

# **A12 Chelmsford to A120 widening scheme**

**TR010060**

## **6.3 ENVIRONMENTAL STATEMENT**

### **APPENDIX 6.1 AIR QUALITY MONITORING RESULTS**

APFP Regulation 5(2)(a)

Planning Act 2008

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

Volume 6

August 2022

## Infrastructure Planning

### Planning Act 2008

# **A12 Chelmsford to A120 widening scheme**

## **Development Consent Order 202[ ]**

---

### **ENVIRONMENTAL STATEMENT**

#### **APPENDIX 6.1 AIR QUALITY MONITORING RESULTS**

---

<b>Regulation Reference</b>	Regulation 5(2)(a)
<b>Planning Inspectorate Scheme Reference</b>	TR010060
<b>Application Document Reference</b>	TR010060/APP/6.3
<b>Author</b>	A12 Project Team & National Highways

<b>Version</b>	<b>Date</b>	<b>Status of Version</b>
Rev 1	August 2022	DCO Application

## CONTENTS

<b>1</b>	<b>Air quality monitoring results .....</b>	<b>2</b>
1.1	Introduction .....	2
1.2	Methodology .....	2
1.3	Monitoring locations .....	2
1.4	Monitoring timescales .....	3
1.5	Bias adjustment .....	4
1.6	Annualisation .....	5
1.7	Site-specific monitoring results .....	7
1.8	Assumption and limitations .....	7
	<b>References .....</b>	<b>10</b>

## LIST OF TABLES

Table 1.1	Site-specific monitoring locations and relevant information .....	3
Table 1.2	Diffusion tube exposure periods.....	3
Table 1.3	AURN site information, and annual and period mean concentrations.....	6
Table 1.4	Derivation of annualisation factor specific to each monitoring site.....	6
Table 1.5	Monitoring results and estimated 2019 annual mean NO <sub>2</sub> concentrations for site-specific survey .....	8

# 1 Air quality monitoring results

## 1.1 Introduction

1.1.1 National Highways commissioned a 12 month NO<sub>2</sub> diffusion tube survey to cover perceived gaps in the coverage provided by local authority monitoring data with regard to the proposed scheme.

1.1.2 This appendix describes the methodology, bias adjustment and results of the monitoring survey.

## 1.2 Methodology

1.2.1 The monitoring was undertaken using NO<sub>2</sub> diffusion tubes. These are a form of passive sampler, whereby the air flow is controlled by natural diffusion and does not involve the pumping of any air. The tubes are 71mm long with an internal diameter of 11mm and contain two stainless steel gauzes at one end. These contain an absorbent (triethanolamine (TEA)) that traps the NO<sub>2</sub> and converts it to nitrite anions, which is then analysed in an accredited laboratory. The other end of the tube is left open to the atmosphere, facing downward to prevent contamination by rain or dust. To ensure that the tubes do not collect any pollutant after leaving their site location they are sealed before their journey to the laboratory.

1.2.2 NO<sub>2</sub> diffusion tubes are an indicative monitoring technique and may exhibit biases relative to continuous analysers, with positive bias being more common than negative (Defra, 2008). Bias adjustments are therefore applied to the tubes as described in Section 1.5 of this appendix. Factors that can cause under- and over-estimation of diffusion tube NO<sub>2</sub> concentrations include:

- the tube location
- meteorology, i.e. wind turbulence at the open end of the tube
- blocking of UV light by the tube material
- interference from peroxyacetyl nitrate (PAN)
- handling during laboratory analysis

1.2.3 The diffusion tubes were supplied by Staffordshire Scientific Services and prepared using 20% TEA in water. The methodologies described within LAQM.TG(16) (Defra, 2021a) have been used to bias adjust and annualise measured NO<sub>2</sub> concentrations for the purposes of this assessment.

## 1.3 Monitoring locations

1.3.1 The survey took place at 11 monitoring locations, accounting for a total of 13 diffusion tubes per month. A further two tubes were analysed to provide a travel blank and an office blank for the purposes of quality control and cross contamination checks. The location and relevant information for each monitoring site is shown in Table 1.1. All tubes were deployed at a height of 2m.

- 1.3.2 Eight of these monitoring locations were within 200m of the air quality Affected Road Network. These were sites J1, J2, J3, J4, J5, J7, J8 and J10, the locations of which are shown on Figure 6.2 [TR010060/APP/6.2].

**Table 1.1 Site-specific monitoring locations and relevant information**

Site ID	Site description	Site type	Location (X,Y)	Distance to kerb (m)
J1	Boleyn Way	Roadside	575705, 210324	2.7
J2	B1137, The Street	Roadside	579506, 212003	1.4
J3	Pasture Road	Roadside	582905, 214601	2.5
J4	Braxted Road	Roadside	584052, 216313	2.9
J5	Braxted Road	Roadside	585646, 217244	0.9
J6	Church Street	Roadside	585529, 218649	2.5
J7	B1023, Inworth Road	Roadside	587686, 218872	0.5
J8	New Lane	Roadside	587780, 220288	2.8
J9	Easthorpe Road	Roadside	589992, 221242	1.1
J10	London Road, near Marks Tey interchange	Roadside	591515, 223594	2.0
J11/J12/J13	B1137, Springfield Road (co-located with CM2)	Roadside	571644, 207183	2.9

## 1.4 Monitoring timescales

- 1.4.1 The diffusion tubes were changed monthly, over two periods between the dates of May 2017 and July 2018. The start and end dates for each monthly exposure period are shown in Table 1.2. Time weighted average concentrations (i.e. period weighted mean concentrations) have been calculated to account for variability in the number of exposure days over each monthly period.

**Table 1.2 Diffusion tube exposure periods**

Monitoring period	Start date	End date	Length of exposure (number of days)
P1	05/05/2017	06/06/2017	32
P2	06/06/2017	07/07/2017	31
P3	07/07/2017	31/07/2017	24
P4	31/07/2017	31/08/2017	31
P5	31/08/2017	02/10/2017	32

Monitoring period	Start date	End date	Length of exposure (number of days)
P6	02/10/2017	30/10/2017	28
P7	26/01/2018	26/02/2018	31
P8	26/02/2018	27/03/2018	29
P9	27/03/2018	24/04/2018	28
P10	24/04/2018	18/05/2018	24
P11	18/05/2018	18/06/2018	31
P12	18/06/2018	10/07/2018	22

## 1.5 Bias adjustment

- 1.5.1 In accordance with LAQM.TG(16), it is optional to apply either a national or local bias adjustment factor to diffusion tubes.
- 1.5.2 National bias adjustment factors are collated in a national database (LAQM National Diffusion Tube Bias Adjustment Factor Spreadsheet (Defra, 2021b)) from a number of co-location studies, allowing the bias at a range of site locations with consistent analysis methods (laboratory and analysis technique) to be considered.
- 1.5.3 A triplicate of diffusion tubes (J11/J12 and J13) were co-located at the Springfield Road (CM2) continuous monitoring site in Chelmsford in order to derive a local bias adjustment factor. However, as a result of tubes going missing between monthly changeovers, eight of the 12 time periods recorded concentrations at only one of the three co-located diffusion tubes.
- 1.5.4 The national bias adjustment factor was therefore utilised to factor raw monitored diffusion tube concentrations in this assessment. The national bias adjustment factor for tubes analysed at Staffordshire Scientific Services was 0.88 in both 2017 and 2018.

## 1.6 Annualisation

- 1.6.1 As stated in LAQM.TG(16) (Defra, 2021a), it is necessary to perform annualisation for any monitoring survey with less than nine months' worth of data over a calendar year, with a minimum of three months' monitoring required.
- 1.6.2 Box 7.10 of LAQM.TG(16) states that two to four nearby (ideally within 50 miles) Automatic Urban and Rural Network (AURN) monitoring sites should be utilised to derive an annualisation adjustment factor. These sites should have a minimum data capture of 85 % and be located in a 'background' environmental setting i.e. urban, suburban or rural background, to minimise air pollution interferences from road traffic sources. Where nearby background sites are not available, industrial and urban sites can be used, although traffic, roadside or kerbside sites should be avoided.
- 1.6.3 For the purposes of this assessment, the following AURN sites have been selected to undertake annualisation (with further information on the sites provided in Table 1.3):
- Canterbury (UKAA00424)
  - Southend-on-Sea (UKAA00409)
  - Thurrock (UKA00272)
- 1.6.4 For each AURN site, an annual mean for the assessment base year of 2019 was calculated (as seen in Table 1.3). Further, for each AURN site and at each diffusion tube location, a monitored period mean (in this case, 5 May 2017 to 10 July 2018) was calculated. The AURN monitored period mean at each survey location was time-weighted according to the number of days of exposure in each monthly monitoring period. In instances where there was missing monthly monitoring data at a diffusion tube site (e.g. missing monitoring data as shown in Table 1.5), the AURN period mean was adjusted to only reflect the months of successful data capture. Therefore, for each AURN site, a range of weighted period mean values was calculated, reflective of the data capture at different diffusion tube locations. The range of weighted AURN period mean values is presented in Table 1.3.
- 1.6.5 A ratio was then produced between the AURN annual mean and AURN weighted period mean specific to each diffusion tube monitoring site (as seen in Table 1.4). The annual/period mean ratios were averaged to produce an annualisation factor for each site-specific monitoring location. The annualisation factors derived for each site-specific monitoring site can be seen in Table 1.4.

**Table 1.3 AURN site information, and annual and period mean concentrations**

AURN site name and ID	Location (X,Y)	Environment type	Data capture (%)	2019 AURN annual mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )	AURN weighted monitoring period mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> ) <sup>1</sup>
Canterbury - UKAA00424	616187, 157319	Urban Background	98.6%	12.1	11.1 - 11.6
Southend-On-Sea - UKAA00409	585823, 186212	Urban Background	98.9%	17.9	16.1 - 17.9
Thurrock - UKA00272	561069, 177893	Urban Background	98.9%	23.4	22.7 - 24.4

<sup>1</sup> The AURN time-weighted period means are dependent on the data capture at the diffusion tube monitoring sites, which can vary between sites; therefore, for each AURN site one weighted AURN period mean was calculated for each diffusion tube location. These are presented as a range for each AURN site in this table. For example, in Canterbury, an AURN time-weighted period mean of 11.1 µg/m<sup>3</sup> was calculated at diffusion site J1 owing to missing diffusion tube data in periods 1 and 10. For the same Canterbury AURN site, an AURN time-weighted period mean of 11.6 µg/m<sup>3</sup> was calculated at diffusion tube site J6 because the exposure period differed from J1 (i.e. missing diffusion tube data for site J6 were in periods 3 and 12).

**Table 1.4 Derivation of annualisation factor specific to each monitoring site**

Site ID	AURN site annual/period mean ratio			Annualisation factor
	Canterbury - UKAA00424	Southend-On-Sea - UKAA00409	Thurrock - UKA00272	
J1	1.090	1.042	0.992	1.041
J2	1.074	1.050	0.996	1.040
J3	1.074	1.050	0.996	1.040
J4	1.074	1.050	0.996	1.040
J5	1.074	1.084	1.020	1.060
J6	1.043	1.002	0.961	1.002
J7	1.074	1.050	0.996	1.040
J8	1.082	1.081	1.004	1.056
J9	1.078	1.112	1.031	1.074
J10	1.074	1.050	0.996	1.040
J11/J12/J13 (co-location average)	1.074	1.050	0.996	1.040



## 1.7 Site-specific monitoring results

- 1.7.1 All diffusion tubes were provided and analysed by Staffordshire Scientific Services with NO<sub>2</sub> concentrations calculated for each tube based on individual exposure times. No data were provided for missing tubes and any unusually low readings were checked with the laboratory for justification.
- 1.7.2 The bias adjusted annual mean NO<sub>2</sub> concentrations for 2019 at all monitoring locations are presented in Table 1.5.

## 1.8 Assumption and limitations

- 1.8.1 The following is a considered list of assumptions and limitations applicable to the monitoring data collected by National Highways. Note that the assessment of the air quality impact owing to the proposed scheme was also supported by established ongoing monitoring undertaken by local authorities:
- Only one location was deployed in triplicate, meaning that where locations were monitored by a single diffusion tube, there may be a greater level of uncertainty in the results for any one month as diffusion tube monitoring results can vary by  $\pm 25\%$ . However, the tubes were deployed over a 12 month period which would balance out this uncertainty.
  - Triplicate diffusion tubes were deployed at a continuous monitoring site to derive a local bias adjustment factor. However, owing to missing data (see Section 1.5 of this appendix) the national bias adjustment factor was used. Bias adjustment for 2017 was chosen over 2018, despite six months in either year, however both factors were the same.
  - Assumption to use 12 months of monitoring data to gain better representation of seasonal variation rather than annualising six months of data in 2018.
  - Defra diffusion tube calendar had not been followed for each month, with some shorter exposure periods. However, time weighting was applied to adjust for the variability in exposure periods.

**Table 1.5 Monitoring results and estimated 2019 annual mean NO<sub>2</sub> concentrations for site-specific survey**

Site ID	Monitoring period NO <sub>2</sub> concentrations (µg/m <sup>3</sup> )												Period mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )	Bias adjusted 2019 annual mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12		
J1	-	20.4	28.4	28.3	27.9	34.0	35.1	33.6	31.3	-	23.0	30.8	29.1	26.7
J2	28.2	24.5	34.8	31.1	30.9	39.3	32.5	31.9	31.7	32.9	23.9	32.4	30.9	28.3
J3	36.8	26.2	46.8	35.6	34.3	40.3	38.5	42.6	40.4	39.0	34.7	38.1	37.5	34.3
J4	27.3	21.3	33.3	25.6	29.0	35.1	34.4	30.3	30.4	34.2	21.8	26.3	28.9	26.4
J5	15.4	10.1	15.8	13.5	15.4	19.6	20.1	-	17.9	17.5	10.8	14.0	15.4	14.3
J6	15.1	9.9	-	14.9	16.6	17.5	16.7	17.5	17.8	21.3	11.6	-	15.7	13.9
J7	33.0	23.7	32.3	26.7	26.9	31.7	29.4	31.2	29.0	32.4	26.3	29.9	29.2	26.7
J8	24.6	15.6	25.4	20.5	22.4	23.1	24.1	27.4	-	23.0	15.3	22.9	22.1	20.5
J9	16.3	11.4	16.8	15.7	14.9	38.6	-	-	17.5	15.6	-	16.4	18.0	17.1
J10	42.7	38.3	54.6	42.0	43.4	53.9	42.3	38.3	40.2	49.3	37.0	44.6	43.5	39.8
J11 (co-location)	-	-	-	37.3	-	20.7	-	37.6	35.9	34.6	32.5	33.8	33.2	-
J12 (co-location)	-	26.7	-	-	-	-	-	39.2	39.5	32	31	31.1	33.2	-
J13 (co-location)	35.6	-	42.1	-	37.7	-	39	42.7	33.3	35.1	36	-	37.6	-

Site ID	Monitoring period NO <sub>2</sub> concentrations (µg/m <sup>3</sup> )												Period mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )	Bias adjusted 2019 annual mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12		
J11/J12/J13 (co-location average)	35.6	26.7	42.1	37.3	37.7	20.7	39.0	39.8	36.2	33.9	33.2	32.5	34.6	31.6

---

## References

Department for Environment, Food and Rural Affairs and the Devolved Administrations (2008). Diffusion Tubes for Ambient NO<sub>2</sub> Monitoring: Practical Guidance. Available at: [https://laqm.defra.gov.uk/documents/0802141004\\_NO2\\_WG\\_PracticalGuidance\\_Issue1a.pdf](https://laqm.defra.gov.uk/documents/0802141004_NO2_WG_PracticalGuidance_Issue1a.pdf). Accessed March 2022.

Department for Environment, Food and Rural Affairs (2021a). Local Air Quality Management: Technical Guidance Note (LAQM TG(16))v1, April 2021.

Department for Environment, Food and Rural Affairs (2021b). National Diffusion Tube Bias Adjustment Factor Spreadsheet (version 9/21), October 2021. Available at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/national-bias/>. Accessed March 2022.