
THE COUNTY COUNCIL OF THE CITY AND COUNTY OF CARDIFF

**PART IV, ENVIRONMENT ACT 1995
LOCAL AIR QUALITY MANAGEMENT**

**Detailed Assessment
Fairoak Road Roundabout, Plasnewydd, Cardiff
May 2014**



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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance during such time.

Detailed Assessment is a requirement for local authorities that have identified areas for further assessment an Updating and Screening Assessment (USA). Where an Updating and Screening Assessment has identified a risk that an air quality objective will be exceeded at a location with relevant public exposure the authority is required to undertake a Detailed Assessment. This Detailed Assessment has been undertaken in accordance with the Technical Guidance LAQM.TG(09).

The aim of the Detailed Assessment is to identify with reasonable certainty whether or not an exceedence is occurring or is likely to occur. Only following a Detailed Assessment should an Air Quality Management Area (AQMA) be declared.

The Council's 2013 Progress Report identified a monitoring location at residential accommodation adjacent to the roundabout at the Fairoak Road/Ninian Road roundabout in Plasnewydd where the National Air Quality Standard for nitrogen dioxide (NO₂) annual mean concentration has been exceeded. In the absence of other sources, this will be as a result of local road traffic emissions.

The site at this location has been included in the Council's monitoring programme since 2002.

This Detailed Assessment focuses on the period since 2008; six years is considered a reasonable period over which to base an assessment and additional monitoring in the locality was commissioned at the beginning of 2008. Monitoring data since 2002 is included for completeness. The assessment gives priority to monitoring data from the site based at residential accommodation, this being considered "relevant exposure" for the assessment of air quality with regard to the annual mean concentration of nitrogen dioxide.

Cardiff Council intends to consult on the proposal to not declare an Air Quality Management Area at the present time. However, given the annual mean concentrations of nitrogen dioxide being measured in the area and the Council's proposal to relocate a Civic Amenity Site closer to the assessment area, it is proposed to continue monitoring in the area for the foreseeable future. The Council will undertake a further detailed assessment of air quality should future years' monitoring data indicate a need.

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1.0 Introduction

1.1 Aim of Report

The Council's 2013 Progress Report identified a monitoring location at residential accommodation adjacent to the roundabout at the Fairoak Road/Ninian Road roundabout in Plasnewydd where the National Air Quality Standard for nitrogen dioxide (NO₂) annual mean concentration had been exceeded in 2012 and in a number of preceding years.

The aim of this Detailed Assessment is to determine whether the nitrogen dioxide National Air Quality Standards are being exceeded currently, and/or if there is a risk of doing so in future years. Should either of these be the case then the Detailed Assessment should determine whether or not an AQMA should be declared.

1.2 Introduction to Local Air Quality Management

Part VI of the Environment Act 1995 requires local authorities to periodically assess the air quality within their area against objectives in the Air Quality Strategy for England, Scotland, Wales, and Northern Ireland.

The structure of the reviews and assessment are set out in the statutory guidance made under the Act. The current guidance is Technical Guidance LAQM.TG(09).

The Detailed Assessment is a requirement of review and assessment of air quality for local authorities that have identified areas where there is a risk of exceedence of an air quality standard or objective.

Monitoring in recent years has shown exceedences of the annual mean nitrogen dioxide National Air Quality Standard at residential accommodation in the vicinity of Fairoak Road roundabout and the Council's 2013 Progress Report concluded that a Detailed Assessment for this area was needed.

There are currently four AQMAs in Cardiff:

- Ely Bridge AQMA
- Stephenson Court AQMA
- Cardiff City Centre AQMA
- Llandaff AQMA

Each of these has been declared because of exceedences of the annual mean National Air Quality Standard for nitrogen dioxide and the primary source of nitrogen oxides in each case is road traffic emissions.

1.3 Objectives for Nitrogen Dioxide

Table 1 shows the two National Air Quality Standards for nitrogen dioxide and relevant locations where they apply.

Table 1 UK Nitrogen Dioxide Objectives and Applicable Areas

Annual Mean: $40\mu\text{g}\text{m}^{-3}$	<p>Applies: Where the public have regular exposure e.g. facades of residential properties, schools, hospitals, libraries</p> <p>Not: Where the public have limited access, residential gardens and kerbsides</p>
1-hour mean: $200\mu\text{g}\text{m}^{-3}$ (not to be exceeded more than 18 times per year)	<p>Applies: Anywhere the public may spend an hour of more. E.g. residential gardens, shopping areas, bus stations, railway stations, car parks</p>

This report assesses measured concentrations of nitrogen dioxide in comparison to the National Air Quality Standard for the annual mean concentration of nitrogen dioxide in the vicinity of the Fair oak Road Roundabout.

Annual mean concentrations of nitrogen dioxide in the area of the Fair oak Road Roundabout area are not sufficiently high for there to be a risk that the 1-hour mean Objective concentration is being exceeded.

1.4 Relationship between Nitrogen Oxides and Nitrogen Dioxide

Nitrogen dioxide (NO_2) is principally a secondary pollutant formed by atmospheric reactions between the primary pollutant (nitrogen oxides) and oxidising substances in the air - primarily ozone.

Atmospheric reactions between nitrogen oxides and ozone generally mean that when nitrogen dioxide levels are high, ozone levels are low and vice-versa. The reaction is cyclical in nature in that oxides of nitrogen scavenge low-level (tropospheric) ozone to form nitrogen dioxide whilst the NO_2 later acts as a donor molecule contributing the additional oxygen atom to form ozone from O_2 under the influence of sunlight. There is a complex relationship between emissions of NO_x and resulting concentrations of NO_2 depending on the amount of available atmospheric oxidants, such as ozone, and the amount of sunlight.

The highest concentrations of NO_2 in the UK generally occur during either winter episodes of poor dispersion (such as stable high-pressure weather events and temperature inversions) when emissions are higher or during summertime photochemical smog episodes.

The main cause of the exceedance of the annual mean air quality objective for NO_2 is emissions from road vehicles. These contribute directly to local concentrations of pollutants and also to background concentrations of this pollutant.

2.0 Methodology

2.1 Scope of Report

A Detailed Assessment should be based on new, appropriate, air quality monitoring (and/or modelling), which has been validated and ratified. It should indicate the spatial extent of any identified exceedence and, if there is an identified exceedence, indicate a tentative AQMA boundary. An AQMA boundary can be larger than the predicted area of exceedence but it must include those areas within which people might reasonably be exposed.

Technical Guidance LAQM.TG(09) places emphasis on monitoring pollutant concentrations as opposed to the more unreliable approach based on dispersion modelling and theoretical assessment of roadside pollutant concentrations. This Detailed Assessment uses monitoring data for local concentrations.

A Detailed Assessment should conclude by identifying whether an Air Quality Management Area (AQMA) should be designated within the area assessed. Under section 83(1) of the Environment Act 1995 local authorities have a duty to declare (by means of an official order) an AQMA in those areas where the air quality standards or objectives are not being met.

3.0 Monitoring of Nitrogen Dioxide in Cardiff

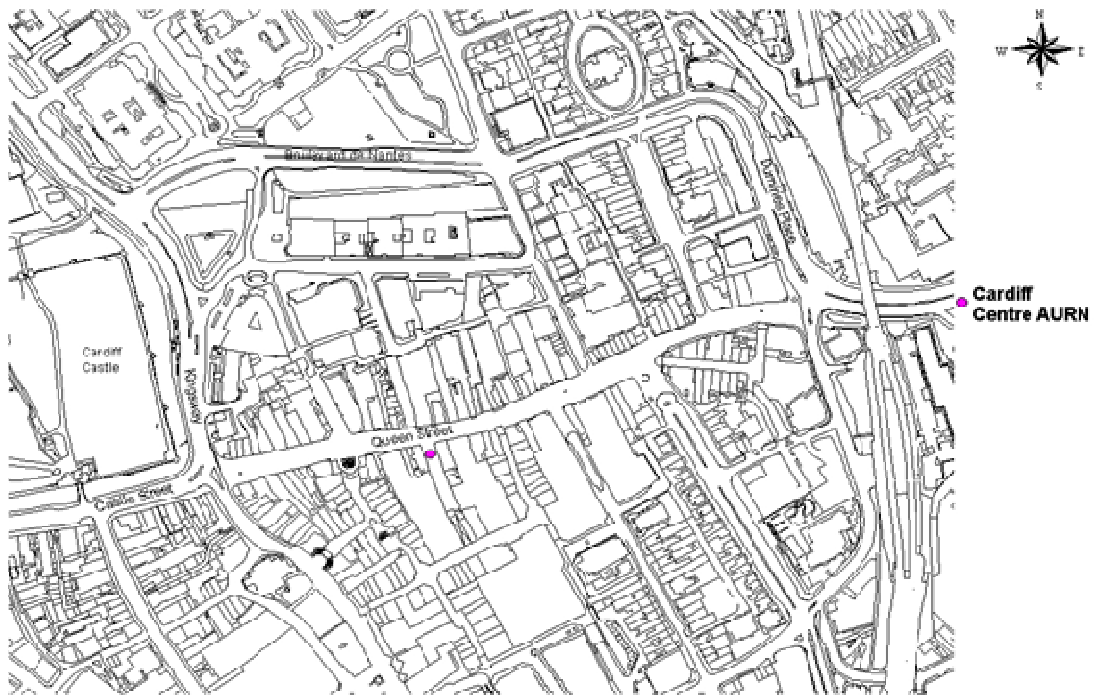
3.1 Local Monitoring Networks

Nitrogen dioxide continues to be monitored extensively in Cardiff. In addition to the permanently located chemiluminescent analyser at DEFRA's Cardiff Centre AURN site, the Council's operates a network of 73 nitrogen oxide diffusion tubes in 2014. There were 68 diffusion tubes in the network in 2013.

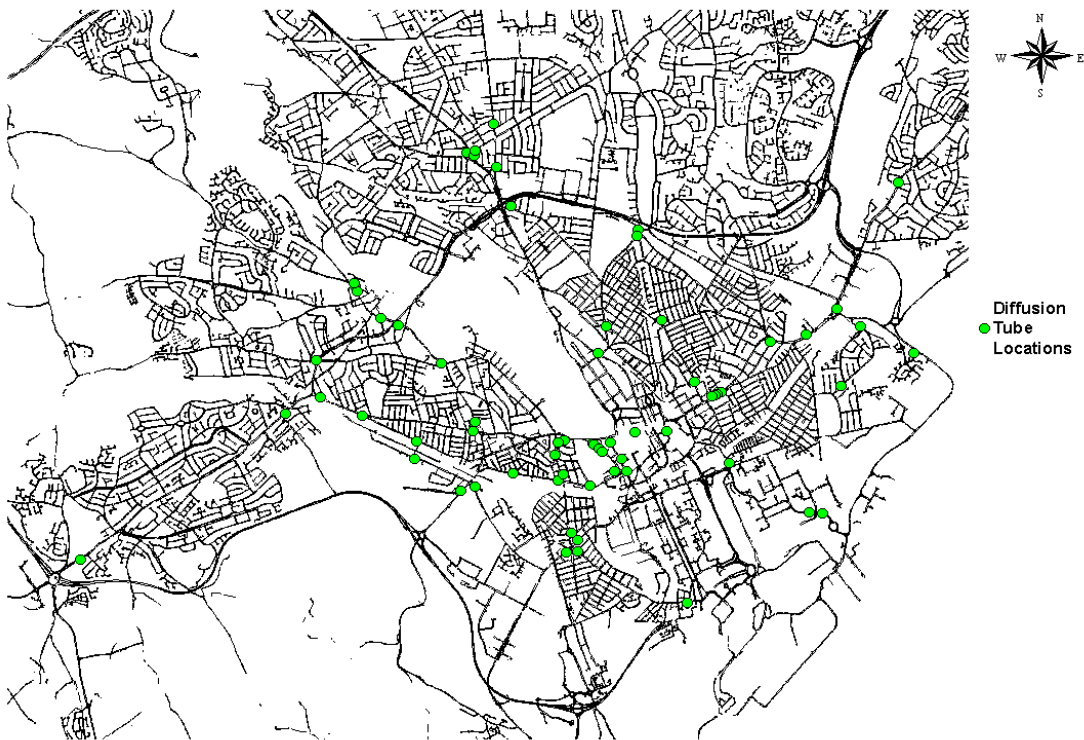
Nitrogen dioxide is currently monitored both inside and outside of Cardiff's four current AQMAs. Three of the diffusion tubes are used in a co-location study at the Cardiff Centre AURN site to provide bias-adjustment factors for the remainder of the local diffusion tube network.

Map 1 shows the location of the Cardiff Centre AURN monitoring site and Map 2 shows the Council's diffusion tube monitoring sites during 2013.

Map 1 Location of Cardiff Centre AURN Site



Map 2 Location of Cardiff Council's Diffusion Tubes in 2013



3.2 Diffusion Tube Bias Adjustment

Measurement of nitrogen dioxide by diffusion tube can be unreliable due to the variety of preparation and analytical methodologies in use and due to errors that may occur during preparation, extraction and analysis. It is important therefore that diffusion tube measurements are validated against a properly calibrated chemiluminescent analyser and the diffusion tube measurements corrected for any systematic bias that may occur.

The Council's diffusion tubes are prepared, extracted and analysed by Cardiff Scientific Services. The tubes are prepared using the 50% TEA in acetone method.

Since February 2002, the Council has co-located three diffusion tubes with the Cardiff Centre AURN site in Frederick Street. The tubes are located on the monitoring station's sample inlet duct. The results are used to determine the local "Bias Adjustment Factor" and "Diffusion Tube Bias" for measurements made by diffusion tube compared to the more accurate measurements made by chemiluminescent analyser.

Technical Guidance advises that the Bias Adjustment Factor (BAF) may be calculated as:

$$\text{BAF} = \frac{\text{CAA}}{\text{DTA}}$$

The percentage Diffusion Tube Bias (DTB) is calculated as:

$$\text{DTB (\%)} = \frac{\text{DTA} - \text{CAA}}{\text{CAA}} \times 100$$

Where: CAA = Chemiluminescent Analyser Average
DTA = Diffusion Tube Average

3.3 Nitrogen Dioxide Monitoring at Fairoak Road Roundabout

3.3.1 Site Description

Fairoak Road Roundabout is located in the Plasnewydd Ward of Cardiff adjacent to Roath Park. The area features a mix of residential properties and open parkland, with Roath Park Lake to the north beyond the A48/Eastern Avenue.

The roundabout is fed by four roads, i.e. Fairoak Road to the south and north, Ninian Road and Lake Road West. Wedal Road joins Lake Road West immediately north of the roundabout and Shirley Road joins Fairoak road immediately to the south. The local road network is therefore complex in layout. The roundabout can get busy during the week, particularly at peak times, with commuter traffic from the residential areas to the north travelling to the City Centre and the Civic Centre to the south.

In terms of topography, the roundabout can be considered to be at the bottom of an east-west valley; Ninian Road and Fairoak Road (north of the roundabout) run eastwards are "at level" with the roundabout. Lake Roads East and West to the north rise gradually away from the roundabout, as do Fairoak Road to the south and Shirley Road, only considerably more steeply. Fairoak Road to the south features in the Cardiff Half-Marathon where its steepness near to the end of the race has earned it rather more colourful epithets.

There is a terrace of residential accommodation immediately to the east of the roundabout and residential accommodation on Ninian Road which, when compared to that adjacent to

the roundabout, is both further away and elevated due to the local topography. There is open parkland opposite the residences on Ninian Road. There is also residential accommodation on Shirley Road, but, again, this is more distant when compared to that adjacent to the roundabout and those houses closest to the roundabout are also elevated.

The railway line to the rear of the terrace of houses adjacent to the roundabout serves local trains but there is no station in the immediate locality.

There is residential accommodation beyond the railway line on Wedal Road and also a small Council Depot and a Civic Amenity Site.

3.3.2 Monitoring Sites

The Council has been monitoring nitrogen dioxide concentrations at 19 Fair oak Road (Site 86) since the beginning of 2002. Data has shown small degrees of fluctuation about the National Air Quality Standard of $40\mu\text{g}\text{m}^{-3}$ since that time. These have been discussed in the Council's annual reports since that time, but a consistent pattern of exceedence has not been found. The situation has been afforded some uncertainty due to road and utility works in the vicinity in recent years; including lengthy works at the entrance to Roath Park adjacent to the roundabout and junction realignment works in 2012/2013, both of which disrupted traffic flows and caused vehicle queuing at various times.

Site 86 (19 Fair oak Road) is at the façade of residential accommodation immediately adjacent to the Fair oak Road roundabout. This was augmented in 2008 by monitoring at a kerbside site (Site 141) at the boundary of elevated residential accommodation adjacent to the Fair oak Road junction with Shirley Road. Significant vehicle queuing can occur at this point, particularly during the evening peak period, due to vehicle lane priorities giving primacy to vehicles entering from Shirley Road,.

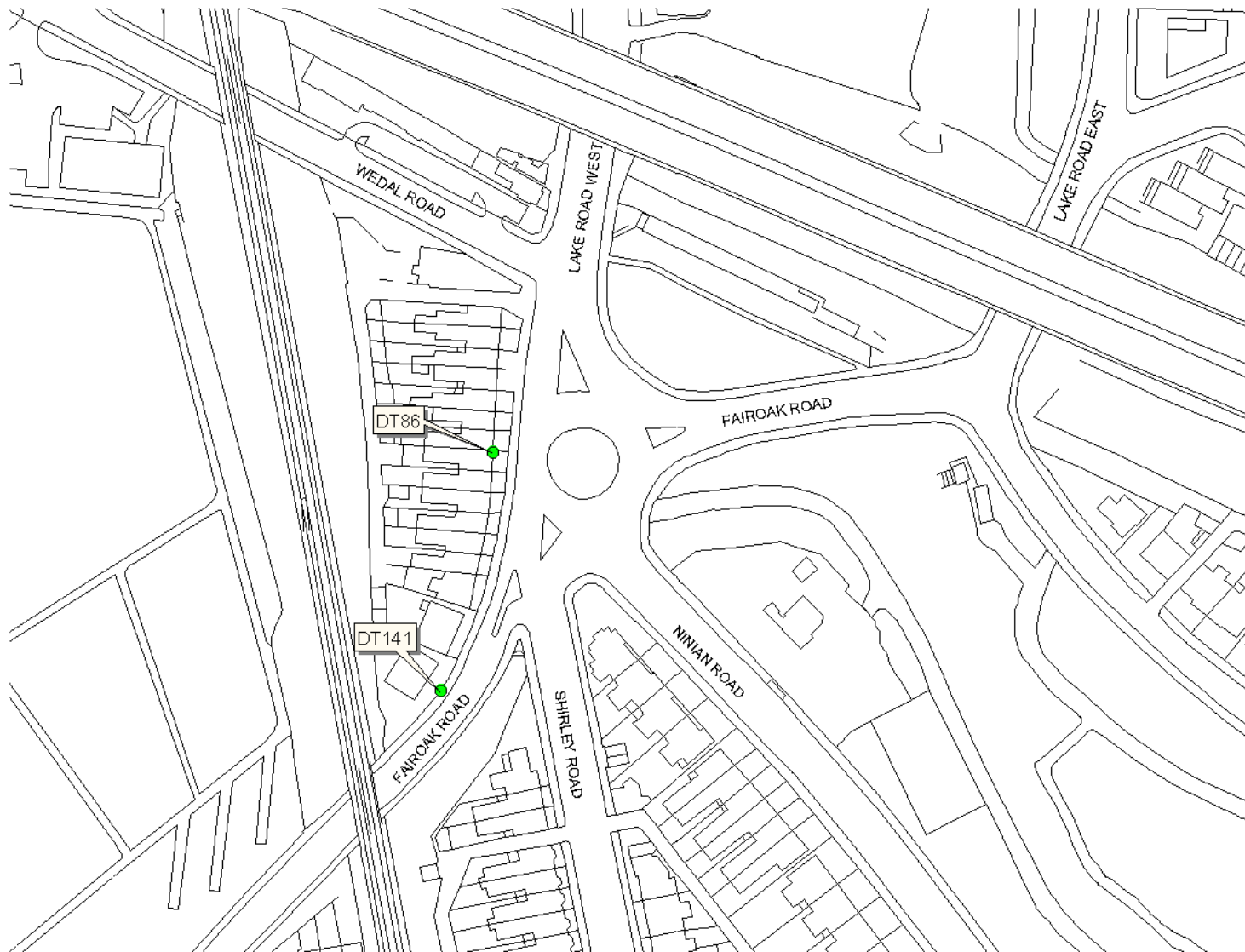
Site 86 is representative of relevant exposure with respect to the annual mean Objective for nitrogen dioxide whereas Site 141 is not.

Monitoring site details are given in Table 2 and Map 3 shows the location of the monitoring sites within the local area.

Table 2 **Details of Diffusion Tube Monitoring Sites**

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
86	19 Fair oak Road	Façade	318452	178805	1.5	NO ₂	N	N	Y 0.10m)	10m	Y
141	Fair oak Road 2	Kerbside	318438	178742	2.0	NO ₂	N	N	N (5m)	1.5m	Y

Map 3 Monitoring Site locations in and around Fairoak Road Roundabout



3.3.3 Background Concentrations

Background concentrations of nitrogen dioxide can contribute a significant proportion of total nitrogen dioxide. National maps of background concentrations are available here:

<http://laqm.defra.gov.uk/maps/2010htm>

Background concentrations are available on a 1km x 1km grid for the whole country.

Site 86 diffusion tube is at grid-reference 318452,178805 and the national map for the 1km x 1km grid-square in which it is located gives a value of 24.8 $\mu\text{g}/\text{m}^3$ for the 2013 background concentration of nitrogen dioxide.

3.3.4 Monitoring Data

Table 3 below gives the ratified, bias-adjusted monitoring data for Site 86 between 2002 and 2007. Table 4 gives the ratified, bias-adjusted monitoring data for Sites 86 and 141 between 2008 and 2013, i.e. since both sites have been operational.

Table 3 Monitoring Data from Fair oak Road Roundabout, 2002 - 2007

Site ID	Site Type	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$					
		2002 (Adjustment Factor = 0.94)	2003 (Adjustment Factor = 0.875)	2004 (Adjustment Factor = 0.81)	2005 (Adjustment Factor = 0.84)	2006 (Adjustment Factor = 0.85)	2007 (Adjustment Factor = 0.88)
86	Façade	39.7	38.6	40.6	40.4	42.3	43.9

Figures in **bold text** indicate exceedences of the 40 $\mu\text{g}/\text{m}^3$ annual mean Objective

Table 4 Monitoring Data from Fair oak Road Roundabout, 2008 - 2013

Site ID	Site Type	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$					
		2008 (Adjustment Factor = 0.84)	2009 (Adjustment Factor = 0.89)	2010 (Adjustment Factor = 0.92)	2011 (Adjustment Factor = 0.88)	2012 (Adjustment Factor = 0.86)	2013 (Adjustment Factor = 0.85)
86	Façade	40.3	41.0	42.6	39.9	40.3	38.8
141	Kerbside	35.3	40.3	43.0	40.0	40.4	37.7

Figures in **bold text** indicate exceedences of the 40 $\mu\text{g}/\text{m}^3$ annual mean Objective

It should be noted that in the Council's 2013 Progress Report the annual mean nitrogen dioxide concentration measured at Site 141 in 2012 was reported as 47.6 $\mu\text{g}/\text{m}^3$. This was incorrect, the correct concentration being as given above.

It is considered unlikely that, had the correct concentration been reported, that this would have altered the conclusion of the 2013 Progress Report, i.e. proceed to a Detailed

Assessment for this area, as the year-on-year results to the end of 2012 indicated a need for one.

3.3.5 Discussion of Monitoring Results

It has previously been discussed, most notably in the Council's 2011 Progress Report, that nitrogen dioxide concentrations in 2010 across the Council's monitoring network were elevated when compared to previous years' data. This was also the case regionally and has been attributed to increased fuel usage during a particularly prolonged period of very cold weather during November and December. When considering the likelihood of future exceedences, data from this year has to be treated with caution.

The data 2011 onwards show a minor (circa 1%) exceedence at both sites in 2012 but compliance in 2011 and 2013. Although compliant with the annual mean Objective, it is possible that nitrogen dioxide concentrations in 2013 were adversely affected by the installation of pedestrian crossing & traffic-calming measures which resulted in increased vehicle queuing, particularly at peak times, during the works.

For Site 86, which is representative of relevant exposure, the concentration measured in 2013 was the lowest since 2003.

4.0 Estimated Population Exposure

The Council's "Published and Working" Electoral Register June 2014 has 54 registered electors living in the 17 residential premises on Fair oak Road in the vicinity of the roundabout (numbers 1 – 33, odd numbers only). This figure includes only people aged 18+.

The 2011 Census data for Fair oak Road indicates that approximately 21% of the population of Fair oak Road is aged under 18.

A reasonable estimate that the population of the 17 residences adjacent to the roundabout is about 70.

5.0 Sources of Nitrogen Oxides

There are no industrial sources of nitrogen oxides in the area. The only potentially significant combustion source of nitrogen oxides is the multi-flue stack serving gas-fired boilers at University Hospital of Wales. The multi-flue stack is more than 1.3km WNW of the roundabout. Due to its location, elevated discharge point and the prevailing south-westerly wind, this is not considered to have a significant effect upon annual mean concentrations in the vicinity of the roundabout.

Emissions of nitrogen oxides from road traffic will be the dominant source of nitrogen oxides in the vicinity of the roundabout.

The most recent classified traffic counts on the local road network were made in February 2012, i.e. before the works to install pedestrian crossings and traffic-calming measures were undertaken. The traffic counts are given in Appendix 1. These indicate that almost 3,900 cars use the six roads in both the morning (08:00 - 09:00hrs) and evening (17:00 - 18:00hrs) peaks. This can cause some congestion on the roads entering the roundabout at

peak times. Lower traffic flows during the remainder of the day do not generally result in vehicle queuing.

Cars are the dominant vehicle type, reflecting the largely residential nature of the areas to the north of the roundabout. This is likely to be commuter traffic travelling to the City Centre/Civic Centre/University and University Hospital of Wales in the morning and returning in the evening. There will also be some school-generated traffic. There is little by way of Heavy Goods Vehicle (HGV) or bus traffic in the vicinity, even at peak hours. Light Goods Vehicle (LGV) traffic adds between 5 – 10% onto car numbers on each of the roads at peak hours.

The busiest road in both peak periods is Lake Road West, generally having around twice as much traffic as any of the other 5 roads. In the evening peak period all bar a small percentage of the traffic (i.e. left-turning traffic from Wedal Road) entering Lake Road West will have travelled around the roundabout and in front of the houses and diffusion tube monitoring Site 86.

Further traffic counts are planned for July/August 2014, i.e. one year following the installation of pedestrian crossings and traffic calming measures.

6.0 Planned Local Developments

The nature of the area around the Fair oak Road Roundabout is well established, being open parkland allied to mature residential properties. For the most part, there is little scope for new residences, new roads or other developments that might increase local emissions of nitrogen oxides.

The exception to this is on Wedal Road, which features a mixture of land uses along its length. These include a Council Depot, residential accommodation, a Household Waste Recycling Centre, a retirement home and a public house. The council is developing plans to move and expand the Household Waste Recycling Centre on the site of the depot. The Household Waste Recycling Centre at Waungron Road in Fairwater has already closed to facilitate this.

It is possible that this proposed development will increase road traffic in the area. The Planning Application for this development has yet to be received but it is anticipated that it will include both road traffic and air quality assessments. Of particular concern will be both the increased traffic flows and the access arrangements, i.e. whether it is planned to allow right-turns off Wedal Road into the new site. If such right-turns are not allowed then traffic arriving from the west on Wedal Road will be obliged to negotiate the junction with Lake Road West and the Fair oak Road Roundabout before re entering Wedal Road. There is therefore potential for adverse air quality impacts at the residences closest to the roundabout and at monitoring Site 86.

Looking further ahead, the Council's draft Local Development Plan includes a number of large currently undeveloped areas in the north of Cardiff with the potential to be used for large-scale housing developments. Whilst there are no firm plans or planning applications made for these sites as yet, the potential for significant development should be recognised. Given the potential for such developments and the constraints of the road network, it is possible that, should development be permitted and take place, that there may be adverse impact upon traffic levels at the Fair oak Road Roundabout.

7.0 Conclusions

When considering the need for an AQMA, weight should be given to the most recent monitoring data. The available monitoring data, particularly from 2011 onwards, shows that:

- concentrations of nitrogen dioxide in 2011 and 2013 were compliant with the annual mean Objective.
- there was a very small exceedence (circa 1%) of the annual mean Objective at both sites in 2012.
- the annual mean nitrogen dioxide concentration measured at Site 86 in 2013, which is a relevant location for the purpose of local air quality management, was the lowest measured since 2003.
- whilst acknowledging that it isn't a legitimate measure of compliance, the average concentrations at Sites 86 and 141 over the three years between 2011 and 2013 are below the annual mean Objective
- taken as a whole, the monitoring data suggest that recent concentrations are tending to be lower than in previous years

There are concerns with regard to proposals to relocate and expand the Household Waste Recycling Centre on Wedal Road as this could increase road traffic in the generally and, in particular, on Fair oak Road Roundabout. This could, in turn, adversely affect nitrogen dioxide concentrations at the facades of the residential accommodation adjacent to Fair oak Road Roundabout.

The extent of any possible increase in local road traffic, and subsequent impact of local air quality, is not known at the present time. Should a planning application be received then the anticipated road traffic and air quality impact assessments will inform the situation.

There is also the potential for increased road traffic in the area should the Local Development Plan be adopted and planning consents granted for large-scale residential developments in the north of Cardiff.

The Council will continue monitoring for nitrogen dioxide at the two sites reported herein and may seek to expand the monitoring network along Wedal Road in the future to measure the impact, if any, of the proposed Household waste Recycling Centre relocation and expansion and other potential developments further afield.

The Council will keep the situation with regard to air quality at Fair oak Road Roundabout under review in annual Progress Reports. However, the available monitoring data, particularly the most recent, suggests that it is not necessary to declare an AQMA at the present time.

8.0 Consultation

Cardiff Council would welcome views on the proposal not to declare an Air Quality Management Area at Fair oak Road Roundabout at the present time but to keep the situation under review.

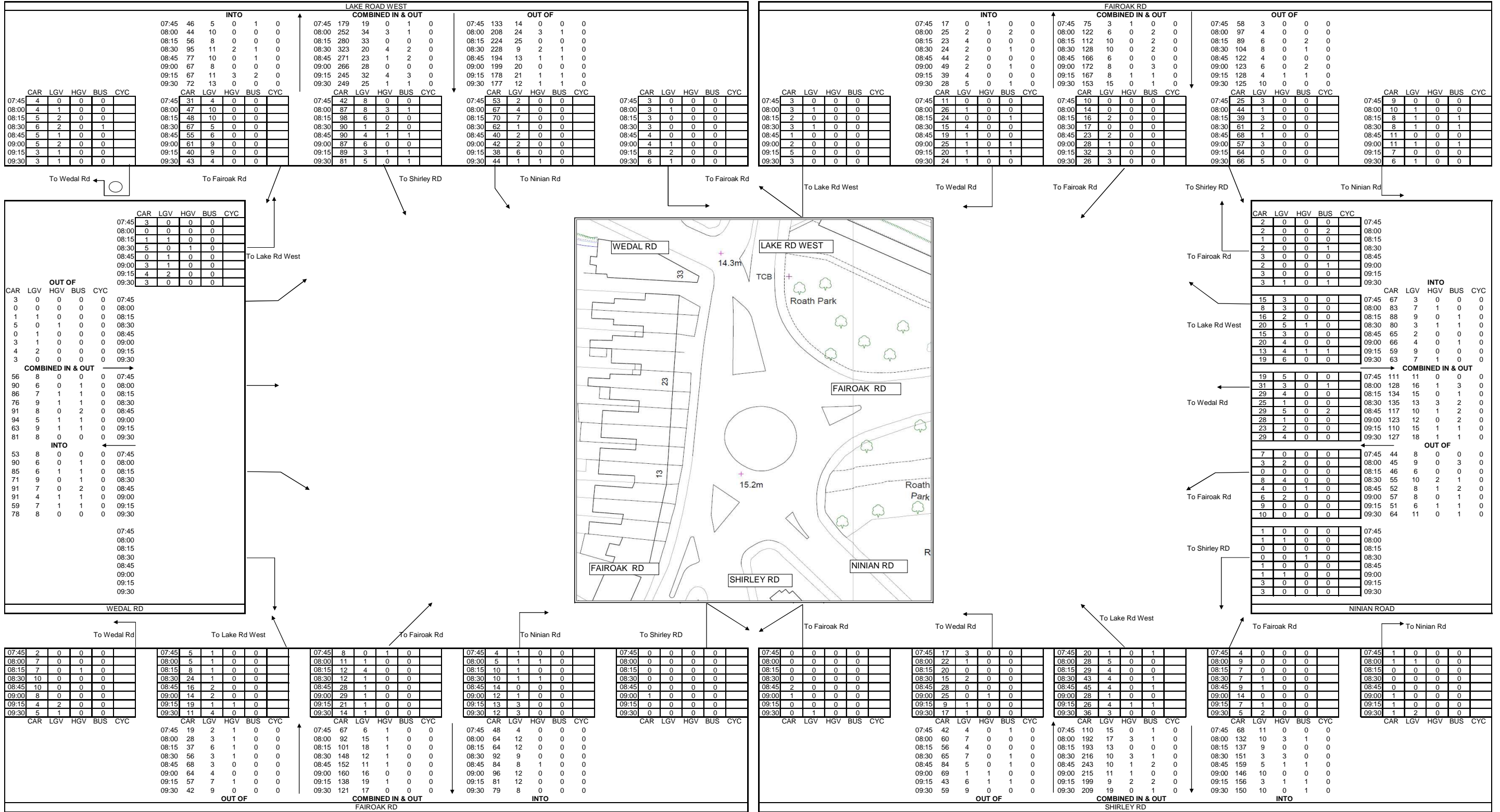
Appendix 1
Classified Traffic Counts – February 2012

AM Peak Hour Junction Survey 07:30 - 09:30

Subject: LAKE ROAD WEST - FAIROAK ROAD - NINIAN ROAD - SHIRLEY RD - FAIROAK ROAD - WEDAL ROAD

Date: 07/02/2012

Day: TUESDAY

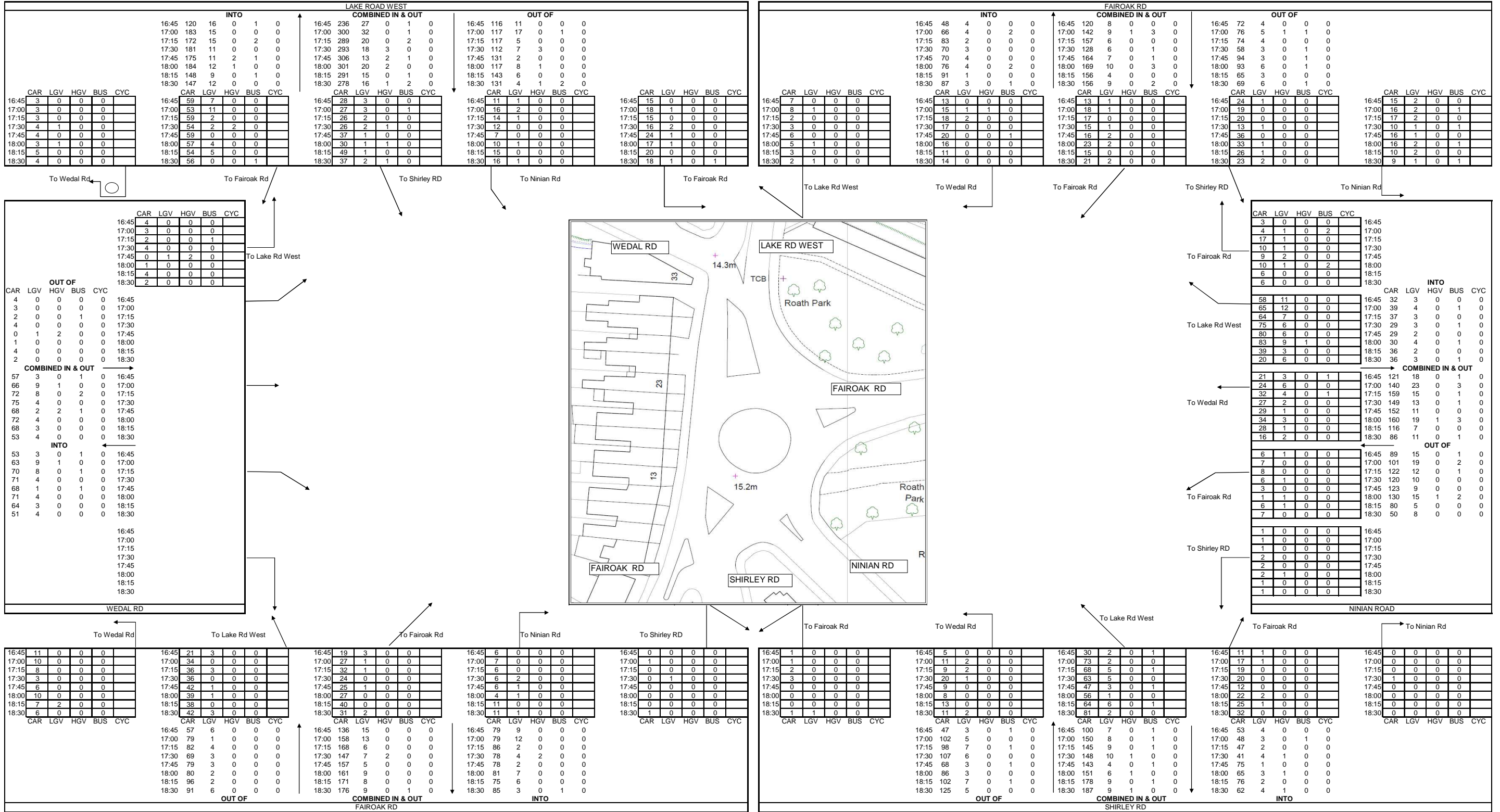


PM Peak Hour Junction Survey 16:30 - 18:30

Subject: LAKE ROAD WEST - FAIROAK ROAD - NINIAN ROAD - SHIRLEY RD - FAIROAK ROAD - WEDAL ROAD

Date: 07/02/2012

Day: TUESDAY

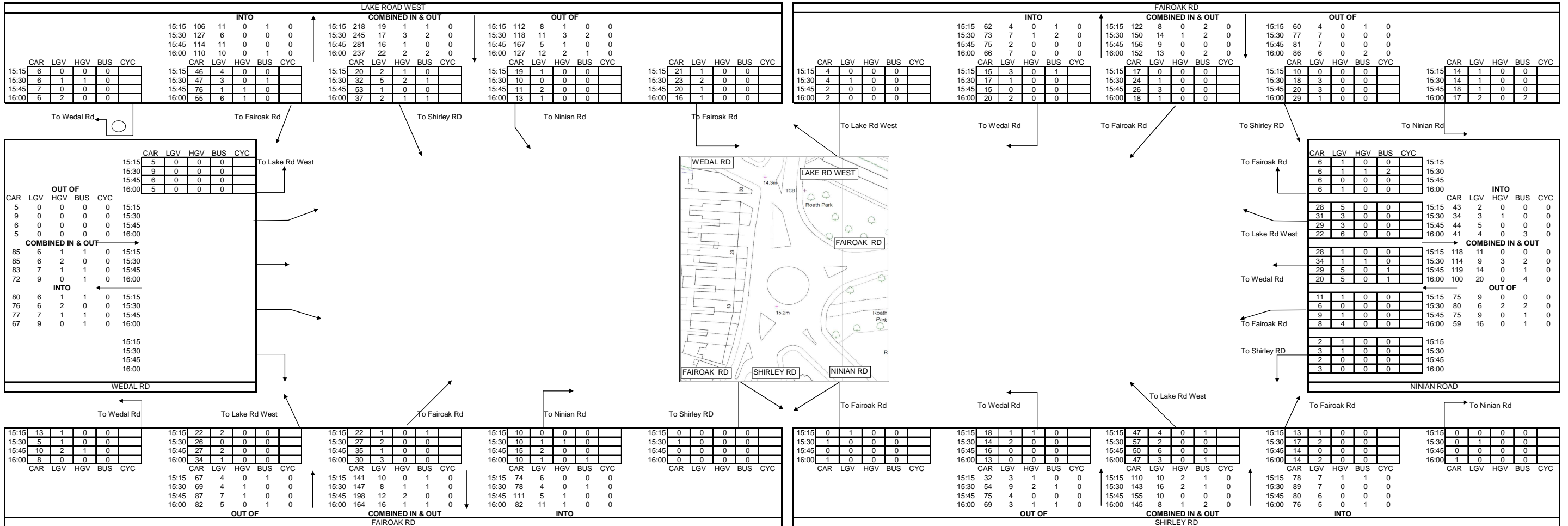


SCHOOL Peak Hour Junction Survey 15:00 - 16:00

Subject: LAKE ROAD WEST - FAIROAK ROAD - NINIAN ROAD - SHIRLEY RD - FAIROAK ROAD - WEDAL ROAD

Date: 07/02/2012

Day: TUESDAY



LAKE ROAD WEST																	
INTO			COMBINED IN & OUT			OUT OF											
15:15	106	11	0	1	0	15:15	218	19	1	1	0	15:15	112	8	1	0	0
15:30	127	6	0	0	0	15:30	245	17	3	2	0	15:30	118	11	3	2	0
15:45	114	11	0	0	0	15:45	281	16	1	0	0	15:45	167	5	1	0	0
16:00	110	10	0	1	0	16:00	237	22	2	2	0	16:00	127	12	2	1	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		
15:15	6	0	0	0		15:15	46	4	0	0		15:15	19	1	0	0	
15:30	6	1	1	0		15:30	47	3	0	1		15:30	10	0	0	0	
15:45	7	0	0	0		15:45	76	1	1	0		15:45	11	2	0	0	
16:00	6	2	0	0		16:00	55	6	1	0		16:00	13	1	0	0	

FAIROAK RD																	
INTO			COMBINED IN & OUT			OUT OF											
15:15	62	4	0	1	0	15:15	122	8	0	2	0	15:15	60	4	0	1	0
15:30	73	7	1	2	0	15:30	150	14	1	2	0	15:30	77	7	0	0	0
15:45	75	2	0	0	0	15:45	156	9	0	0	0	15:45	81	7	0	0	0
16:00	66	7	0	0	0	16:00	152	13	0	2	0	16:00	86	6	0	2	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		
15:15	4	0	0	0		15:15	17	0	0	0		15:15	10	0	0	0	
15:30	4	1	0	0		15:30	24	1	0	0		15:30	18	3	0	0	
15:45	2	0	0	0		15:45	26	3	0	0		15:45	20	3	0	0	
16:00	2	0	0	0		16:00	18	1	0	0		16:00	29	1	0	0	

WEDAL RD																	
OUT OF			COMBINED IN & OUT			INTO											
15:15	5	0	0	0		15:15	85	6	1	1	0	15:15	80	6	1	1	0
15:30	9	0	0	0		15:30	85	6	2	0	0	15:30	76	6	2	0	0
15:45	6	0	0	0		15:45	83	7	1	1	0	15:45	77	7	1	1	0
16:00	5	0	0	0		16:00	72	9	0	1	0	16:00	67	9	0	1	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

LAKE RD WEST																	
INTO			COMBINED IN & OUT			OUT OF											
15:15	20	2	1	0		15:15	141	10	0	1	0	15:15	74	6	0	0	0
15:30	32	5	2	1		15:30	147	8	1	1	0	15:30	78	4	0	1	0
15:45	53	1	0	0		15:45	198	12	2	0	0	15:45	111	5	1	0	0
16:00	37	2	1	1		16:00	164	16	1	1	0	16:00	82	11	1	0	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

FAIROAK RD																	
INTO			COMBINED IN & OUT			OUT OF											
15:15	15	3	0	1		15:15	118	11	0	0	0	15:15	75	9	0	0	0
15:30	17	1	0	0		15:30	114	9	3	2	0	15:30	80	6	2	2	0
15:45	15	0	0	0		15:45	119	14	0	1	0	15:45	75	9	0	1	0
16:00	20	2	0	0		16:00	100	20	0	4	0	16:00	59	16	0	1	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

WEDAL RD																	
OUT OF			COMBINED IN & OUT			INTO											
15:15	13	1	0	0		15:15	67	4	0	1	0	15:15	78	7	1	1	0
15:30	5	1	0	0		15:30	69	4	1	0	0	15:30	89	7	0	0	0
15:45	10	2	1	0		15:45	87	7	1	0	0	15:45	80	6	0	0	0
16:00	8	0	0	0		16:00	82	5	0	1	0	16:00	76	5	0	1	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

FAIROAK RD																	
OUT OF			COMBINED IN & OUT			INTO											
15:15	22	2	0	0		15:15	141	10	0	1	0	15:15	74	6	0	0	0
15:30	26	0	0	0		15:30	147	8	1	1	0	15:30	78	4	0	1	0
15:45	27	2	0	0		15:45	198	12	2	0	0	15:45	111	5	1	0	0
16:00	34	1	0	0		16:00	164	16	1	1	0	16:00	82	11	1	0	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

SHIRLEY RD																	
OUT OF			COMBINED IN & OUT			INTO											
15:15	18	1	1	0		15:15	110	10	2	1	0	15:15	78	7	1	1	0
15:30	14	2	0	0		15:30	143	16	2	1	0	15:30	89	7	0	0	0
15:45	16	0	0	0		15:45	155	10	0	0	0	15:45	80	6	0	0	0
16:00	13	0	0	0		16:00	145	8	1	2	0	16:00	76	5	0	1	0
CAR	LGV	HGV	BUS	CYC		CAR	LGV	HGV	BUS	CYC	CAR	LGV	HGV	BUS	CYC		

SATURDAY 3 Hour Junction Survey 16:30 - 18:30

Subject: LAKE ROAD WEST - FAIROAK ROAD - NINIAN ROAD - SHIRLEY RD - FAIROAK ROAD - WEDAL ROAD

Date: 12/05/2012

Day: SATURDAY

