Reigate & Banstead
BOROUGH COUNCIL
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Progress Report on Air Quality within the Borough of Reigate and Banstead.

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Abbreviations and Definitions

AADT	Annual Average Daily Traffic flow - mean of 7 days.
AAWT	Annual Average Weekday Traffic flow - mean of 5 days Mon - Fri..
AQMA	Air Quality Management Area.
AURN	Automatic Urban and Rural Network - the national air pollution monitoring network in the UK operated by DEFRA.
DEFRA	Department of the Environment, Food and Rural Affairs (formerly DETR).
DfT	Department of Transport.
DMRB	Design Manual for Roads and Bridges.
EA	Environment Agency.
EIA	Environmental Impact Assessment.
ERG	Environmental Research Group - King's College.
EU	European Union.
g	gram.
kg	kilogram.
HA	Highways Agency.
HGV	Heavy Goods Vehicle (essentially lorries).
LAQM	Local Air Quality Management.
LGV	Light Goods Vehicles (essentially vans).
LTP	Local Transport Plan (produced by Surrey County Council).
m^3	cubic metre.
mppa	million passengers per annum.
netcen	National Environmental Technology Centre, UK.
NO_2	Nitrogen Dioxide.
NO_x	Oxides of Nitrogen (mainly NO and NO_2 expressed as NO_2 equivalent).
NPL	National Physical Laboratory.
O_3	Ozone.
ppb	part(s) per billion.
SCC	Surrey County Council.
SO_2	Sulphur Dioxide.
TEA	triethanolamine.
TEMPRO	Trip End Model Program.
µg	microgram (1 millionth of a gram).
µg m^{-3} (µg/m^3)	microgram(s) per cubic metre.

Executive Summary

E.1 Part IV of the Environment Act 1995 requires local authorities to periodically review air quality in their area against current and future air quality objectives as set out in the Air Quality Strategy 2007, and the Air Quality Standards (2007).

E.2 As part of the above act the council is required to produce a 'Progress Report' detailing any new developments within the borough that may affect air quality, the results of any air pollution monitoring to date, and where an air quality management area has been declared an update on any action plan the council may have aimed at reducing air pollution within that area.

E.3 Within Reigate and Banstead the concentration of six of the seven pollutants that are assessed when examining air quality i.e. carbon monoxide, benzene, 1,3 butadiene, lead, sulphur dioxide, and particulate matter (PM_{10}), continue to meet and in most cases are considerably lower than the relevant UK objectives or EU limit values, as there have been no new developments either within or in the immediate vicinity of the borough that would affect the concentrations of these pollutants.

E.4 The main pollutant of concern within the borough remains nitrogen dioxide from road traffic, or road traffic and aircraft emissions in the case of Horley. There were six areas of the borough where the UK annual mean objective for nitrogen dioxide was breached in either 2006 or 2007:

i) A217 Blackhorse Lane,
ii) Reigate High Street / West Street,
iii) Drift Bridge, Banstead,
iv) Merstham High Street,
v) M25,
vi) Horley near Gatwick Airport,

all of which have previously been declared air quality management areas.

E.5 Long term monitoring in the borough indicates that there has been no improvement in air quality between 2004 and 2007 at sites located within 5 to 10 m of the major A roads within the borough. This is despite evidence in some cases of a decline in the volume of traffic on the roads, suggesting that the vehicles themselves are becoming 'dirtier'.

E.6 This lack of improvement in nitrogen dioxide concentrations despite falling road traffic is not unique to the borough, but does run counter to projections by DEFRA that show continuing improvements in air quality due to the reduction in vehicle emissions from newer (cleaner) vehicles more than offsetting increases in the number of vehicles on the road. The most likely cause for the absence of the predicted improvements in nitrogen dioxide concentrations in practice is the shift both nationally and locally from petrol to diesel vehicles, which produce much more nitrogen dioxide (so called primary nitrogen dioxide) than an equivalent petrol engine.

E.7 Nitrogen dioxide concentrations within the A23 Dean Lane, A217 Rushworth Road, and M23 (south), air quality management areas (AQMAs) continue to meet the UK air quality objectives. However, the flat trend in nitrogen dioxide concentrations at the Dean Lane and Rushworth Road sites, and as concentrations are close to the UK objective for this pollutant, means that both air quality management areas will remain for now, with a further review on revoking these AQMAs undertaken in 2010. A similar review will also be undertaken on the M23 (south) AQMA in 2010 once the environmental impact assessment of the north terminal development at Gatwick is completed.

E.8 Air quality action plans for the M25 and for the non airport sources of pollution in Horley are on track, and while the action plan for the airport sources of pollution in Horley has fallen behind this is now due for completion by the end of 2008. The air quality action plan for Reigate High Street has also been completed and is currently being circulated for internal consultation, although preparatory work for some of the measures within the plan is already underway.

E.9 Although outside the remit of the local air quality management regime (and council control), the concentration of ozone in the borough and across south Surrey and Sussex remains a cause for concern. Since monitoring began in the borough in 2005 the UK air quality strategy objective for this pollutant has never been met, with typically 30 plus occasions each year when this pollutant reaches concentrations capable of having 'acute' i.e. immediate health effects on people with respiratory problems. To put this into context while nitrogen dioxide concentrations in the borough breach the UK air quality standards protecting long term health, they rarely (if ever) are high enough to have an immediate effect on residents' health.

1.0 Introduction

1.1 Part IV of the Environment Act 1995 requires local authorities to periodically review air quality in their area against current and future air quality objectives as set out in the Air Quality Strategy[1] 2007 (DEFRA, 2007), and the Air Quality Standards (2007). The air quality objectives set out in these documents (Table 1.1) are derived from health based standards recommended by the Government's Expert Panel on Air Quality Standards (EPAQS), but the objectives also take into account the costs, benefits, feasibility, and practicality of reaching such standards.

1.2 Under these regulations the council was required to undertake an updating and screening assessment of air quality, completed in May 2006 (AQC, 2006a), which identified a need to proceed to a detailed assessment of air quality on the High Street in Merstham, as the concentration of nitrogen dioxide was predicted to breach the 2005 UK annual average objective. The detailed assessment (AQC, 2007) confirmed the findings of the updating and screening assessment, and resulted in the declaration of a new air quality management area (AQMA) covering the High Street in Merstham.

1.3 This new air quality management area was in addition to the council's existing AQMAs:

i) along the M25 (declared 29/4/02)
ii) on the M23 to the south of the M25 (declared 29/4/02)
iii) in Horley near to Gatwick Airport (declared 29/4/02)
iv) at the junction of Rushworth Road and the A217 (declared 15/7/05)
v) at the junction of the A23 and Dean Lane in Hooley (declared 15/7/05)
vi) on the A217 near Blackhorse Lane (declared 24/5/06)
vii) along Reigate High Street and West Street (declared 24/5/06 and extended 05/11/07)
viii) at the junction of the A2022 / B291 - Drift Bridge (declared 10/1/07)

which had also been declared based on breaches or predicted breaches of the 2005 annual average objective for nitrogen dioxide.

1.4 This 'Progress Report' is a further requirement under the air quality regulations and is essentially an update on the current monitoring results from around the borough, and on measures aimed at reducing the concentration of pollutants within the AQMAs to below the objective concentrations.

[1] The Air Quality Strategy 2007 replaces the Air Quality Strategy 2000 (DETR, 2000), and the Air Quality Strategy Addendum (2003).

1.5 The current report contains data from monitoring up to and including 2007 (the last year for which a complete data set was available), although the only 'new' data is from 2006 and 2007, as the production of the detailed assessment in 2007 meant that the majority of the non AQMA data for 2006 was not formally reported in 2007.

	Limit	Exceedences	Measure	Annual Mean Limit	Achieve By
CO	10 mg m^{-3}	-	maximum daily running 8 hour mean		31/12/03
NO_2	200 µg m^{-3} (105 ppb)	18 x $year^{-1}$	1 hr mean	40 µg m^{-3} (21 ppb)	31/12/05*[a]
SO_2	350 µg m^{-3} (132 ppb)	24 x $year^{-1}$	1 hr mean	-	31/12/04
	125 µg m^{-3} (47 ppb)	3 x $year^{-1}$	24 hr mean	-	31/12/04
	266 µg m^{-3} (100 ppb)	35 x $year^{-1}$	15 min mean	-	31/12/05
Benzene	16.25 µg m^{-3} (5 ppb)	-	running annual mean		31/12/03
	5 µg m^{-3} (1.54 ppb)	-	annual mean	-	31/12/10
1,3 Butadiene	2.25 µg m^{-3} (1ppb)	-	running annual mean		31/12/03
Pb	-	-	-	0.5 ng m^{-3}	31/12/04
	-	-	-	0.25 ng m^{-3}	31/12/08
PM_{10}	50 µg m^{-3}	35 x $year^{-1}$	24 hr mean	40 µg m^{-3}	31/12/04*[b]
$PM_{2.5}$	-	-	-	25 µg m^{-3}	31/12/20*[c,d]
O_3	100 µg m^{-3} (50 ppb)	10 x $year^{-1}$	daily max. of running 8 hour mean		31/12/05*[c,e]

*[a] the EU limit values for nitrogen dioxide (identical to the objectives set out here) are to be met by 01/01/10.
*[b] the proposed UK PM_{10} objective for 2010 of 20 µg m^{-3}, and only 7 days per year with concentrations over 50 µg m^{-3}, has been dropped in favor of a new (weaker) objective for $PM_{2.5}$.
*[c] these are UK objectives that are not part of the *local* air quality management regime. However the progress report does cover these pollutants given their potential impact on health.
*[d] the $PM_{2.5}$ objective also includes the requirement for a 15 % reduction in people's exposure between now (mean 3 year concentration 2008 to 2010) and 2020 (mean 3 year concentration 2018 to 2020), based on urban background concentrations.
*[e] the EU legislation relating to ozone is more lax allowing 25 breaches of a max. running 8 hour mean of 120 µg m^{-3}, which is averaged over 3 years. The EU standard applies from 31/12/10.
By 2020 the running 8 hour mean of the 120 µg m^{-3} must not be breached.

Table 1.1: Air Quality Objectives for the Purposes of Local Air Quality Management.

2.0 Methodology

2.1 The methodologies used throughout this work are drawn from DEFRA's technical guidance - LAQM TG(03) (DEFRA, 2003a), the frequently asked questions on the DEFRA website (DEFRA, 2008a), and reference has also been made to the progress report guidance - LAQM PRG(03) (DEFRA, 2003b).

2.1 Road Traffic

2.2 Road traffic data used in this report is derived from automatic and manual road traffic counts undertaken by Surrey County Council and the Department for Transport (DfT). Projected traffic flows were supplied by Surrey CC based on the Trip End Model Program (TEMPRO) v.5.1 / SE regional data v.53 (05/10/06) as the county traffic model used in previous reports is no longer in use, although a new model is in development.

2.3 However traffic modelling is still undertaken in the vicinity of Gatwick Airport using a CONTRAM model, and thus where appropriate projected data for Gatwick has been obtained from this model. Although no formal study has been published on the accuracy / precision of the Gatwick traffic model an informal examination of the model, based on very limited data and reported in the 2005 progress report (RBBC, 2005), indicated that there was no evidence to suggest that the Gatwick model was any better (or worse) than any other comparable transport model.

2.4 The projection of roadside / kerbside monitoring data back to the relevant receptor was performed using the NO_2 with Distance from Roads Calculator (Marner, 2008), which has replaced the projection method using the Design Manual for Roads and Bridges (DMRB) spreadsheet. Background pollutant concentrations were obtained from the LAQM website (DEFRA, 2008b), and projected forward using the method set out by Brown (2003).

2.5 Distance measurements throughout this report were obtained from the council's GIS system (ArcView 9.1), using a mastermap base layer supplied by Ordnance Survey, or are from field measurements.

2.2 Monitoring

2.2.1 Real Time Monitoring

2.6 The council operates a total of three real time monitors, as set out in Table 2.1 below.

Site	Location	Location Type	Pollutant	Instrument	Installed
RG1	Horley	Suburban	NO_x / PM_{10}	Monitor Labs / R&P TEOM	July 2000
RG2	Horley	Suburban	NO_x	Environnment (AC32M)	Sept 2003 (in current form)
RG3	Crawley	Rural	NO_x / O_3	Both Monitor Labs	Feb 2005

Table 2.1: Real Time Monitors Currently in Operation within Reigate and Banstead.

All sites are operated to UK AURN standards, with data management by ERG King's College London, and bi-annual audits by the National Physical Laboratory (NPL). In addition the NO_x analyser at RG1 is now part of the UK AURN having joined in 2007, and all of the real time monitoring data in this report has been fully verified and ratified up until 31st December 2007.

2.2.2 Diffusion Tubes

2.7 The council's diffusion tube programme is operated in accordance with the practices and exposure periods of the UK diffusion tube network. All of the diffusion tubes used within the borough are supplied by Lambeth Scientific Services, with the NO_2 diffusion tubes using 50 % triethanolamine (TEA) in acetone.

2.8 The NO_2 diffusion tube data presented in this report has had a locally derived correction factor applied based on tubes co located in triplicate at a single real time monitoring site (RG1) up until 2005, using the methodology set out by DEFRA (DEFRA, 2003a; AQC, 2004). Data from 2005 has had a locally derived correction factor applied based on co located triplicate tubes at all three real time sites 'averaged' using orthogonal regression. The correction factor applied is stated in the summary results (Appendix B), with the individual tube values. Data capture across the real time sites in 2006 and 2007 ranged from 95.9 % to 99 % and is summarised in Table 4.4.

2.9 The council uses correction factors calculated from its own monitoring equipment in preference to the 'national average' for Lambeth Scientific to ensure:

- a consistency in the data between years, as often the national average is from less than four sites which vary from year to year.
- traceability of QA/QC for the real time sites.
- as data from the real time sites are often used to calculate tube correction factors for periods of less than one year.

2.10 Comparisons of the 2006 and 2007 correction factors (1.46 and 1.14, respectively) to the national diffusion tube spreadsheet produced by AQC on behalf of DEFRA (AQC, 2008a) demonstrates that the Reigate and Banstead (RBBC) bias adjustment factor is generally higher than the national 'average' (1.28 and 1.07 in 2006 and 2007, respectively), although the factor used by RBBC is within the 'spread' of individual local authority bias adjustment factors. For example Spelthorne (a Surrey local authority comparable to RBBC) has a bias adjustment factor of 1.57 for 2006 i.e. higher than the RBBC factor, while the RBBC 2007 adjustment factor is comparable to that from a similar site in York. Therefore while the RBBC bias adjustment factors are higher than average, the factors are not unreasonably high.

2.11 Nevertheless the diffusion tube concentrations reported in this progress report will be slightly higher than if the 'national' adjustment factor were used, although it is important to point out that this would have no impact on the pattern of AQMAs seen across the borough.

2.2.2.1 Nitrogen Dioxide Diffusion Tube Blanks

2.12 Each month three diffusion tubes (two until 2007) are left 'capped' and thus unexposed at the council offices, as part of the diffusion tube survey within the borough. The aim of this is to give an indication of the 'blank' values of the diffusion tubes (Table 2.2).

	2003	2004	2005	2006	2007
RB91	8	17	12	8	4
RB92	9	12	12	7	5
RB127	-	-	-	-	3
Mean*	8	14	17	7	4
Limit of Detection *2	10.6	25.1	12.8	10.0	7.7

*based on unrounded values
2LOD = mean + 3 standard deviation
Correction factors 2003 to 2007 respectively, 1.29, 1.32, 1.35, 1.46, 1.14.

Table 2.2: Blank Nitrogen Dioxide Diffusion Tube Concentrations (µg m^{-3}).

2.13 Table 2.2 indicates that the diffusion tube blanks have shown considerable variability over the years, and that any measured nitrogen dioxide concentrations 'in the field' below 10 to 12 µg m^{-3} are potentially no different from the blank. However, with the 2004 data the 'in field' nitrogen dioxide concentrations need to be over 25 µg m^{-3} before they can be regarded as different from the blank values with any confidence. Thus when examining the diffusion tube data in Appendix B and section 4 the variability of the tube blanks needs to be borne in mind, especially when examining the 2004 data.

2.2.2.2 Comparison of the Accuracy and Precision of Gradko and Lambeth Scientific Nitrogen Dioxide Diffusion Tubes.

2.14 Although the triplicate diffusion tube blanks and the 'in field' co located diffusion tubes give an indication of both the accuracy and precision of the nitrogen dioxide diffusion tubes from a given laboratory, there is limited data on how the accuracy and precision of diffusion tubes varies between laboratories in a real life monitoring location where all of the local variables have been kept constant.

2.15 Therefore a one year study was undertaken where triplicate tubes from both Gradko and Lambeth Scientific services (both 50 % TEA in acetone) were exposed alongside a chemiluminescent analyser at three sites across Surrey. A further set of triplicate tubes from each supplier were also kept as blank controls.

2.16 The chemiluminescent NO_x analysers used in this study were selected for their good QA/QC controls, and as together they covered a range of NO_2 concentrations and site types (Table 2.3).

Site	Site Type	NO_x Analyser	Local site operator	QA/QC and Data Management
Guildford	Roadside	Horiba	Guildford BC	AEA Technology
Mole Valley	Urban Background	Monitor Labs	ERG	NPL / ERG
RBBC (RG3)	Rural / Other*	Monitor Labs	RBBC	NPL / ERG
Blanks	Stored at RBBC at 20 ^{o}C.		RBBC	-
* The site is in a rural setting, but is affected by pollution from Gatwick Airport when winds are from the north.				

Table 2.3: Summary of the Monitoring Sites used in the Inter Laboratory NO_2 Diffusion tube Comparison Study.

2.17 Although the study aimed to compare tubes over a 12 month period at all three sites, this was not possible in practice at the Guildford and Mole Valley sites where tubes were exposed for only 11 months. Tube changes at all three sites were within 1 day of one another except at the Mole Valley site in late May 2008, when tubes were changed on 4/6/08 instead of 28/5/08. Therefore while comparisons between laboratories at a given site are valid, a degree of caution is needed when comparing results between sites.

2.18 The results of the comparison study are shown in Figure 2.1, and summarised in Table 2.4.

Figure 2.1: Gradko and Lambeth Scientific NO_2 Diffusion Tube Concentrations vs. Chemiluminescent NO_2 Concentrations.

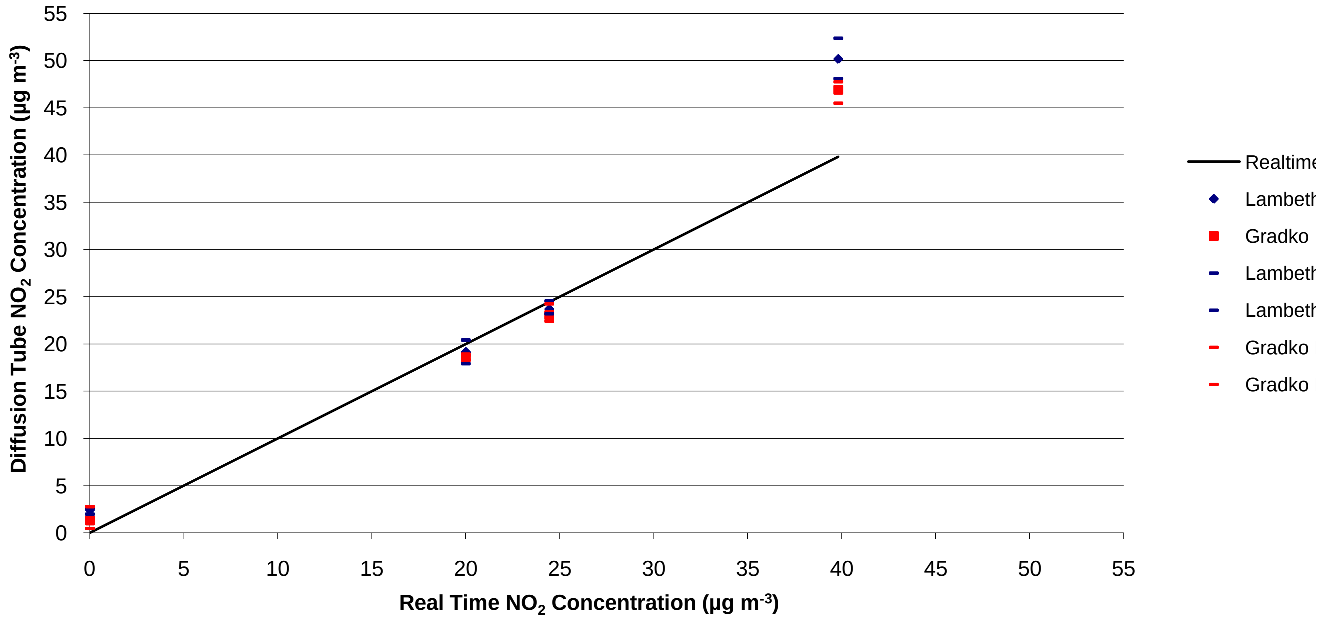


Table 2.4: Statistical Summary of Diffusion Tube Intercomparison Results.

Real Time Analyser

Site	Mean	Data Capture (%)
Guildford	39.8	99.47
Mole Valley	24.4	99.45
Reigate & Banstead	20.0	99.47
Blanks	-	-

Lambeth Diffusion Tubes

Site	n (months)	Mean	Max	Min	SD	Rel. SD (%)	Real time : Tube Ratio
Guildford	11	50	52	48	2.1	4.3	0.79
Mole Valley	11	24	25	23	0.7	3.1	1.03
Reigate & Banstead	12	19	20	18	1.3	6.5	1.05
Blanks	12	2	3	2	0.4	15.7	-

Gradko Diffusion Tubes

Site	n (months)	Mean	Max	Min	SD	Rel. SD (%)	Real time : Tube Ratio
Guildford	11	47	48	45	1.2	2.6	0.85
Mole Valley	11	23	24	22	1.0	4.4	1.06
Reigate & Banstead	12	19	19	18	0.2	1.3	1.08
Blanks	12	1	3	0	1.3	95.2	-

All values µg m^{-3}, unless other units specified or ratio.

All tubes 50 % TEA in acetone.

Real time sites maintained to AURN standards.

Study period September 2007 to August 2008 inclusive.

Triplicate tubes from each supplier were changed monthly, as per national diffusion tube network dates.

Mole Valley and RBBC real time data from January to August 2008 based on provisional results.

2.19 Overall the tubes from both laboratories follow a similar pattern (Figure 2.1), and follow a pattern that is often seen with NO_2 diffusion tubes of underestimating the concentration at low concentrations of nitrogen dioxide (albeit very marginally in this study), and overestimating the concentration at higher concentrations of nitrogen dioxide[1].

2.20 In the current study the Lambeth tubes were marginally more accurate at the lower concentrations than the Gradko tubes, but less so at the higher concentrations (albeit based on one set of triplicate tube results), while the Gradko tubes on balance were slightly more precise.

2.21 In diffusion tube monitoring arguably the most important factor is good tube precision, especially where a single tube is used, as this gives a greater degree of confidence that differences in concentrations between sites are genuine rather than due to the inherent variability of the tubes themselves. Any inaccuracy can then be corrected for by a bias adjustment factor. However, where the bias adjustment factor is not a consistent under or over estimate of the 'true' concentrations, then arguably accuracy becomes increasingly important, especially as the majority of the diffusion tube results are being compared to a fixed standard.

2.22 Overall the study demonstrates that the diffusion tubes supplied by Lambeth Scientific are (not unexpectedly) broadly comparable to tubes supplied by at least one other laboratory, albeit not quite as precise. The study also suggests that there *may* be an improvement in the accuracy of the corrected tube results if a site specific correction factor is calculated for roadside sites, when concentrations are around 40 µg m^{-3}.

2.23 The impact of a site specific correction factor will be investigated in 2009, when a chemiluminescent analyser is installed on Reigate High Street with co located diffusion tubes. However for this progress report a single bias adjustment factor based on orthogonal regression has been applied to the data, regardless of the tube location, in the absence of more detailed local information on roadside sites.

[1] Although such a pattern is often seen, this is not always the case. For example diffusion tubes (Lambeth Scientific) located at roadside sites in Haringey (42 µg m^{-3}, single co located tube) and Islington (65 µg m^{-3}, co located triplicate tubes) had bias adjustment factors of 1.24 and 1.23 respectively in 2007, and so here the tubes were underestimating rather than overestimating the high roadside concentrations.

3.0 New Developments

3.1 To date (September 2008) there have been no new developments within, or in the vicinity of, the borough that are likely to lead to a significant deterioration in air quality within the borough. However, the following developments have been proposed either within or near AQMAs, or have an air quality aspect to them.

3.1 Residential Developments

3.1.1 Horley AQMA

3.2 Work has now commenced on the first of two new major residential developments in Horley. The two developments known as the Horley NE sector (700 homes), which is currently being built, and the Horley NW sector (1600 homes) are located between 1 and 1.5 km to the north of the current Horley AQMA and are due for completion around 2015 to 2016.

3.3 The impact of these developments on air quality was discussed in the 2005 progress report (RBBC, 2005), although in essence the development is not predicted to result in a breach of either the UK or EU limit values for air quality - including the annual average nitrogen dioxide limit value. Nevertheless, the concentration of nitrogen dioxide is predicted to increase slightly at some properties in the immediate vicinity of the new housing developments, due to the increase in road traffic travelling to / from the development.

3.4 At this stage it is too early to measure what, if any, impact the development has in practice on the Horley AQMA, although the traffic generated by both developments is being factored into modelling work on the AQMA in post 2015 scenarios.

3.1.2 Drift Bridge AQMA, Banstead

3.5 Plans to redevelop the residential properties within this AQMA were submitted in early 2007. However the original proposals would have:

i) increased the number of people exposed to annual mean nitrogen dioxide concentrations > 40 $\mu g\ m^{-3}$ i.e. in breach of the UK annual average objective,

ii) exposed the residents of the new development to higher concentrations of nitrogen dioxide than the current residents, given the proposed proximity of the new development to the road junction compared to the existing properties.

3.6 The proposals to develop the site were rejected by the council in mid 2007 on grounds other than air quality, and the decision to refuse planning permission was subsequently upheld on appeal in

March 2008. At present no further plans have been submitted to develop the site, although it is worth noting that if developed in an appropriate way then this AQMA could be revoked.

3.1.3 Reigate High Street AQMA

3.7 A planning application was made in early to 2008 to Tandridge District Council (a neighbouring authority) for a development of around 2000 houses on the current site of the Redhill aerodrome. The application was subsequently withdrawn, but a traffic assessment produced for Reigate and Banstead BC indicated that had the development gone ahead then traffic flow within the High Street would have increased by around 7 % (AADT) with a consequent increase in nitrogen dioxide concentrations within the Reigate High Street AQMA.

3.1.4 Other Residential Developments

3.8 The council is currently working on plans for a major redevelopment of Redhill town centre, including the building of new residential properties on sites previously used for non residential purposes. Therefore a monitoring program has been put in place to assess air quality within these new proposed residential sites, and proposals have been submitted for an in depth air quality assessment to be undertaken in 2009.

3.2 Commercial Developments

3.2.1 Non Airport

3.9 Preliminary work is currently underway on assessing the air quality impact of a major new superstore in Redhill. The study is to examine both the impact of the store within the immediate area of the site, and also its potential impact on traffic flows within the Reigate High Street AQMA to the west, the Merstham High Street AQMA to the north, and a former AQMA site on the A23 to the south of the development.

3.2.2 Airport Development

3.2.2.1 North West Zone Stands Project

3.10 This proposal involves the creation of a group of new aircraft stands at Gatwick Airport to replace stands that will be out of use while various redevelopment projects take place on the airport. The air quality impact of this development will be examined as part of an environmental impact assessment by the airport in late 2008, although at this stage it is thought unlikely that this particular development will lead to a significant change in air quality within the Horley AQMA.

3.2.2.2 North Terminal Extension (NTX Project)

3.11 Gatwick Airport is also proposing to extend the north terminal at the airport so that it is capable of handling an extra 4 million passengers per annum (mppa), thus increasing capacity at the terminal from 16 to 20 mppa and the overall passenger throughput at the airport from 36 to 40 mppa. The development therefore has the potential to have a significant impact on air quality within the Horley AQMA, and the airport is proposing to model pollutant concentrations within the Horley AQMA in 2019 (when 40 mppa are predicted to pass through the airport if the new terminal is in place) as part of an environmental impact assessment. In the impact assessment the airport proposes to consider the following scenarios (Table 3.1), in addition to comparing the results to the 2005/6 modelling work that is due for completion in early 2009.

	Passengers per Annum (millions)	**Aircraft Movements**
Base Case 2019	36	260,000
Airport with Development 20019	40	275,000

Table 3.1: Air Quality Modelling Scenarios for the North Terminal Extension EIA in 2019.

3.12 Until the modelling work is complete it is difficult to judge the air quality impact. However, it is worth noting that in 2007/8 35.6 mppa used the airport, and this resulted in 266,500 movements (including 260 500 commercial flights) at the airport (BAAG, 2008). Therefore for 36 mppa to result in 260,000 movements in total by 2019 will require at least some improvement in passenger load factors, and / or the use of larger aircraft to achieve an overall reduction in aircraft movements.

3.13 It is also worth noting that the forecast movements for the 40 mppa scenario in 2019 are somewhat different from the forecast movements for a 40 mppa scenario modelled in 2004, albeit for 2010 rather than 2019, when the airport considered that 40 mppa would result in 280 414 aircraft movements at the airport. Again this suggests that the airport is expecting a shift towards larger aircraft and / or higher load factors over and above those it was forecasting in 2004.

3.14 The results of the 2019 modelling scenarios are due in mid 2009, and therefore will be commented on in the 2010 progress report.

3.3 Biomass Boilers

3.15 A 0.84 MW biomass boiler has been installed as part of a residential heating scheme at a new housing development (Park 25) in Redhill. The boiler is due to go 'live' at the start of 2009, with heating for the development currently provided by mains gas. The boiler is not predicted to result in a breach of the air quality standards, including the relevant PM_{10} standards.

3.16 However, given:

i) the potential impact of particulate pollution < 10 µm in aerodynamic diameter on health, and

ii) the UK Government's objective of reducing public exposure to $PM_{2.5}$

the council will be keeping track of biomass boiler installations within the borough, so that the cumulative impact of the boilers on ambient PM_{10} and $PM_{2.5}$ concentrations can be assessed.

4.0 Monitoring Data

4.1 The main pollutant of concern within Reigate and Banstead is nitrogen dioxide primarily from road traffic, in common with many other local authorities within the UK, with the exception of the Horley AQMA where aircraft rather than road traffic are a major source of this particular pollutant.

4.2 However the council does also monitor the concentration of benzene, and until 2006 sulphur dioxide, at a couple of sites within the borough as part of a long term 'watching brief', using passive diffusion tubes supplied by Lambeth Scientific. This is to identify if there are any major changes in the concentrations of these pollutants between the main towns within the borough, either within a given year or between years.

4.3 The concentration of particulate matter (PM_{10}) is also measured in Horley, as part of a long term program to ensure that the PM_{10} concentrations in the vicinity of the airport are comparable to those that might be expected within a typical suburban area in the UK.

4.1 Benzene

4.4 Benzene concentrations are measured at three sites within the borough, on the High Street in Reigate (RB1), at a residential property in Horley close to Gatwick airport (RB11), and on the A23 near to the M25 (RB20) in Merstham. The Merstham site has no relevant receptors in the immediate vicinity of the tube, unlike the other sites, and essentially represents a 'worst case' location.

4.5 There are predicted to be no breaches of the UK objective / EU limit value for benzene anywhere within the borough (RBBC, 2003; AQC, 2006a), but the purpose of these sites is to keep a 'watching brief' on this pollutant, and to ensure that the concentration of benzene at the site in Horley remains similar to that measured at other sites due to the frequent, though short lived, smell of aviation kerosene at the Horley site.

4.6 The monitoring is undertaken using passive BTEX diffusion tubes supplied by Lambeth Scientific, with the tubes changed monthly along with the NO_2 diffusion tubes. The results from these tubes are shown in Figure 4.1 and summarised in Table 4.1.

Table 4.1: Annual Mean Benzene Concentrations (µg m^{-3}) in Reigate, Horley, and Merstham.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
RB1 - Reigate	5.9	4.1	2.8	2.7	2.7	2.5	2.1	2.5	2.7	2.5
RB11 - Horley	2.4	2.3	1.9	2.1	1.8	2.4	1.7	1.8	2.5	2.5
RB20 - Merstham	5.1	3.4	1.7	1.9	2.1	2.2	1.8	1.8	2.2	2.2

BTEX tubes (not pumped)
Tubes are not calibrated alongside an automatic monitor, and therefore absolute between year changes should be interpreted with care.
Concentrations also need to be interpreted with care as the ratio between the BTEX components is variable. See Appendix A.

Figure 4.1: Benzene Concentrations 1998 - 2007.

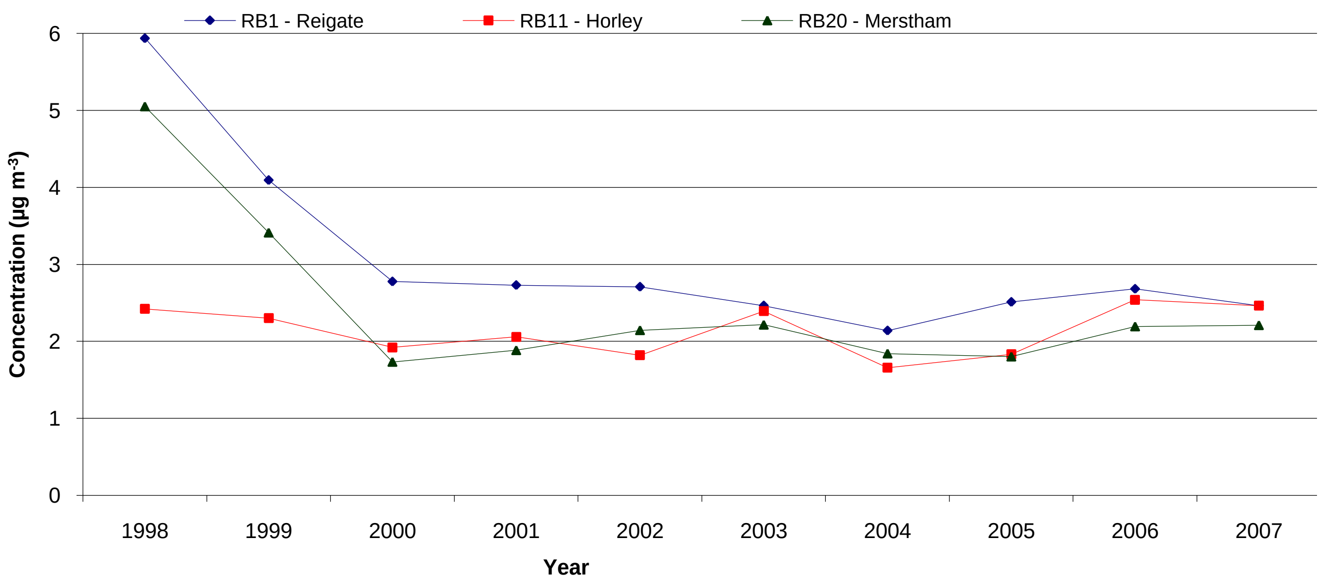
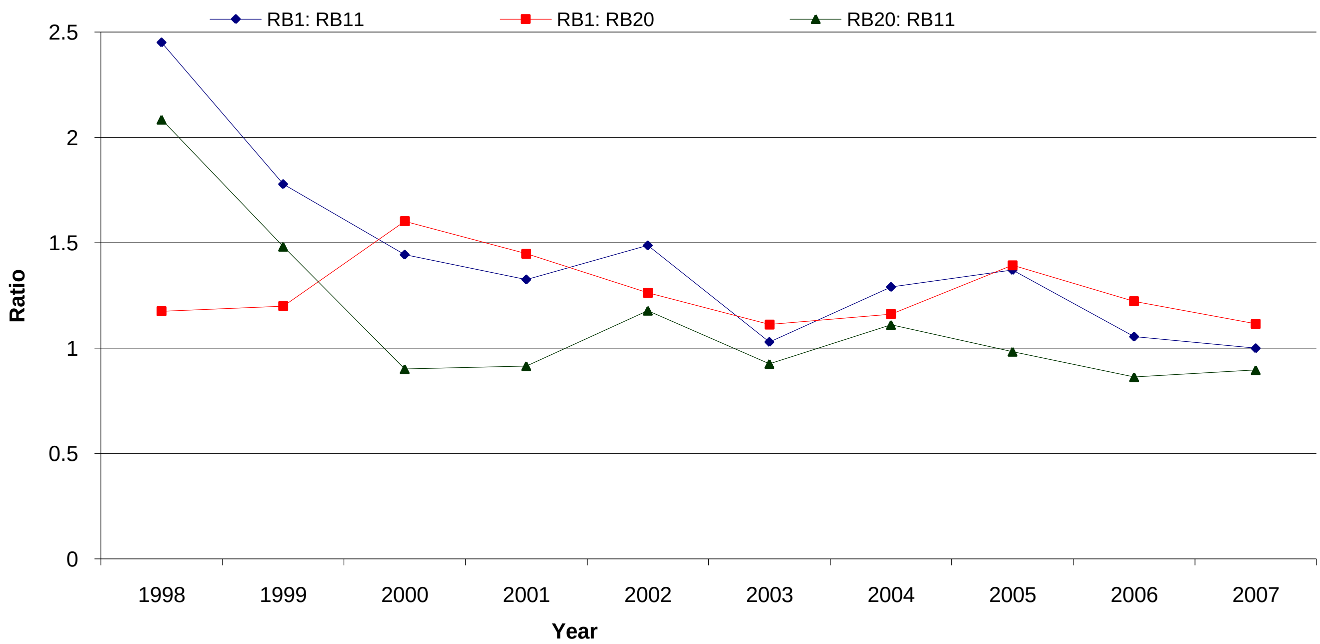


Figure 4.2: Ratios of Benzene Concentrations between Sites 1998 - 2007.



4.7 The results in Table 4.1 need to be interpreted with a degree of caution when comparing them to the national standards, as the tubes in the borough have not been calibrated against a real time monitor, and the concentration of benzene is around double that expected based on the concentrations of ethyl benzene and around treble the expected concentrations based on the concentration of ortho xylene in 2007 (Appendix A) regardless of whether the tubes are measuring benzene concentrations in the vicinity of the airport or simply road traffic.

4.8 A study examining the concentration of benzene in the vicinity of petrol stations (Jones, 2000) demonstrated that BTEX tubes tend to underestimate the concentration of benzene compared to real time analysers, although this was based on two week sampling periods rather than the 4 to 5 week periods used in the council's current monitoring programme. Conversely, the technical guidance from DEFRA (DEFRA, 2003) states that diffusion tubes over read by 30 % compared to gas chromatography analysers, although no exposure period is given.

4.9 Nevertheless, even assuming that the values from the BTEX tubes are correct and are not 'over reading' the benzene concentrations based on the ethyl benzene and ortho xylene concentrations, with benzene concentrations of around 2.5 $\mu g\ m^{-3}$ even if the BTEX tubes underestimate a real time monitor by a factor of two, the benzene concentrations at these sites still currently meet the 2010 annual objective value for benzene of 5 $\mu g\ m^{-3}$, and are expected to continue to meet this standard based on modelling work in 2003 (RBBC, 2003) and the updating and screening assessment in 2006 (AQC, 2006a).

4.10 Although the BTEX tubes are not calibrated alongside a real time monitor, and thus it is difficult to be confident in the absolute accuracy of the benzene measurements, the primary purpose of these tubes is to keep a watching brief on changes in benzene concentrations between sites on a relative basis year to year (Figure 4.2). When the data is analysed in this way along with the measured values (Figure 4.1) there is a marked decline in the roadside concentration of benzene in Reigate and Merstham between 1998 and 2000, while the benzene concentration near Gatwick has remained largely unchanged between 1998 and 2007 albeit at a lower initial concentration than at the other two sites.

4.11 Table 4.1 also demonstrates that residents' current exposure to benzene in Horley, despite the frequent smells of aviation kerosene, is no greater than that in Reigate High Street or Merstham on an annual basis.

4.2 Sulphur Dioxide

4.12 Previous work undertaken as part of the Review and Assessment process (RBBC, 2003; AQC, 2006a) has consistently found that the sulphur dioxide objectives (Table 1.1) are being met within the borough, and that these objectives are likely to continue to be met into the future. As there have been no new developments either within or in the vicinity of the borough that are likely to lead to an increase in sulphur dioxide concentrations, the findings of the previous studies remain unchanged.

4.13 The council had monitored sulphur dioxide in the borough over a number of years using diffusion tubes supplied by Lambeth Scientific. This monitoring was not intended to produce data for comparison to the air quality objectives, but was used to keep a watching brief on how sulphur dioxide concentrations varied between different areas of the borough in a given year, and for tentatively examining long terms trends assuming that the errors associated with the tubes remained consistent from year to year, as the tubes were not calibrated alongside a real time monitor. The data to date for all of the sulphur dioxide tubes is shown in Figure 4.3 and Table 4.2.

4.14 Although the intention of the sulphur dioxide monitoring program was to keep an on going watching brief at around four sites across the borough, monitoring ceased at the end of 2006 as additional nitrogen dioxide monitoring meant that savings had to be made elsewhere in the monitoring budget. As there was no evidence to suggest that the sulphur dioxide objectives were or likely to be breached based on previous review and assessments of the borough's air quality, and as measured concentrations were stable across the borough (Figure 4.3), the sulphur dioxide monitoring programme was wound up.

4.15 Nevertheless, the data to the end of 2006 shows a clear decline in sulphur dioxide concentrations across the borough between 1997 and 2001. Potentially such a fall could be due to changes in laboratory practice over the years, given the absence of a real time monitor to calibrate the tubes, but the fact that similar falls are seen elsewhere in the UK at this time suggests that the decrease in sulphur dioxide concentrations across the borough was genuine.

4.16 By 2006 sulphur dioxide concentrations across the borough are broadly comparable to one another, with no real change in concentrations between 2001 and 2006, although sulphur dioxide concentrations at RG11 (an urban background site near Gatwick Airport) are generally more variable on a year to year basis than at other sites.

Figure 4.3: Annual Mean Sulphur Dioxide Concentrations 1997 - 2006.

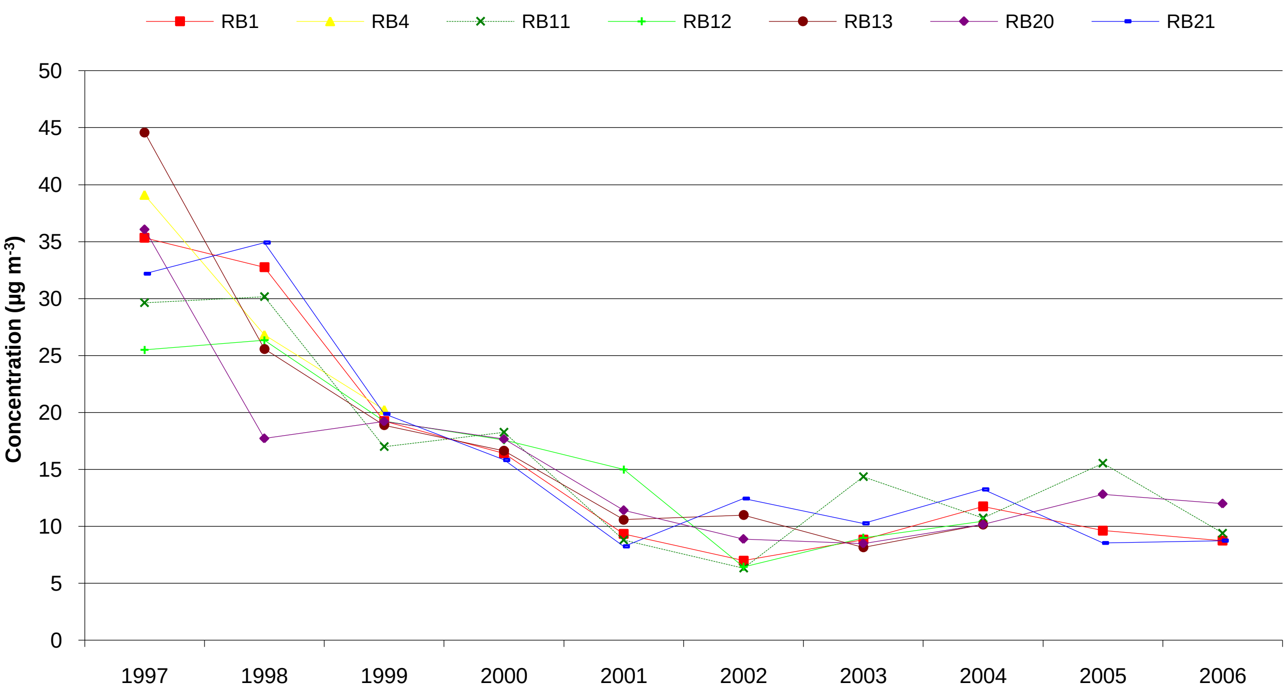


Table 4.2: Annual Mean Sulphur Dioxide Concentrations around Reigate & Banstead (µg m^{-3}).

Site Details:			1997		1998		1999		2000		2001		2002		2003		2004		2005		2006	
	Location	Type	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n	Conc.	n
RB1	High St, Reigate	Roadside	35	12	33	12	19	8	16	12	9	12	7	8	9	12	12	12	10	11	9	12
RB4[a]	Rushworth Rd, Reigate	Ubn Bkgrd	39	11	27	11	20	8														
RB11	Riverside, Horley	Ubn Bkgrd	30	11	30	12	17	9	18	11	9	10	6	9	14	11	11	12	16	11	9	12
RB12[b]	Massetts Rd, Horley	Roadside	26	12	26	12	19	8	18	12	15	9	6	9	9	12	10	11				
RB13[b]	Off Massetts Rd, Horley	Carpark	45	12	26	12	19	9	17	11	11	12	11	8	8	12	10	12				
RB20	London Rd, Merstham	Kerbside	36	12	18	11	19	9	18	12	11	12	9	9	9	12	10	12	13	11	12	12
RB21	Drift Bridge, Banstead	Roadside	32	11	35	12	20	9	16	12	8	12	12	9	10	11	13	12	9	11	9	12

[a] Site redeveloped in 2000.
[b] Monitoring ceased in 2005 for financial reasons, and at all sites in 2006.
Monitoring undertaken using passive SO2 diffusion tubes changed as per the national nitrogen dioxide diffusion tube network.
No bias adjustment factors have been applied to the data. Tubes supplied by Lambeth Scientific.

4.17 Although the sulphur dioxide monitoring data was / is not intended for compliance monitoring, in general if the annual average concentration exceeds 18.6 µg m^{-3} then the 15 minute standard for sulphur dioxide (Table 1.1) is likely to be breached (Lambeth Scientific, 2004). Assuming that the diffusion tubes are accurate, given the lack of calibration against a real time monitor, then there have been no breaches of the sulphur dioxide objectives at the monitoring sites since 2001, which ties in with the findings of the borough wide assessments of air quality in 2003 and 2006.

4.3 Nitrogen Dioxide

4.18 The council monitors nitrogen dioxide concentrations at a total of 82 sites across the borough primarily using nitrogen dioxide diffusion tubes. The majority of the monitoring takes place within areas that have been declared an air quality management area (AQMA), although limited monitoring also takes place in former AQMAs to ensure that the NO_2 concentrations in these areas continue to meet the relevant air quality objective, and monitoring is also undertaken at 11 'background' sites within the borough. The purpose of this background monitoring is to:

- provide an informed response to residents concerns about pollution in their immediate area.
- to put the concentrations measured within the AQMAs into a wider context.
- to monitor long and short term trends in nitrogen dioxide concentrations for comparison purposes to those within the AQMAs.
- to obtain further information on areas identified by screening assessments or professional judgement, as having nitrogen dioxide concentrations that may be close to the objective values.

4.19 All of the nitrogen dioxide diffusion tube monitoring data discussed in the following sections has been 'corrected' using an appropriate bias adjustment factor, so that the results are directly comparable to the UK/EU objective and limit values. Details of the tube types, laboratory used, and the calculation of correction factors is discussed in section 2.2.2. The individual tube results for 2002 to 2007 can be found in appendix B.

4.3.1 Former AQMA: M23 North

4.20 Monitoring takes place at three sites within this former AQMA, although only two sites are classed as relevant receptors (RB40, RB41 - Figure 4.4). At the relevant receptors the monitoring data indicates that the annual mean concentration of nitrogen dioxide continues to meet the relevant UK air quality objective of 40 µg m^{-3} (Figure 4.5).

Figure 4.4: Former AQMA M23 North - Shepherd's Hill Monitoring Sites.

Figure 4.7: Former AQMA (Flying Scud) on the A23 Brighton Road.

4.21 Nitrogen dioxide concentrations across the three monitoring sites within this former AQMA were generally lower in 2007 compared to 2006, although this fall was most likely due to the changes in the prevailing weather conditions in 2007 (cooler and less sun than 2006) rather than an improvement in vehicle emissions.

4.22 Figure 4.6 shows that the overall trend in nitrogen dioxide concentrations at the residential monitoring sites (RB41) is essentially flat i.e. no improvement (or decline) in air quality, based on a 3 year rolling mean to smooth out the weather impacts, although there is a limited improvement in air quality at the kerbside monitoring site on Shepherd's Hill (RB42).

4.23 Figure 4.5 also shows the projected nitrogen dioxide concentrations in 2010, 2015, and 2020 based on projection factors supplied by DEFRA, which show an on going improvement in air quality. However these predicted improvements should be viewed with a degree of caution, given that similar improvements were forecast based on DEFRA projection factors in 2003 and yet these improvements did not occur in practice given the trends seen to date (Figure 4.6).

4.3.2 Former AQMA: A23 Flying Scud

4.24 Nitrogen dioxide concentrations at this site (Figure 4.7) have essentially been flat at around 37 µg m^{-3} since 2004, although concentrations have jumped in 2007 to 41 µg m^{-3}, and so breached the air quality standard. At this stage it is not proposed to redeclare this site an AQMA, given the long term trend at this site is flat (Figure 4.6). However, monitoring at this site will continue, and if concentrations remain above the UK annual mean objective for nitrogen dioxide then the site will be redeclared an AQMA.

4.3.3 Current AQMA: A23 Dean Lane (AQMA Order 5)

4.25 The concentration of nitrogen dioxide at this monitoring site (Figure 4.8 and Figure 4.5) is essentially unchanged from that measured in 2004, with concentrations around 40 µg m^{-3}, and consequently the long term trend at this site (Figure 4.6) is also essentially flat, as the small fall in concentrations between 2005 and 2006 is a function of to the elevated concentrations in 2003 rather than anything else.

Figure 4.5: Annual Mean Nitrogen Dioxide Concentrations - Current and Former AQMA sites on the M23, A23, and A217 (Measured to 2007, Projected 2010 - 2020).

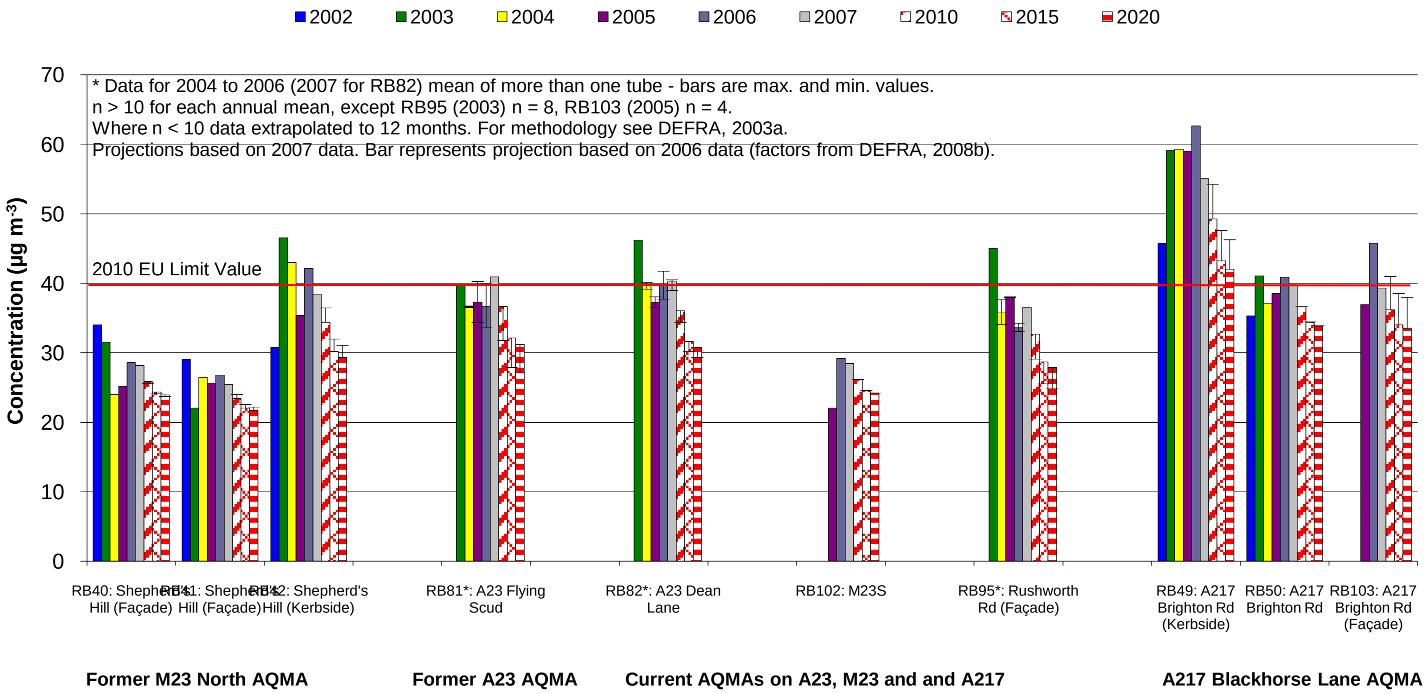
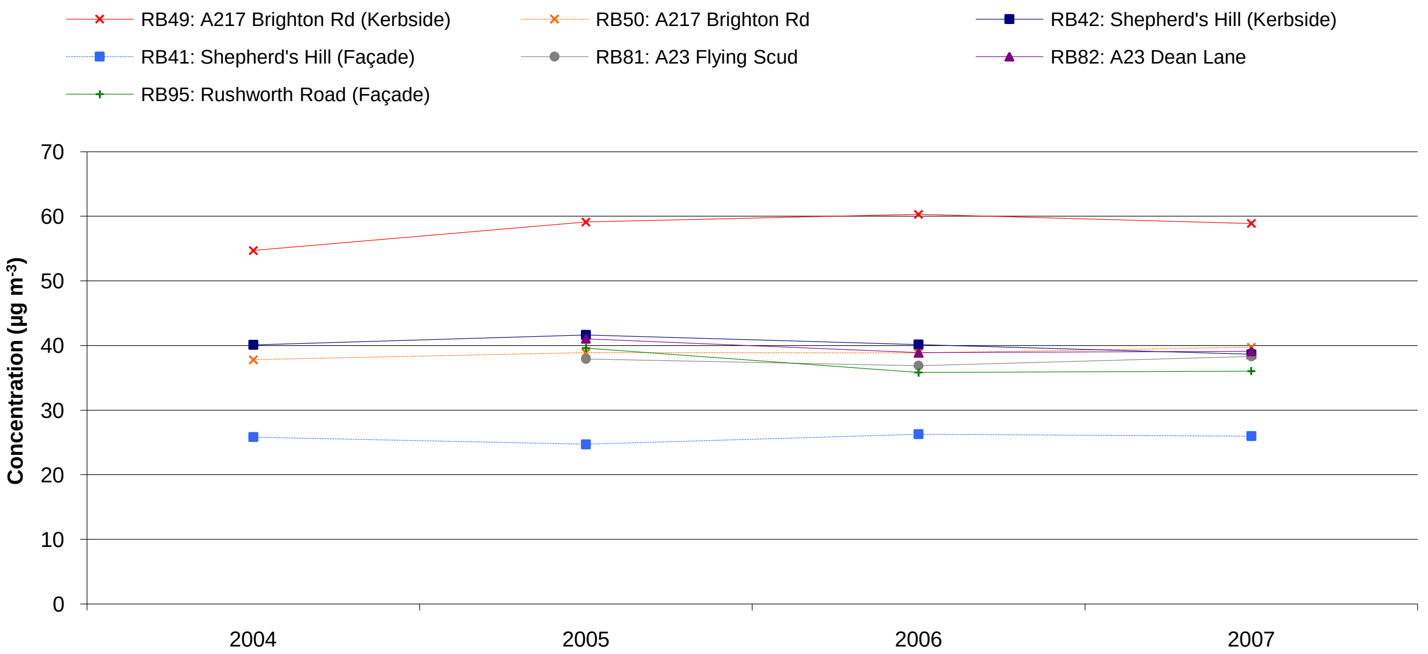


Figure 4.6: Three Year Rolling Mean Nitrogen Dioxide Concentrations within the Blackhorse Lane, A23 Dean Lane, & A217 Rushworth Rd AQMAs and the former AQMAs on the M23 (north) & A23.



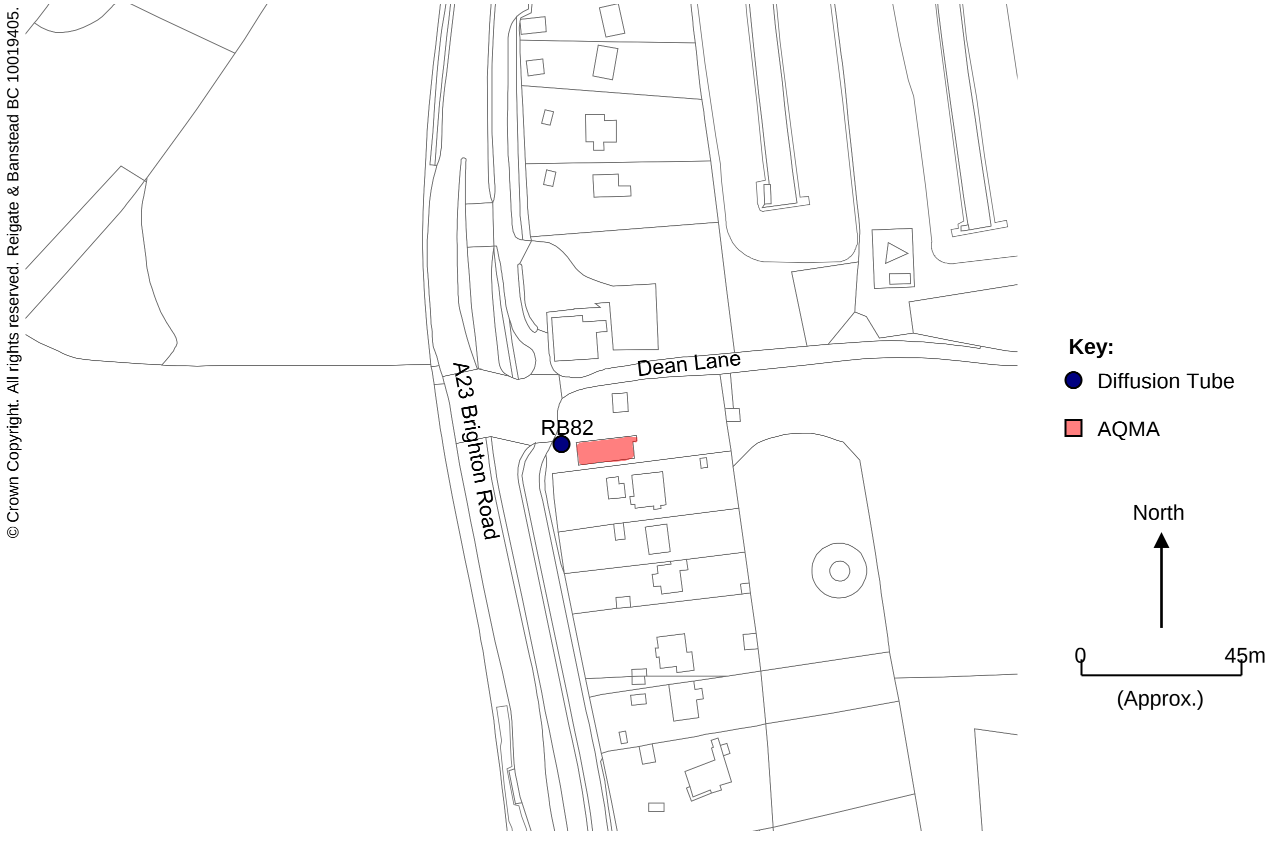


Figure 4.8: A23 / Dean Lane AQMA, Hooley Surrey.

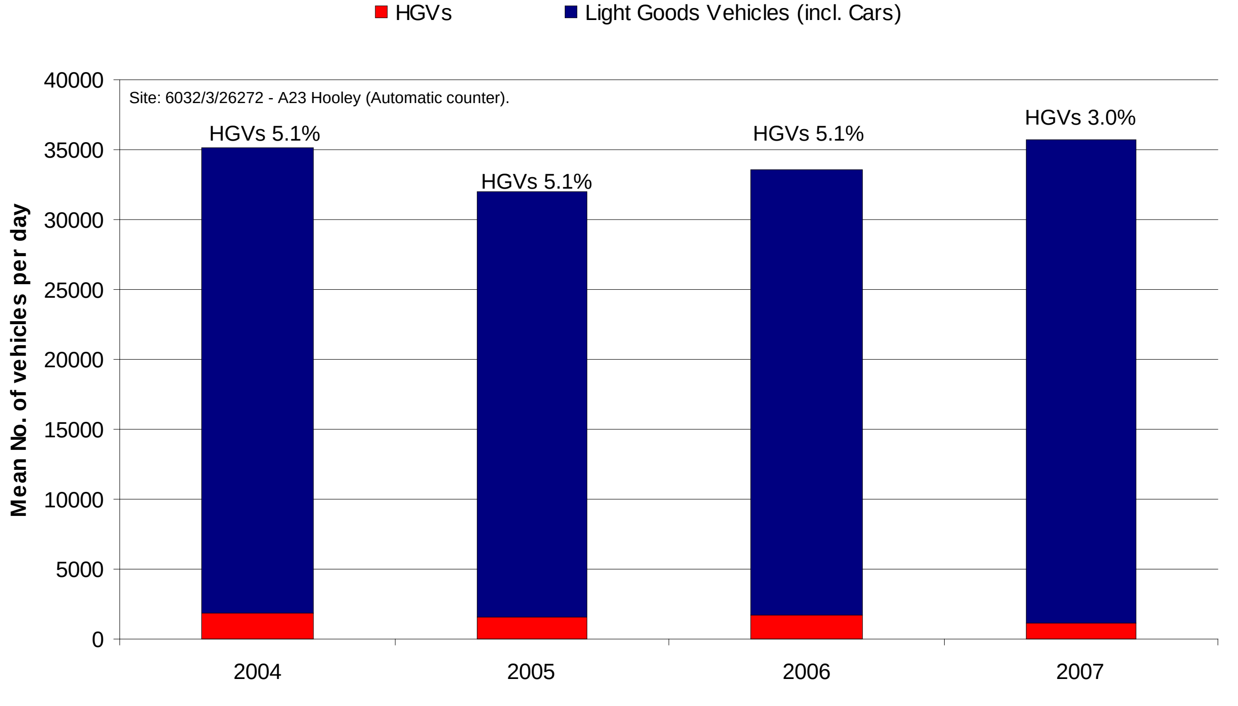


Figure 4.9: Annual Mean Daily Traffic Flows - A23 Hooley (Near Dean Lane).

4.26 Although much of the year to year variation in the nitrogen dioxide concentrations (Figure 4.5) is likely to reflect the prevailing weather conditions, the fall in nitrogen dioxide concentrations in 2005 does coincide with an apparent fall in traffic along the A23 (Figure 4.9). The reason for this fall in road traffic in 2005 is unknown, though traffic flows have since returned to 2004 levels in 2007. Equally the reason for the decline in the % HGVs from around 5 % to 3 % in 2007 is also unknown[1], as there are no apparent problems with the traffic counter.

4.27 Although the diffusion tube at the Dean Lane site just meets the UK air quality objective, the relevant receptor is located a further 9 m from the A23 compared to the monitoring site (Figure 4.8). Therefore the measured concentrations were extrapolated back to the relevant receptor using the 'NO_2 with Distance from Roads Calculator' by Marner (2008), and these results are summarised in Figure 4.10 and Table 4.3.

4.28 Table 4.3 demonstrates that the nitrogen dioxide concentrations at the relevant receptor on Dean Lane continue to meet the UK air quality objectives, with concentrations of around 35 µg m^{-3}.

4.29 The Further Assessment of the Dean Lane AQMA in 2006 (AQC, 2006c) concluded that while the UK objective for nitrogen dioxide was being met, that the Dean Lane AQMA should be retained and that monitoring should continue at the site to ensure that the UK objective continued to be met under a range of weather conditions. Based on this report the council decided[2] that the Dean Lane AQMA would remain in place until 2008, when the monitoring results would be reviewed again and a decision made on whether or not to revoke the AQMA.

4.30 Although the UK annual mean air quality objective for nitrogen dioxide is being met at Dean Lane, in view of the absence of the predicted improvement in air quality within this AQMA and as at present road traffic appears to be increasing, albeit back to levels seen in 2004, the council will:

i) retain the current AQMA as a precautionary measure,

ii) continue the current monitoring at the site for a further three years,

iii) review the need for the AQMA again in April 2010 in light of the new monitoring data.

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[1] the Coulsdon bypass (a new part of the A23) was under construction over much of this period, although the completion of works would have been unlikely to cause such an abrupt drop in 2007 compared to 2006. Equally the London Low Emission Zone came into force in February 2008 and so would not have caused such a fall in HGVs in 2007.

[2] Council Executive meeting 18th October 2006.

Figure 4.10: Expected Reduction in Annual Mean Nitrogen Dioxide Concentration with Distance from the Kerb at A23 / Dean Lane AQMA in 2007 (after Marner, 2008).

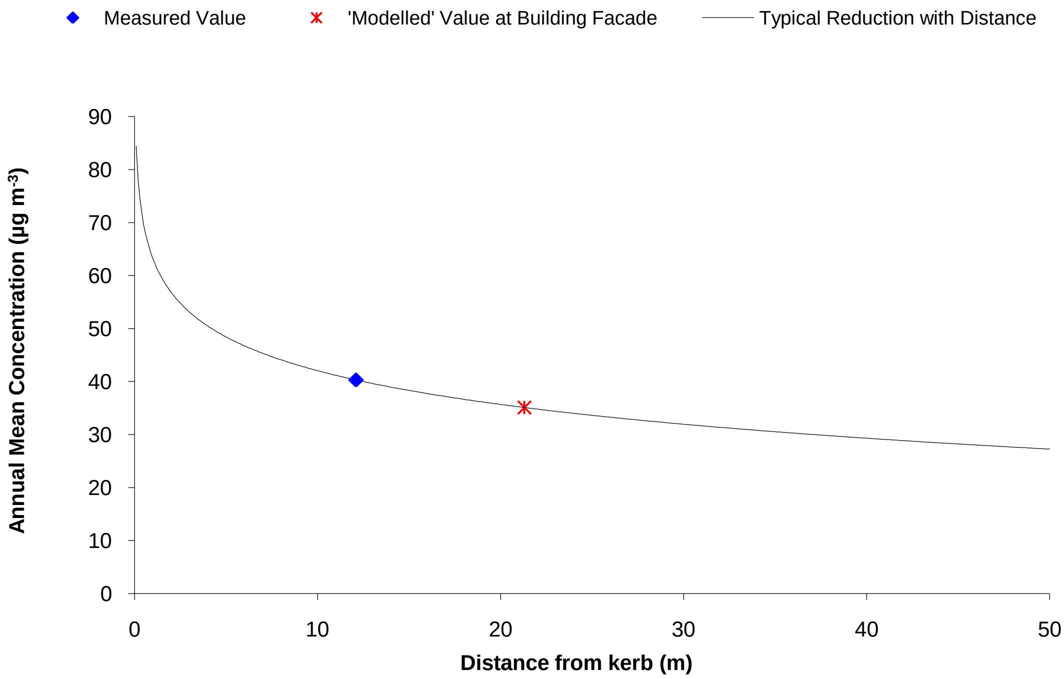

Table 4.3: Extrapolated Annual Mean Nitrogen Dioxide Concentrations at the Relevant Receptor on the A23 / Dean Lane Junction (2003 to 2007), projected values 2010 to 2015.

	2003	2004	2005	2006	2007	2010**	2015**	2020**
Measured Concentration (RB82*)	46	40	37	40	40	36	32	31
Extrapolated Conc. at Building Façade	40	35	33	35	35	32	28	27

All values µg m^{-3} rounded to nearest whole number.

* values are the average of two diffusion tubes from 2004.

** Projected values based on 2007 measured values.

Extrapolations based on NO_2 with distance from roads calculator v.1 (30/6/08) www.airquality.co.uk.

Distances: monitor to kerb = 12.1 m, Building façade to kerb = 21.3 m.

Background concentrations used in calculator from background maps *www.airquality.co.uk* , grid square 527500, 155500. (2003 value estimated).

Background concentrations adjusted to non mapped years using Year Adjustment Calculator v.2.2a *(www.airquality.co.uk)* .

4.3.4 Current AQMA: M23 South (AQMA Order 2)

4.31 This site (Figure 4.11a and 4.11b) was declared an AQMA on 29th April 2002 based on dispersion modelling in the council's Stage 3 assessment in 2001 (AQC, 2001). The site consists of a single residential property to the west of the M23 between junctions 9 and 8, and access problems over the years have meant that it has been difficult to install any monitoring equipment to confirm the findings of the modelling. A diffusion tube was finally installed in 2004 (RB97 - Appendix B), but on going site access problems and continued tube losses meant that monitoring ceased in early 2005.

4.32 A surrogate site (RB102 - Figure 4.11b) was therefore set up in 2005 in a field 2 km to the north of the relevant receptor[3] but at a comparable distance from the motorway. Monitoring data from this site (Figure 4.5) clearly indicates that the air quality objectives for nitrogen dioxide at the M23(S) AQMA are being met by a considerable margin, with annual mean concentrations around 28 to 29 $\mu g\ m^{-3}$.

4.33 A co-located tube supplied by the Highways Agency (Appendix B) from a different laboratory (Gradko, 20 % TEA in water) shows good agreement with the existing tube, albeit based on 1 years results. The Highways Agency also located a tube right next to the M23 (RB108) and nitrogen dioxide concentrations only increased by around 2 $\mu g\ m^{-3}$.

4.34 In view of the monitoring results from the surrogate site, and as even close in to the motorway the concentration of nitrogen dioxide on the western side of the M23 is only around 30 $\mu g\ m^{-3}$, the M23(S) AQMA could be revoked. However, there are proposals to expand passenger throughput at Gatwick Airport by around 5 million passengers per annum by 2019, which will result in increased traffic volume on the M23. At this stage it is thought unlikely that the development will lead to a breach of the air quality standards at this site on the M23, but in view of these plans the M23(S) AQMA will be formally revoked in April 2010 once the air quality impact of the north terminal extension has been modelled. In the meantime monitoring at the site will continue for at least a further three years so that the overall trend in nitrogen dioxide concentrations at this site can be ascertained.

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[3] Traffic flow on the motorway at both points is unchanged, and the elevation (the motorway runs atop an embankment) is similar at both sites.

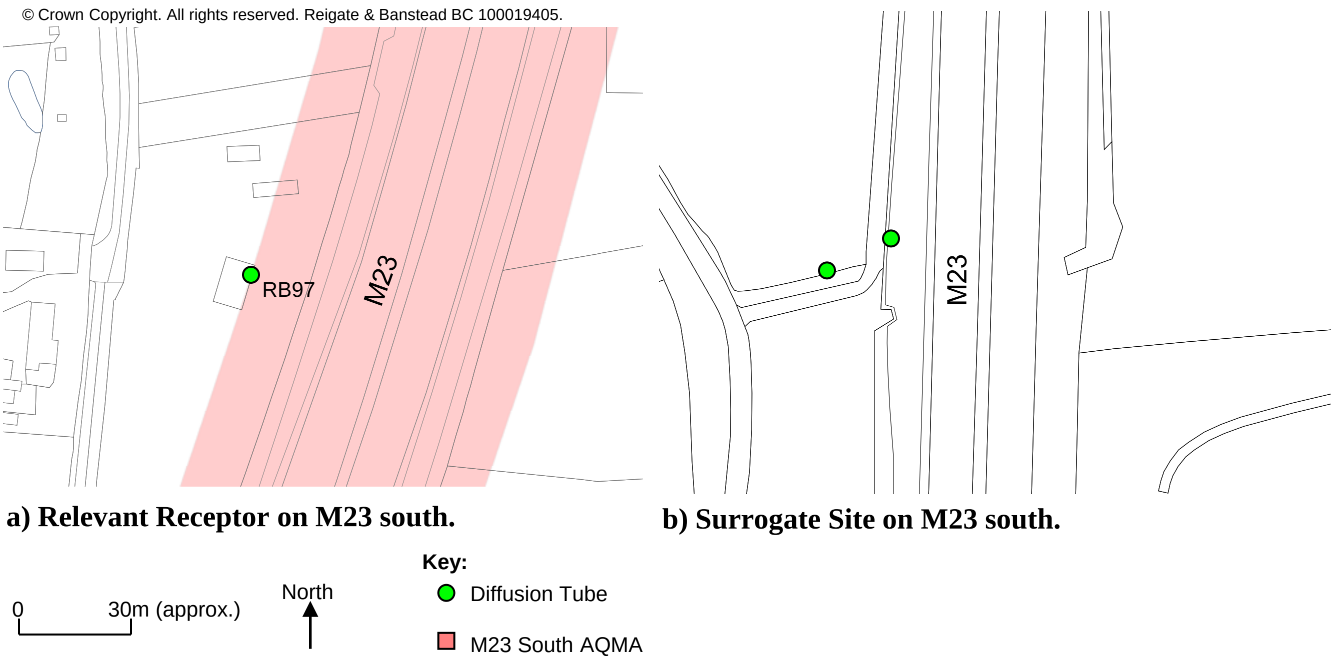


Figure 4.11a/b: Location of Relevant Receptor and Surrogate Monitoring Sites within the M23 South AQMA.

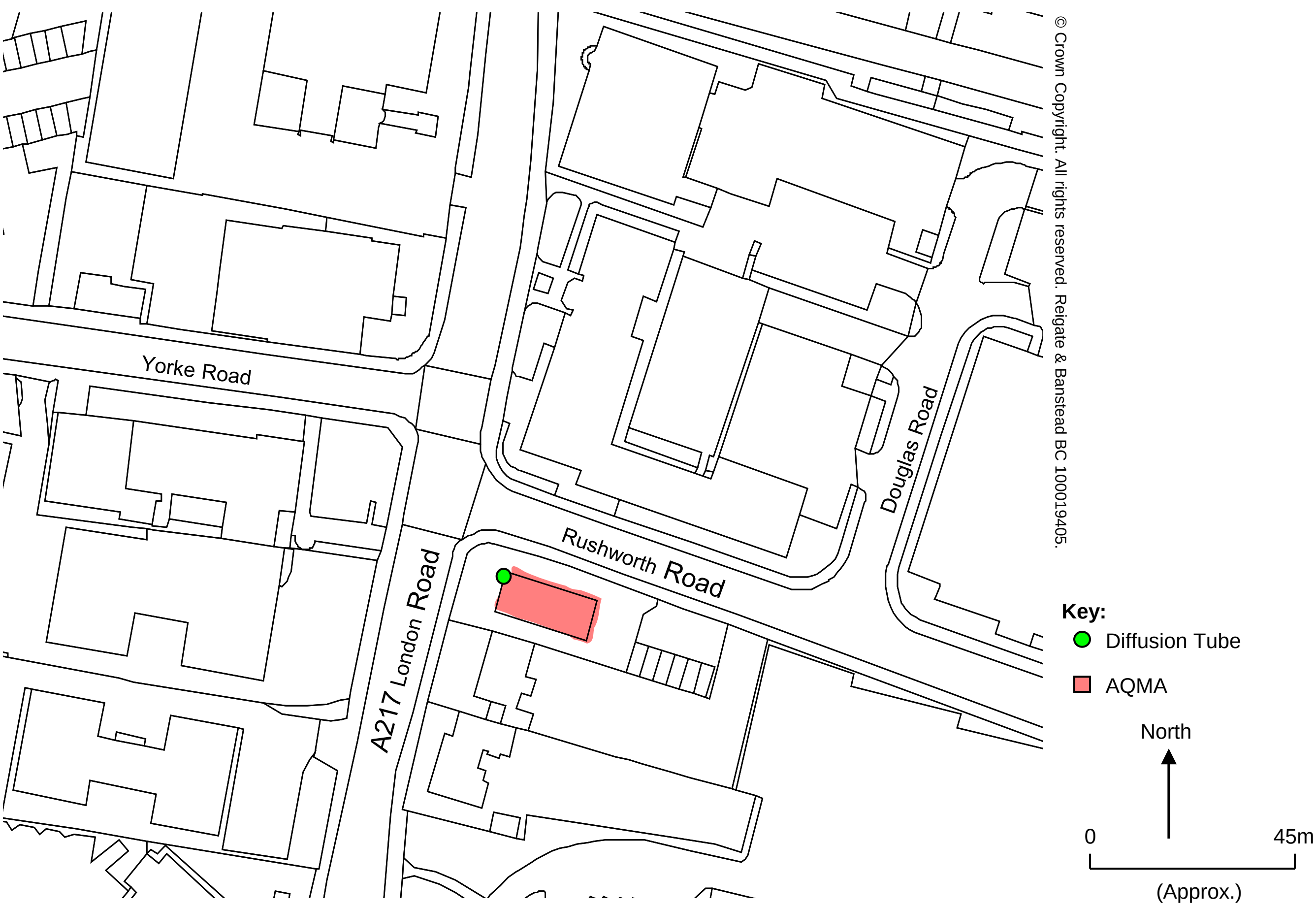


Figure 4.12: Rushworth Road Air Quality Management Area (AQMA).

4.3.5 Current AQMA: A217 / Rushworth Road (AQMA Order 4)

4.35 Nitrogen dioxide concentrations within the Rushworth Road AQMA (Figure 4.12) continue to meet the UK air quality objectives, and while concentrations in 2007 were up slightly at 37 µg m^{-3} compared to 34 µg m^{-3} in 2006 the concentrations in 2007 are comparable to those in 2004 and 2005 (Figure 4.5).

4.36 The overall trend (Figure 4.6) in concentrations at this site (RB95) is essentially flat, with no real improvement in nitrogen dioxide concentrations over the past four years. Nitrogen dioxide concentrations have fallen slightly based on a three year rolling average, but this reflects the very high concentrations in 2003 rather than any significant overall improvement.

4.37 The Rushworth Road AQMA was declared on the 15th September 2005, and following a further assessment of this site (AQC, 2006c) it was concluded[4] that:

> i) although the site was predicted *not* to breach the UK air quality objective for nitrogen dioxide, as concentrations in 2005 were high and close to the UK objective the existing AQMA would remain and be monitored as a precautionary measure.
>
> ii) the data for the site would be reviewed in 2008, with a view to revoking the AQMA as per the A23 Dean Lane site.

4.38 Although nitrogen dioxide concentrations continue to meet the UK air quality objectives at the Rushworth Road AQMA with no overall improvement in the concentrations to date, and concentrations still close to the annual mean UK air quality objective, the Rushworth Road AQMA is to remain for now with a further review undertaken in 2010.

4.3.6 Current AQMA: A217 / Blackhorse Lane (AQMA Order 6)

4.39 The Blackhorse Lane AQMA (Figure 4.13) met the UK annual mean air quality objective for nitrogen dioxide in 2007, albeit with concentrations of 40 µg m^{-3} and 39 µg m^{-3} at the relevant receptors (Figure 4.5 and Appendix B). Concentrations in 2006 were generally higher at all three sites within this AQMA, and consequently all sites in 2006 breached the UK objective for nitrogen dioxide.

[4] Council executive meeting 18/10/06.

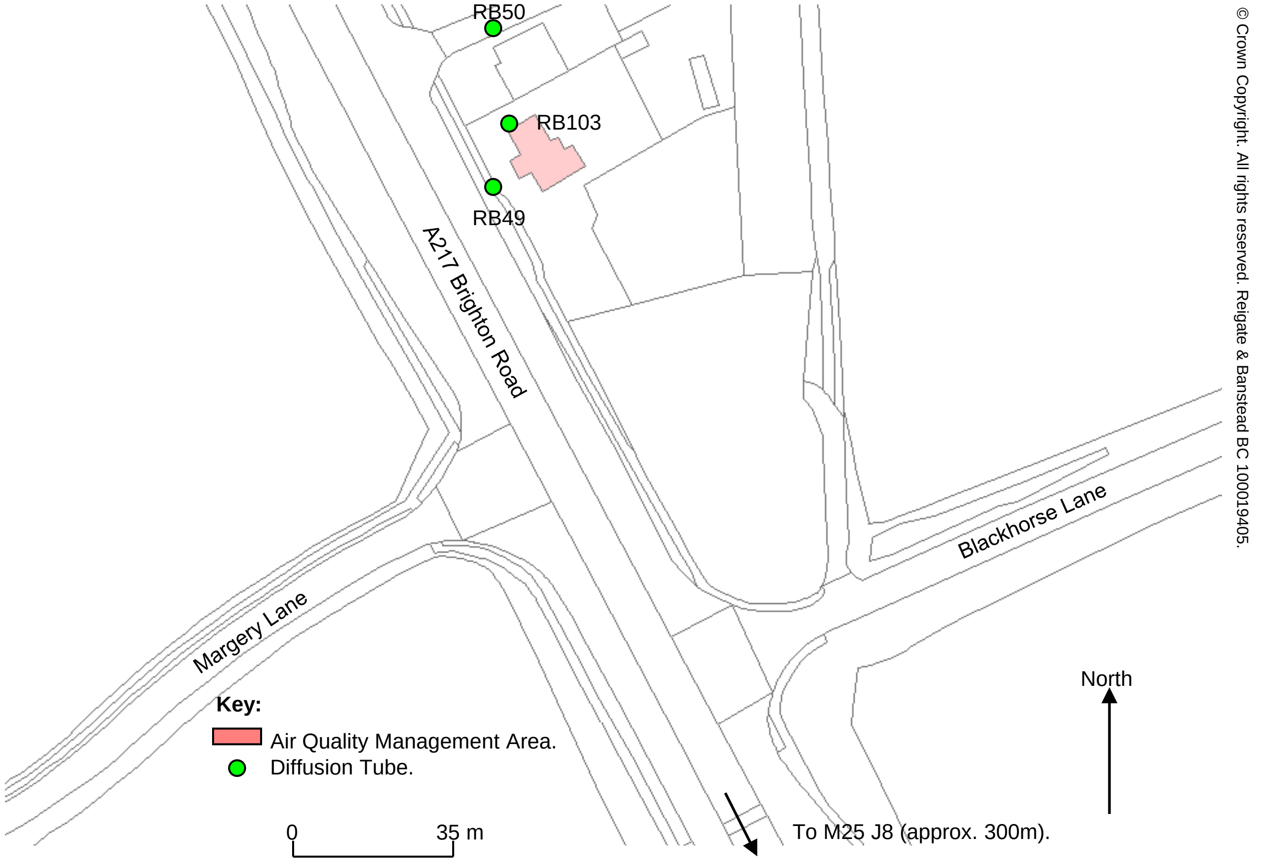


Figure 4.13: Blackhorse Lane Air Quality Management Area and Monitoring Locations.

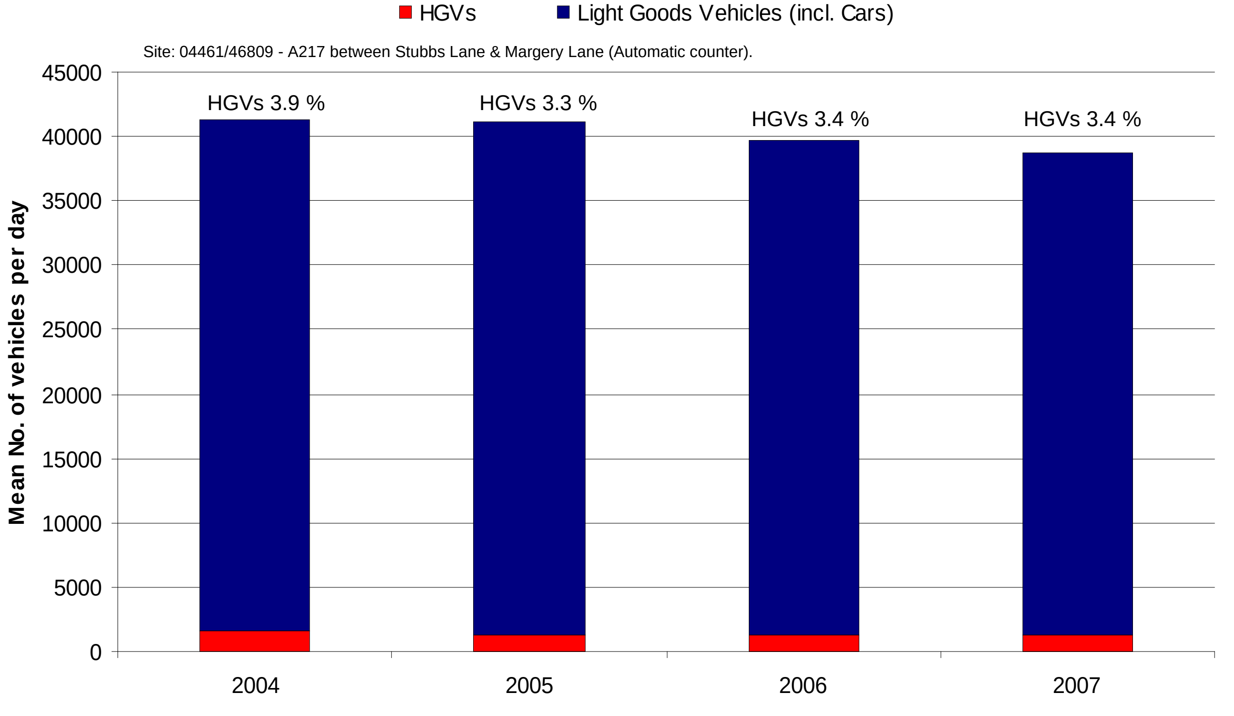


Figure 4.14: Annual Mean Daily Traffic Flows - A217 Blackhorse Lane.

4.40 The kerbside concentration of nitrogen dioxide (RB49) in 2006 was the highest recorded to date, and the overall trend (Figure 4.6) in kerbside concentrations is up, although in part this data is biased by a low concentration recorded in 2002 and high concentrations recorded in 2006.

4.41 The overall trend in concentrations at the relevant receptors where a sufficiently long data set is available (Figure 4.6) indicates that concentrations have risen slightly between 2004 and 2007, by around 2 µg m^{-3} based on a three year rolling mean. This apparent increase in nitrogen dioxide concentrations is not due to an increase in road traffic as traffic, which travels at around 40 mph on this particular section of the A217, has fallen slightly between 2004 and 2007 (Figure 4.14) in contrast to the increase seen on the A23 near Dean Lane.

4.42 This fall in road traffic is not unexpected, as traffic monitoring across Surrey suggests that between 2005 and 2007 there has been negligible growth in road traffic on several of Surrey's roads (Pitt, 2008). Given the fall in road traffic at the Blackhorse Lane AQMA and yet static if not rising nitrogen dioxide concentrations between 2004 and 2007, this suggests that either the emissions from road traffic at this site or the background nitrogen dioxide concentrations are rising.

4.3.7 Current AQMA: Reigate High Street (AQMA Order 9)

4.43 The Reigate High Street AQMA (Figure 4.15a and Figure 4.15b) was originally declared on 24th May 2006, but was subsequently extended to include part of West Street and the one way section of London Road on 5th November 2007. Unlike other AQMAs within the borough the High Street AQMA is relatively enclosed, with the High Street itself and the section of Bell Street within the AQMA essentially street canyons, which limits the dispersion of the road traffic pollution. Also while the section of Church Street and the eastern end of West street within the AQMA are not technically street canyons, these streets are also enclosed by buildings on both sides which limits pollutant dispersal.

4.44 The monitoring sites within this AQMA are a mix of building façade and kerbside sites in roughly a 3:2 split, as marked in Figures 4.16a and 4.16b. The purpose of the kerbside sites is to help assess the nitrogen dioxide concentrations that pedestrians may be exposed to, and if this exposure is likely to exceed the 1 hour nitrogen dioxide objective (annual mean >60 µg m^{-3}). The kerbside sites are also used where suitable building façade sites were / are not available.

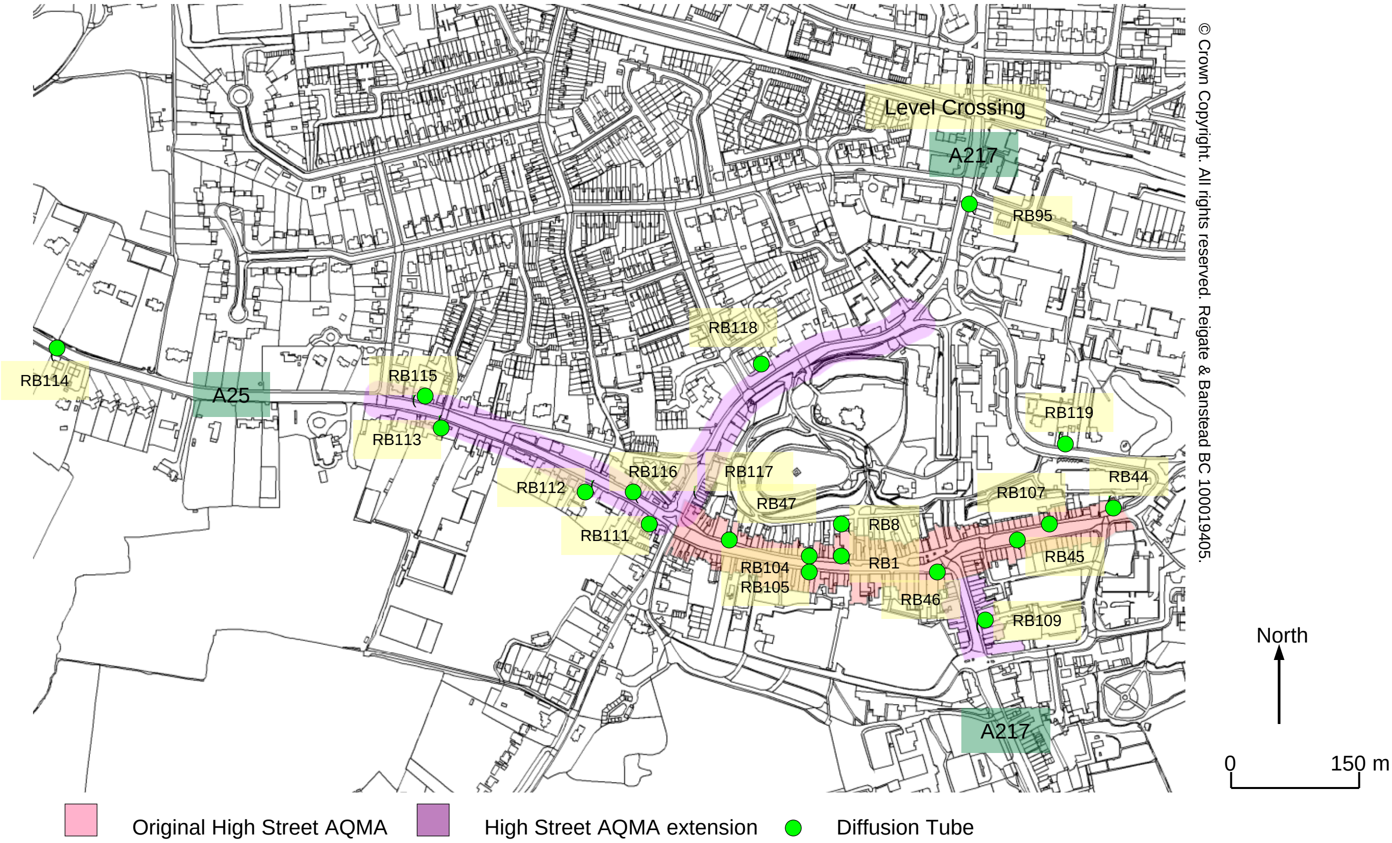


Figure 4.15a: Current Air Quality Management Area and Diffusion Tube Monitoring in and around Reigate.

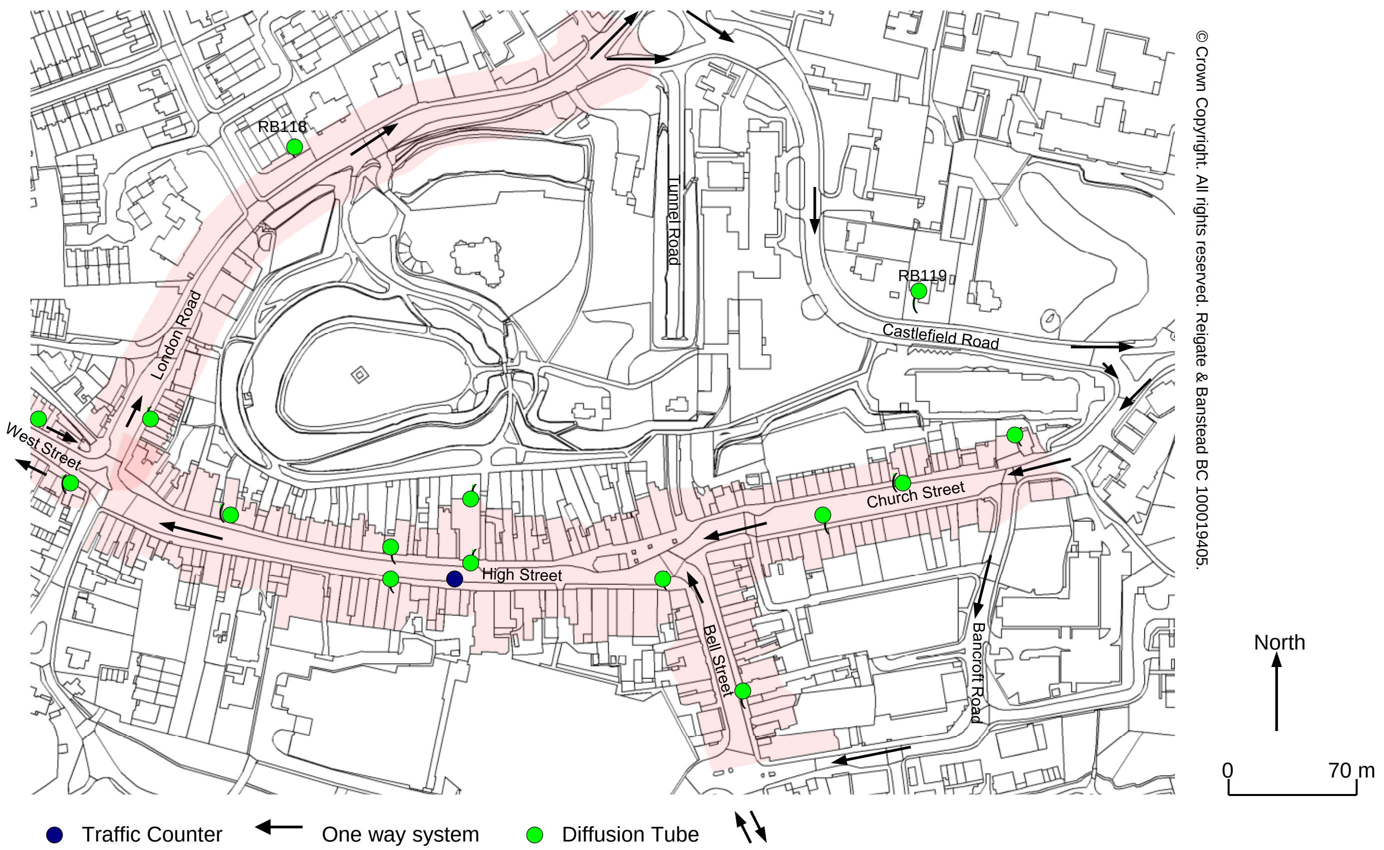


Figure 4.15b: One Way System along Reigate High Street.

Figure 4.16a: Annual Mean Nitrogen Dioxide Concentrations - Reigate High Street Church Street, and Bell Street. (Measured 2002 - 2007, Projected 2010 - 2020).

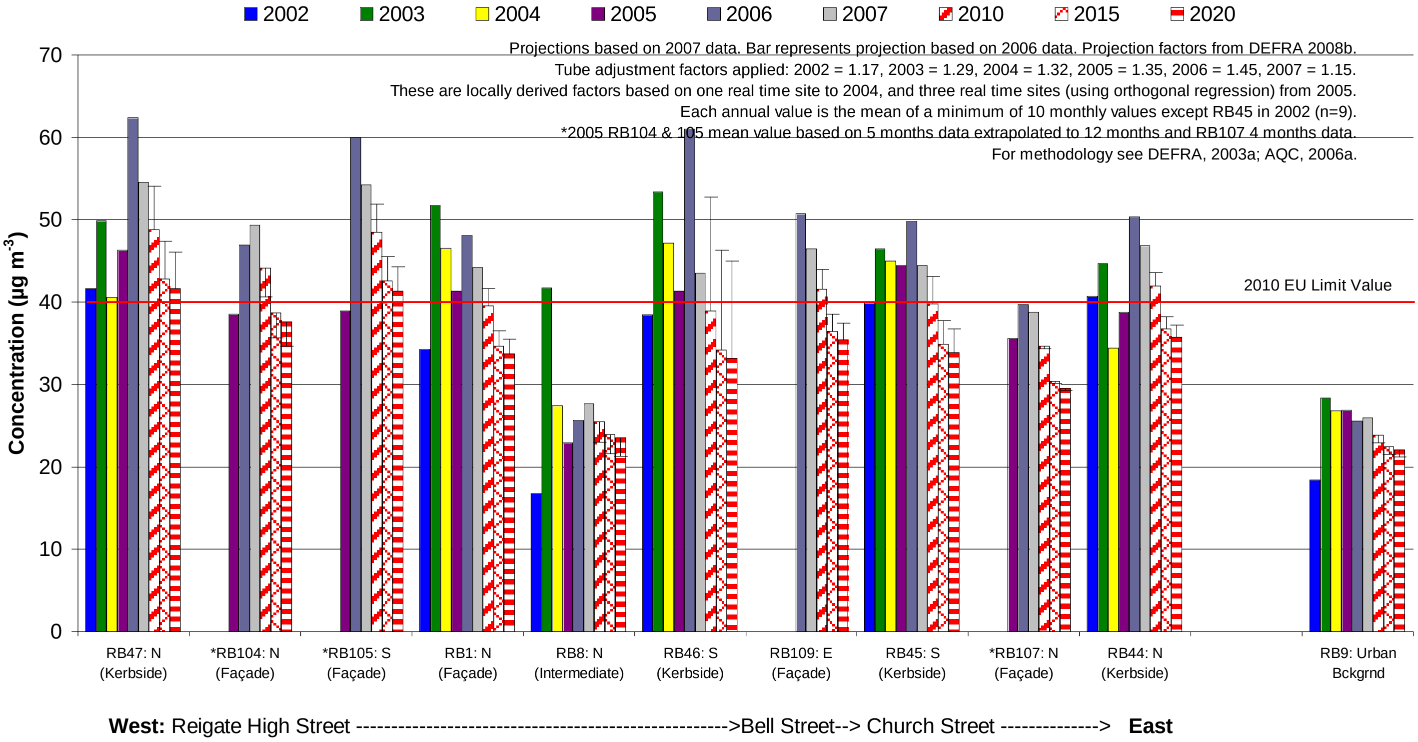
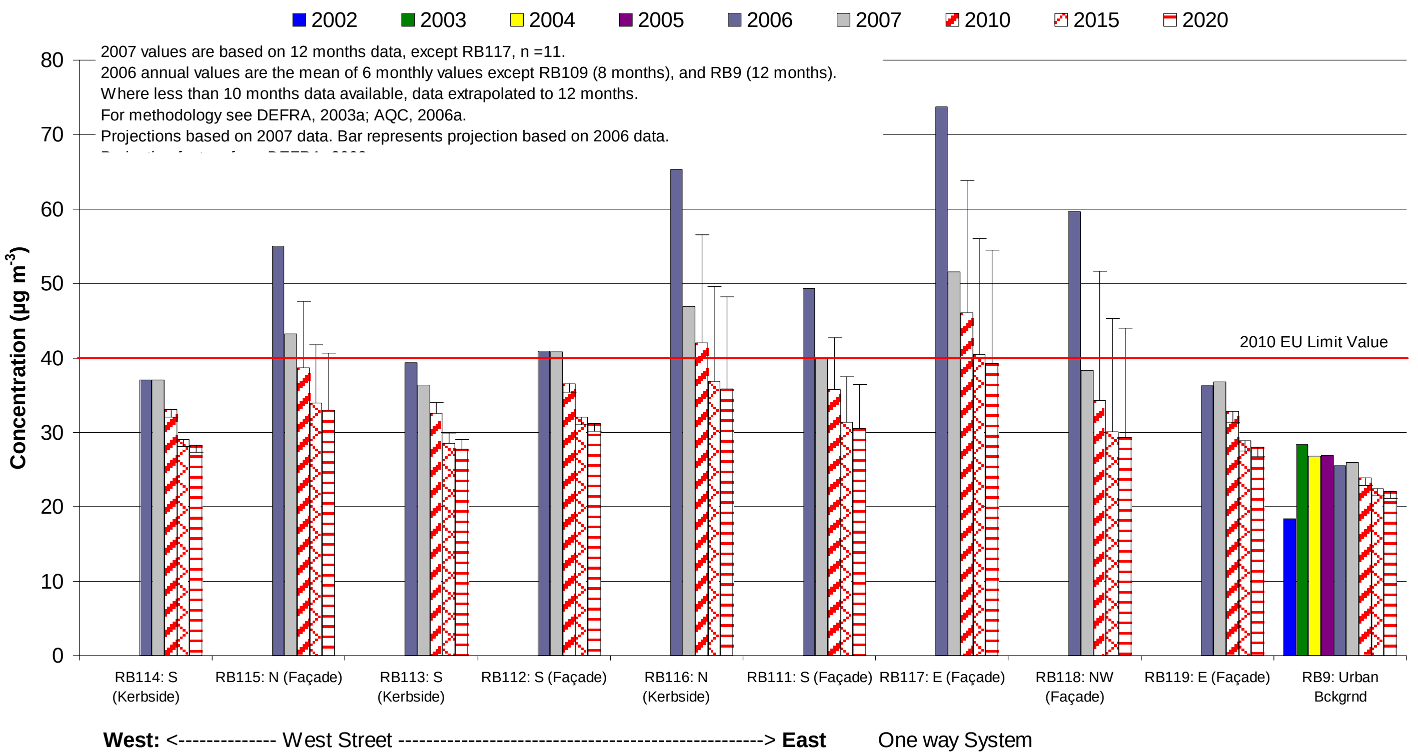


Figure 4.16b: Annual Mean Nitrogen Dioxide Concentrations - West Street & London Road / Castlefield Road (Measured to 2007, Projected 2010 - 2020).



4.45 In the 2005 progress report it was stated that the decline in nitrogen dioxide concentrations with distance from the kerb over a relatively short distance was not that significant, based on results from the DMRB model used at that time. However, further research suggests that there is a rapid initial fall off in nitrogen dioxide concentrations with distance from the kerb, as demonstrated at the Dean Lane site (Figure 4.10).

4.46 Despite this rapid decline in concentrations with distance from the kerb, when the RB47 site for example is extrapolated back to the building façade using the NO_2 with distance from roads calculator[5], nitrogen dioxide concentrations in 2007 were still around 42 µg m^{-3} and so in breach of the UK annual average objective. Equally it is worth noting that this extrapolation technique may slightly overestimate the fall in concentrations in a street canyon, as RB104 and RB1 are both located on building façades at a similar distance from the kerb as the building at RB47 yet measured concentrations of 49 µg m^{-3} and 44 µg m^{-3}, respectively, in 2007 compared to the extrapolated RB47 value of 42 µg m^{-3}.

4.47 The other factor to consider with the High Street monitoring is that the diffusion tubes are located on the ground floor, while on the High Street, Church Street, and Bell Street, the residential premises are on the first floor over ground floor retail premises. However research by Heal (2005) suggests that in practice the increase in height at most results in a 1 to 2 µg m^{-3} fall in nitrogen dioxide concentrations. While this reduction in concentration with height is of benefit, nitrogen dioxide concentrations within the High Street AQMA will still breach the UK annual mean objective.

4.48 The monitoring results from the High Street AQMA indicate that nitrogen dioxide concentrations in 2006 were among the highest recorded to date, although at the background (RB9) and intermediate (RB8) sites there was little change in the concentrations compared to previous years. Nitrogen dioxide concentrations at certain sites also exceeded 60 µg m^{-3} in 2006, and thus it is likely that the 1 hour objective (Table 1.1) was also breached in 2006 (AQC, 2003). However, a degree of caution is needed in relation to measured concentrations on West Street in 2006, given that the annual mean is based on 6 months data 'extrapolated' to 12 months.

4.49 In 2007 the concentration of nitrogen dioxide continued to breach the UK annual mean objective of 40 µg m^{-3} at a number of building façades, although it is unlikely that the 1 hour standard was breached in 2007 given that the annual mean concentrations are significantly below 60 µg m^{-3}.

4.50 In general concentrations along West Street are higher on the north side of the road compared to the south due to the prevailing SW wind, while the impact of the street canyon with its reversed air flow can clearly be seen with RB104 and RB105 (located opposite one another on the High Street) where concentrations are higher on the south side of the High Street. Nitrogen dioxide concentrations on Castlefield Road (RB119) continue to meet the UK air quality objectives, which confirms the decision not to declare this part of the wider High Street AQMA, although the residential properties on Castlefield Road have since been converted to business premises and thus are no longer 'relevant' receptors.

4.51 The overall trend in nitrogen dioxide concentrations on the High Street (there is currently insufficient data to analyse trends on West Street) is generally upwards, while the background (RB9) and intermediate (RB8) sites show no real change in concentrations over the last 4 years with a possible small increase at RB9, and a small (if any) fall at RB8 (Figure 4.17).

4.52 This upward trend in nitrogen dioxide concentrations within 5 m of the road on the High Street has occurred despite the volume of road traffic on the High Street[6] remaining constant / falling slightly over the past 4 years (Figure 4.18). This flat / slight fall in road traffic on the A217 in the High Street is consistent with the pattern seen at another traffic monitoring site on the A217 near the Blackhorse Lane AQMA, suggesting that the lack of growth seen / slight falls are genuine.

4.53 Therefore the increase in nitrogen dioxide concentrations on the High Street is most likely the result of an increase in emissions from vehicles using the High Street, given that concentrations at the background monitoring site have remained fairly constant. The exact cause of this increase in emissions is unclear, and could be due to a drop in traffic speeds / increased congestion on the High Street. In the absence of vehicle speed data a fall in vehicle speeds cannot be ruled out, but given that a similar pattern was seen at the Blackhorse Lane AQMA where speeds are around 40 mph, compared to 0 - 30 mph on the High Street, it would appear that vehicle emissions of nitrogen dioxide in general are increasing in the immediate vicinity of roads, rather than the increase being due to site specific local factors.

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[5] Kerbside 55 µg m^{-3}, background 26 µg m^{-3}, 2.9 m to kerb.
[6] Traffic counts are undertaken on the A217 in the High Street. Data is not available for the A25 West Street, but the nature of the one way system suggests that the trend in traffic volume on the A25 is likely to be similar to that on the A217.

Figure 4.17: Three Year Rolling Mean Nitrogen Dioxide Concentrations within Reigate.

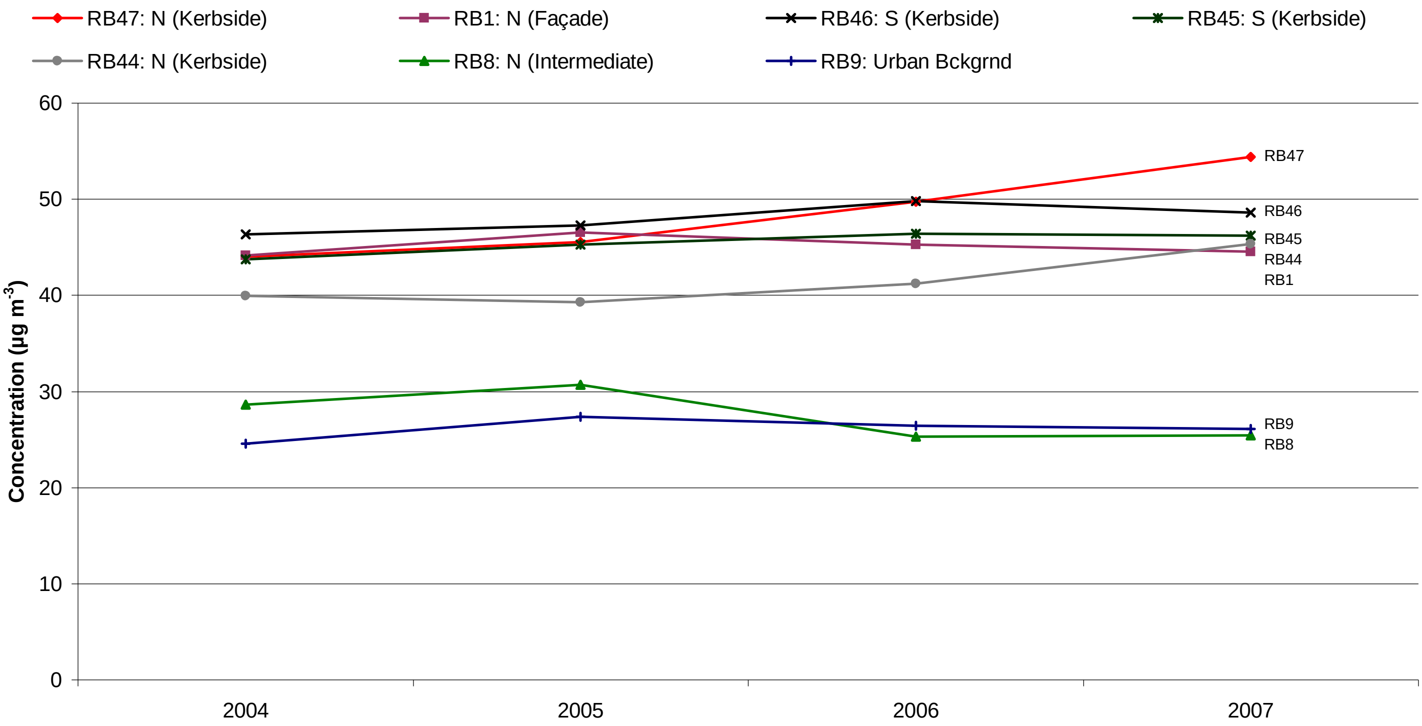
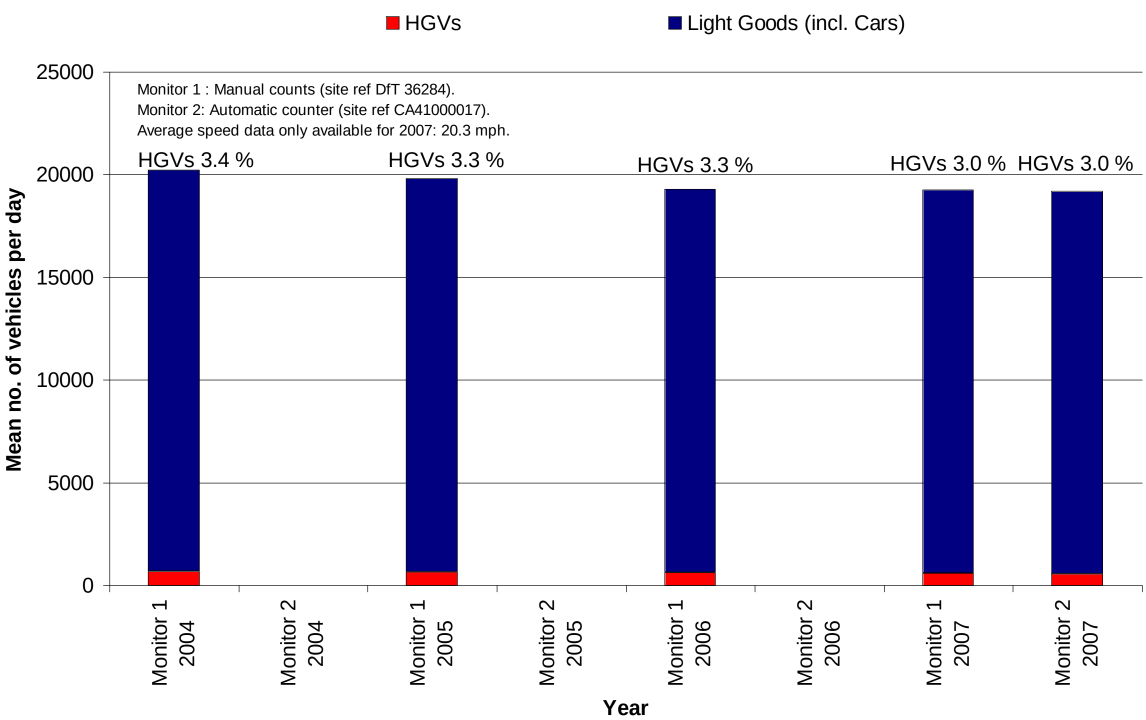


Figure 4.18: Annual Mean Daily Traffic Flows on Reigate High Street.



4.54 One of the most likely causes of a general increase in roadside nitrogen dioxide concentrations is the progressive shift towards diesel vehicles over the last 6 to 7 years, which in 2006 made up 38 % of the vehicle fleet compared to 16 % in 1997, while diesel fuel sales are up 30 % from 1997 to 2005. As a result of this shift to diesel there is much more direct nitrogen dioxide emitted, known as primary nitrogen dioxide, due to the higher compression ratios used in diesel engines. In addition, a number of vehicles with diesel particulate filters also inject nitrogen dioxide directly into the exhaust system to regenerate i.e. clean up the particle filter. Thus this average increase in nitrogen dioxide per vehicle is likely to account, at least in part, for the increase in roadside vehicle nitrogen dioxide concentrations seen on the High Street.

4.3.8 Current AQMA: Drift Bridge, Banstead (AQMA Order 8)

4.55 The Drift Bridge AQMA (Figure 4.19) was declared on 10th January 2007. Monitoring within the AQMA (RB106) indicates that the annual mean UK air quality objective for nitrogen dioxide was met at this site in 2007, albeit with a concentration of 39 $\mu g\ m^{-3}$ (Figure 4.20 / Appendix B).

4.56 The concentration of nitrogen dioxide at the kerbside site in the vicinity of the AQMA (RB21) reached its highest level to date in 2006, in common with a number of other kerbside and roadside sites within the borough e.g. Reigate High Street, Shepherd's Hill, and the A217 Blackhorse Lane. However RB3 and RB23 which are used as background sites, albeit located close to lightly used roads, showed limited changes between 2006 and 2007 (Figure 4.20).

4.57 The overall trend in nitrogen dioxide concentrations over the past 3 years (2005 to 2007) at the Banstead site is essentially flat (Figure 4.21). There is evidence of an increase in concentrations at the kerbside site (RB21), although in part this is driven by the high concentrations recorded in 2006, while the slight downward trend at RB22 and slight upward trend at RB3 and RB23 between 2004 and 2005 are more a reflection of one off events than long term trends. At present there is insufficient monitoring data from RB106 to examine trends, and it will be 2011 before any meaningful trend analysis can be done at this site.

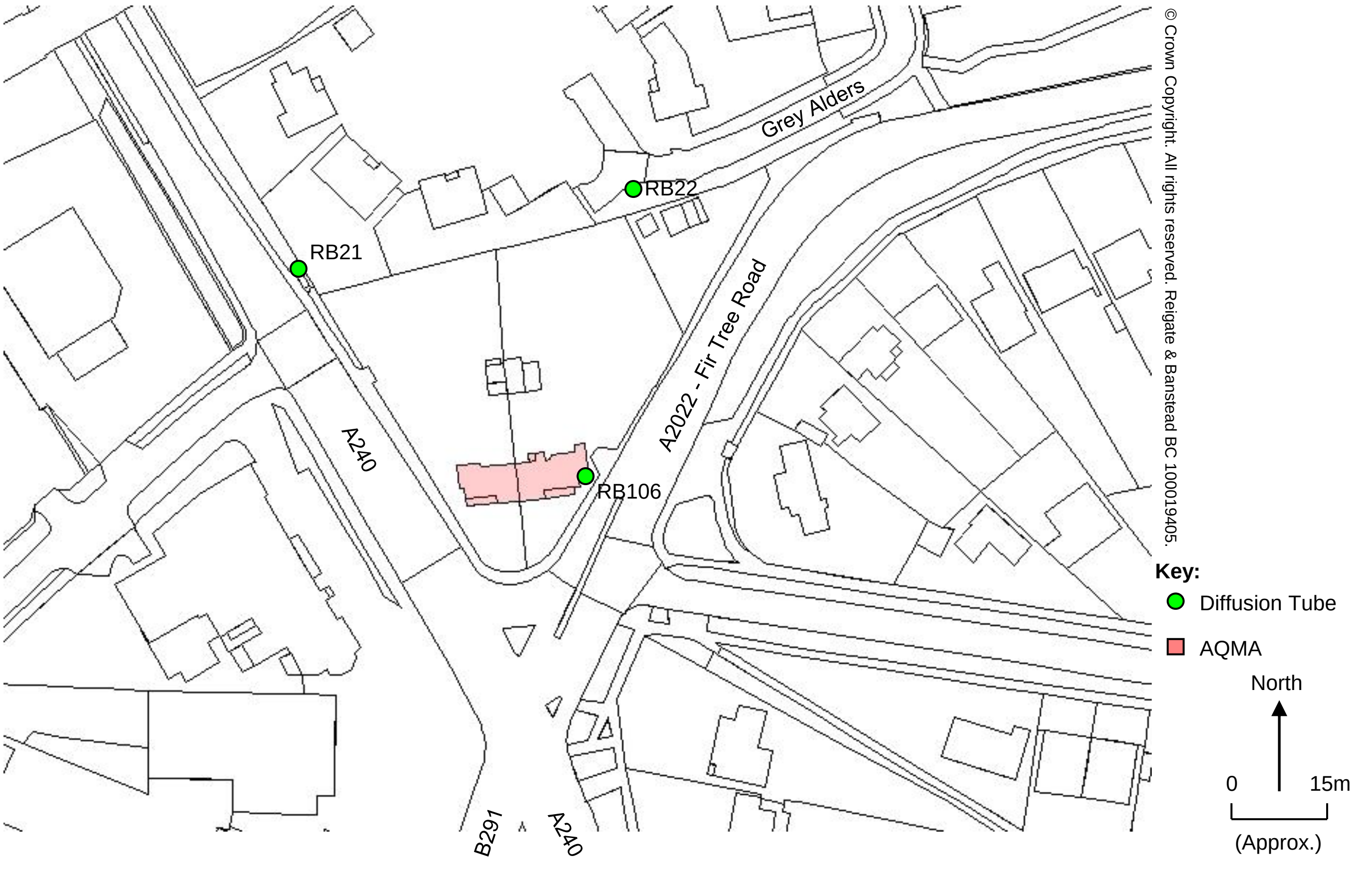


Figure 4.19: A2022 / A240 - Drift Bridge AQMA, Banstead.

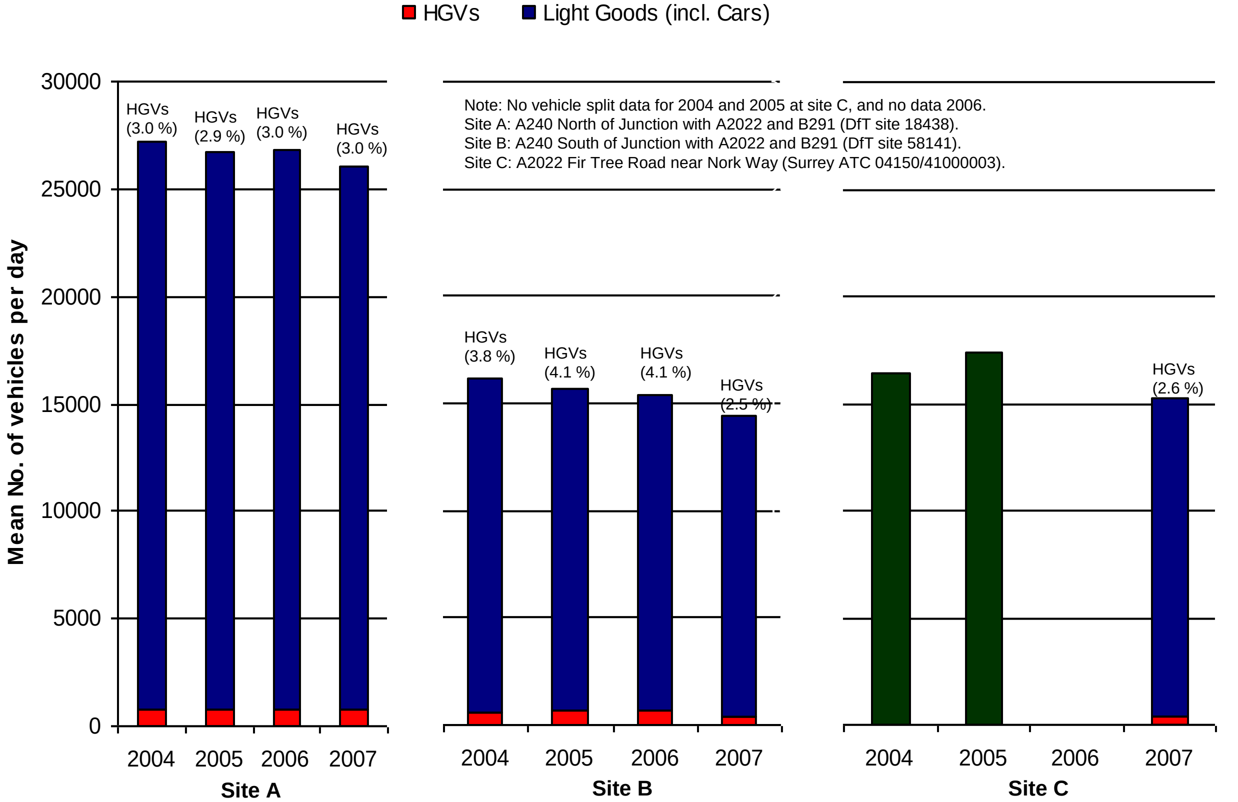


Figure 4.22: Annual Mean Daily Traffic Flows - Drift Bridge, Banstead.

Figure 4.20: Annual Mean Nitrogen Dioxide Concentrations - Banstead Background Sites, and Drift Bridge AQMA (Measured to 2007, Projected 2010 - 2020).

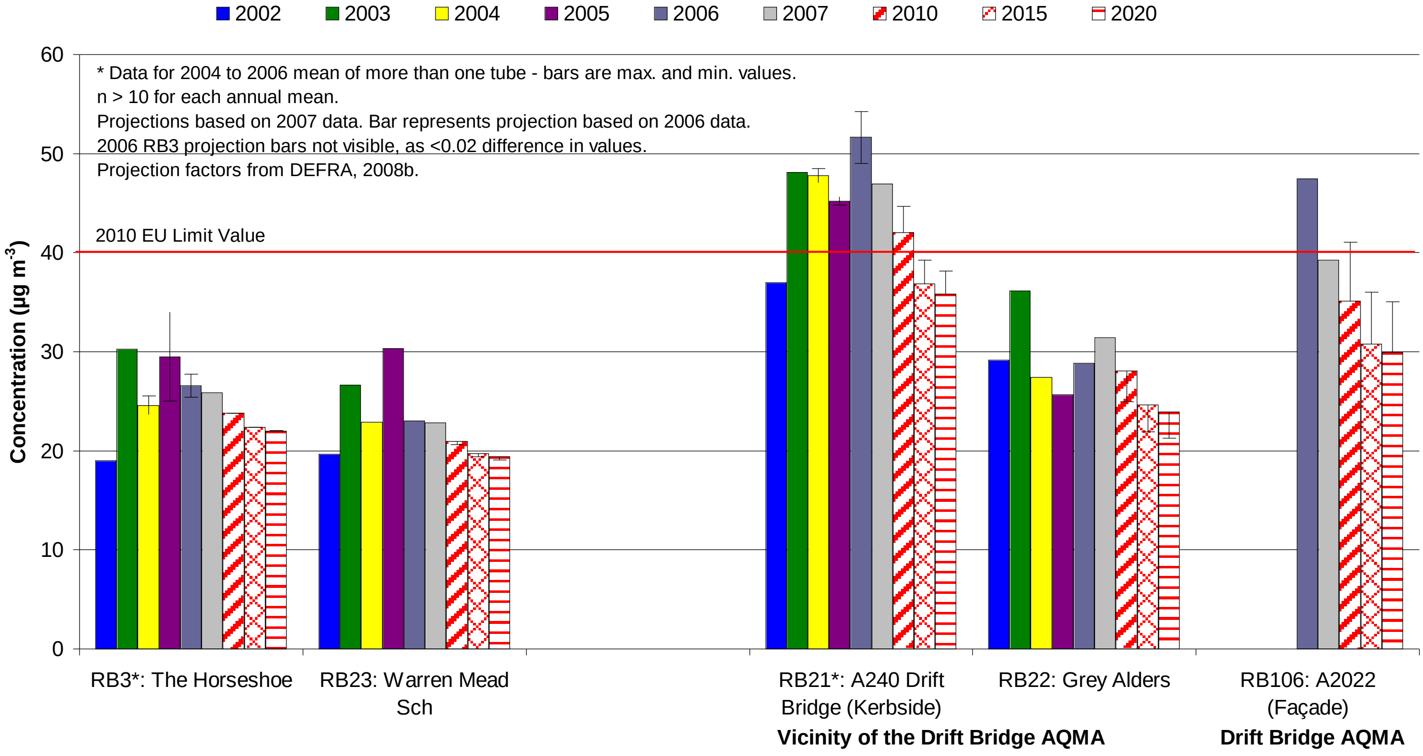


Figure 4.21: Three Year Rolling Mean Nitrogen Dioxide Concentrations: Banstead Background Sites and in the vicinity of the Drift Bridge AQMA.

4.58 Although the overall trend in nitrogen dioxide concentrations in the vicinity of the Drift Bridge AQMA is essentially flat, the volume of road traffic (Figure 4.22) shows a small downward trend. This slight downward trend is not unique, and is seen at two road traffic counters on the A217 (north and south of the M25), although it is not seen on the A23 at Dean Lane, nor on the A23 in Merstham High Street (see below).

4.59 Given the lack of road traffic growth and possibly even a small decline at the Banstead AQMA, coupled with progressively tighter vehicle emissions standards, a fall in nitrogen dioxide concentrations would be expected at this site. However as seen elsewhere in the borough there has been no improvement in air quality in practice, with the kerbside concentrations at Drift Bridge at best unchanged. The most likely explanation for this lack of improvement in air quality, as on Reigate High Street, is an increase in direct nitrogen dioxide emissions resulting from the increasing proportion of diesel vehicles on the roads in this area.

4.3.9 Current AQMA: Merstham High Street (AQMA Order 10)

4.60 The Merstham High Street AQMA (Figure 4.23) was declared on 30th April 2008 following on from the detailed assessment of air quality in Merstham in 2007 (AQC, 2007), which indicated that the annual mean concentration of nitrogen dioxide was likely to breach the UK air quality objective. Monitoring within the AQMA indicates that during 2007 (Figure 4.24) the annual mean air quality objective for nitrogen dioxide at both RB110 and RB124, which are both relevant receptors, was breached thus confirming the dispersion modelling work that lead to the declaration of the AQMA.

4.61 In common with several of the other kerbside and roadside sites across the borough, roadside nitrogen dioxide concentrations in Merstham at RB20 in 2006 were at their highest level since 2003. Elsewhere in Merstham nitrogen dioxide concentrations on Brook Road and Station Road North (Village Hall) continue to meet the UK air quality objectives, although concentrations are slightly elevated compared to the background site in Redhill (RB17) due to the contribution made by the M25 to nitrogen dioxide pollution in Merstham.

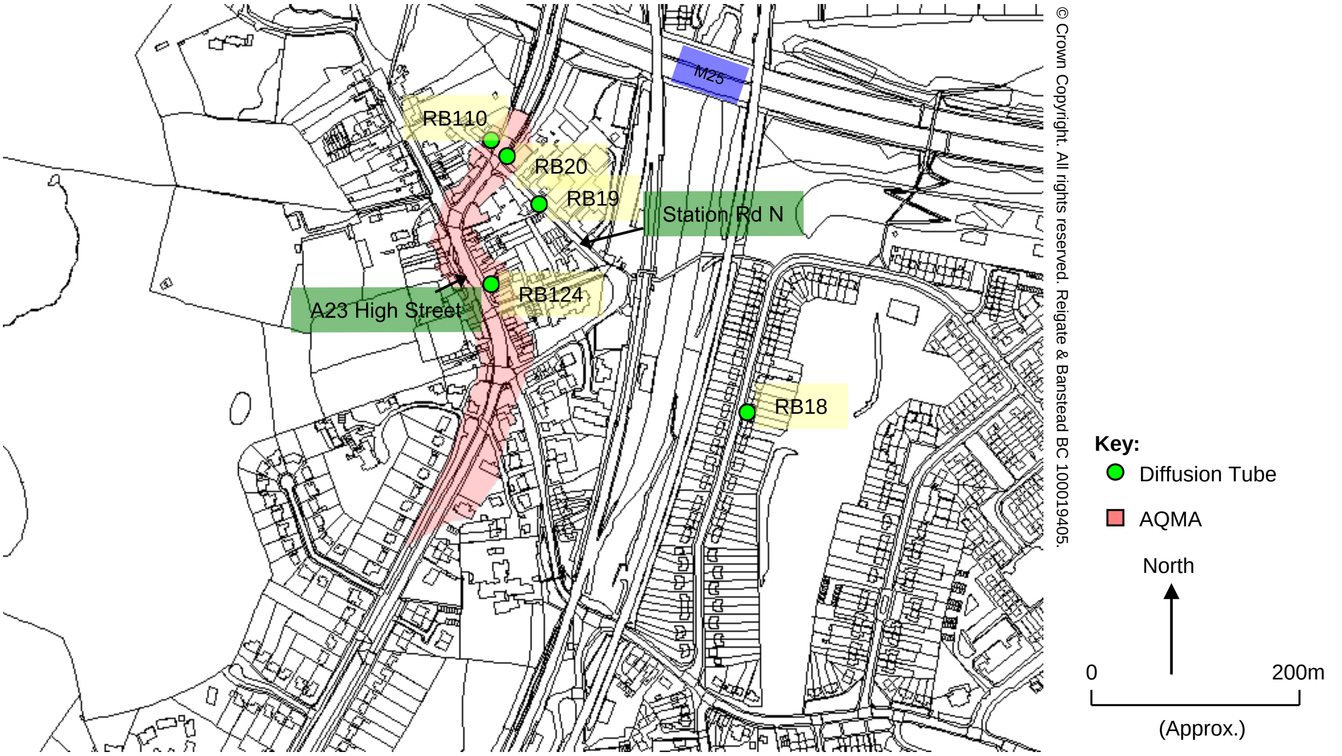


Figure 4.23: A23 Merstham High Street AQMA.

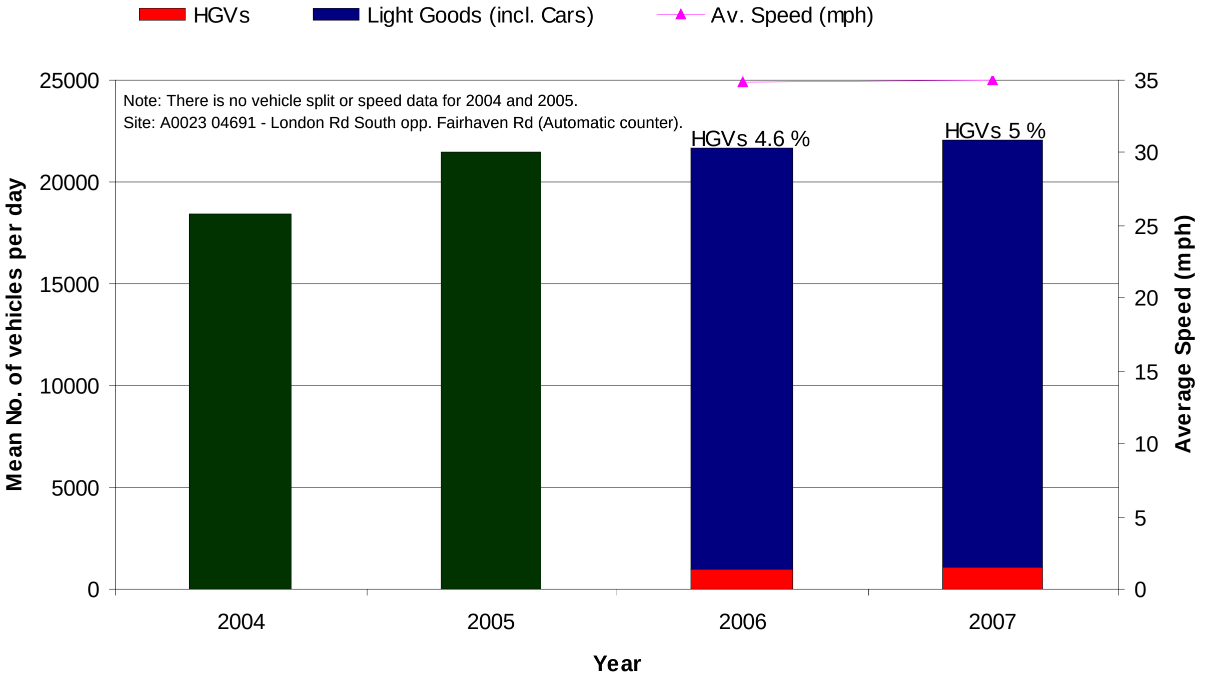


Figure 4.26: Annual Mean Daily Traffic Flow - A23 Merstham.

Figure 4.24: Annual Mean Nitrogen Dioxide Concentrations 2002 to 2007: Redhill Background Site and Merstham (Projected values 2010 - 2020).

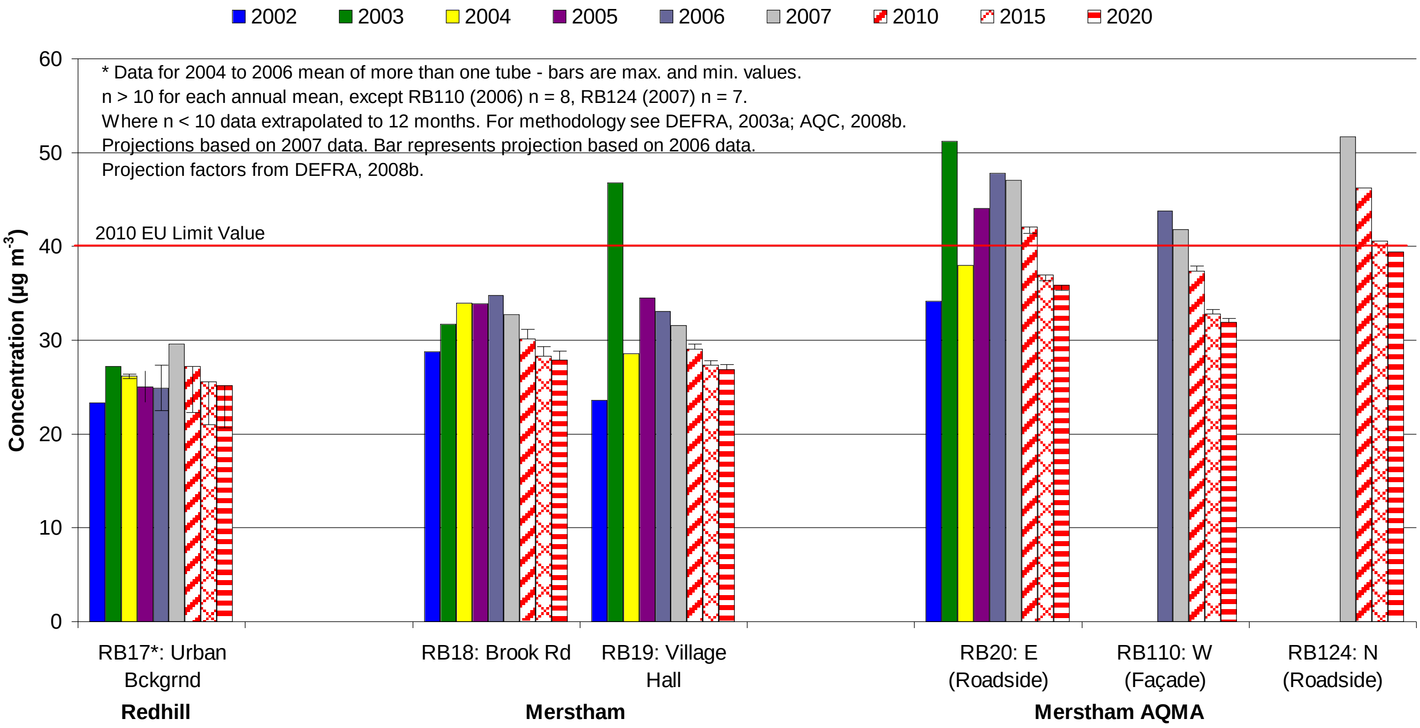
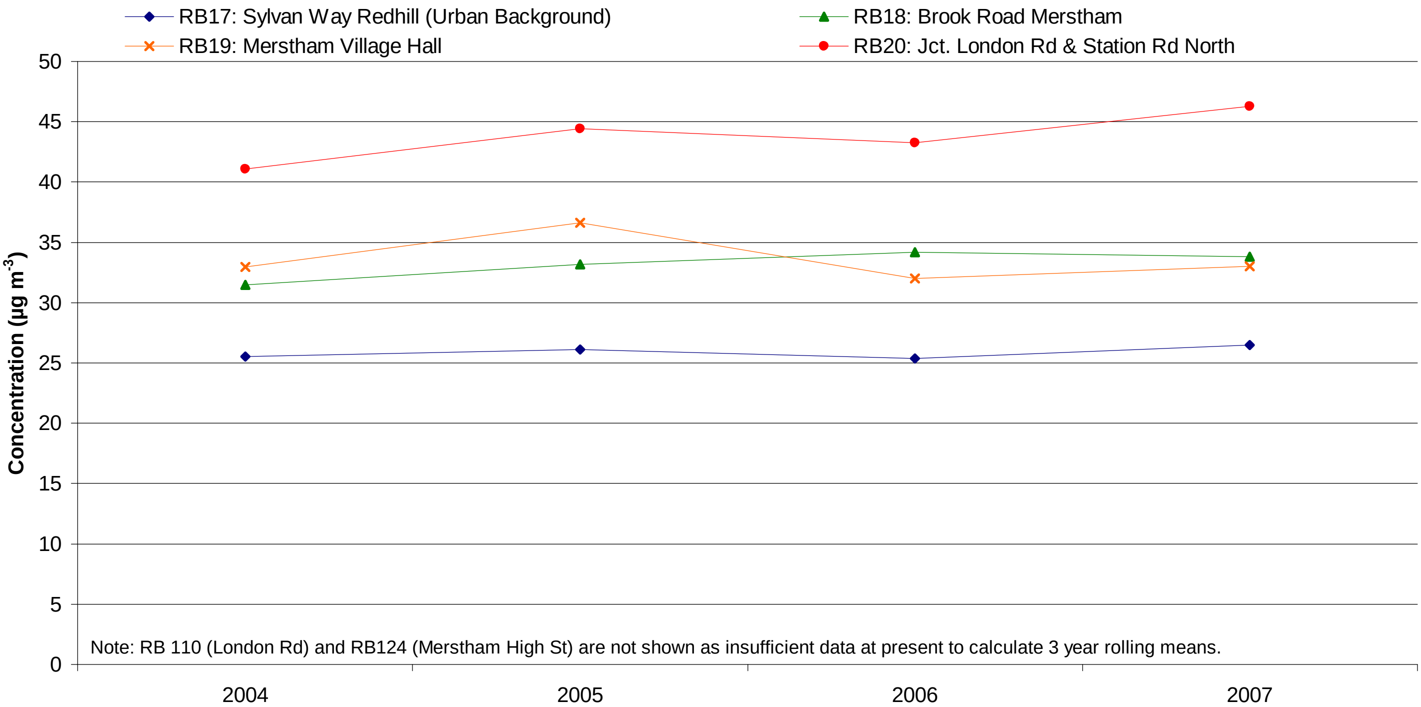


Figure 4.25: Three Year Rolling Mean Nitrogen Dioxide Concentrations: Redhill Background Site and Merstham.



4.62 The overall trend in nitrogen dioxide concentrations (Figure 4.25) is generally flat / possible small upward trend at Brook Road and Merstham Village Hall (Station Road North), and this is also the case at the background site in Redhill. However, at the roadside site (RB20) there is a significant upward trend in nitrogen dioxide concentrations. At the relevant receptors within the AQMA there is currently insufficient data to examine the trends, as the monitoring has not been in place for a sufficient length of time.

4.63 The trend of rising roadside nitrogen dioxide concentrations in Merstham, as elsewhere, is most likely to be due to the increase in direct nitrogen dioxide emissions as a consequence of the increasing proportion of diesel vehicles in the national vehicle fleet. However, it is also worth noting that the volume of traffic on this section of the A23 has increased slightly between 2004 and 2007 (Figure 4.26), compared to the flat / falling traffic volumes on the A217 (2 sites) and A240. This increase is consistent with the increasing traffic seen further north on the A23 at Dean Lane, although the Merstham site lacks the one off drop in traffic volume after 2004 seen at the Dean Lane site (Figure 4.9).

4.64 This rising traffic volume in Merstham could explain why the trend in roadside nitrogen dioxide concentrations shows a definitive increase, rather than the flat / possible increase seen at some other sites where there is no traffic growth or even a decline in the traffic volume.

4.3.10 Current AQMA: M25 (AQMA Order 1)

4.65 The M25 AQMA (Figure 4.27) is located between junctions 7 and 9 of the M25 within the borough boundaries, and consists of a 30 m strip either side of the motorway. The AQMA was declared on 29th April 2002 as the annual mean concentration of nitrogen dioxide was predicted to breach the UK air quality objective in 2005.

4.66 Monitoring takes place at 12 sites along the M25 with all of the tubes located on residential façades, with the exception of RB33 which was moved in November 2004 from a drainpipe on the property to a post at an equal distance from the motorway as the original monitoring location / house.

4.67 The monitoring results (Figure 4.28) indicate that the UK annual mean air quality objective for nitrogen dioxide was met at all monitoring sites in 2007, and was breached at one site (RB30) and possibly RB33 (given the relative imprecision of the diffusion tubes) in 2006.

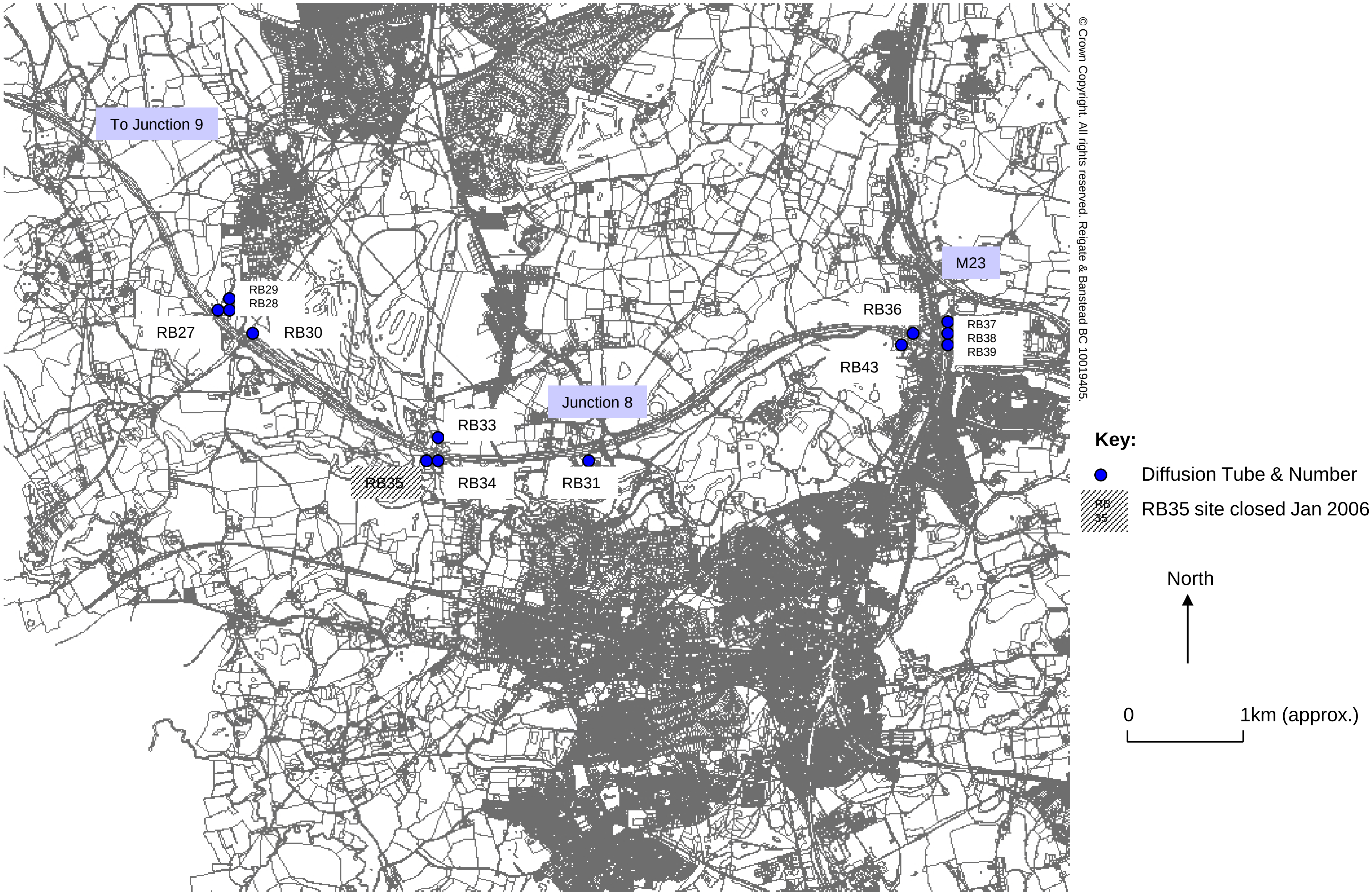


Figure 4.27: Location Map of M25 Diffusion Tubes.

Figure 4.28: Annual Mean Nitrogen Dioxide Concentrations - M25 AQMA (Measured to 2007, Projected 2010 - 2020).

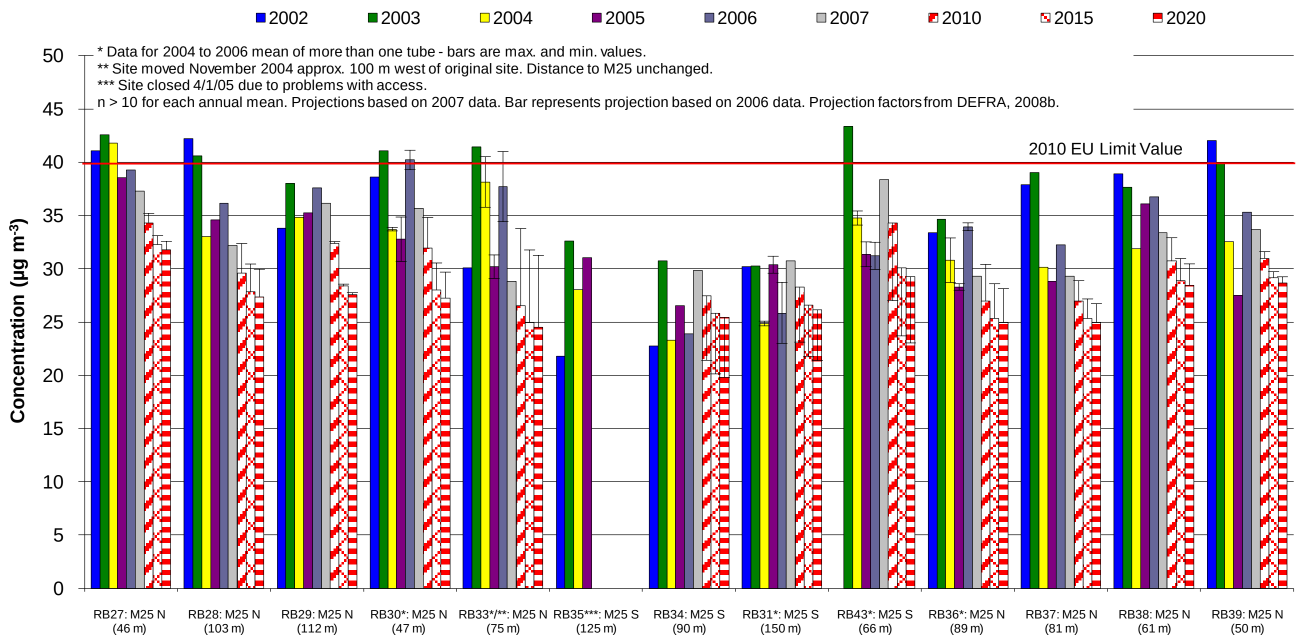
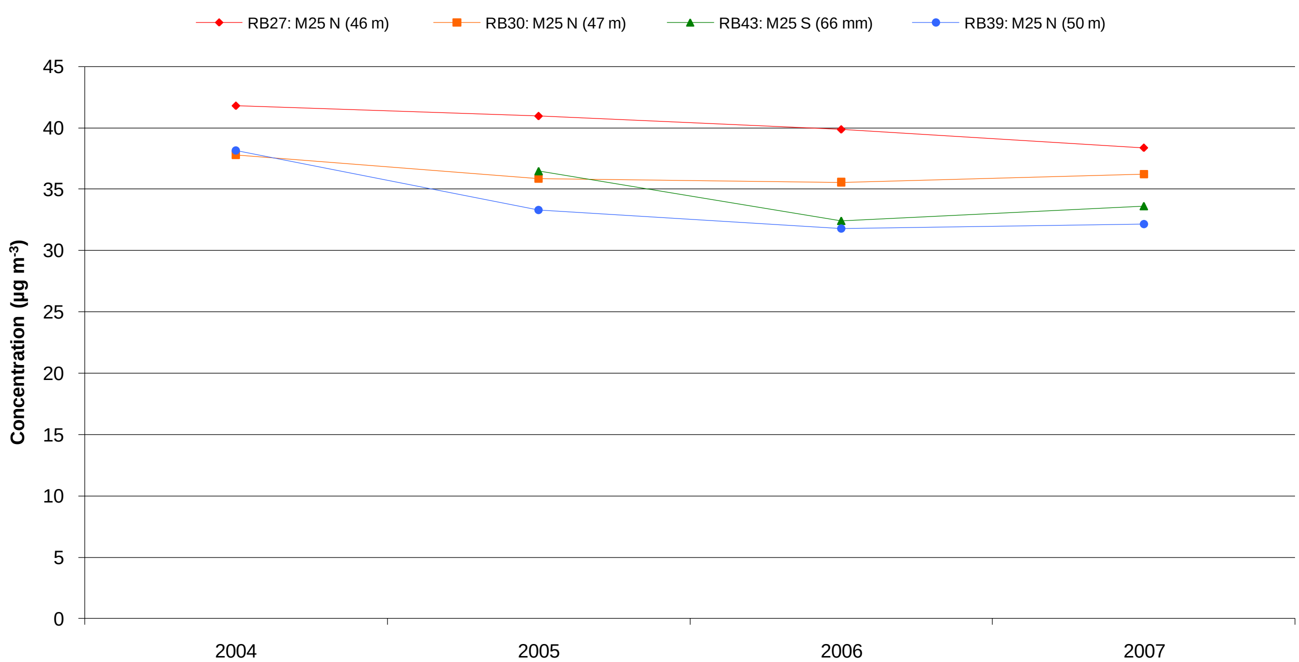


Figure 4.29: Three Year Rolling Mean Nitrogen Dioxide Concentrations within the M25 AQMA.



4.68 Although all of the monitoring sites met the objective in 2007 it is important to note that there is a relevant (worst case) receptor on Ashcombe Road (RB37 to RB39 are a perpendicular transect to the M25 on Ashcombe Road) which is located only 13 m from the edge of the M25, and thus closer to the motorway than any of the current monitoring in this area. Using the 'NO_2 with Distance from Roads Calculator' (Marner, 2008) and the data from RB39[7] the worst case receptor is predicted to have an annual mean NO_2 concentration of 45 µg m^{-3} in 2007.

4.69 However, there is a degree of uncertainty as to the 'true' concentration at this worst case receptor, as the distance between RB39 (the monitoring site) and the worst case receptor at 23 m is greater than the 10 m extrapolation distance recommended by the distance from roads model (Marner, 2008). It is also worth noting that the M25 at this site is in an 8 -10 m high cutting, which may affect pollutant dispersion from the motorway. Nevertheless, it is likely that the annual mean NO_2 concentration was breached at this particular site on the M25 in 2007.

4.70 The other main point of note with the nitrogen dioxide concentrations along the M25 (Figure 4.28) is that while concentrations measured at sites to the north of the motorway in 2006 were higher than in 2007 this was not the case for sites to the south of the motorway, which in 2007 had very high NO_2 concentrations (comparable to those measured in 2003) and much higher than the concentrations measured in 2006. As the elevated concentrations in 2007 compared to 2006 are seen at all three southern sites regardless of distance from the motorway or location, the most likely explanation for this is that there were a greater proportion of winds from a northerly direction in 2007 compared to 2006.

4.71 Based on a three year rolling average (2004 to 2007 - Figure 4.29) the overall trend in nitrogen dioxide concentrations at properties *closest* to the motorway, both north and south, is generally down, particularly at the RB27 site. The other sites analysed (RB30, 43, and 39) also show a downward trend, although by 2007 the trend is flat and possibly beginning to rise. However, this downward trend at the M25 sites does contrast with the trends seen at he roadside sites in Reigate, Merstham, and Banstead where there is largely a flat to upward trend in concentrations between 2004 and 2007.

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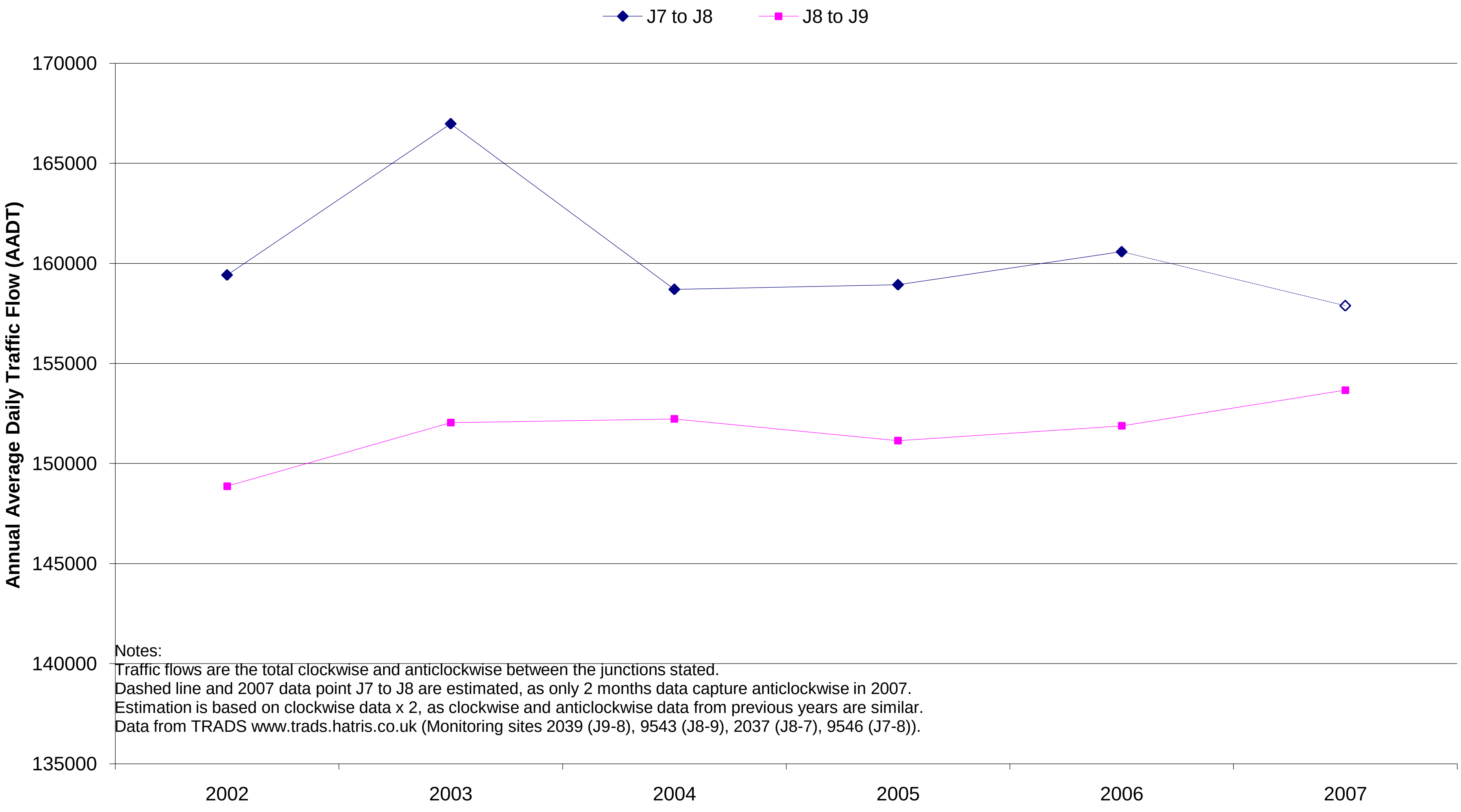
[7] RB39= 34 µg m^{-3} in 2007, 36 m from kerb, worst case receptor 13 m from kerb, background (526500, 155500): 20.3 µg m^{-3} (2005), 19.3 µg m^{-3} (2007).

Figure 4.30: Annual Mean Daily Traffic Flow within the M25 AQMA.



4.72 The overall trend in traffic volume on the M25 is generally upwards, especially between junctions 8 to 9, (Figure 4.30) with the apparent fall in traffic between junctions 7 and 8 in 2007 more likely a reflection of the poor data capture over this period rather than a genuine change in traffic volume. The peak in traffic flow between junctions 7 and 8 in 2003 is unexplained, but is not due to any form of equipment failure.

4.3.11 Current AQMA: Horley near Gatwick Airport (AQMA Order 3)

4.73 The Horley AQMA was declared on 29th April 2002 and essentially covers the Horley Gardens Estate located to the NE of Gatwick Airport (Figure 4.31). Monitoring takes place at a number of points within the AQMA primarily using diffusion tubes to determine the spatial extent of the nitrogen dioxide concentrations across the estate, although there are also two real time monitoring sites RG1 (which is part of the AURN) and RG2 (Figures 4.31 / 4.32). Monitoring is also undertaken by the council at a further site (RG3) located to the SW of the airport in Crawley, which is primarily used for model verification purposes, and further monitoring is undertaken by Gatwick Airport Limited on airport at the LGW3 site located almost directly under the NE end of the runway.

4.74 The real time sites RG1 and RG2 are 550 m apart and as might be expected the NO_x and NO_2 concentrations between the sites correlate reasonably well with one another. In general the RG1 data is able to 'explain' 77 % of the variance in the hourly mean NO_2 concentrations at RG2 (Appendix C). As might be expected the correlation between RG3 and RG1 and 2 is much lower, with the RG3 data able to account for 17 % of the variance in the RG2 hourly mean NO_2 concentration and 28 % of the variance in the RG1 data. This lower correlation reflects the fact that airport emissions have a much larger impact on RG2 than RG1, and as the main wind direction leading to elevated pollution concentrations at RG3 is very different to that at RG1 and RG2.

4.75 The monitoring results from the diffusion tubes to date (2003 to 2007) are shown in Figures 4.33 to 4.37 and summarised in Appendix B, while the current modelling results for 2010 (based on 38 million passengers per annum using the airport) are shown in Figure 4.38.

4.76 The monitoring results clearly show the elevated concentrations in 2003 which were seen at monitoring sites across the borough, but since 2003 there has only been a single monitored breach of the annual mean UK air quality objective for nitrogen dioxide, which was recorded in 2006 when concentrations reached 41 µg m^{-3}.

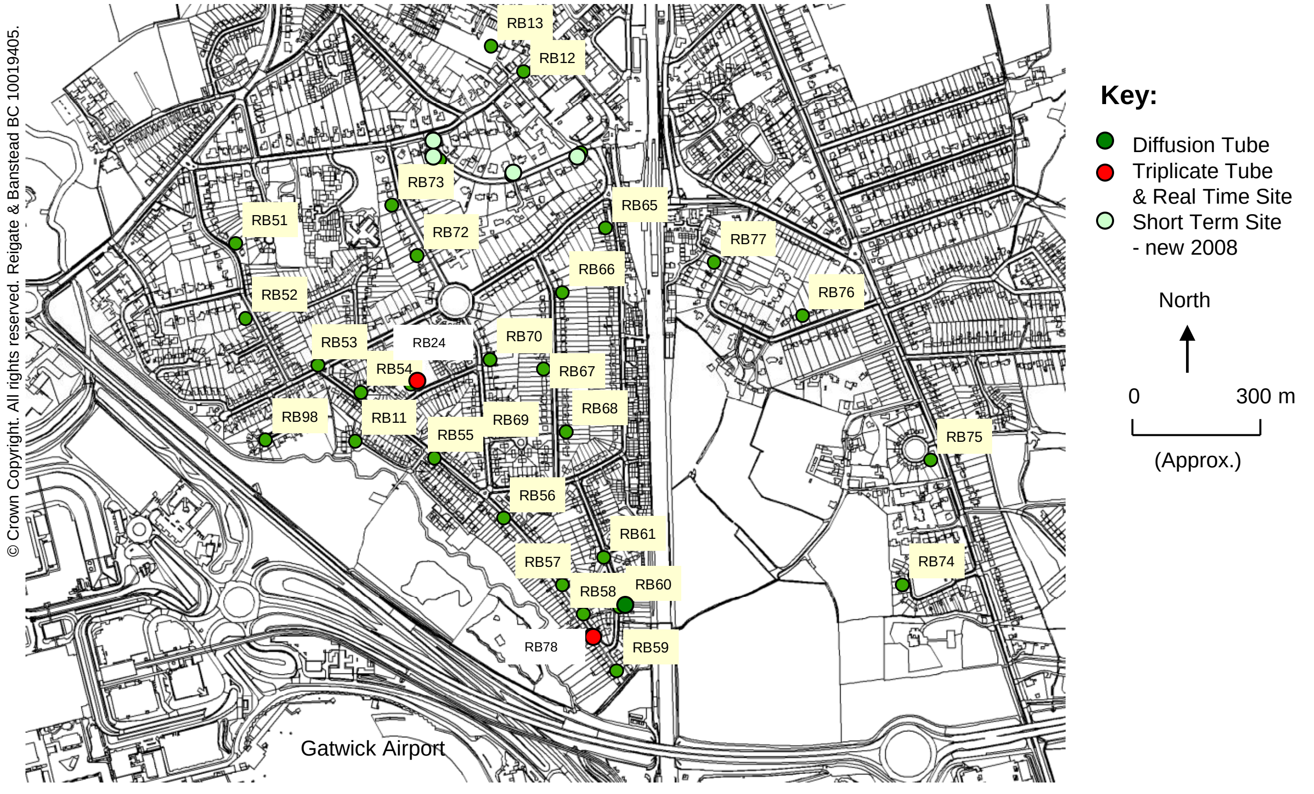


Figure 4.31: Location of Diffusion Tubes within Horley.

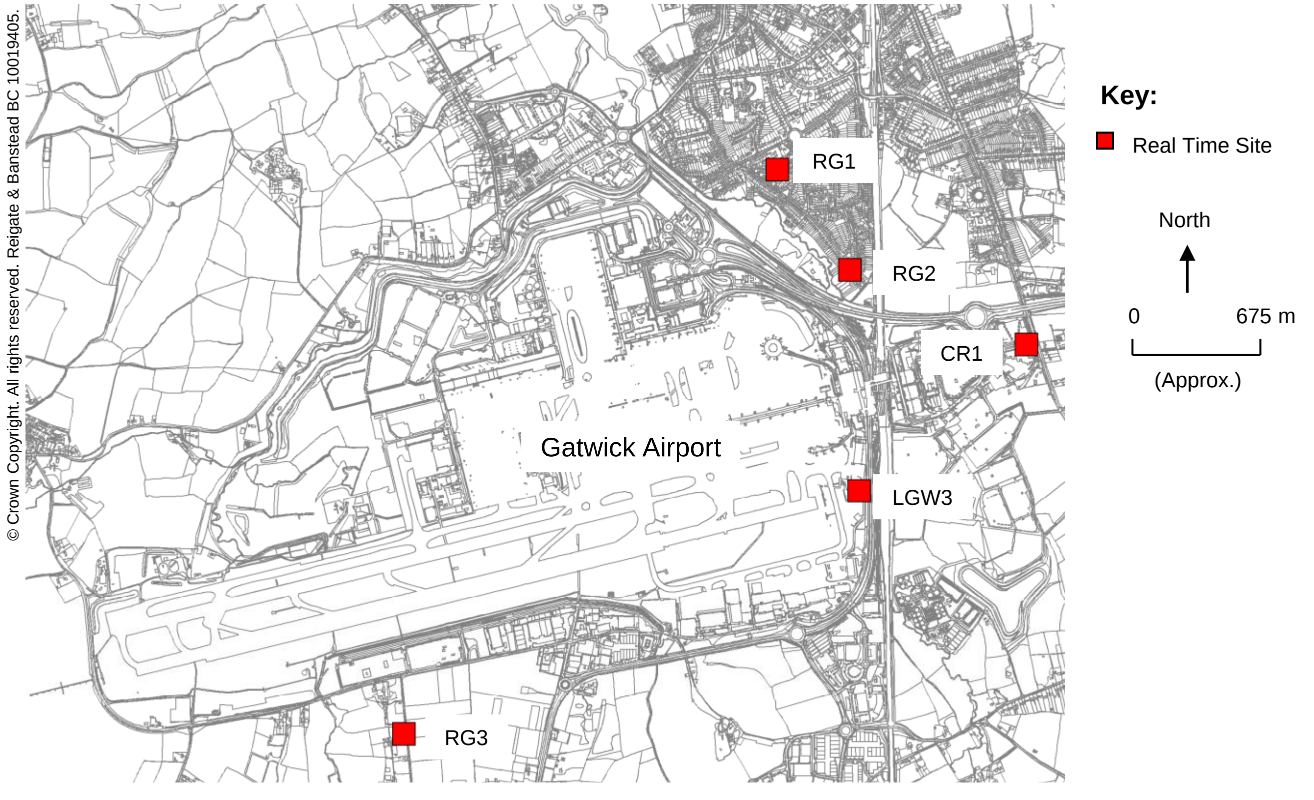


Figure 4.32: Location of Real Time Monitoring around Gatwick Airport.

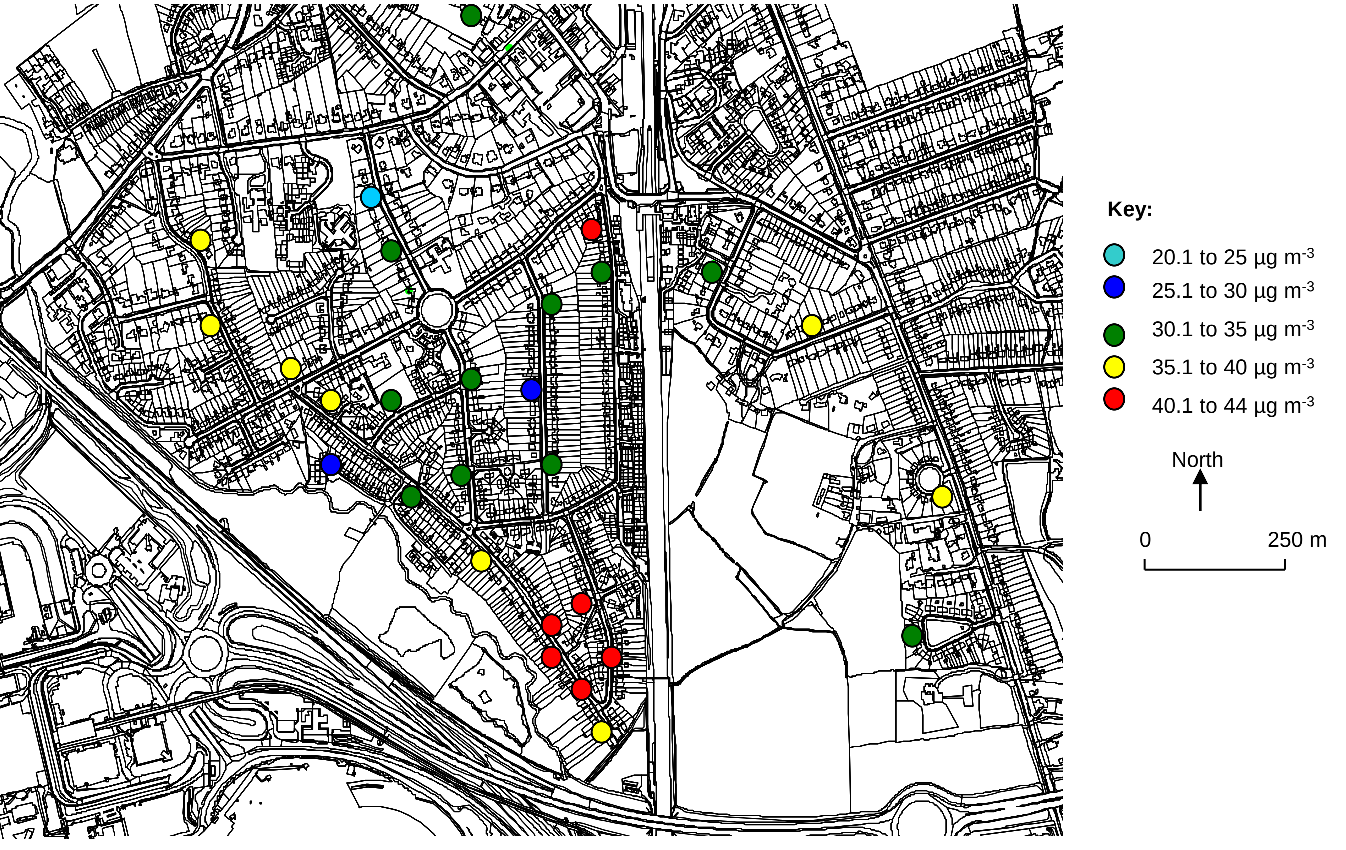


Figure 4.33: 2003 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.29 (n=11), for details see RBBC, 2004.

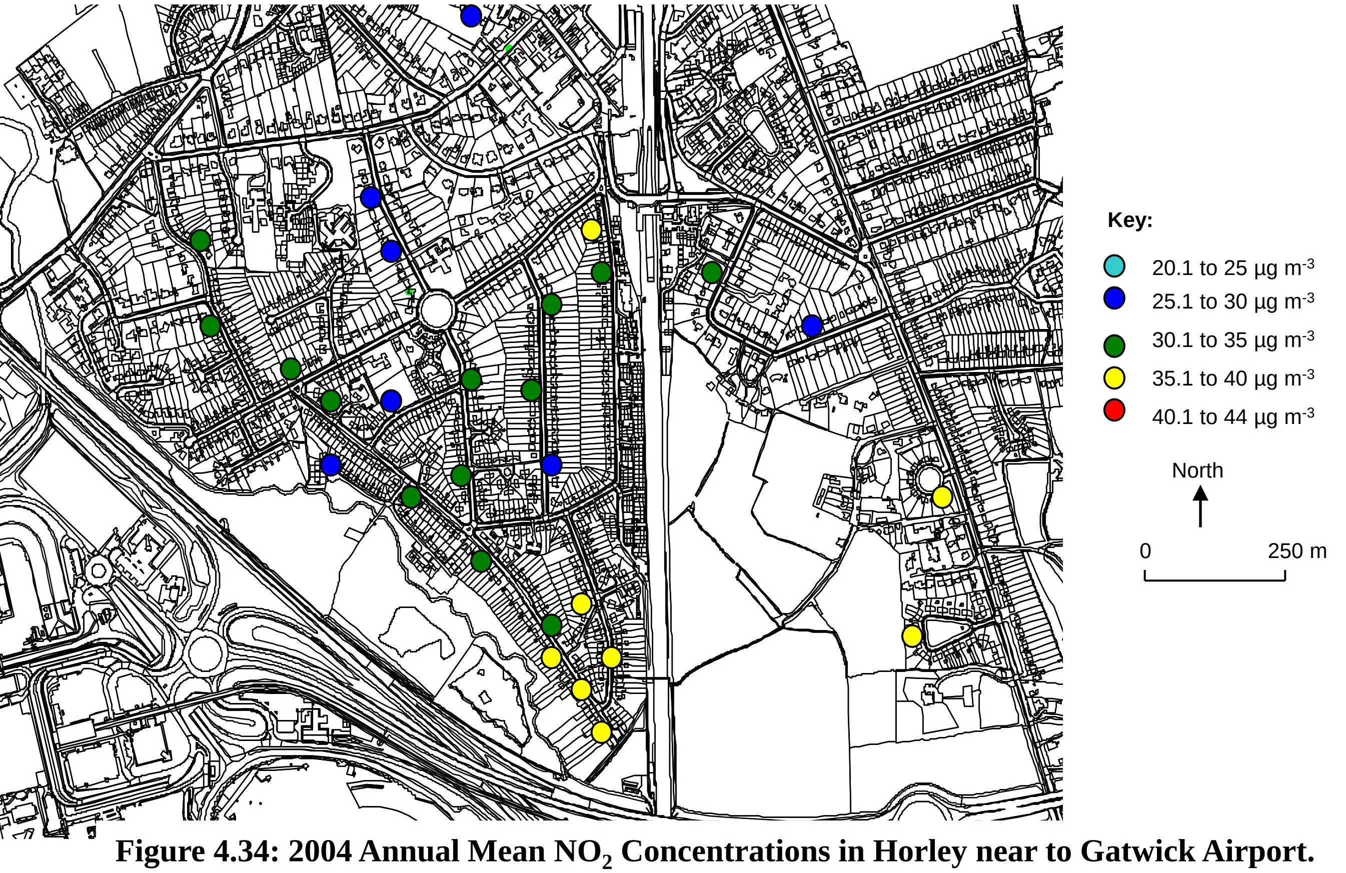


Figure 4.34: 2004 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.32 (n=12).

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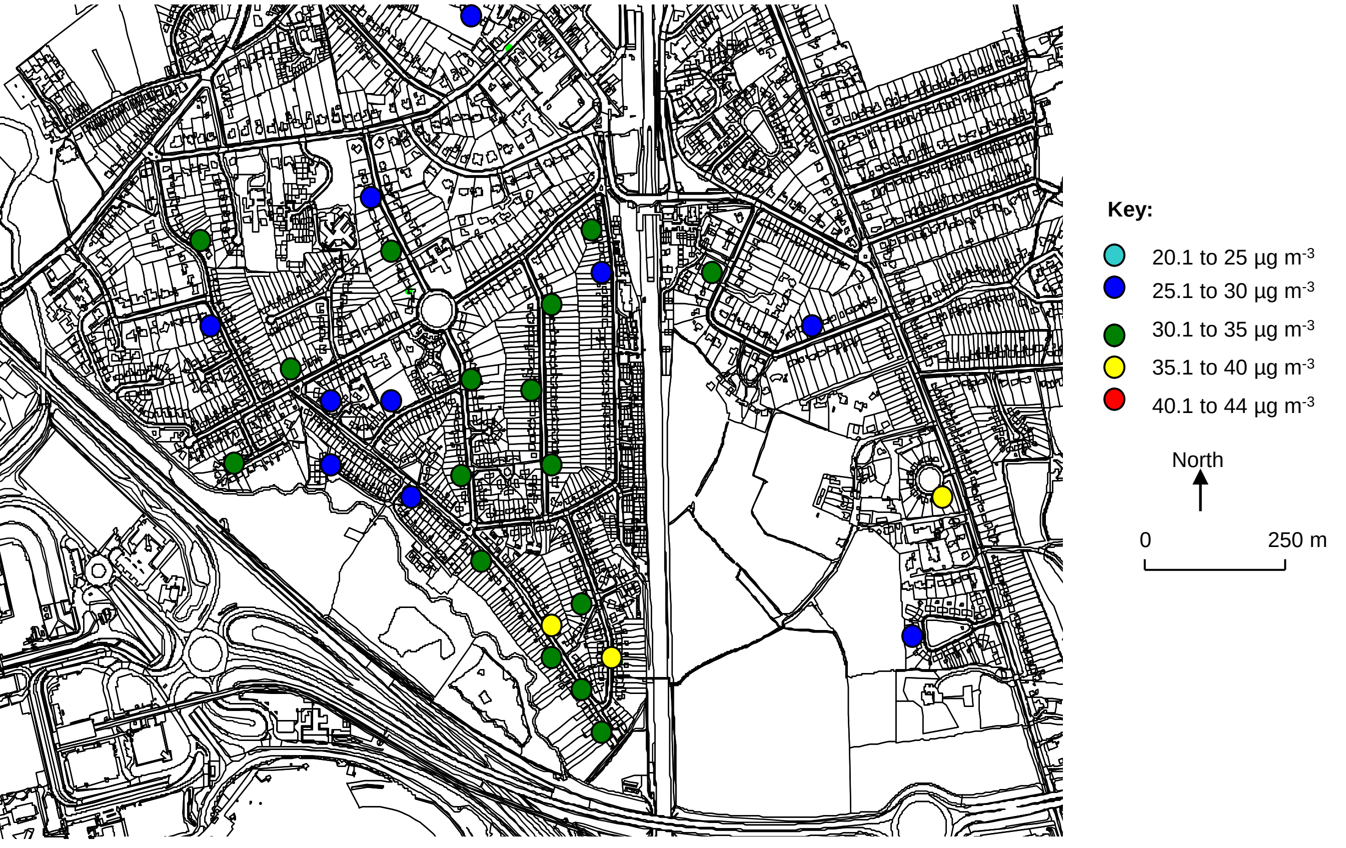

Figure 4.35: 2005 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.35 (n=11).

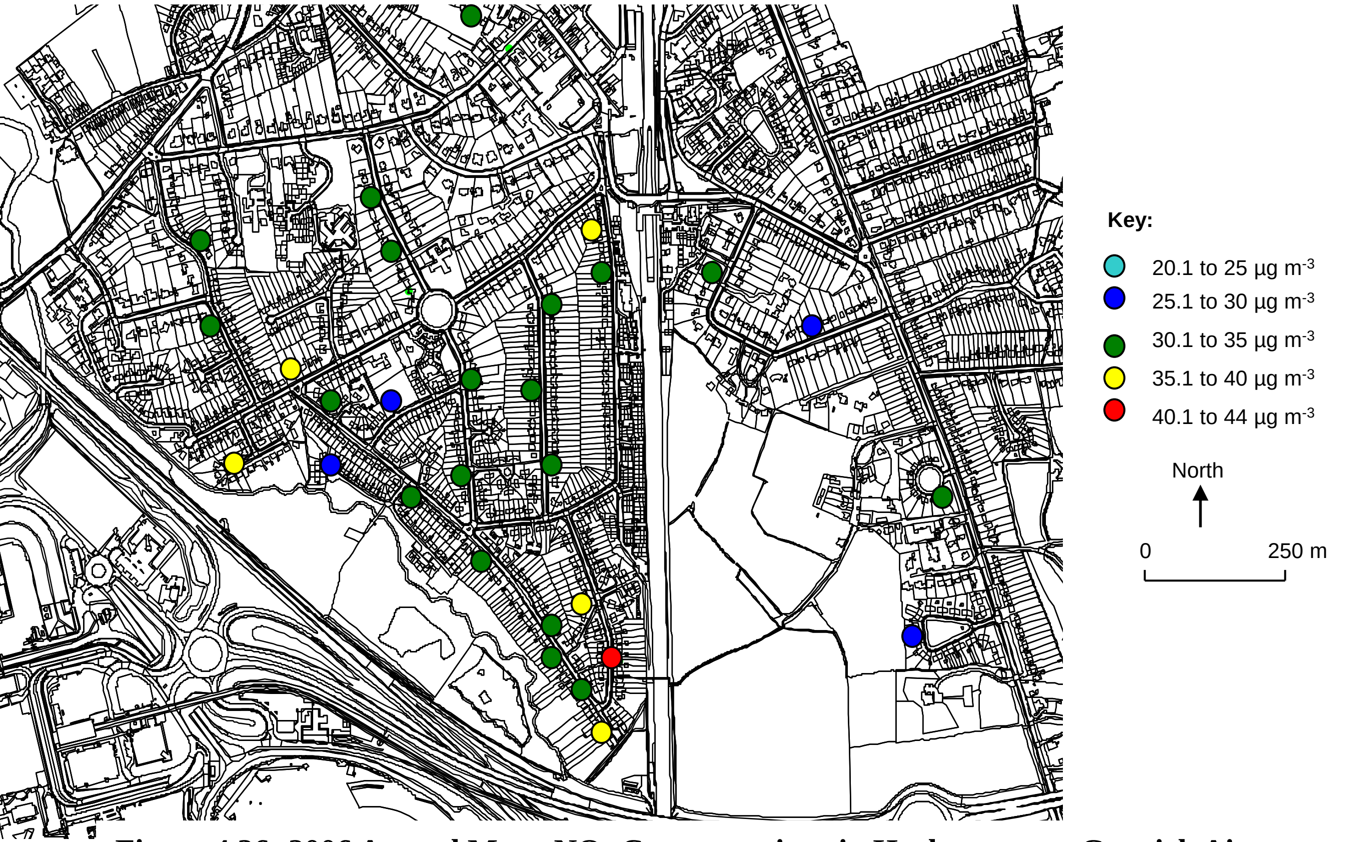

Figure 4.36: 2006 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.45 (n=12).

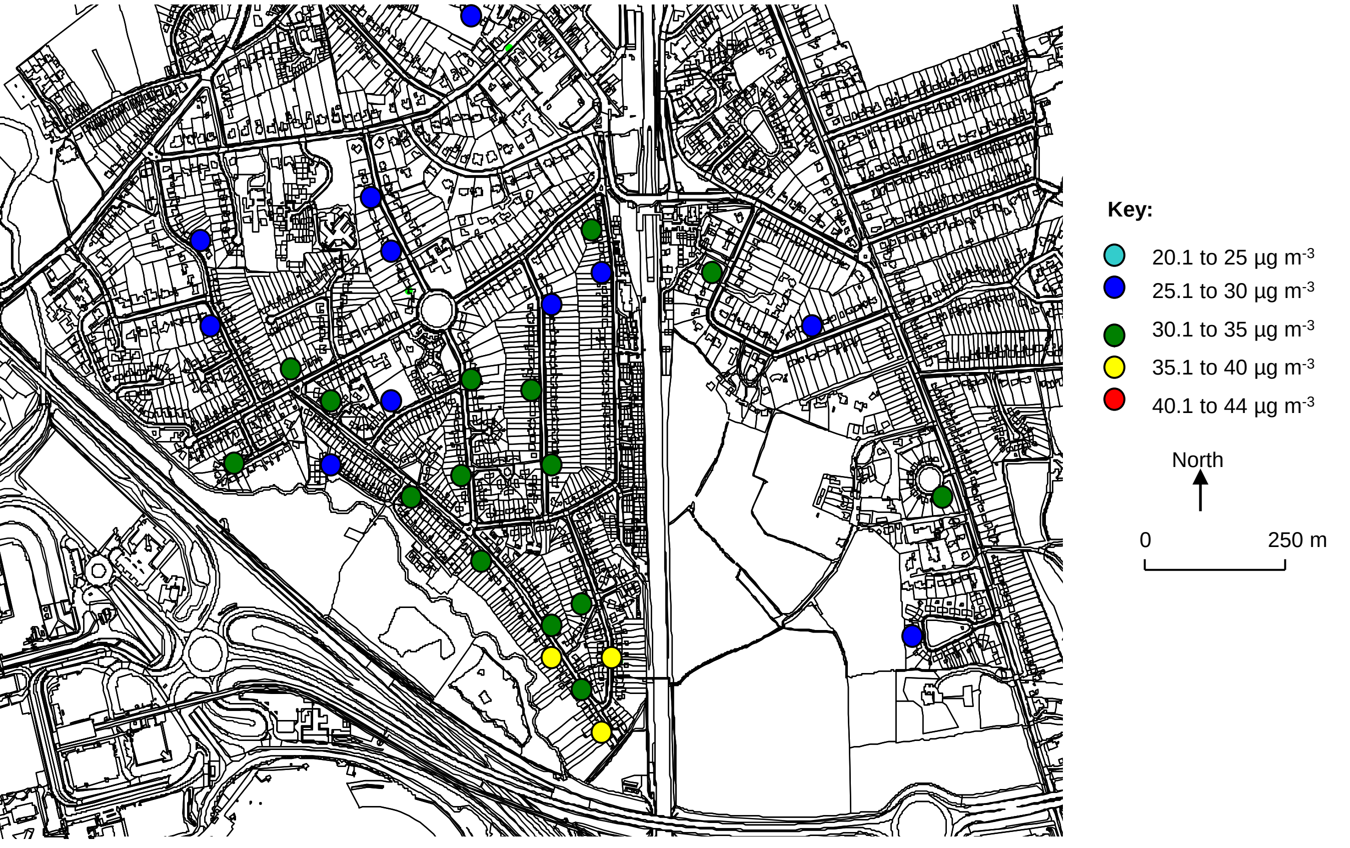

Figure 4.37: 2007 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.
Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.15 (n=12).

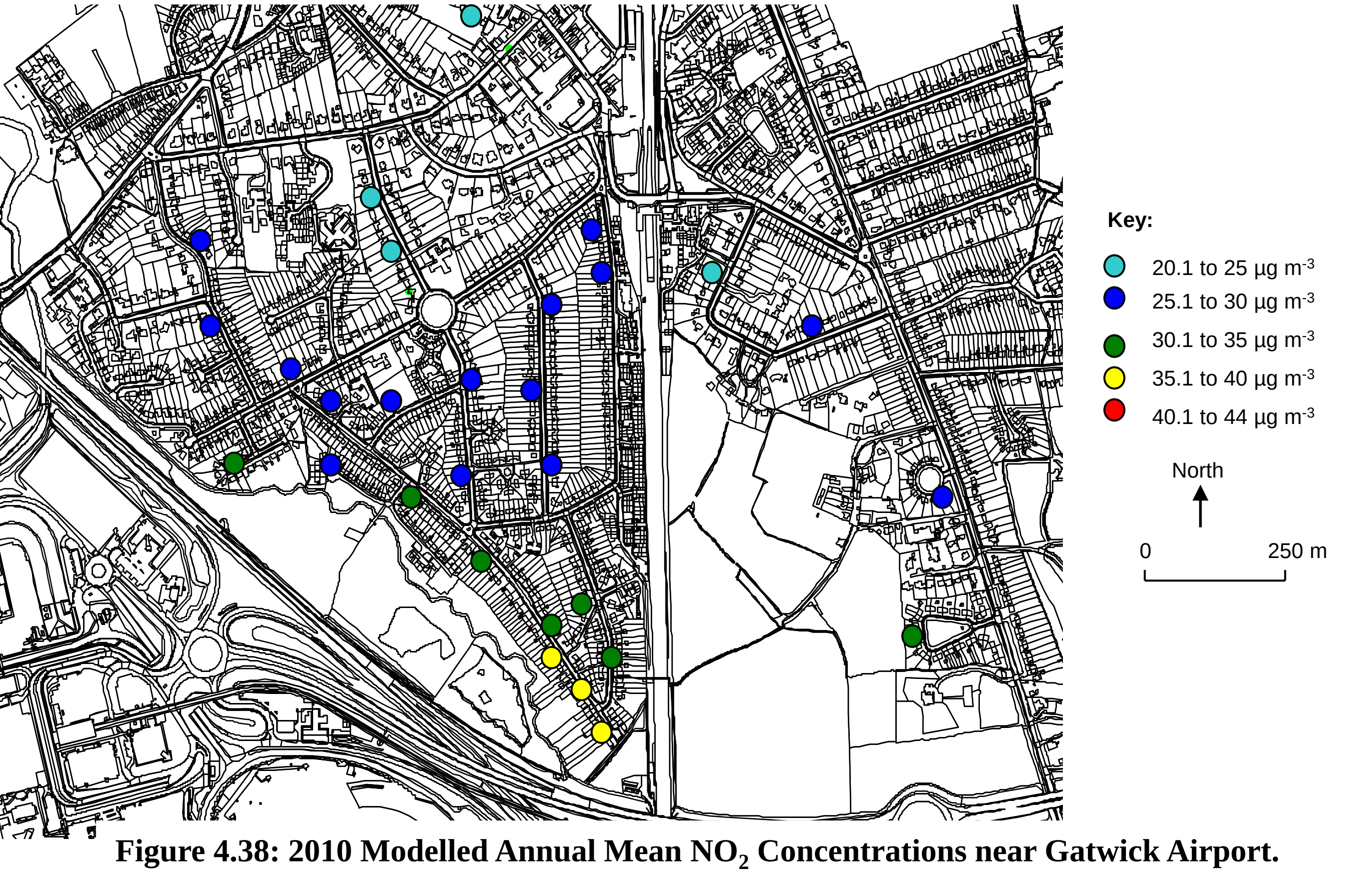

Figure 4.38: 2010 Modelled Annual Mean NO_2 Concentrations near Gatwick Airport.
Modelled values based on scaled 2002/3 dispersion modelling and 2010 Emissions Inventory. For full methodology see NETCEN, 2004.

4.77 However, nitrogen dioxide concentrations at the southern most point of the Horley Gardens Estate have remained consistently high, if below the UK objective, with concentrations up to 39 µg m^{-3} in 2005 and 2007. Thus while the air quality standard is not technically in breach, concentrations consistently remain close to the UK air quality objective.

4.78 The main concern with the Horley Gardens AQMA is that unlike the other air quality management areas where road traffic pollution alone is the cause of the air quality problems, and which is predicted to decline in the longer term, within the Horley AQMA there is also a significant aircraft / airport related component to the pollution problem which is currently forecast to grow in the longer term.

4.79 Dispersion modelling[8] by Gatwick Airport suggests that by 2010 the airport will be responsible for over 50 % of the NO_x pollution at the RG59 site (Figure 4.39b), and while the modelling suggests that the road traffic contribution to NO_x pollution will fall between 2005 and 2010 (Figure 4.39a/b) in real terms, NO_x emissions from the airport and thus the contribution from the airport to the nitrogen dioxide concentrations are predicted to increase in real terms.

4.80 Consequently, any improvement in air quality at the southern end of the Horley Gardens Estate is dependant on the extent to which the predicted falls in road traffic emissions are offset by the predicted rise in emissions from the airport. Thus if the airport grows at a slower rate than predicted the air quality will improve to a greater degree and vice versa.

4.81 To date the overall trend in NO_2 concentrations at RG1 (Figure 4.40 / Table 4.4) is downwards. At RG1 the airport related NO_x emissions make up 25 % of the measured NO_x concentrations, and so with this single site it is difficult to say if the improvements in air quality are the result of reductions in emissions on airport, or have occurred as a result of falls in the background concentrations of NO_x / NO_2, or if the impact is the result of a combination of falls in airport and non airport emissions combined.

4.82 At the RG2 site where the airport is responsible for around 50 % of the NO_x concentrations, there is insufficient data to determine what the overall trend in NO_2 concentrations is, based on the three year rolling mean as there are only two data points. However, if the annual data at RG2 is examined there appears to have been not much change in the last three years, although in this respect RG1 shows a similar pattern.

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[8] See NETCEN (2004) for more details, although a new modelling run should be complete for 2010 by 2009.

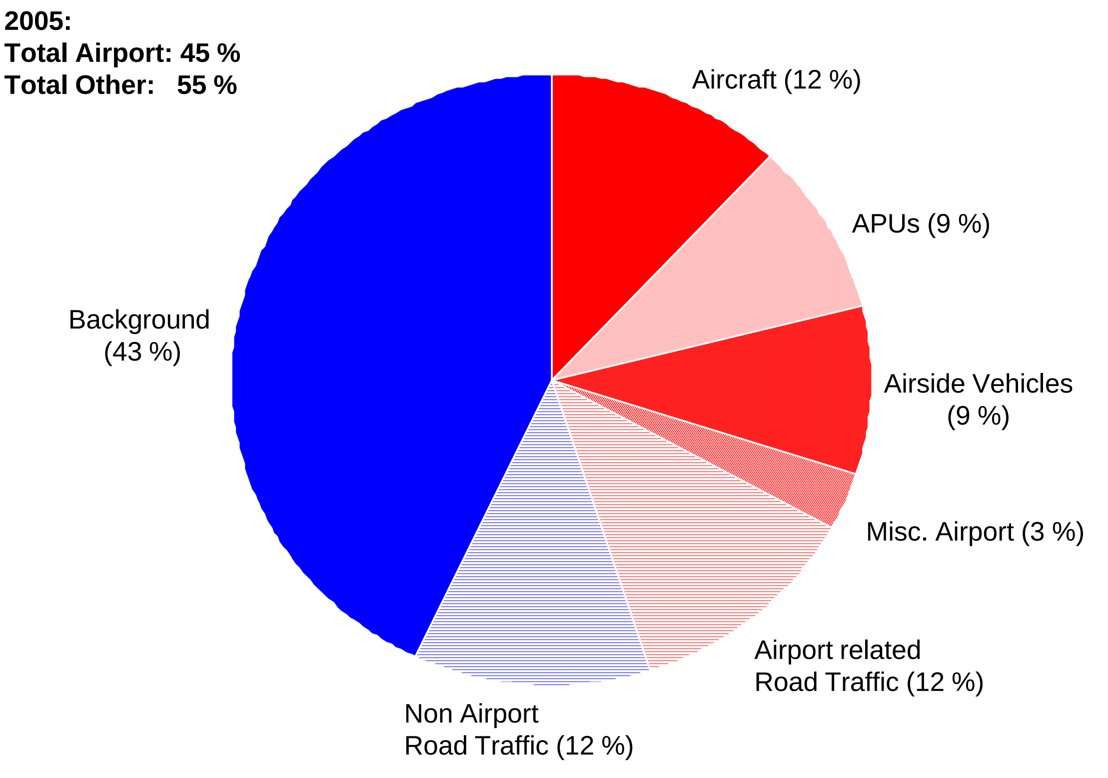


Figure 4.39a: NO_x Contribution by Source to RB59 in 2005 (NO_2 Concentration: 41 µg/m^3).

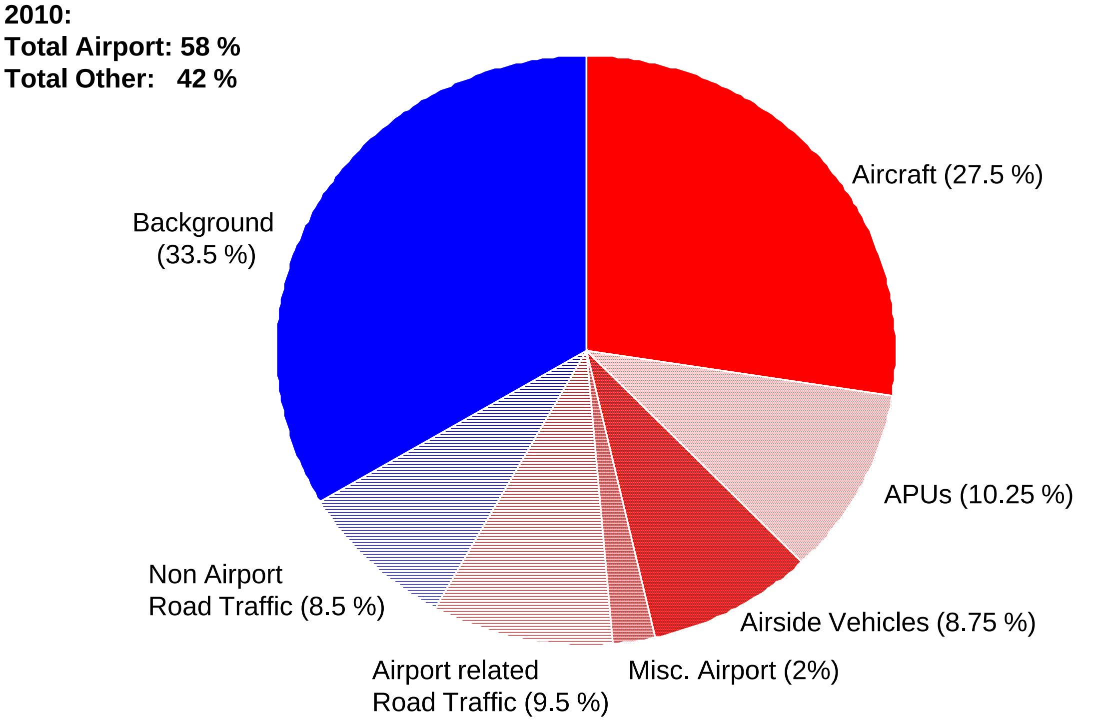


Figure 4.39b: NO_x Contribution by Source to RB59 in 2010 (NO_2 Concentration: 42 µg/m^3).

Figure 4.40: Annual Mean & Three Year Rolling Mean Nitrogen Dioxide Concentrations Horley (RG1, RG2) and Crawley (RG3).

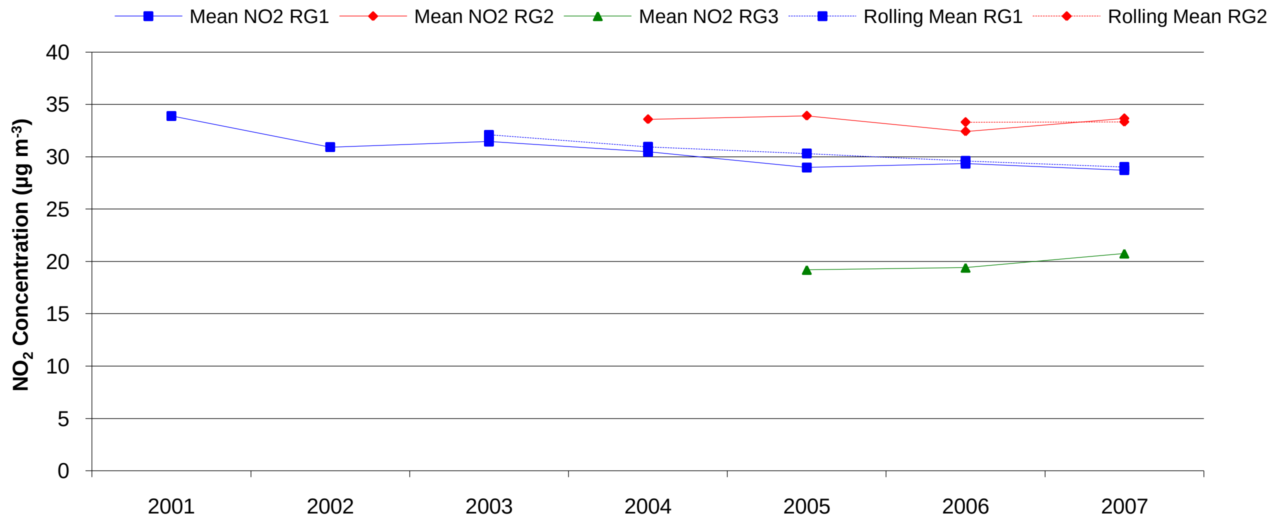


Table 4.4: Historical Annual Mean Nitrogen Dioxide Concentrations and Data Capture Rates RG1, RG2, and RG3.

	RG1		RG2		RG3	
Year	Mean	Data Cap. (%)	Mean	Data Cap. (%)	Mean	Data Cap. (%)
2001	33.9	99.2				
2002	30.9	99.2				
2003	31.5	99.4				
2004	30.5	99.6	33.6	87.7		
2005	29.0	98.0	33.9	96.9	*19.2*	*72.7*
2006	29.3	98.5	32.4	95.9	19.4	97.9
2007	28.7	99.0	33.7	96.2	20.8	98.8

Locations:

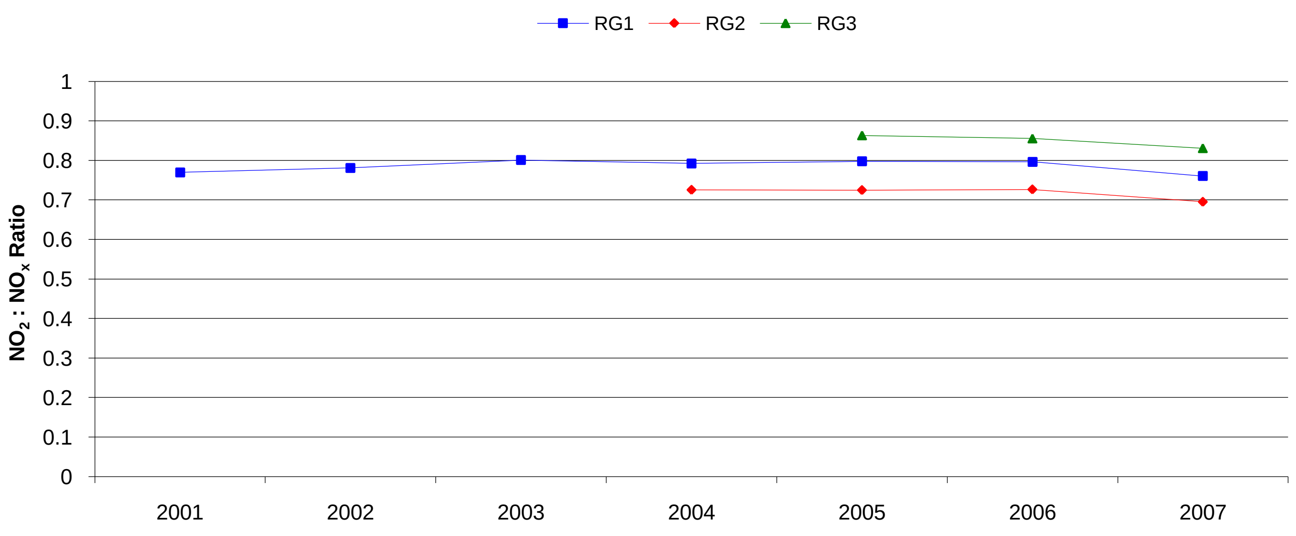
RG1 is located on the Horley Gardens Estate in Michael Crescent (NE of the Airport).

RG2 is located on the Horley Gardens Estate in The Crescent (NE of the Airport).

RG3 is located to the SW of the airport in Poles Lane, Crawley.

Italics indicate annual mean value to be interpreted with caution as data capture rate under 75 %.

Figure 4.41: Annual Mean NO_2 : NO_x Ratio around Gatwick Airport (2001 - 2007).



4.83 The NO_2 : NO_x ratio at the three sites (Figure 4.41) rose slightly at RG1 between 2001 and 2003, but since then has remained fairly constant although with a significant fall in 2007 which is reflected at RG2 and RG3. This fall in the NO_2 : NO_x ratio in 2007 is most likely the result of an increase in NO concentrations in 2007, given the rise in NO_2 concentrations at RG2 and RG3. However, why such an increase occurred is unknown.

4.84 Monitoring at the LGW3 site is undertaken for modelling rather than compliance monitoring purposes, as concentrations measured at this site 'contain' a significant aircraft NO_x component given the site's proximity to the runway, and also a large road traffic component (with easterly winds) given its proximity to the A23.

4.85 The site has been in operation since 1997 and despite some significant falls in NO_x concentrations, including post 2001 (Figure 4.42), the NO_2 concentrations have fallen at a much slower rate as might be expected. There was a dip in NO_2 concentrations in 2004 and 2005, although this coincided with a change in site operator, and when the original operator returned in 2006 concentrations rose slightly. Thus it is difficult to determine if this fall was genuine or an artefact of the servicing.

4.86 Nevertheless both NO_x and NO_2 concentrations have fallen at LGW3 over the past 10 years, with the significant falls in NO_x post 2001 in part due to the fall in passengers at the airport following the events of September that year. Thus the decline in NO_x and NO_2 concentrations at LGW3 is likely to have been due to a combination of a reduction in road traffic emissions and the overall background concentrations of NO_x and NO_2, and the reduction in passenger traffic through the airport (which did not return to 2001 levels until 2005), which resulted in a very different (and cleaner) aircraft fleet operating out of the airport post 2001.

4.87 The concentration of nitrogen dioxide measured on airport in 2006 and 2007 has remained constant at 40 $\mu g\ m^{-3}$, although as noted at RG1, 2 and 3 there appears to have been a significant 'spike' in NO concentrations at LGW3 in 2007, and this is reflected in the NO_x concentration and NO_2 to NO_x ratio (Figure 4.43).

Figure 4.42: Annual Mean and 3 Year Rolling Annual Mean NO_2 and NOx Concentrations at LGW3.

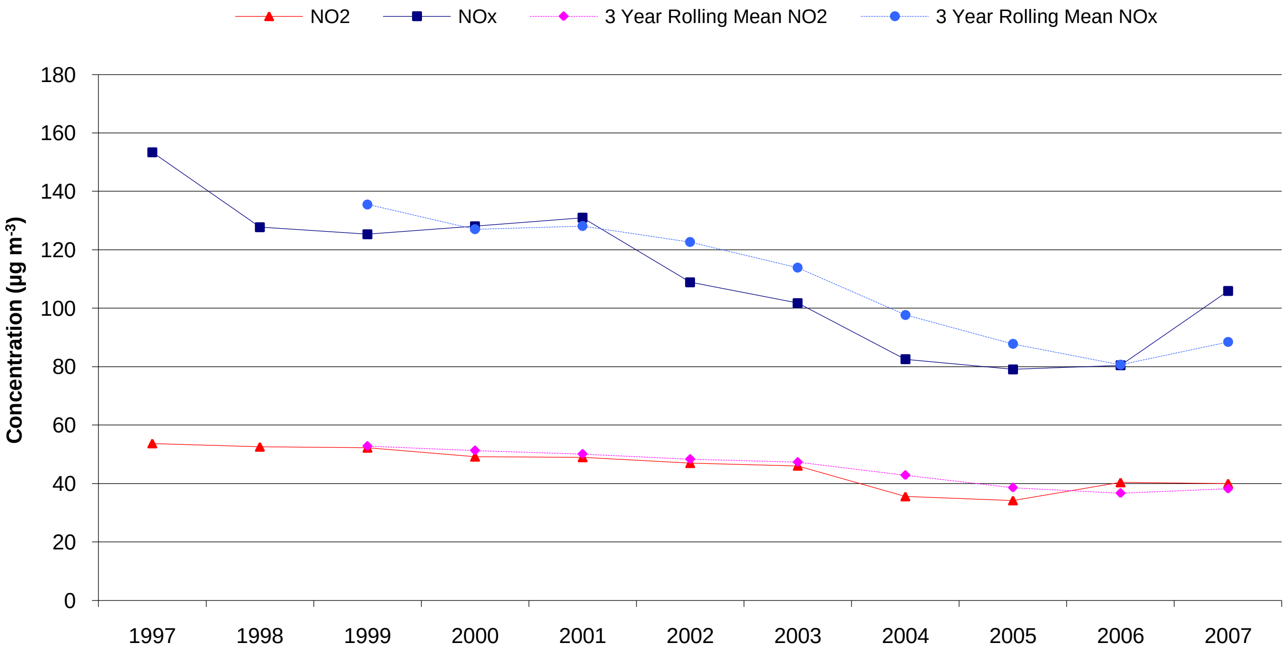
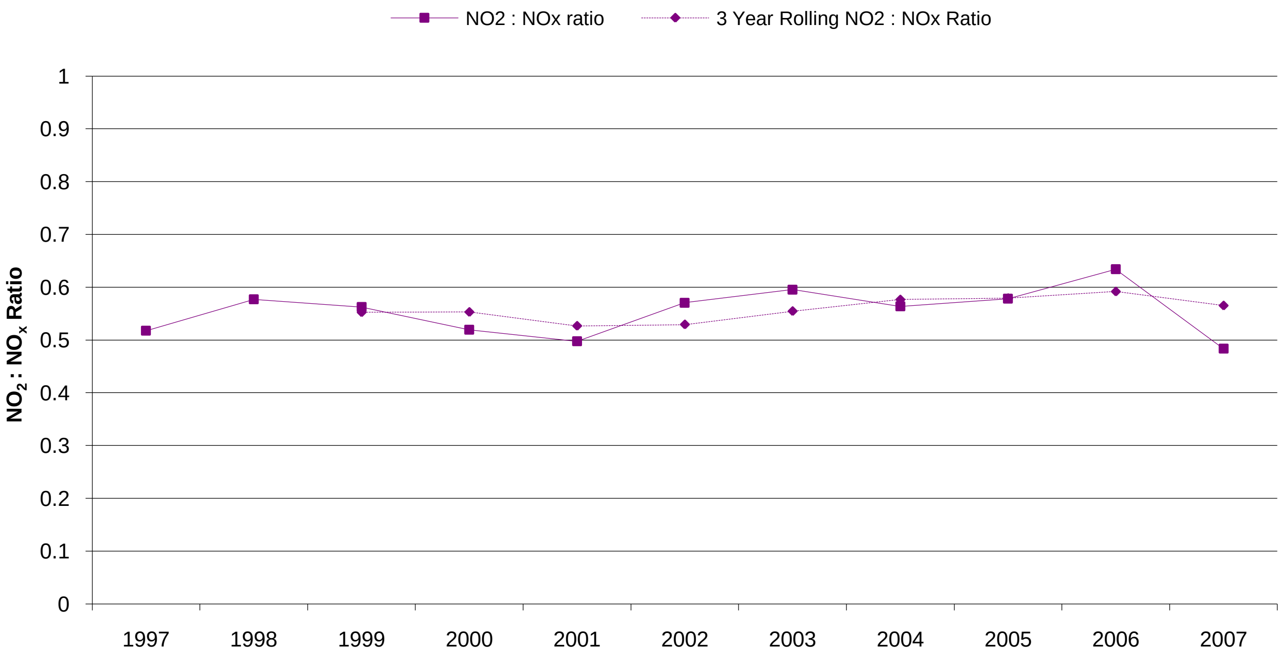


Figure 4.43: Annual Mean and 3 Year Rolling Annual Mean $NO_2 : NO_x$ Ratio at LGW3.



4.4 PM_{10}

4.88 The council monitors PM_{10} concentrations at a single site within the borough, at the RG1 monitoring station in Horley, using an R&P TEOM. The primary purpose of the site is to examine the trend in suburban background PM_{10} concentrations over the longer term, to ensure that residents' exposure to PM_{10} is not increasing with time.

4.89 Although the site is located in the vicinity of Gatwick Airport dispersion modelling suggests that the airport contribution to PM_{10} at this site is less than 1 µg m^{-3} i.e. under 5 %, and so while the site cannot be considered truly representative of typical PM_{10} exposure on suburban housing estates across the borough it is likely to represent a good approximation of typical residential exposure.

4.90 The results from the TEOM (Figure 4.44 / Table 4.5) have simply been multiplied by 1.3, rather than using the volatile correction method, so that comparisons with previous years are possible, as the site is purely for trend analysis rather than compliance monitoring. Nevertheless the results indicate that the annual mean, and the number of days over 50 µg m^{-3}, more than meet the EU limit value for this pollutant (Table 1.1).

4.91 The long term trend in the annual mean PM_{10} concentrations at this site at present is essentially flat with small year to year fluctuations within a narrow band of values, unless there is a significant weather impact as in 2003.

4.92 The main point to note is that 2006 and 2007 have seen the highest *daily* concentrations recorded in the past seven years, with the daily maximum of 94.8 µg m^{-3} occurring on 25/3/07 part of a cluster of days around the end of March / early April 2007 that were over the daily limit value. Although at this stage it is impossible to say if this is the start of a trend or simply part of the natural variation from year to year, the trend in the maximum daily concentration and number of days over 50 µg m^{-3} is as important as the trend in the annual mean given the acute i.e. short term health risks[9] associated with each 10 µg m^{-3} rise in daily PM_{10} concentrations.

[9] The increase in relative risk per 10 µg m^{-3} increase in daily PM_{10} levels varies from study to study. However as a guide there is around a 0.75 % increase in deaths brought forward, and around a 0.8 % increase in risk of admission to hospital for cardiovascular / respiratory problems per 10 µg m^{-3} rise.

Figure 4.44: Annual Mean PM_{10} Concentrations (TEOM x1.3) - Michael Crescent, Horley.

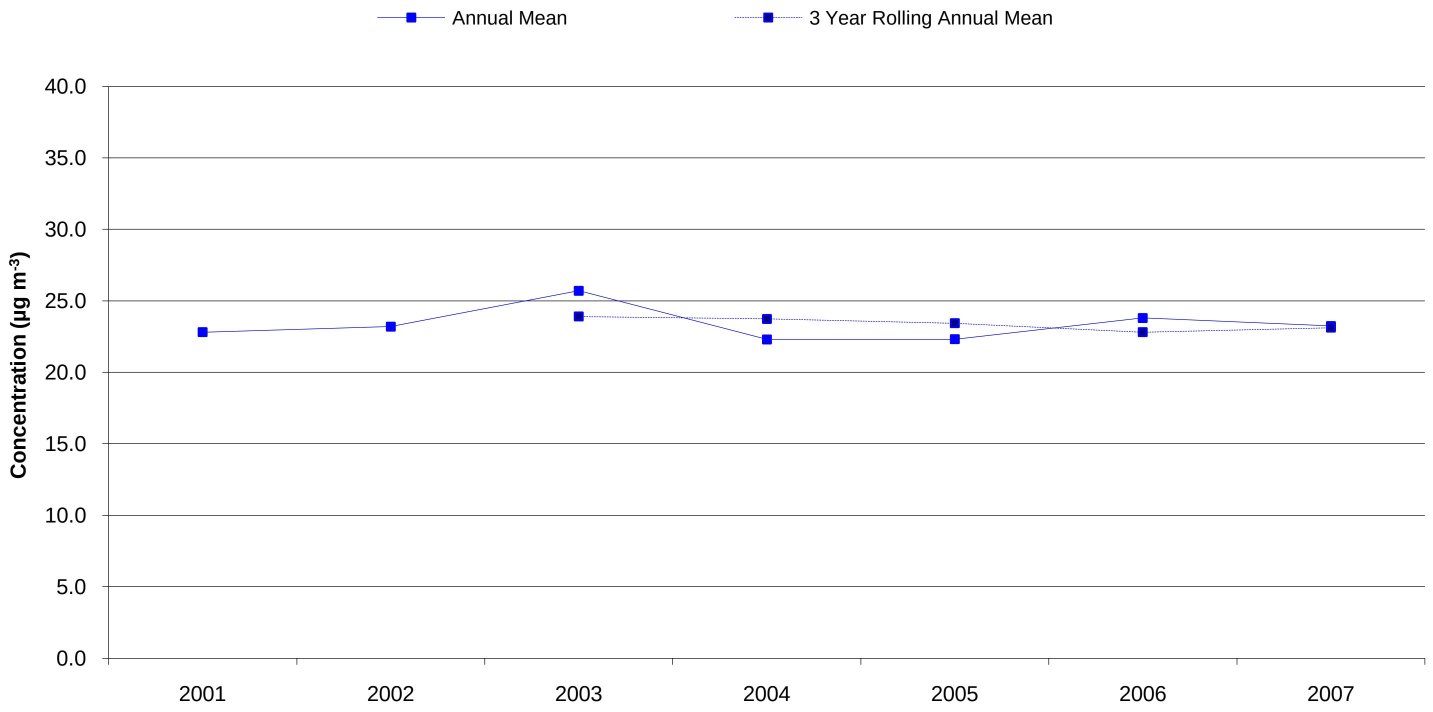


Table 4.5: Historical PM_{10} (TEOM x1.3) Concentrations 2001 to 2007 At Michael Crescent, Horley, Surrey (RG1).

	Annual Mean	Days > 50 µg m-3	Max.	Min.	Median	SD	n (days)	% Data Capture
2001	22.8	6	73.0	8.5	20.4	9.4	364	99.7
2002	23.2	6	63.9	6.8	21.3	8.3	365	100.0
2003	25.7	16	75.8	6.4	21.9	11.4	363	99.5
2004	22.3	0	48.9	7.3	20.3	7.3	366	100.0
2005	22.3	3	52.8	8.3	20.6	7.4	360	98.6
2006	23.8	5	81.3	10.9	21.9	8.8	362	99.2
2007	23.2	9	94.8	7.0	21.1	9.9	365	100.0
Objective	40 (or less)	< 35	-	-	-	-	-	90 +

All values µg m^{-3} unless stated otherwise.

4.5 Non Criteria Pollutants: Ozone

4.93 Ozone (O_3) is a regional pollutant and as such does not fall within the remit of local air quality management. However the UK government does have a national objective (Table 4.6) for ozone in its own air quality strategy (DEFRA, 2007), although this is a policy aim and there is no requirement for the Secretary of State to met this objective.

Objective	To be met by	Measure	Source
100 µg m^{-3} to be exceeded no more than 10 x per annum	2005	8 hr running mean	UK Air Quality Strategy (DEFRA, 2007)
120 µg m^{-3} to be exceeded no more than 25 x per annum	2010	Maximum daily 8 hr running mean	UK Air Quality Standards Regulations / EU Directive 2008/50/EC
120 µg m^{-3} with no exceedences	?*	Maximum daily 8 hr running mean	UK Air Quality Standards Regulations / EU Directive 2008/50/EC*
*The original EU 3rd daughter directive on air quality stated that progress towards meeting this objective should use 2020 as a benchmark. This wording has since been dropped in the 2008/50/EC document.			

Table 4.6: UK / EU Air Quality Objectives for Ozone.

4.94 Although there is no requirement for the council to examine the concentration of ozone with regard to these objectives, ozone is both an important pollutant in its own right from a health perspective, and as the concentration of ozone will in part determine the concentration of nitrogen dioxide within the borough as:

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad \text{(Equation 4.1)}$$

4.95 As nitrogen dioxide is a pollutant of concern within the borough especially in the longer term in the Horley AQMA, and as ozone is likely:

i) to be the only pollutant in the borough where concentrations are high enough on a regular basis to have acute health impacts,

ii) to increase considerably in urban areas over the coming years as NO_x concentrations fall,

the council considered it important that some preliminary data was collected on the trend in ozone concentrations.

4.96 Initially an ozone diffusion tube (Lambeth Scientific) was installed at RB11 in 2003 (Figure 4.31), with the tube changed each month along with the NO_2 diffusion tubes. Although the purpose of the tube was to examine the long term trend in the annual mean concentration of ozone i.e. to act as a watching brief, this approach is limited in that it assumes that the inter year variability in the ozone tubes is constant, which may not necessarily be the case e.g. as with NO_2 diffusion tubes.

4.97 Consequently a real time (Monitor Labs) ozone analyser was installed at the RG3 site in 2005 (Figure 4.32). The aim of this site was:

i) to give a greater degree of certainty to the ozone trend analysis.

ii) to examine ozone concentrations with respect to the ozone air quality standards.

iii) to build up a data base of historical data with a view to being able to forecast ozone concentrations, so that a pollution alert service could be set up across East Surrey given that ozone is the most likely pollutant to cause acute health effects within the borough.

4.98 The results of the monitoring program to date are shown in Table 4.7.

Year	**Annual Mean Concentration (μg m^{-3})**					**Data Capture at RG3**	**No. days 8 hr running mean > 100 μg m^{-3} at RG3**
	RB11 (Diffusion tube)	**n**	**RB100 located at RG3 (Diffusion tube)**	**n**	**RG3 (real time)**		
2003	45	10	-	-	-	-	-
2004	40	10	-	-	-	-	-
2005	32	10	-	-	-	-	> 20[*a]
2006	58	12	-	-	53.7	57 %[*b]	37[*b]
2007	50	12	43	12	44.9	100 %	21
Standard	-	-	-	-	-	90 %[*c]	10

[*a] the ozone analyser had a fault throughout 2005 which meant that it constantly under read the 'true' value. Despite this the UK air quality standard for ozone was still breached.
[*b] the problem with the analyser persisted into 2006, hence the low data capture, and the number of days >100 μg m^{-3} is likely to represent an underestimate of the true value.
[*c] evenly over the year with 75 % data capture in any 8 hour period.

Table 4.7: Annual Mean Ozone Concentrations at RB11 and RG3, and No. of Days where 8 Hour Rolling Mean > 100 μg m^{-3} - 2006 to 2007.

4.99 The monitoring data suggests that the ozone concentrations at RB11 in 2006 and 2007 were the highest annual mean concentrations recorded to date, although this assumes that the year to year variability in the tubes themselves is limited. The real time monitoring data (RG3) also demonstrates that since the installation of the equipment in 2005 that the UK air quality objective for ozone has not been met at the RG3 site, even when the equipment was under reading the ozone concentrations in 2005.

4.100 Given the regional nature of ozone the UK objective is also unlikely to have been met across a relatively large area covering most of the rural areas in the south of the borough and north Crawley.

4.101 The poor data capture at RG3 pre 2007, due to the under reading of the equipment, means that little can be said in terms of the trend in the annual average ozone concentrations. Nevertheless, there does appear to be a good agreement between the co located ozone diffusion tube and the real time monitor, although with only one annual mean it is impossible to say if the agreement between the two represents a genuine agreement of simply a 'one off'. However as monitoring at the site will continue for at least another 8 years a more accurate assessment of the diffusion tube performance will be available for the next progress report in 2010.

5.0 Action Planning

5.1 There are currently a total of nine air quality management areas (AQMAs) within the borough, although not all of the sites have action plans as summarised in Table 5.1.

AQMA	AQMA Order No.	Action Plan Produced	Comments
Dean Lane	5	N	Site meets the UK air quality objective for NO_2, but margin for 'error' means that the site is kept under review. To date the objectives are still being met, but the flat trend in NO_2 concentrations means the revocation of the AQMA will be reconsidered in 2010.
Rushworth Road	4	N	The air quality objectives are being met at this site. AQMA retained as a precautionary measure, as predicted improvements in NO_2 concentrations have not occurred in practice. Revocation of the AQMA will be considered again in 2010.
M23 (South)	2	N	Site meets UK air quality objectives for NO_2, and AQMA is likely to be revoked in 2010 once the environmental impact assessment of the north terminal extension at Gatwick is complete.
M25	1	Y	Plan produced April 2004.
Horley Nr. Gatwick	3	Y	Action plan for non airport sources produced in April 2006. Plan for minimising on airport pollution by BAAG currently at draft version 5 (Sept 2008).
Reigate High Street	9*	Y	Plan produced in draft form June 2008, currently (Sept 2008) circulating internally. Although the plan is currently in draft format some of the initial work has already begun.
Blackhorse Lane	6	Y	Plan produced in draft form June 2008, currently (Sept 2008) circulating internally.
Drift Bridge, Banstead	8	N	Action plan will be produced in due course now that appeal to develop the site has been refused.
Merstham High Street	10	N	AQMA declared in April 2008. Action plan will be produced in due course.
*Formerly AQMA number 7 prior to AQMA extension to include Bell Street, West Street and part of London Road.			

Table 5.1: Summary of AQMAs within the Borough and Action Planning to Date.

5.2 As the M23 AQMA is likely to be revoked and as the Dean Lane and Rushworth Road AQMAs are currently being retained as a precautionary measure, given the absence of the predicted improvements in air quality, an action plan will only be produced for these sites if there is a significant deterioration in air quality that results in a breach of the air quality standard.

5.3 The remaining two sites without an action plan were either declared an AQMA relatively recently (Merstham), or have had planning issues which have delayed the production of the action plan given the uncertainty over how the site would be developed.

5.1 Reigate High Street and Blackhorse Lane AQMAs

5.4 The Blackhorse Lane and Reigate High Street action plans have just been completed, and are currently in an internal review process. However, some preliminary work is already underway to examine the viability of using the traffic management system on the High Street to minimise pollutant concentrations.

5.2 M25 AQMA

5.5 A summary of the measures within the M25 action plan and an update on the current situation is shown in Table 5.2. Aside from the monitoring the majority of the actions within the plan are now complete. As discussed in section 4.3.10 there has been an improvement in air quality within the M25 AQMA but as the main measure suggested by the Highways Agency focused on the eastern end of the AQMA, where the worst case receptor is located, and yet comparable improvements are seen at the western end of the AQMA as well it suggests that much of the improvement in air quality is likely to have occurred regardless of the action plan measures.

5.6 One of the original suggestions put to the Highways Agency in 2003 was for a reduction in the speed limit to 50 mph on this section of the M25, to see if a reduction in speed resulted in a measurable reduction in nitrogen dioxide concentrations in practice. At the time the HA ruled this out saying that speed reductions did not necessarily produce the reduction in air pollution predicted by modelling, quoting from a document on the role of the Highways Agency in Local Air Quality Management (HA, 2003). However, it is worth noting that subsequent work by the Highways Agency (DfT, 2004) has demonstrated that reductions in speed do reduce road traffic emissions in practice, both directly and by minimising flow breakdown which results in less stop / start driving and so lower emissions.

5.7 Although not in the original action plan the Highways Agency are currently installing traffic light controlled access to the M25, known as 'ramp metering', on the anticlockwise on slip at junction 8 which is activated once congestion reaches a certain level on the motorway. While this measure will have no impact on the clockwise traffic flows, such a measure may help reduce congestion at the eastern end of the AQMA near the worst case receptor at RB39. The impact of the proposals on air quality have not been quantified by the Highways Agency, as its focus is on improving traffic flow, but the impact (if any) is likely to be beneficial rather than detrimental at this site.

Table 5.2: Summary of Actions to Date for the M25 Air Quality Management Area.

Action	Responsible	Start Date	Original Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Safety and lane discipline review of J7 M25.	HA	End 2003	April 2004	Information finally received 2nd Quarter 2005	Complete. Conclusion of review is that existing signage and road markings can be improved, with new signage J8 to 7 proposed, along with new road markings.	None.
Improve Signing / Road markings on anticlockwise approach to J7 M25.	HA	April 2004	April 2005 subject to confirmation	Complete Q3 2006.	Signs and markings installed.	Scheme primarily aimed at improving road safety. AQ improvements offered by scheme were not considered likely to have a significant impact, but this was all Highways Agency were proposing. **'Ramp Metering' now being proposed for J8 anticlockwise (see section 5.2).**
Continue with Diffusion Tube Survey.	RBBC (Pollution Team)	June 2002	Dec. 2010 (minimum)	Tube study on going, extended to 2015.	Results to date in this report (section 4.3.10). NO_2 concentrations are falling but at a slower rate than expected.	Many A roads show no improvement in NO_2 concentrations, thus limited improvement on M25 is not unique to motorway. Survey will now continue until at least 2015.
On going review of the Sheffield study into reduced speed limits on M'ways, and practical impact on air quality.	RBBC (Pollution Team)	2003	?	Proposed completion Feb 2005.	At a meeting on 13/4/05 (HA, 2005) it was said that the study was running a 'few months' late. Studies elsewhere e.g. Rotterdam (AQM, 2005) indicate that a fixed speed limit of 50 mph does give a significant reduction in NO_x in practice.	Discussions with Sheffield's AQ team in Q1 2007 (Daly, 2007) indicated they were unaware of HA study. To date (Sept 2008) have yet to see a report or commentary on study. However DfT report on the impact of controlled motorways, indicates that on the M25 speed restrictions do lead to an improvement in air quality (DfT, 2004).
Make central Government aware of the disproportionate emissions from articulated vehicles.	RBBC / HA	2003	on going	Letter sent to DfT 17/3/04. Response 8/4/04.	Response from DfT stated that unlikely that there would be any new measures to address HGV emissions before 2011. No further action taken on this to date.	This is the only way to achieve a significant reduction in NO_x / NO_2 on this section of the motorway, and on UK and EU roads in general. Also one of the most cost effective overall as tackles the problem at source.

HA: Highways Agency; RBBC: Reigate and Banstead Borough Council.

5.3 Horley AQMA

5.8 The action plan for the Horley Air Quality Management Area was divided into two sections, non airport pollution and airport related pollution, as the council has no control over the airside emissions from the airport. The action plan for the non airport pollution sources was produced in April 2006 (Appendix D), and the aim of this plan was to minimise any increase in local road traffic emissions beyond 2010 due to two major new housing developments being built in Horley.

5.9 The plan did not seek to achieve large reductions in non airport sources of pollution, as large improvements in the existing local road transport emissions could relatively easily be negated by small increases in emissions from the airport.

5.10 The action plan for airport derived sources of pollution was due for completion in 2007, although to date (Sept 2008) draft versions of the action plan are still under discussion with the final version now due for completion by December 2008. The airport action plan is also one of a series of commitments contained in a new s106 agreement between the airport and Crawley Borough Council[1], which will effectively enforce the publication and implementation of the airport's air quality action plan.

5.11 The measures and actions to date in the Horley action plan for non airport pollution are summarised in Table 5.3.

[1] Although Crawley Borough Council are the planning authority for the airport, the s106 signatories have a memorandum of understanding with the other local authorities around the airport including Reigate and Banstead.

Measure	Cost[(a)]	Air Quality Improvement [(b)]	Person / organisation responsible	Indicator	Start Date	Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Limit Road Transport Growth to 5.5 % by 2011 from 2004/5 levels. (Annex 9 LTP).	High (3)	c.0.1 µg m^{-3} (2) at RB59[(c)]	SCC (via LTP 6).	For current traffic flows see note 'd' at end of table.	April 2006	April 2011	On going	To date traffic flows are essentially flat in this area, or showing falls.	M23 traffic figures for 2004 indicator have been revised, but this does not impact on trend to date. Traffic on the A217 has risen 1.45 % 2004 to 2007, and fallen 3.4 % on the M23 spur over the same period.
Fastway Route (Horley to Crawley via Gatwick).	High (3)	<0.1 µg m^{-3} (3)	SCC / RBBC/ HTC/ BAAG.	Reduction in peak hour traffic flow.	Jan 2006	April 2011	Initial phase of the works is complete and project on track.	On going	Final stage of the route will be completed once construction of new housing begins.
Fastway Interchange at Horley Station.	High (3)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	April 2006	April 2011	Completed (as of Sept 2008)	Interchange complete	Impact on air quality of this individual project is negligible. However this is one part of a wider project that should help minimise any growth in NO_2 concentrations from the new housing developments in Horley.
Bus Priority Lanes on A23 (p105 5.43 in LTP).	Medium (2)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	Unknown	April 2015	Scheme still under consideration, but limited progress beyond this.	On going	Minimal benefit to air quality within Horley AQMA.
Extension of Fastway to Redhill and Reigate. (LTP2 aspiration).	High (3)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	Unknown	April 2015 (if implemented)	On going	On going	Original plan noted that project may not go ahead. To date there is no information on if the project will / will not go ahead. However, impact of project on worst case receptor is negligible.

Measure	Cost[(a)]	Air Quality Improvement [(b)]	Person / organisation responsible	Indicator	Start Date	Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Maintain current taxi licensing regime.	Low (1)	<0.1 µg m^{-3} (3) at RB59	RBBC Licensing.	Standards relating to Taxis maintained	On going	On going	On going	On going	Current scheme means that entire taxi fleet is replaced every 9 years. Minimal impact on Horley AQMA.
Public Service Agreement to reduce Congestion on the A217 and A23 (Horley Road).	Low (1) (to RBBC)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC/ ODPM. Contact Linden Mendes SCC.	5 % reduction in average vehicle delay by March 2008.	March 2005	March 2008	March 2008	The 5% reduction target was met, but due to traffic signal changes alone, and not signal changes and greater car sharing combined as originally intended.	Project had no bearing on Horley AQMA. Intention was to note reasons for success / failure of project, and bear these in mind – if appropriate – for future reference if congestion becomes a problem within the Horley AQMA. The results suggest that there is still scope for improvements in traffic flows based on the timings of traffic signals.
Travel Plans (Work).	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	RBBC / Local employers Contact Tim Dukes (SCC).	4 to 5 plans to be completed per annum.	On going	On going	On going	On going	As most major employers in Horley had a travel plan in place impact on AQMA itself was limited. Preliminary work is now beginning on the feasibility of a Horley wide travel plan i.e. examining travel for the whole town rather than on an individual employer / school level.
Travel Plans (Schools) (LTP indicator TP3).	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	SCC (Richard Peplow).	All Horley Primary and Secondary schools have, and have implemented, a travel plan.	On going	December 2010.	On going and currently on target.	Note impact from this scheme on concentrations within the AQMA is very limited.	Proposals to now look at travel planning for the whole town, rather than on the individual employer / school level.
Continued Promotion of Surrey Car Share.	Low (1) (to RBBC)	<0.1 µg m^{-3} (3) at RB59	Contact at RBBC – Raymond Dill Policy & Regeneration.	Steady Growth in number of participants. (1300 users at start of 2006).	On going	On going	On going but still only around 1300 users (1286 at end of 2007).	Limited promotion of scheme to date, but new 'push' due to start shortly.	Measurable improvements in air quality unlikely in the short term, minimal if any impact on air quality within the AQMA.
Implementation of Council Travel Plan.	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	RBBC Raymond Dill Policy & Regeneration.	Implementation of plan.	Jan 2006	Implemented end 2008	Main implementation stage is now July 2009.	On going	Implementation allows council to encourage other employers to implement their own plans, with possible benefits for Horley, especially with airport travel plan.

Measure	Cost[a]	Air Quality Improvement [b]	Person / organisation responsible	Indicator	Start Date	Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Incorporation of Sustainable energy policy into local development framework document.	Low (1) to RBBC, possibly Medium (2) to High (3) to developers.	Variable, depending on scheme.	RBBC Policy & Regeneration Raymond Dill.	Incorporation of policy	Current	Jan 2007	Complete.	Document now included.	Benefit to Horley AQMA marginal in short term. However, may help reduce growth in background NO_2 concentrations from new developments in area, which would be of benefit.
Horley Design Guide: - Low NO_x boilers.	Low (1)	<0.1 µg m^{-3} (3) at RB59	RBBC Leon Hibbs	Measure adopted by developers.	June 2005	Jan 2007	Initial stage complete Jan 2007.	Measure is now in the design guide, though building work yet to begin.	Aim is to minimise growth in background. Although the measure is in the design guide the next stage is to see if adopted by developers.
- Minimum of 10 % of energy from renewable sources.	Medium (2)	<0.1 µg m^{-3} (3) at RB59, but potential increase for local 'hot spots' depending on source.	RBBC Policy & Regeneration Raymond Dill.	Scheme up and running.	On going	Jan 2007 for local development framework policy	Initial stage complete Jan 2007.	Measure now in design guide.	As with low NO_x boilers the next stage is to see if measure taken up by developers and the system used. Risk of localised NO_x 'hot spots' if for example biomass burner.
- Home Zone.	Medium (2)	<0.1 µg m^{-3} (3) at RB59	RBBC Planning	New developments completed as home zones.	On going	Jan 2007	Jan 2007.	Policy in design guide.	Impact on air quality potentially low. However, may encourage walking over short distances and avoid car use.
Monitoring.	Low (1) to Medium (2) depending on time scale	N/A	RBBC Leon Hibbs	Data capture > 90 %.	On going	On going	Initial discussions with Gatwick on replacing the older monitoring equipment.	Data capture consistently in excess of 90 %, new equipment purchase likely in 2009.	Sites are important for examining trends in measured pollutant concentrations, and compliance monitoring.

Measure	Cost[a]	Air Quality Improvement [b]	Person / organisation responsible	Indicator	Start Date	Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Local Forums / Policy: - AQ Working Group with BAAG.	Low (1) to RBBC	1 µg m^{-3} (1) at RB59	RBBC Pollution Team	No specific measure, but will include Gatwick AQ plan implemented, on going predictive modelling work.	On going	On going	Meetings are on going. Airport action plan due Dec 2008 and additional modelling work due mid 2009.	On going	Work is progressing but slower than originally intended. On the modelling front the lack of progress is due to a lack of emissions factors from DEFRA.
- New section 106 agreement and sustainable development strategy.	Low (1) to RBBC	1 µg m^{-3} (1) at RB59	RBBC Planning and Environ. Health. Others: GAJA, GOG, GATCOM.	Agreement and Implementation of new agreement and strategy.	On going	Mid 2007	This is now complete (Sept 2008). Agreement to be signed by the end of 2008,	Completed	Only if the measures in the agreement are completed, and the outcome of any studies in the agreement acted upon, will any improvement in air quality occur. Timetable for work has slipped, but as of now (Sept 2008) agreement likely to be in place by December 2008.
National / EU measures: - Tighter vehicle emissions standards.	Low (1) to RBBC, but very high (3+) to industry.	Up to 1 µg m^{-3} (1) at RB59	UK Government via EU.	Higher standards in place.	?	?	No progress to date, as per M25.	-	Direct NO_2 emissions are unlikely to be a problem within the Horley AQMA, given the distance from the road network.
- Tighter aircraft engine emissions standards.	Low (1) to RBBC, but very high (3+) to industry.	Aim is to reduce the rate of growth of aircraft emissions.	UK Government via EU.	Higher standards in place.	?	?	Discussed informally with DfT representative on 16/10/07, especially the need initially for better and publicly available data on APU emissions.	-	APU emissions are also a source of concern, and the lack of manufacturers' data on emissions makes assessing the scale of the impact difficult. Thus in the first instance emissions testing of APUs needs to be introduced.

Notes:
[a] (1) Low £<100K, (2) Medium £100K to £1 million, (3) High £1 million to £10 million.
[b] (1) improvement of 1 $\mu g\ m^{-3}$, (2) 0.1 to 1 $\mu g\ m^{-3}$, (3) <0.1 $\mu g\ m^{-3}$.
[c] as used mid line forecast in original TEMPRO model equivalent to a 10 % increase in traffic 2005 to 2010.

[d] The current traffic flows as measured on roads in the area are as follows:

	Site ID	AADT 2004	AM weekday peak flow 2004	PM Weekday peak flow 2004
A217 (Mill Lane / Nursery Lane)	A0217 (04063A)	18,061	2036 (8 to 9am)	1703 (17 to 18:00)
A23 (just before Massetts Rd / Woodroyd Av.)	A0023 (04082C)	29,392	2217 (8 to 9am)	2493 (17 to 18:00)
M23 Gatwick Spur* (contact Margaret King at: area4@interroutejv.co.uk)	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and 529498, 141694)	65,964 (2% HGV)	1702 (9 to 10am) to M23 3172 (9 to 10am) to Gatwick	2691 (18 to 19:00) 1665 (14 to 15:00)
***Note these are the revised figures (2008) for 2004. The original 2004 figures are shown below.**				
M23 Gatwick Spur (contact Margaret King at: area4@interroutejv.co.uk)	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and 529498, 141694)	63,500 (2% HGV)	4719 (8 to 9am) 4874 (9 to 10am)	3862 (17 to 18:00) 4236 (18 to 19:00)
2007 Figures:				
A217 (Mill Lane / Nursery Lane)	A0217 (04063A)	18,323 Up 1.45 % on 2004.	1881 (8 to 9am) Down 7.6% on 2004.	1802 (17 to 18:00) Up 5.8% on 2004.
A23 (just before Massetts Rd / Woodroyd Av.)	A0023 (04082C)	Site discontinued in 2005 and replacement site not installed as planned.		
M23 Gatwick Spur	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and	63,696 (2% HGV) Down 3.4% on 2004.	1737 (8 to 9am) to M23 2971 (8 to 9am) to Gatwick	2385 (17 to 18:00) 1570 (13 to 14:00)

RB59 is the worst case receptor within the Horley Air Quality Management Area (AQMA).

BAAG: British Airports Authority – Gatwick.
GAJA: Gatwick Airport Joint Local Authorities.
GATCOM: Gatwick Consultative Committee.
GOG: Gatwick Officers Group.
HTC: Horley Town Council.
ODPM: Office of the Deputy Prime Minister.
RBBC: Reigate and Banstead Borough Council.
SCC: Surrey County Council.

Table 5.3: Summary of Actions to date for the Non Airport Sources of Pollution within the Horley AQMA.

6.0 Summary and Conclusions

6.1 The concentrations of benzene, 1,3 Butadiene, carbon monoxide, lead, particulate matter (measured as PM_{10}), and sulphur dioxide, within Reigate and Banstead continue to meet the relevant EU limit values and UK objectives for these pollutants, and there have been no new developments either within or in the vicinity the borough that would affect the concentrations of these pollutants.

6.2 The overall trend in benzene, sulphur dioxide and PM_{10} concentrations since 2002 has essentially been flat i.e. neither an improvement nor deterioration in air quality.

6.3 Ozone concentrations continue to breach UK guideline values at the RG3 monitoring site, and are also likely to be in breach in rural areas to the south of the borough due to the regional nature of this pollutant. While the assessment and control of ozone is outside the remit of local authorities, and measures to control ozone are taken at a national level, ozone is currently the only pollutant in Reigate and Banstead that regularly reaches concentrations capable of causing acute i.e. immediate health problems for residents with pre existing respiratory problems.

6.4 Nitrogen dioxide concentrations across the majority of the borough either meet, or meet by a considerable margin the relevant UK air quality objectives, and concentrations have remained fairly constant between 2004 and 2007 based on background monitoring away from the M25.

6.5 Within the former air quality management areas, M23 (North) and the A23 Flying Scud, nitrogen dioxide concentrations have also remained relatively unchanged, and while the air quality standards continue to be met a breach of the annual mean nitrogen dioxide standard did occur in 2007 at the Flying Scud site. However at this stage it is not proposed to redeclare the Flying Scud AQMA given the overall flat trend in nitrogen dioxide concentrations to date, although the site will be kept under review.

6.6 Within the Dean Lane AQMA the nitrogen dioxide air quality objectives continue to be met, as predicted in previous years, but the overall trend in concentrations is flat rather than showing a continual improvement as predicted by computer modelling of this site. Consequently the AQMA will remain as a precautionary measure, with a review of the AQMA declaration at this site in 2010.

6.7 The Rushworth Road AQMA also continues to meet the air quality objectives for nitrogen dioxide, but concentrations remain relatively high (within 10 % of the objective) and the predicted improvements in air quality at this site have not occurred in practice, with the overall trend in concentrations unchanged between 2004 and 2007. The Rushworth Road AQMA will therefore be retained, with a further review on revoking the AQMA undertaken in 2010.

6.8 Monitoring within the M23 (South) AQMA indicates that the air quality standards are being met and therefore that the AQMA can be revoked. However, given the potential impact of the North Terminal Extension at Gatwick Airport on traffic flows on this section of the M23, a final decision on revoking the M23(S) AQMA will be taken in 2010 once the environmental impact assessment of the terminal development has been completed.

6.9 The current situation with the remaining air quality management areas is summarised in Table 6.1.

AQMA	**UK Objective Breached in / at**				**Trend in NO_2 Concentration 2004 to 2007**	**Trend in Road Traffic 2004 to 2007**
	2006		**2007**			
	Monitored receptor	**Worst Case receptor**	**Monitored receptor**	**Worst Case receptor**		
Blackhorse Lane	Y	Y	No Breach	No Breach	No change	Decreasing
Reigate High Street	Y	Y	Y	Y	Increasing	No change / Decreasing
Drift Bridge, Banstead	Y	Y	No Breach	Y	No change (2005 to 7)	Decreasing
Merstham High Street	Y	Y	Y	Y	Increasing	No change / Increasing
M25	Y	Y	No Breach	Y	Decreasing	Increasing
Horley Nr. Gatwick	Y	Y	No Breach	No Breach	Decreasing*	N/A**

*Decreasing on airport and off airport. At the worst case receptor the trend appears flat, but there is limited data to date.
** Road traffic contributes to pollution at Gatwick, but is one of a number of sources and not the dominant source.

Table 6.1: Summary of AQMAs in Breach of the UK Annual Mean Nitrogen Dioxide Objective, and Pollutant and Traffic Trends.

6.10 Although Table 6.1 demonstrates that breaches of the annual mean air quality objective for nitrogen dioxide continue within these AQMAs, the key finding of the long term monitoring to date is that residential properties within 5 to 10 m of a main road i.e. excluding Gatwick and the M25, have seen no improvement in nitrogen dioxide concentrations between 2004 and 2007. This pattern is not just seen within the AQMAs in Table 6.1, but also at the Dean Lane and Rushworth Road AQMAs.

6.11 This lack of improvement and even deterioration in air quality in relation to nitrogen dioxide is a cause for concern given that national projection factors have consistently suggested that nitrogen dioxide concentrations should fall progressively with time, given the continual improvement in vehicle fleet emissions, and that the degree of improvement would be such that this would more than off set the predicted growth in road traffic.

6.12 The absence of an improvement in nitrogen dioxide concentrations is of even greater concern in view of the fact that within some AQMAs there is evidence that road traffic decreased over the same period, suggesting that the 'average vehicle' is in fact becoming more rather than less polluting in terms of nitrogen dioxide.

6.13 The most likely cause of this 'dirtier' vehicle fleet is the shift to diesel vehicles and the resultant increase in direct NO_2 emissions. However given the improvements seen in nitrogen dioxide concentrations near the M25, despite increasing traffic volume, it suggests that this increase in direct NO_2 emissions is problematic primarily close to main A roads i.e. as with most of the AQMAs within Reigate and Banstead.

6.14 This impact of diesels is unlikely to be unique to Reigate and Banstead, but it does mean that action plan measures aimed at improving air quality are unlikely to do so, and at best may only prevent air quality deteriorating further in the short term until the number of diesel vehicles stabilises. At a national level these results, if repeated, warrant further investigation by DEFRA given the implications for compliance with the EU limit values for nitrogen dioxide in 2010.

Appendix A.

BTEX Diffusion Tube Data:

Ratio of Benzene to TEX compounds 1998 to 2007.

	Ratio: Benzene : Benzene Ideal value = 1			Ratio: Toluene : Benzene Ideal value = 3.5			Ratio: Ethyl Benzene : Benzene Ideal value = 1			Ratio: P/M Xylenes : Benzene Ideal value = 2			Ratio: Ortho Xylene : Benzene Ideal value = 1		
	RB1	RB11	RB20	RB1	RB11	RB20	RB1	RB11	RB20	RB1	RB11	RB20	RB1	RB11	RB20
1998	1	1	1	3.0	2.6	2.7	0.6	0.7	0.6	0.8	0.7	0.8	0.6	0.6	0.6
1999	1	1	1	2.9	2.3	2.3	0.8	0.8	0.7	1.0	0.8	0.8	0.8	0.7	0.7
2000	1	1	1	3.9	3.4	3.2	1.0	1.1	1.2	1.4	1.2	1.6	1.2	1.1	1.6
2001	1	1	1	4.0	2.9	3.4	1.1	1.0	1.2	1.5	1.4	1.5	1.3	1.3	1.3
2002	1	1	1	3.4	2.5	2.7	0.7	0.6	0.7	1.5	0.9	1.2	0.9	0.7	0.9
2003	1	1	1	3.1	2.1	2.6	0.9	0.6	0.7	1.9	0.9	1.7	0.8	0.5	0.9
2004	1	1	1	2.9	2.3	3.1	1.0	1.3	1.2	2.3	2.0	2.6	0.8	0.9	1.3
2005	1	1	1	2.2	1.8	2.1	0.8	0.9	2.7	1.8	1.6	4.1	0.8	0.9	1.6
2006	1	1	1	1.7	1.4	1.7	0.5	0.4	0.4	1.1	0.8	1.0	0.7	0.4	0.5
2007	1	1	1	1.8	1.6	1.7	0.6	0.4	0.5	1.1	0.7	0.8	0.3	0.3	0.3

The 'normal' ratio of the BTEX components is 1:3.5:1:2:1 based on µg m^{-3} concentrations (DEFRA, 2003a).

Appendix A: Ratio of Benzene to TEX Compounds measured by Passive BTEX Tubes.

Appendix B.

Nitrogen Dioxide Diffusion Tube Data 2002 - 2007.

												Projected data					
	All values µg m^{-3} except n	2002		2003		2004		2005		2006		2007		2010		2015		2020	
Sire Ref.	Location	Factor 1.17	n	Factor 1.29	n	Factor 1.32	n	Factor 1.35	n	Factor 1.46	n	Factor 1.145	n	using 2007	using 2006	using 2007	using 2006	using 2007	using 2006
	Reigate																		
RB8	Urban Background: Castle Walk, Reigate	17	11	42	9	27	12	23	11	26	12	28	12	*25*	*23*	*24*	*22*	*24*	*21*
RB9	Urban Background: St. Mary's Rd	18	11	28	10	27	12	27	11	26	12	26	12	*24*	*23*	*22*	*22*	*22*	*21*
	Reigate AQMA																		
RB114	Sign Post, 87 West Street, Reigate									37	6	37	12	*33*	*32*	*29*	*28*	*28*	*27*
RB115	Lamppost, 36 West Street, Reigate									55	6	43	12	*39*	*48*	*34*	*42*	*33*	*41*
RB113	Lamppost opposite Newbury Road									39	6	36	12	*33*	*34*	*29*	*30*	*28*	*29*
RB112	Lamppost, 21 West Street, Reigate									41	6	41	12	*37*	*35*	*32*	*31*	*31*	*30*
RB116	Lamppost, 12 West Street, Reigate.									65	6	47	12	*42*	*57*	*37*	*50*	*36*	*48*
RB111	Drainpipe, 1 West Street, Reigate									49	6	40	12	*36*	*43*	*31*	*37*	*31*	*36*
RB109	Drainpipe, 27a Bell Street, Reigate									51	8	46	12	*42*	*44*	*36*	*39*	*35*	*37*
RB117	Drainpipe, 8 London Road, Reigate									74	6	52	11	*46*	*64*	*40*	*56*	*39*	*54*
RB118	Drainpipe, Burlington Place, Reigate									60	6	38	12	*34*	*52*	*30*	*45*	*29*	*44*
RB119	Drainpipe, Castlefield Road, Reigate									36	6	37	12	*33*	*31*	*29*	*28*	*28*	*27*
RB47	Outside 78 High St, Reigate	42	10	50	11	41	12	46	10	62	12	55	11	*49*	*54*	*43*	*47*	*42*	*46*
RB104	Drainpipe, High Street, Reigate							39	4	47	12	49	11	*44*	*41*	*39*	*36*	*38*	*35*
RB105	Drainpipe, High Street, Reigate							39	4	60	12	54	12	*48*	*52*	*43*	*46*	*41*	*44*
RB1	34-36 High Street, Reigate	34	11	52	11	47	12	41	11	48	12	44	12	*40*	*42*	*35*	*37*	*34*	*35*
RB46	Signpost, 5 High St, Reigate	38	10	53	11	47	12	41	11	61	12	44	12	*39*	*53*	*34*	*46*	*33*	*45*
RB45	Signpost outside 38 Church St, Reigate	40	9	46	9	45	11	44	10	50	12	44	11	*40*	*43*	*35*	*38*	*34*	*37*
RB107	Drainpipe, 29 Church Street, Reigate							36	3	40	12	39	12	*35*	*34*	*30*	*30*	*30*	*29*
RB44	Lamppost, 45 Church St, Reigate	41	10	45	11	34	12	39	11	50	12	47	12	*42*	*44*	*37*	*38*	*36*	*37*
	Redhill																		
RB17*	Urban Background: Sylvan Way, Redhill	23	11	27	11	26	12	25	10	25	12	30	11	*27*	*22*	*26*	*21*	*25*	*21*
	Merstham																		
RB18	Lamppost, 60 Brook Road, Merstham	29	7	32	10	34	10	34	10	35	12	33	10	*30*	*31*	*28*	*29*	*28*	*29*
RB19	Merstham Village Hall, Station Road	24	11	47	11	29	11	34	11	33	11	32	12	*29*	*30*	*27*	*28*	*27*	*27*
	Merstham AQMA																		
RB20	Junction London Road & Station Road North	34	11	51	10	38	12	44	11	48	12	47	11	*42*	*41*	*37*	*36*	*36*	*35*
RB110	Drain Pipe, London Road North, opp. RB20									44	8	42	12	*37*	*38*	*33*	*33*	*32*	*32*
RB124	Lamppost, 22 High Street, Merstham											52	7	*46*		*41*		*39*	
	Banstead																		
RB3*	Nr. Ambulance Station, Horseshoe, Banstead	19	11	30	11	25	12	30	11	27	12	26	12	*24*	*24*	*22*	*22*	*22*	*22*
RB23	Urban Bkgrd: Warren Mead School, Banstead	20	10	27	11	23	12	30	11	23	12	23	12	*21*	*21*	*20*	*19*	*19*	*19*

	All values µg m^{-3} except n	2002		2003		2004		2005		2006		2007		2010		2015		2020	
Sire Ref.	**Location**	Factor 1.17	n	Factor 1.29	n	Factor 1.32	n	Factor 1.35	n	Factor 1.46	n	Factor 1.145	n	using 2007	using 2006	using 2007	using 2006	using 2007	using 2006
	Drift Bridge AQMA																		
RB21*	Opp. Drift Bridge Hotel, Reigate Road, Banstead	37	11	48	10	48	12	45	11	52	12	47	11	*42*	*45*	*37*	*39*	*36*	*38*
RB22	Opposite 2 Grey Alders, Banstead	29	11	36	10	27	12	26	11	29	12	31	12	*28*	*25*	*25*	*22*	*24*	*21*
RB106	On one way sign, Crossways, Fir Tree Road									47	12	39	12	*35*	*41*	*31*	*36*	*30*	*35*
	Horley																		
RB12	Horley Police Station, Massetts Road, Horley	34	11	39	11	34	12	31	11	41	12	37	12	*33*	*36*	*29*	*31*	*28*	*30*
RB13	Public Car Park, off Massetts Road, Horley	24	10	32	9	28	12	29	11	33	12	27	12	*25*	*28*	*21*	*25*	*21*	*24*
	Horley AQMA																		
RB11	RB11: Riverside	36	11	30	11	26	12	28	10	28	12	27	12	*See note* [2]					
RB24,25,2	Urban Background Michael Crescent	30	10	31	11	28	12	29	11	28	12	28	12	*See note* [2]					
RB51	Wolverton Gardens		7	38	11	30	12	31	11	32	12	27	12	*See note* [2]					
RB52	Wolverton Gardens		7	35	11	31	12	28	11	34	12	29	12	*See note* [2]					
RB53	Cheyne Walk		7	37	10	31	12	34	11	37	12	35	12	*See note* [2]					
RB54	Crescent Way		7	35	9	33	12	29	11	33	12	31	12	*See note* [2]					
RB55	Crescent Way		4	34	11	34	12	29	11	35	12	34	12	*See note* [2]					
RB56	The Crescent		7	37	10	33	12	33	10	32	11	31	12	*See note* [2]					
RB57	The Crescent		7	42	11	34	12	38	11	35	12	35	12	*See note* [2]					
RB58	The Crescent		7	40	11	38	12	34	11	34	12	36	12	*See note* [2]					
RB59	The Crescent		7	40	11	39	12	34	11	37	12	38	12	*See note* [2]					
RB60	The Crescent		7	43	11	36	12	39	11	41	12	39	12	*See note* [2]					
RB61	The Crescent		7	43	11	36	12	33	11	37	12	34	12	*See note* [2]					
RB64	The Drive		5	33	11	34	11	30	11	33	12	30	12	*See note* [2]					
RB65	The Drive		6	41	11	39	12	34	11	36	12	34	12	*See note* [2]					
RB66	Fairfield Avenue		7	32	11	32	12	30	11	33	11	30	12	*See note* [2]					
RB67	Fairfield Avenue		7	28	10	34	12	33	10	31	12	31	12	*See note* [2]					
RB68	Fairfield Avenue		7	33	11	27	11	31	11	32	12	31	12	*See note* [2]					
RB69	Upfield		4	33	11	30	12	31	10	33	11	30	12	*See note* [2]					
RB70	Upfield		7	33	11	35	12	31	11	34	12	31	12	*See note* [2]					
RB71	Roundabout, Upfield,		6	34	11	31	12												
RB72	Upfield		7	34	10	28	12	30	10	31	12	28	12	*See note* [2]					
RB73	Upfield		7	24	9	29	12	28	11	32	12	28	12	*See note* [2]					
RB74	Meadowcroft Close		7	32	11	37	12	28	11	29	12	27	12	*See note* [2]					
RB75	Roundabout, The Coronet		7	37	11	37	12	35	10	32	12	35	11	*See note* [2]					
RB76	Limes Avenue		7	36	11	30	11	28	11	27	12	27	12	*See note* [2]					
RB77	Staffords Place		6	32	11	31	12	32	11	30	12	31	12	*See note* [2]					
RB78,79,8	The Crescent			41	11	37	12	33	11	32	12	37	12	*See note* [2]					

	All values µg m^{-3} except n	2002		2003		2004		2005		2006		2007		2010		2015		2020	
Sire Ref.	**Location**	Factor 1.17	n	Factor 1.29	n	Factor 1.32	n	Factor 1.35	n	Factor 1.46	n	Factor 1.145	n	using 2007	using 2006	using 2007	using 2006	using 2007	using 2006
RB98	16/17 Woodroyd Gardens							33	11	36	12	34	12	*See note [2]*					
RB99, 100	Rural: Poles Lane Pumping Station, Crawley							24	10	20	12	21	12						
	M23 North (Former AQMA)																		
RB40	Shepherd's Hill, Merstham	34	11	32	11	24	12	25	11	29	12	28		*26*	*26*	*24*	*24*	*24*	*24*
RB41	Shepherd's Hill, Merstham	29	11	22	11	26	12	26	11	27	12	25	12	*23*	*24*	*22*	*23*	*22*	*22*
RB42	Kerbside: Shepherd's Hill, Merstham	31	11	47	11	43	12	35	11	42	12	38	12	*34*	*36*	*30*	*32*	*29*	*31*
	A23 Brighton Road (Former AQMA)																		
RB81*	Outside Flying Scud PH, Brighton Road, Redhill			40	11	37	12	37	11	37	12	41	12	*37*	*32*	*32*	*28*	*31*	*27*
	A23 Dean Lane AQMA																		
RB82*	Outside 1 Deans Lane Hooley			46	11	40	12	37	11	40	12	40	12	*36*	*34*	*32*	*30*	*31*	*29*
	M23 South AQMA																		
RB97						25	5												
RB102	Field near Bridleway, Hathersham Farm, Horley							22	4	29	12	28	12	*26*	*26*	*25*	*25*	*24*	*24*
	A217 Rushworth Road AQMA																		
RB95*	Rushworth Road			45	8	36	12	38	11	34	11	37	12	*33*	*29*	*29*	*26*	*28*	*25*
	A217 Blackhorse Lane AQMA (North J8 M25)																		
RB49	Kerbside: Brighton Road	46	11	59	11	59	12	59	10	63	12	55	12	*49*	*54*	*43*	*48*	*42*	*46*
RB50	Just off Brighton Road	35	11	41	11	37	12	39	11	41	12	40	11	*37*	*37*	*34*	*34*	*34*	*34*
RB103	Building façade, Brighton Road							37	4	46	12	39	12	*36*	*41*	*34*	*39*	*33*	*38*
	M25 AQMA																		
RB27	Sturts Lane, Walton on the Hill	41	11	43	11	42	12	39	11	39	12	37	12	*34*	*35*	*32*	*33*	*32*	*33*
RB28	Sturts Lane, Walton on the Hill	42	11	41	11	33	12	35	11	36	12	32	11	*30*	*32*	*28*	*30*	*27*	*30*
RB29	Sturts Lane, Walton on the Hill	34	11	38	11	35	11	35	11	38	12	36	12	*32*	*33*	*28*	*29*	*28*	*28*
RB30*	Chequers Lane, Walton on the Hill	39	11	41	11	34	12	33	11	40	12	36	12	*32*	*35*	*28*	*31*	*27*	*30*
RB31*	Reigate Hill	30	11	30	11	25	12	30	11	26	12	31	12	*28*	*23*	*27*	*22*	*26*	*21*
RB33*/**	Margery Grove, Mogodor	30	11	41	11	38	10	30	11	38	12	29	12	*27*	*34*	*25*	*32*	*25*	*31*
RB34	Merrywood Grove, Mogodor	23	11	31	11	23	11	27	11	24	11	30	12	*27*	*21*	*26*	*20*	*25*	*20*
RB35***	Merrywood Grove, Mogodor	22	11	33	11	28	12	31	9										
RB36*	Gatton Bottom	33	11	35	11	31	12	28	11	34	12	29	12	*27*	*30*	*25*	*29*	*25*	*28*
RB37	Ashcombe Road, Merstham	38	10	39	11	30	12	29	11	32	12	29	12	*27*	*29*	*25*	*27*	*25*	*27*
RB38	Ashcombe Road, Merstham	39	11	38	11	32	12	36	11	37	12	33	12	*31*	*33*	*29*	*31*	*28*	*30*
RB39	Ashcombe Road, Merstham	42	11	40	9	33	12	27	11	35	12	34	12	*31*	*32*	*29*	*30*	*29*	*29*
RB43*	Quality Street, Merstham			43	11	35	12	31	11	31	12	38	12	*34*	*27*	*30*	*24*	*29*	*23*

	All values µg m^{-3} except n	2002		2003		2004		2005		2006		2007		2010		2015		2020	
Sire Ref.	**Location**	Factor 1.17	n	Factor 1.29	n	Factor 1.32	n	Factor 1.35	n	Factor 1.46	n	Factor 1.145	n	using 2007	using 2006	using 2007	using 2006	using 2007	using 2006
	Control Blanks																		
RB91	Blank Control			8	11	17	12	12		8	12	4	12						
RB92	Blank Control			9	11	12	12	12		7	11	5	12						
RB127	Blank Control											3	4						
	Highways Agency Monitoring (Gradko Duplicates).																		
RB39 RPS	Ashcombe Road											31	12						
RB59 RPS	Outside 92/94 The Crescent, Horley											34	12						
RB102 RP	In Field near Bridleway, Hathersham Farm											28	11						
RB108 GP	Fence post Footpath Hathersham Farm											30	11						

* Mean of two tubes from 2003 to 2006 (inclusive). RB82 2003 to date is the mean of two tubes.
** Site moved November 2004 approx. 100 m west of original site. Distance to M25 unchanged.
RB33 Value in 2004 detailed assessment 43 µg m^{-3} as single value not average.
*** Site closed 4/1/05 due to problems with access.
RB45 Site moved 60 m east of original site (14-16 Church Street) on 1/11/07. Distance to road unchanged.
RB71 Discontinued 4/1/05.
RB97 operated 1/6/04 to 3/5/05 (see Appendix D, RBBC, 2005 for adjustment factor). Due to continued problems tube moved to RB102 in August 2005.
RB102 located in field at equal distance from M23 as property was at RB97.
All tubes are supplied by Lambeth Scientific (50 % TEA in acetone), except Highways Agency Tubes which are from Gradko (20 % TEA in water).
Bias adjustment factors for 2002, 2003, and 2004 based on a single co-location study of triplicate diffusion tubes at RG1 Michael Crescent (RBBC, 2005)
Bias adjustment factor from 2005 onwards based on three sites with co-located triplicate diffusion tubes (RG1 Michael Crescent, RG2 The Crescent, and RG3 Poles Lane Crawley) and orthogonal regression.
Bias adjustment for Highways Agency Gradko tubes (20 % TEA in water) from 30/09/08 diffusion tube spreadsheet. 2007 = 0.89.
If n < 9 months, data adjusted to annual mean equivalent as per DEFRA (2003a). See AQC (2006b, 2007, 2008b) respectively for 2005, 2006, and 2007 adjustments applied.
[1] Projected values (shaded and *in italics*) based on appropriate roadside or background factors from DEFRA, 2008b.
[2] Projected values are only available for road traffic. In the vicinity of the airport rising airport emissions are likely to off set falling road traffic emissions, and so more detailed modelling is required. Results to 2015 due to be modelled by March 2010.

Appendix C.

Correlation between RG1, RG2, and RG3 in 2006 and 2007.

Figure C.1: Correlation between Hourly Nitrogen Dioxide Concentrations at RG1 and RG2 (2006 to 2007).

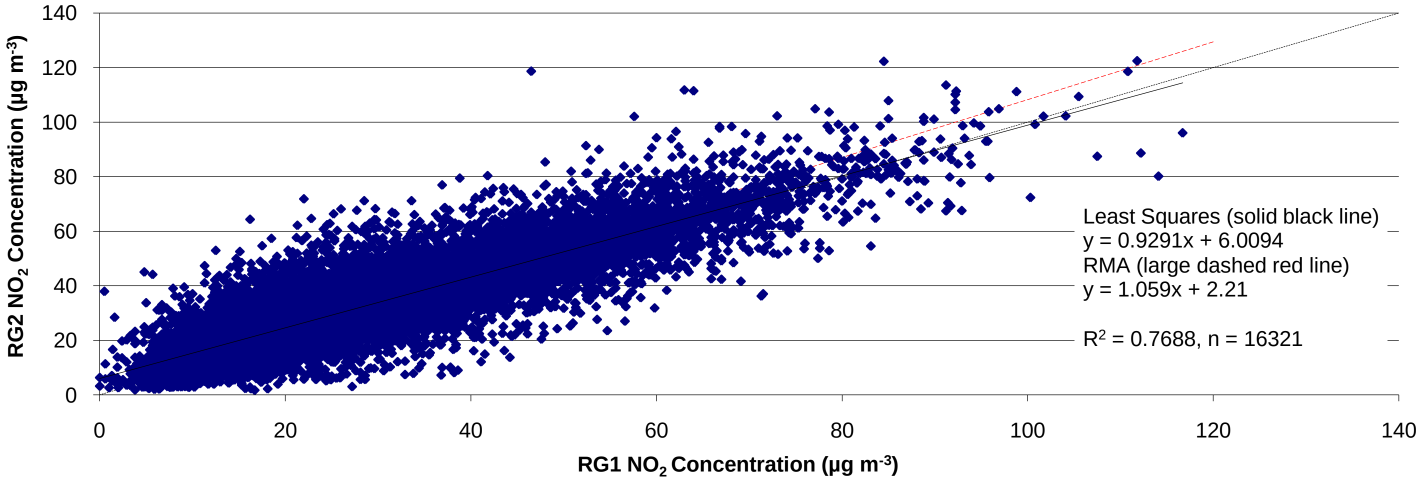


Figure C.2: Correlation between Hourly Nitrogen Dioxide Concentrations at RG3 (SW of Gatwick) and RG1 (North East of Gatwick) - 2006 and 2007 data.

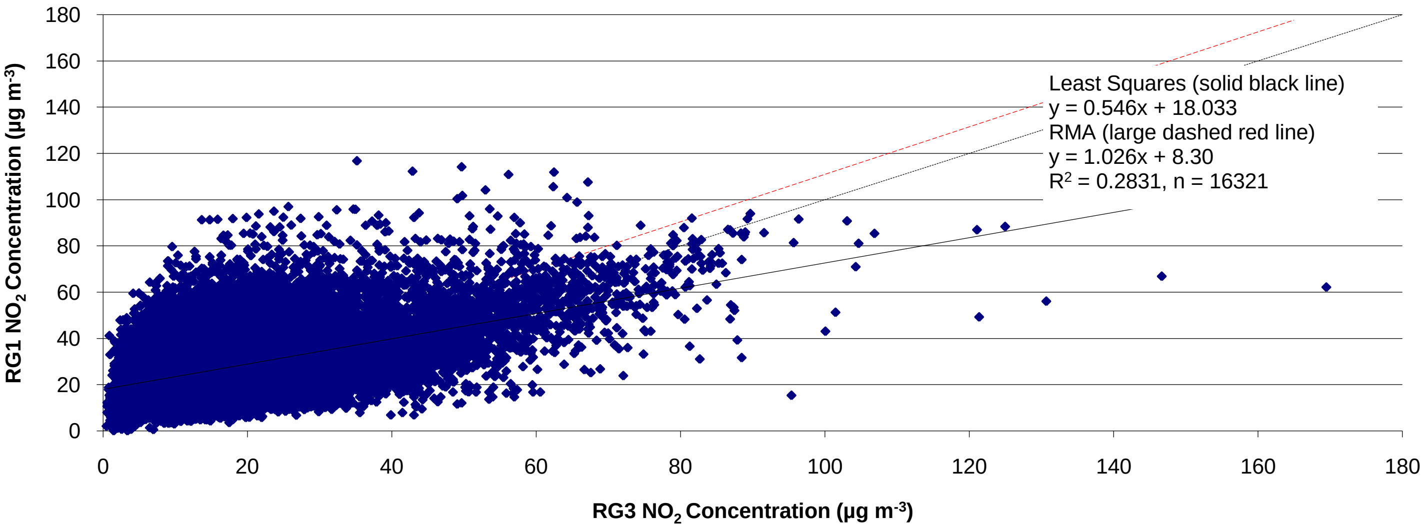
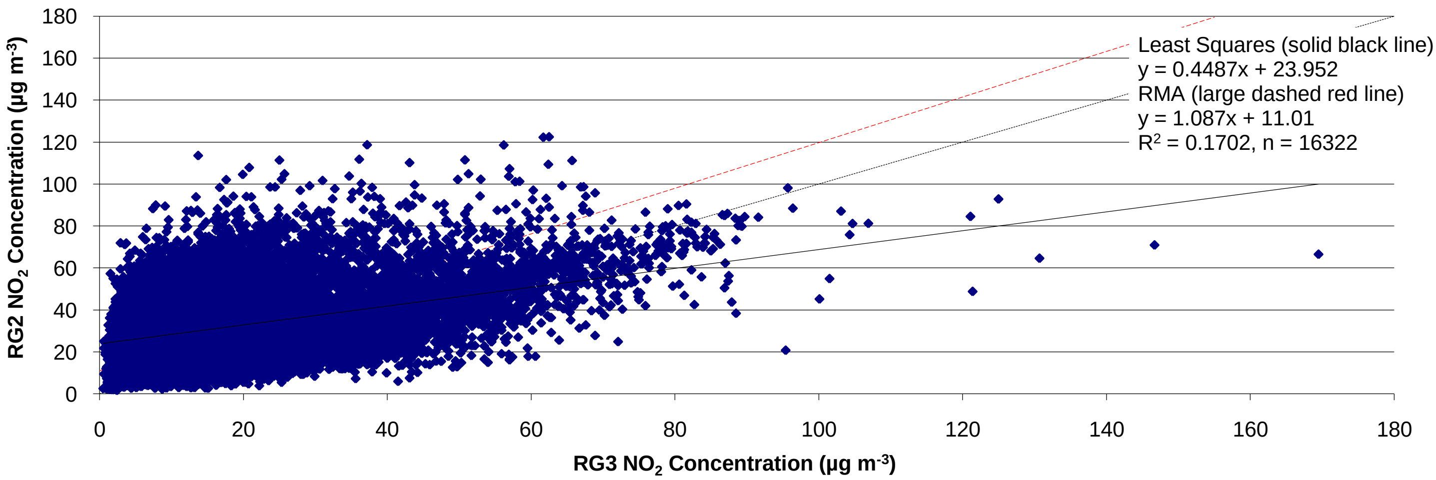


Figure C.3: Correlation between Hourly Nitrogen Dioxide Concentrations at RG3 (SW of Gatwick) and RG2 (North East of Gatwick) - 2006 and 2007 data.



Appendix D.

Summary of Proposed Actions for the Non Airport Sources of Pollution within the Horley AQMA.

Measure	Cost[a]	Air Quality Improvement [b]	Person / organisation responsible	Indicator	Start Date	Completion Date	Additional Benefits	Potential Problems	Comments	Simple Cost : Benefit for Air Quality Purposes. (Cost x AQ Improvement, 1 = most cost effective)
Limit Road Transport Growth to 5.5 % by 2011 from 2004/5 levels. (Annex 9 LTP).	High (3)	c.0.1 µg m^{-3} (2) at RB59[c]	SCC (via LTP 6).	For current traffic flows see note 'd' at end of table.	April 2006	April 2011	Primary aim is to limit growth in congestion across Surrey. If scheme is successful air quality benefits will be county wide, not just within the AQMA.	Failure of LTP. For air quality this would have minimal impact on Horley AQMA, as already working to higher traffic flows. (see note c).	Cost borne by Surrey County Council	6
Fastway Route (Horley to Crawley via Gatwick).	High (3)	<0.1 µg m^{-3} (3)	SCC / RBBC/ HTC/ BAAG.	Reduction in peak hour traffic flow.	Jan 2006	April 2011	Main aim is to reduce peak hour traffic flows, and thus congestion.	Fails to achieve modal shift in peak hours.	General measure to reduce car usage. If significant shift does occur, as seen else where, impact on air quality within AQMA could be as high as 0.1 µg m^{-3}.	9 (possible 6 if significant modal shift (> 5%)).
Fastway Interchange at Horley Station.	High (3)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	April 2006	April 2011	If helps modal shift, then benefits for AQ and congestion on all major roads in area. Improved transport links for non motorists.	Project is subject to funding.	Cost is £2 million, with cost split between SCC, local authorities, and others. Impacts on AQ within AQMA will be small, but will not have an adverse impact.	9
Bus Priority Lanes on A23 (p105 5.43 in LTP).	Medium (2)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	Unknown	April 2015	Faster public transport.	Depends on nature of the scheme. If existing lane space is used up, possible increased congestion for other road users at junctions. If this does occur then risk of decline in air quality in these areas.	Minimal benefit to air quality within Horley AQMA.	6

Measure	Cost[(a)]	Air Quality Improvement[(b)]	Person / organisation responsible	Indicator	Start Date	Completion Date	Additional Benefits	Potential Problems	Comments	Simple Cost : Benefit for Air Quality Purposes. (1 = most cost
Extension of Fastway to Redhill and Reigate. (LTP2 aspiration).	High (3)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC for information contact Emily Mottram Policy & Regeneration (RBBC).	Project Completion	Unknown	April 2015 (if implemented)	Main benefits of scheme are improved public transport links within the borough. Also possible improvements in AQ within Reigate High Street AQMA.	Project may not go ahead, no measurable benefit for Horley AQMA.	As impacts on air quality within the AQMA are small to negligible, failure of the scheme has no impact on air quality within the Horley AQMA.	9
Maintain current taxi licensing regime.	Low (1)	<0.1 µg m^{-3} (3) at RB59	RBBC Licensing.	Standards relating to Taxis maintained	On going	On going	New vehicles for passengers, thus potentially safer. Lower emissions across borough.	Cost of measures to taxi operators.	Current scheme means that entire taxi fleet is replaced every 9 years. Minimal impact on Horley AQMA.	3
Public Service Agreement to reduce Congestion on the A217 and A23 (Horley Road).	Low (1) (to RBBC)	<0.1 µg m^{-3} (3) at RB59	SCC / RBBC/ ODPM. Contact Linden Mendes SCC.	5 % reduction in average vehicle delay by March 2008.	March 2005	March 2008	Main aim is reduction in congestion on these routes. This may have a minor impact on air quality if congestion is reduced.	No impact on pollution within Horley AQMA. Risk that congestion problem is simply moved elsewhere.	Success or failure of project has no bearing on Horley AQMA. However, reason for success / failure worth bearing in mind – if appropriate – for future reference if congestion becomes a problem within the Horley AQMA.	3
Travel Plans (Work).	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	RBBC / Local employers Contact Julia Dawe Policy & Regeneration (RBBC).	4 to 5 plans to be completed per annum.	On going	On going	Wider air quality benefits for borough, reduced congestion on roads, or reduced rate of congestion growth.	Potentially high implementation and running costs for employer. Unlikely to have impact on air quality in Horley AQMA, as major businesses in area already have plans.	Plan is nothing unless implemented, maintained and updated. Most major employers in Horley have a travel plan in place.	3 to 6

Measure	Cost[(a)]	Air Quality Improvement[(b)]	Person / organisation responsible	Indicator	Start Date	Completion Date	Additional Benefits	Potential Problems	Comments	Simple Cost : Benefit for Air Quality Purposes. (1 = most cost effective)
Travel Plans (Schools) (LTP indicator TP3).	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	SCC (Richard Hoyland).	All Horley Primary and Secondary schools have, and have implemented, a travel plan.	On going	2010 / 12	Depending on type and nature of plan, reduced congestion in vicinity of schools, reduced AM peak flows. If pupils cycling then health benefits.	Minimal impact on air quality within Horley AQMA. Possible safety risks to cyclists and pedestrians if poor road sense.	Risk that when Head / person responsible for plan leaves, active implementation of plan ceases.	3 to 6
Continued Promotion of Surrey Car Share.	Low (1) (to RBBC)	<0.1 µg m^{-3} (3) at RB59	Contact at RBBC – Raymond Dill Policy & Regeneration.	Steady Growth in number of participants. (1300 users at start of 2006).	On going	On going	Lower rate of traffic growth on roads.	Risk of bad experiences when using scheme will put people off.	Measurable improvements in air quality unlikely in the short term, minimal if any impact on air quality within the AQMA.	3
Implementation of Council Travel Plan.	Low to medium (1 to 2)	<0.1 µg m^{-3} (3) at RB59	RBBC Raymond Dill Policy & Regeneration.	Implementation of plan.	Jan 2006	Implemented end 2008.	Enables council to demonstrate commitment to travel plans. Possible improvements in air quality on Reigate High Street.	Negligible impact on Horley air quality management area.	Implementation allows council to encourage other employers to implement their own plans, with possible benefits for Horley.	3 to 6
Additional Cycle Paths in Horley.	Medium (2)	<0.1 µg m^{-3} (3) at RB59	SCC. For information contact Raymond Dill Policy & Regeneration (RBBC).	Additional 5 km of cycle paths linking Horley Station, new developments, airport, and shops.	Jan 2005	Dec 2010	Extension of existing cycle path network. Potential health improvements from increased exercise.	No one uses new routes, hence ‘waste’ of money.	AQ impact minimal unless major shift to cycling. Although risk that paths are not used, at present the lack of paths and heavy traffic on the road is a disincentive to cycle.	6

Measure	Cost[a]	Air Quality Improvement[b]	Person / organisation responsible	Indicator	Start Date	Completion Date	Additional Benefits	Potential Problems	Comments	Simple Cost : Benefit for Air Quality Purposes. (1 = most cost effective)
Incorporation of Sustainable energy policy into local development framework document.	Low (1) to RBBC, possibly Medium (2) to High (3) to developers.	Variable, depending on scheme.	RBBC Policy & Regeneration Raymond Dill.	Incorporation of policy	Current	Jan 2007	Reduction in CO_2 emissions.	Depending on energy source there is a risk of local AQ hotspots e.g. biomass burning. Also additional cost to development.	Benefit to Horley AQMA marginal in short term. However, may help reduce growth in background NO_2 concentrations from new developments in area, which would be of benefit.	?
Horley Design Guide: - Low NO_x boilers.	Low (1)	<0.1 µg m^{-3} (3) at RB59	RBBC Leon Hibbs	Measure adopted by developers.	June 2005	Jan 2007	None – aim is to reduce local NO_x emissions.	Higher emissions boilers chosen – rate of increase in background higher than need be.	Aim is to minimise growth in background.	3
- Minimum of 10 % of energy from renewable sources.	Medium (2)	<0.1 µg m^{-3} (3) at RB59, but potential increase for local 'hot spots' depending on source.	RBBC Policy & Regeneration Raymond Dill.	Scheme up and running.	On going	Jan 2007 for local development framework policy	Minimises CO_2 emissions. Sustainable energy supply.	Amenity / visual impact of scheme – though dependent on source. Risk of localised NO_x 'hot spots' if for example biomass burner.	Background NO_x benefit dependent on source used, and if burning fuel if heat generated used in a local heating scheme.	6
- Home Zone.	Medium (2)	<0.1 µg m^{-3} (3) at RB59	RBBC Planning	New developments completed as home zones.	On going	Jan 2007	Makes for a more pleasant residential area. Encourages walking.	If cars running at much lower speeds risk of more pollution generated.	Impact on air quality potentially low. However, may encourage walking over short distances and avoid car use.	6
Monitoring.	Low (1) to Medium (2) depending on time scale	N/A	RBBC Leon Hibbs	Data capture > 90 %.	On going	On going	Equipment also available for some emergency planning scenarios.	N/A	Real time background site used for diffusion tube work elsewhere in the borough.	N/A

Measure	**Cost[(a)]**	**Air Quality Improvement[(b)]**	**Person / organisation responsible**	**Indicator**	**Start Date**	**Completion Date**	**Additional Benefits**	**Potential Problems**	**Comments**	**Simple Cost : Benefit for Air Quality Purposes. (1 = most cost effective)**
Local Forums / Policy: - AQ Working Group with BAAG.	Low (1) to RBBC	1 µg m^{-3} (1) at RB59	RBBC Pollution Team	No specific measure, but will include Gatwick AQ plan implemented, on going predictive modelling work.	On going	On going	Good working relationship with BAAG. Also access to data to enable future modelling of the airport.	None, other than airport action plan may not be implemented.	Good opportunity to share council and airport technical expertise in relation to measures affecting air quality. Also to include surrounding local authorities where relevant.	1
- New section 106 agreement and sustainable development strategy.	Low (1) to RBBC	1 µg m^{-3} (1) at RB59	RBBC Planning and Environ. Health. Others: GAJA, GOG, GATCOM.	Agreement and Implementation of new agreement and strategy.	On going	Mid 2007	Work also relates to noise, surface access, water quality. Aim is to maintain profile of AQ as potential longer term problem if not addressed.	AQ measures 'watered down' so that do not deliver real improvement in air quality.	AQ improvement is connected to the above measure, not in addition to it.	1
National / EU measures: - Tighter vehicle emissions standards.	Low (1) to RBBC, but very high (3+) to industry.	Up to 1 µg m^{-3} (1) at RB59	UK Government via EU.	Higher standards in place.	?	?	UK and EU wide benefits, not just local.	Improvements on an urban test cycle do not translate into improvements in emissions in the real world.	Policies and standards for different areas e.g. safety must be co-ordinated, so that benefits are maximised.	3+
- Tighter aircraft engine emissions standards.	Low (1) to RBBC, but very high (3+) to industry.	Aim is to reduce the rate of growth of aircraft emissions.	UK Government via EU.	Higher standards in place.	?	?	Global benefits not just for AQ around airports, but also from a climate change perspective.	-	Aircraft emissions are the only growing source of NO_x at Gatwick between 2005 and 2010.	?

Notes:
[a] (1) Low £<100K, (2) Medium £100K to £1 million, (3) High £1 million to £10 million.
[b] (1) improvement of 1 µg m^{-3}, (2) 0.1 to 1 µg m^{-3}, (3) <0.1 µg m^{-3}.
[c] as used mid line forecast in original TEMPRO model equivalent to a 10 % increase in traffic 2005 to 2010.

[d] The current traffic flows as measured on roads in the area are as follows:

	Site ID	AADT 2004	AM weekday peak flow 2004	PM Weekday peak flow 2004
A217 (Mill Lane / Nursery Lane)	A0217 (04063A)	18,061	2036 (8 to 9am)	1703 (17 to 18:00)
A23 (just before Massetts Rd / Woodroyd Av.)	A0023 (04082C)	29,392	2217 (8 to 9am)	2493 (17 to 18:00)
M23 Gatwick Spur* (contact Margaret King at: area4@interroutejv.co.uk)	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and 529498, 141694)	65,964 (2% HGV)	1702 (9 to 10am) to M23 3172 (9 to 10am) to Gatwick	2691 (18 to 19:00) 1665 (14 to 15:00)

***Note these are the revised figures (2008) for 2004. The original 2004 figures are shown below.**

M23 Gatwick Spur (contact Margaret King at: area4@interroutejv.co.uk)	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and 529498, 141694)	63,500 (2% HGV)	4719 (8 to 9am) 4874 (9 to 10am)	3862 (17 to 18:00) 4236 (18 to 19:00)

2007 Figures:

A217 (Mill Lane / Nursery Lane)	A0217 (04063A)	18,323	1881 (8 to 9am)	1802 (17 to 18:00)
A23 (just before Massetts Rd / Woodroyd Av.)	A0023 (04082C)	Site discontinued in 2005, and replacement site not installed.		
M23 Gatwick Spur	6009 & 6010 (TRADS 2 Ref) (529427, 141683) and	63,696 (2% HGV)	1737 (8 to 9am) 2971 (8 to 9am)	2385 (17 to 18:00) 1570 (13 to 14:00)

RB59 is the worst case receptor within the Horley Air Quality Management Area (AQMA).

BAAG: British Airports Authority – Gatwick.
GAJA: Gatwick Airport Joint Local Authorities.
GATCOM: Gatwick Consultative Committee.
GOG: Gatwick Officers Group.
HTC: Horley Town Council.
ODPM: Office of the Deputy Prime Minister.
RBBC: Reigate and Banstead Borough Council.
SCC: Surrey County Council.

Appendix D: Summary of Proposed Actions for the Non Airport Sources of Pollution within the Horley AQMA.

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