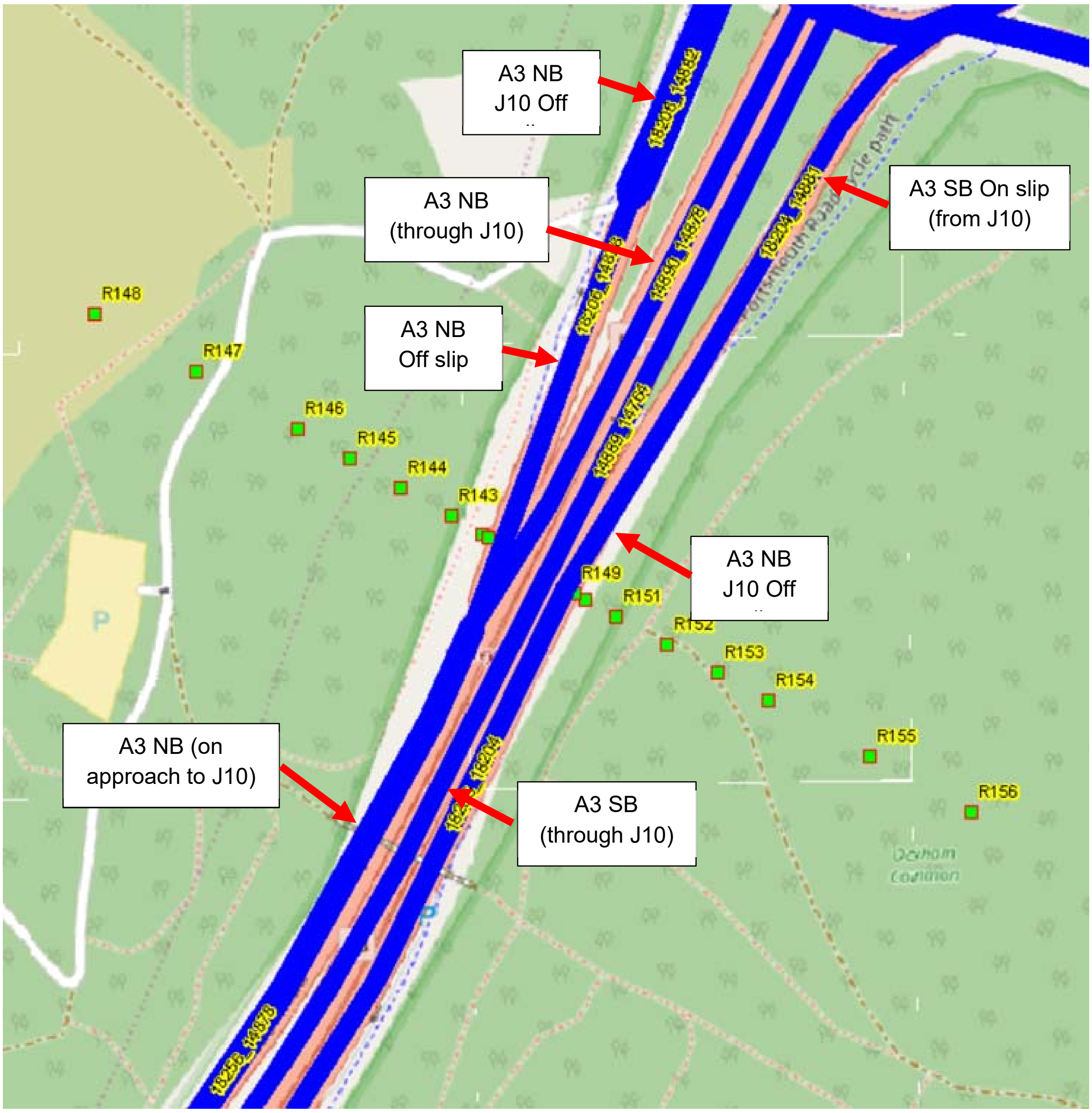

Figure 1: Road Links and Receptor Transects

2.1 The emissions for nitrogen oxides (NOx) have been based on the speed banding factors from the HE IAN185/15 for Motorways in 2022, as confirmed by Vicki Sykes in an email dated 22 June 2020 at 12:46. The meteorological data used are those for Heathrow Airport for 2015, as used by HE. For the meteorological site, the surface roughness has been input as 0.2 m, with a Moinin-Obukhov (MO) length of 30 m, and for the modelled area a surface roughness of 1.0 m with a MO length of 10 m (it is recognised this may differ from the values used by HE (which are not stated in APP-050), but are those that would be used by AQC for a modelling study in this location).

2.2 The results have been output for each of the receptors on Transect 4 at a height of 1.5 m for both the Do Nothing (DN) and Do Minimum (DM) scenarios in 2022. It has not been possible to verify the model, so the results are the raw unadjusted values, however, this does not affect the relative concentrations between DN and DM that are used to derive the changes in nitrogen deposition.

Model Results

2.3 The raw model road-NOx concentrations (i.e. the NOx arising only from emissions on the roads shown in Figure 1) are set out in Table 1 for the DN and DM scenarios.

Table 1: Calculated Annual Mean NOx Concentrations

Receptor	DN ($\mu g/m^3$)	DM ($\mu g/m^3$)	Ratio DM/DN
R149 (7 m from kerb)	35.8	35.5	0.9917
R150 (10 m from kerb)	28.4	28.4	0.9983
R151 (25 m from kerb)	17.9	18.0	1.0075
R152(50 m from kerb)	11.0	11.1	1.0129
R153 (75 m from kerb)	7.8	7.9	1.0154
R154 (100 m from kerb)	5.9	6.0	1.0167
R155 (150 m from kerb)	3.8	3.9	1.0183
R156 (200 m from kerb)	2.7	2.7	1.0194

Calculation of In-Combination Changes in Nitrogen Deposition

2.4 The NOx concentrations have been used to derive the changes in nitrogen deposition using ratios between the scenarios in the AQC and HE modelling. The ratios have been applied to the nitrogen deposition increments arising from NOx from the road traffic, i.e. the background of 12 kg N/ha/yr has been removed first then added back on. The 2022 DM nitrogen deposition due to NOx alone as set out by HE in REP10-007, was taken as the starting point. The next step was to apply the DM/DN ratio from the AQC modelling (see Table 1) to give a 2022 DM nitrogen deposition. The DS/DN ratio of the NOx contribution to nitrogen deposition, from the HE modelling results in REP10-007, was then applied to the 2022 DM nitrogen deposition derived from the AQC modelling, to give a 2022 DS nitrogen deposition derived from the AQC modelling. These values were then adjusted to include ammonia (by doubling the NOx contribution as a (non-precautionary) proxy for accounting for ammonia). The results are set out in Table 2.

Table 2: Calculated Nitrogen Deposition from AQC Modelling

Receptor	N Dep due to NOx			N Dep including Ammonia		
	DN (kg N/ha/yr)	DM (kg N/ha/yr)	Derived DS (kg N/ha/yr)	DN (kg N/ha/yr)	DM (kg N/ha/yr)	Derived DS (kg N/ha/yr)
R149 (7 m from kerb)	25.89	25.77	27.11	39.78	39.55	42.22
R150 (10 m from kerb)	23.06	23.04	24.08	34.12	34.08	36.17
R151 (25 m from kerb)	19.55	19.61	20.17	27.1	27.21	28.33
R152 (50 m from kerb)	17.31	17.38	17.69	22.62	22.76	23.37
R153 (75 m from kerb)	16.25	16.32	16.55	20.5	20.63	21.10
R154 (100 m from kerb)	15.53	15.59	15.59	19.06	19.18	19.18
R155 (150 m from kerb)	14.8	14.85	14.69	17.6	17.70	17.39
R156 (200 m from kerb)	14.38	14.43	14.43	16.76	16.85	16.85

2.5 The values set out in Table 2 have been used to show the In-combination impacts as a percentage of the critical load (10 kg N/ha/yr). The results are presented in Table 3 for both the original modelling carried out by HE (as set out in Table A, which is an update of the HE table in REP10-007 submitted by the RHS at Deadline 11) and for the AQC modelling.

Table 3: Comparison of In-Combination Nitrogen Deposition Impacts from HE Modelling and AQC Modelling

Receptor	In-Combination Change (DS-DN) as % of Critical Load from HE Modelling	In-Combination Change (DS-DN) as % of Critical Load from AQC Modelling
R149 (7 m from kerb)	**-30.3%**	**24.4%**
R150 (10 m from kerb)	**-8.3%**	**20.5%**
R151 (25 m from kerb)	**-7.2%**	**12.3%**
R152(50 m from kerb)	**-3.0%**	**7.5%**
R153 (75 m from kerb)	**-1.0%**	**6.0%**
R154 (100 m from kerb)	**-0.4%**	**1.2%**
R155 (150 m from kerb)	**0.2%**	**-2.1%**
R156 (200 m from kerb)	**1.6%**	**0.9%**

3 Conclusion

3.1 The AQC modelling produces very different results for nitrogen deposition on Transect 4 to those produced by HE. The new results are more consistent with those for the other 5 transects within the SPA, all of which show significant adverse in-combination impacts on nitrogen deposition.

3.2 The AQC modelling has been based on the same traffic flows and speeds as used by HE to derive the results in REP10-007. The RHS has, however, also set out concerns that the speeds used by HE in the DN are too low (as set out in its Deadline 11 response to the HE's response to Q4.3.3). If the same speed bandings were to be applied to the DN emission as those for the DM, then the increases in nitrogen deposition would be even greater than those shown in the last column of Table 3.

3.3 The analysis set out in this Note makes clear that it is not appropriate to rely on the in-combination results for Transect 4 as set out by HE in REP10-007.

A1 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc FIAQM

Prof Laxen is an Associate of Air Quality Consultants, a company which he founded in 1993. He has over 40 years' experience in environmental sciences and has been a member of Defra's Air Quality Expert Group and the Department of Health's Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM_{10}, $PM_{2.5}$ and ozone and was responsible for setting up the UK's urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports and for providing guidance and support to local authorities carrying out their local air quality management duties. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries, published over 70 scientific papers and given numerous presentations at conferences. He is a Fellow of the Institute of Air Quality Management.

Ricky Gellatly, BSc (Hons) CSci MIEnvSc MIAQM

Mr Gellatly is a Principal Consultant with AQC with over eight years' relevant experience. He has undertaken air quality assessments for a wide range of projects, assessing many different pollution sources using both qualitative and quantitative methodologies, with most assessments having included dispersion modelling (using a variety of models). He has assessed road schemes, airports, energy from waste facilities, anaerobic digesters, poultry farms, urban extensions, rail freight interchanges, energy centres, waste handling sites, sewage works and shopping and sports centres, amongst others. He also has experience in ambient air quality monitoring, the analysis and interpretation of air quality monitoring data, the monitoring and assessment of nuisance odours and the monitoring and assessment of construction dust. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is a Technical Director with AQC and has more than 20 years' experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has been an expert witness at several public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to the UK Government’s air quality review and assessment helpdesk, Transport Scotland, Transport for London, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. Dr Marner is a member of Defra’s Air Quality Expert Group.