Ripley high Street air quality monitoring between 16th March and 15th July 2017

1 Introduction

TRL installed an air quality monitoring station to conduct continuous monitoring of oxides of nitrogen (NO, NOx, NO_2) a TEOM to measure PM_{10} particulate fraction and an Osiris unit to measure $PM_{2.5}$ at 1/2 High Street, Ripley. Monitoring was carried out on behalf of Ripley Parish Council. The map coordinates for the monitoring location are (51.300129, −0.492760) and can be seen as green point in Figure 1. The location of the nearest postcode to the site is GU23 6AU. Alongside the continuous monitoring an array of 10 diffusion tubes were deployed at 8 locations in the surrounding area. The locations of which can be seen below in Figure 1 (one green point and seven blue points).

The Osiris unit used to measure $PM_{2.5}$ is not an accredited method for monitoring particulates but is to be used as an indicative measure. This would be compared to the VCM corrected TEOM data for the PM_{10} to ensure levels were accurate.

Monitoring began on 16th March 2017. This report covers data collected between 16th March 2017 and 7th June 2017.

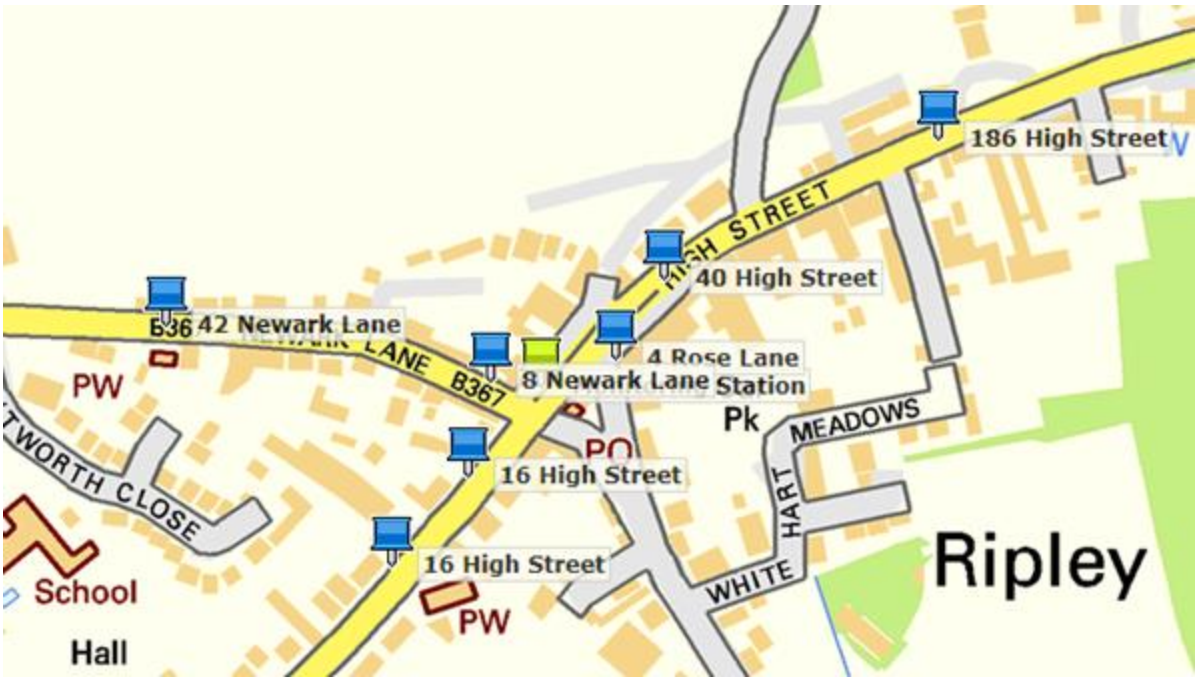

Figure 1: Map of diffusion tube and continuous monitoring station location

2 Nitrogen oxide monitoring

Air quality standards and objectives are set out in the Air Quality (England) Regulations 2000 (as amended 2002) and the 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS). The limits contained within the AQS are based upon concentrations over a given period of time that are considered acceptable in terms of the effects of each pollutant on human health.

Table 1 outlines the Air Quality objectives for NO_2, as set out in the UK AQS.

Table 1: Air Quality Strategy objectives for nitrogen dioxide (NO_2) and particulates (PM_{10} and $PM_{2.5}$)

Objective
UK objectives for NO_2 set in regulations
Hourly average concentration of 200 µg/m^3 not to be exceeded more than 18 times a year
Annual mean of 40 µg/m^3
UK objectives for PM_{10} set in regulations
24- hour mean of 50ug/m^3 not to be exceeded more than 35 times a year
Annual mean of 40 µg/m^3
UK objectives for $PM_{2.5}$ set in regulations
Work towards reducing emissions/ concentrations of fine particulate matter ($PM_{2.5}$)

2.1 Hourly graphs and statistics

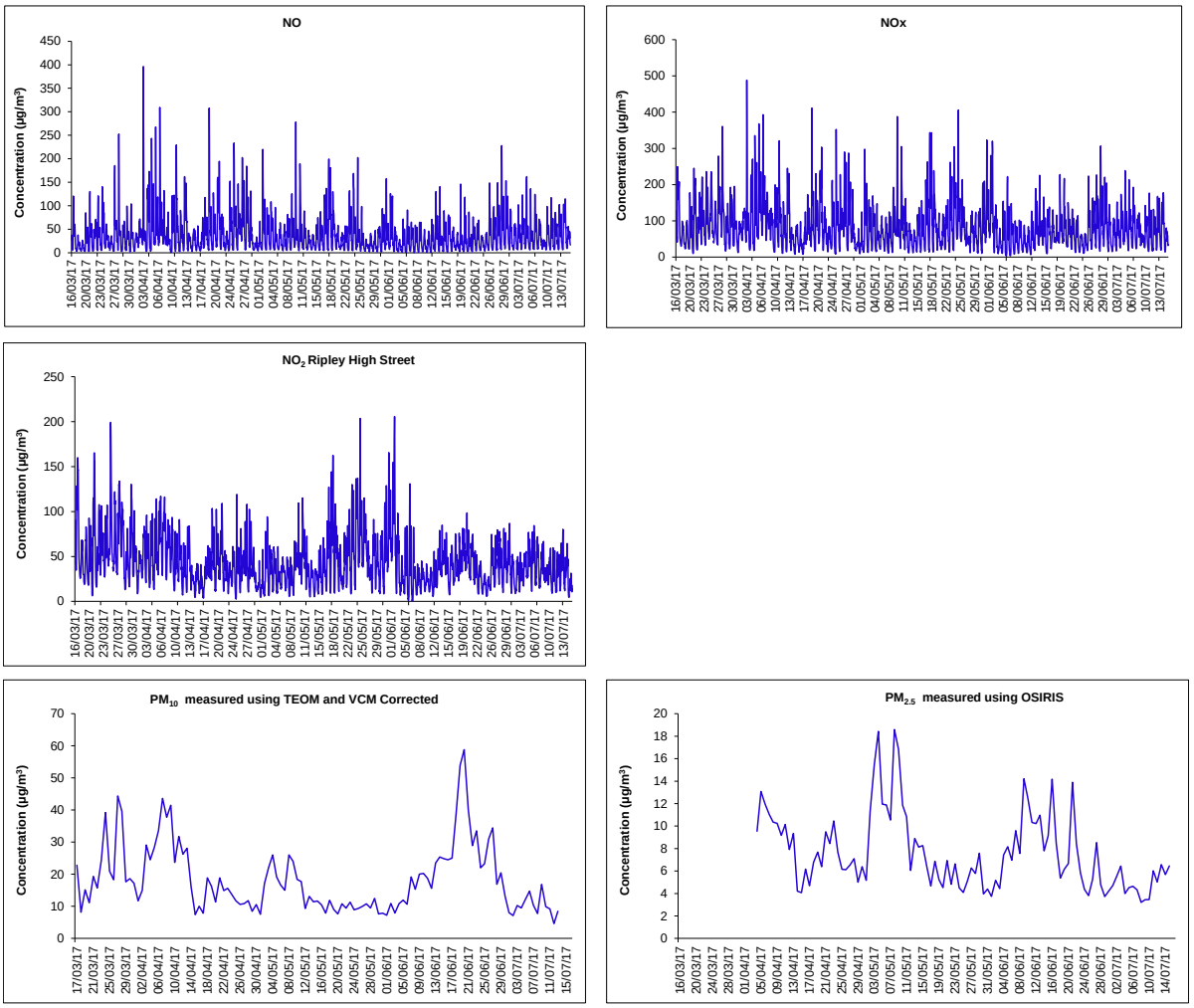

Figure 2: Hourly graphs for Ripley High Street

Table 2: Hourly statistics for the Ripley High Street – 16/03/17 to 15/07/17

	NO	NO_x	NO_2	PM_{10}	*$PM_{2.5}$
NO_2 hourly mean objective (200 µg/m^3, 18 exceedances/year)			**2**		
PM_{10} 24-hour mean objective (50µg/m^3, 35 exceedances per year)				**2**	
Minimum (µg/m^3)	0.7	2.5	0.6	-0.4	0.0
Average (µg/m^3)	37.0	80.5	43.6	18.1	7.6
Standard deviation (µg/m^3)	36.6	58.6	28.6	14.9	4.4
Median (µg/m^3)	27.0	67.1	38.2	13.7	6.6
Maximum (µg/m^3)	396.4	488.6	205.7	189.5	42.5
Data capture (%)	99.8	99.8	99.8	95.6	100.0

*Not installed until 3/04/17

2.2 Diffusion tube results

Tube number	Location	Month 1 (6/3/17 to 5/4/17) NO_2 (µg/m^3)	Month 2 (5/4/17 to 8/5/17) NO_2 (µg/m^3)	Month 3 (8/5/17 to 7/6/17) NO_2 (µg/m^3)	Time weighted average NO_2 (µg/m^3)
1 (triplicate)	Monitoring station OS 51.300129, -0.492760	**43.09**	38.74	30.45	37.43
2	Lamppost 42 Newark Lane OS 51.300468, -0.495630	30.35	27.88	23.42	27.22
3	30mph sign – 16 High street OS 51.299706, -0.492176	**45.30**	39.93	32.76	39.33
4	Lamppost next to Bakery, 4 Rose lane OS 51.300641, -0.491786	30.41	28.96	24.56	27.98
5	Sign- 40 High street OS 51.300641, -0.491786	**41.01**	33.89	33.68	36.19
6	Parking sign, 186 High street OS 51.301285, -	32.75	30.20	26.70	29.88

	0.489656				
7	Lampost, 8 Newark Lane OS 51.300165, -0.493145	**48.45**	**48.29**	35.59	44.11
8	Blue sign 16 High Street OS 51.299283, -0.493929	36.52	33.18	27.99	32.56

2.2.1 Bias adjustment

The results of the collocation of the tubes with the automatic monitor can be used to derive a bias adjustment factor for the monitoring period. The continuous monitoring data was available from the 16th March as opposed to the 6th March when the diffusion tubes were deployed and therefore the average has been calculated between 16/3/17 and 7/06/17. The tubes are under-reading compared with the automatic monitor, thus the bias adjustment factor is 1.27 (47.4/37.4). This factor is applied to the three-month mean results for each of the sites.

2.2.2 Annualisation

The results shown are for a period of just over 3 months (6th March 2017 to 7th June 2017). Normally, results are given over a 12 month period to allow for seasonal variations. As this data is not available for this site, then an annualisation factor has been derived by reviewing nearby monitoring data. For this, 2016 data has been used from three sites in Guildford. As the data we have covers most of March, April and May, the average of these 3 months has been compared to the annual average in the Guildford data in order to obtain an annualisation factor.

Table 3: Monthly monitoring data from Guildford for 2016
NO_2 data in µg/m^3

	GD3 Josephs Road	GD10 The Garth	GD13 YMCA
Jan	26	20	37
Feb	23	23	31
March	30	23	40
Apr	22	21	32
May	22	14	38
June	19	14	32
July	15	13	29
August	16	15	27
Sept	18	13	28
Oct	28	20	33

Nov	25	25	37
Dec	37	30	46
March-May average	24.67	19.33	36.67
Year average	23.42	19.25	34.17
Annualisation factor	0.949	0.996	0.932
Average factor		0.959	

The resulting bias adjusted and annualised average NO_2 concentration as shown in Table 4.

Table 4: Bias adjusted and annualised NO_2 data in µg/m^3

Site	Bias adjusted	Annualised data
1	47.53	45.58
2	34.57	33.15
3	49.95	47.90
4	35.53	34.07
5	45.97	44.08
6	37.95	36.40
7	56.02	53.72
8	41.36	39.66

Discussion

Air quality monitoring began at the Ripley High street site on 16th March 2017, this report presents the data collected between 16th March 2017 and 15th July 2017. In addition, the provisional calibrated and ratified hourly data values presented in this report have been provided to Ripley Parish Council.

The data capture rate for this monitoring period has been very good with a rate of 99.8% being achieved for nitrogen oxides and 95.7% for PM_{10} monitored using the TEOM. The data capture rate for the Osiris monitoring $PM_{2.5}$ was 98.1%. This instrument was installed on the 3rd April due to a failure noted at the pre-deployment test which required the analyser to be sent back to the manufacturer.

Hourly average statistics for oxides of nitrogen at the Ripley High Street are shown in Table 2. The table shows that in this monitoring period there were two exceedances of the hourly NO_2 objective of 200 µg/m^3 as set out in the AQS. The exceedances occurred on the 25th May at 08:00 and 2nd June at 17:00 both of these exceedances occurred during peak rush hour periods and are likely to be due to a build-up of traffic.

The results from the monitoring have been compared to other AURN urban traffic sites in the South of England including Chatham roadside, Luton A505 roadside and Reading London Road. The trends in concentration at Ripley are similar to those seen at these other

three sites. Concentrations at the Ripley site are often higher than those seen at the Chatham and Reading sites but similar to those at the Luton site.

The average NO_2 concentration for the four month monitoring period is 43.6 µg/m^3. This is above the annual mean objective limit of 40 µg/m^3 set out in the AQS. These results should be treated with caution as data only cover a four month period and may not exceed the annual mean objective if a longer monitoring period was undertaken.

The diffusion tube results indicate that some sites would have exceeded the annual mean objective in 2016 based on the annualised values derived from the three month monitoring period. These have been highlighted in red. It can be seen that sites 1, 3, 5 and 7 all exceed the annual objective, potentially by a substantial amount.

Site 7 is of concern where the two months monitoring indicate very high concentrations at a similar level and although the third months data does not exceed the objective limit the result is still high. The annualised result is very high based on the current monitored data. This diffusion tube is located on the lamp post next to the building façade near the junction at Newark Lane. There are a number of receptors very close to the roadside slightly further along the road. This area is of the greatest concern as there is a narrowing of the road, which results with traffic queuing, which is the likely cause of the high concentrations at this site.

If the new local development at Wisley airport does go ahead it is predicted that there will be an increase in up to 4000 vehicles in the area. A proportion of these vehicles are likely to travel through Ripley. The resultant increase in traffic through Ripley is likely to worsen the air quality in Ripley. The particular area of concern is Newark lane which already has queuing traffic due to the narrowed junction. An increase in traffic traveling along this route is likely to increase queue lengths at the junction and this in turn could affect more houses further away from the junction.

It is recommended that if agreement could be made with the local residents that the tube is located on the façade of one of these houses or monitoring continues at this site.

The PM_{10} concentrations monitored using the TEOM analyser has been VCM (Volatile Correction Method) corrected to ensure the results are accredited. The average PM_{10} concentration for the four month period is 18.1µg/m^3 this is below the annual mean objective limit of 40µg/m^3. There have been two exceedances of the 24-hour mean objective within this period which occurred on 19th and 20th June. Elevated concentrations were also seen at the Chatham and Reading sites during this two day period. This indicates that there may have been a wider particulate pollution episode during this time.

The $PM_{2.5}$ concentration during the monitoring period has an average of 7.6µg/m^3. There are no set objective limits for England only that work should be done to reduce concentrations/ emissions of fine particulate matter. However the objective limit that has been set for Scotland is 10µg/m^3 which the average concentrations at Ripley are below.

Ripley sites 3, 5 and 7 distance corrections

Site	Easting	Northing	Lat	Long	Distance to receptor	Bias adjusted and annualised NO2 mean	Distance of receptor to kerb	Distance to kerb	Local annual background mean*
3	505135	156693	51.299668	-0.493356	4.5	47.9	3	0.75	25.61
5	505240	156806	51.300656	-0.491822	9	44.1	4	0.5	25.61
7	505153	156746	51.300134	-0.493079	2	53.7	1	1	25.61

**Average of annual mean NO2 data from GD3, GD10 and GD13 Guidford automatic sites in 2016*

NO2 Fall-Off With Distance from Roads Calculator v4.2

Site Name/ID	Distance (m)		NO_2 Annual Mean Concentration ($\mu g/m^3$)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
Site 3, (30mph sign, 16 High Street)	0.8	3.0	25.6	47.9	42.2	Predicted concentration at Receptor above AQS objective.
Site 5 (Parking sign, 40 High Street)	0.5	4.0	25.6	44.1	37.3	Predicted concentration at Receptor within 10% the AQS objective.
Site 7 (lampost, 8 Newark Lane)	1.0	1.0	25.6	53.7	53.7	Predicted concentration at Receptor above AQS objective.