SECOND STAGE REVIEW AND ASSESSMENT OF AIR QUALITY

IN

THE BOROUGH OF REIGATE AND BANSTEAD

NOVEMBER 1999

Reigate and Banstead Borough Council
Environmental Health Services
Caberfeigh
24 Hatchlands Road
Redhill
Surrey
RH1 6AR

Tel: 01737 276401/402
Fax: 01737 276404

CONTENTS

List of tables

List of figures

Executive Summary

The Review and Assessment of air quality is the initial part of the Local Air Quality Management (LAQM) process, and this report provides the second stage of the phased Review and Assessment. The intention of the phasing is to ensure that local authorities only undertake as much work as necessary, enabling those local authorities without air quality problems the opportunity not to use up valuable resources. Specific guidance notes have been provided by the DETR for undertaking the Review and Assessment.

This report provides the technical input to the second stage Review and Assessment for the Reigate and Banstead Borough Council. This stage requires the screening of the specific sources of emissions identified in the first stage review and assessment, with the aim to further review and assess whether there is a significant risk of any of the national air quality objectives for 2005 not being achieved. The first stage of the Review and Assessment indicated that further investigation was required for the following pollutants: carbon monoxide, nitrogen dioxide and PM10.

The screening models used in the report were as recommended in the Government's guidance and the approach adopted was precautionary. The main screening methods proposed were as follows:

- for road transport sources, the revised Highway Agency's Design Manual for Roads and Bridges (DMRB) model,
- for industrial sources, the Environment Agency's Guidance for Estimating the Air Quality Impact of Stationary Sources (GN24), although this screening method was not used.

The results of the screening can thus inform the Council on the need or otherwise to proceed with the third stage of the review and assessment.

This report suggests that further investigation is needed for all of the pollutants identified in the first stage review and assessment for which air quality objectives for 2005 have been set, namely:

Carbon monoxide
Nitrogen dioxide
PM10

The Reigate and Banstead Borough Council is therefore recommended to undertake the third stage review and assessment for these pollutants.

The Department of the Environment, Transport and Regions however, has written to all local authorities regarding the Review and Assessment of PM10 and advised that the objective for PM10 is likely to be revised next year following consultation.

The current proposal is that the NAQS objective will be amended in line with the EC Daughter Directive Stage 1 limit values and the expected likelihood of this is, that the need to declare Air Quality Management Areas for PM10 will be significantly reduced.

Page 2 left blank intentionally

1.0 Introduction

1.1 This is the Stage 2 Review and Assessment technical report for the Reigate and Banstead Borough Council, which assists with the local air quality management process as laid down by Part IV of the Environment Act 1995.

1.2 The Stage 1 report, dated June 1999 identified which of the relevant specified National Air Quality Strategy (NAQS) pollutants, as well as localities of concern for each, should be the focus of this second stage review and assessment

1.3 The overall purpose of the Review and Assessment is to enable local authorities to appraise current and future air quality for their geographical area against the objectives of the Air Quality Regulations 1997. The review and assessment follows a three stage phased approach and all local authorities are required to undertake the first stage. Local authorities should then only proceed to subsequent stages if necessary. The assessment requires air quality to be predicted for the year 2005 and assessed against the air quality objectives (summarised in Appendix 1). If the results of this assessment are such that the objectives are unlikely to be met by the year 2005 the local authority can designate an Air Quality Management Area (AQMA) and must prepare a written action plan.

1.4 The recommendations from the Stage 1 review and assessment report for the Reigate and Banstead Borough Council indicated that there is a possibility of an exceedence of the objectives at the end of 2005 and hence the Stage 2 review and assessment should proceed for the following NAQS pollutants:

- Carbon monoxide – (CO)
- Nitrogen dioxide - (NO_2)
- PM10

The aim of this Stage 2 report is therefore to provide a further screening of these pollutants only.

2.0 Development of Review and Assessment

2.1 The above-mentioned Guidance (paragraph 1.11 of LAQM TG4 (98)) [(1)] advises that -

"The aim of the second stage review and assessment is to provide a further screening of pollutant concentrations in the local authority areas. It is not intended that it should provide an accurate prediction of levels of current or future air quality across the whole of the authority's area. The second stage does not require a local authority to estimate every area of exceedence within its locality for each pollutant in question or to estimate the geographical extent of potential exceedences."

2.2 The screening for the second stage therefore involves the selection of a number of locations, where the highest concentrations are likely. These need review and assessment as to whether there is a significant risk of the NAQS objective not being achieved. If the second screening stage predicts that the relevant air quality objective will not be achieved by the end of 2005, the Council will need to undertake a detailed and accurate third stage air quality review and assessment using detailed monitoring, modelling and emission inventories.

2.3 Local authorities are also required, when undertaking the stages of the review and assessment to have regard to locations where individuals are likely to be exposed over the averaging time of the prescribed objective. The following approach is recommended (from para. 1.14 of LAQM TG4):

- For objectives with short averaging times (SO_2 and hourly NO_2) reviews and assessments should be focused on any non-occupational, near ground level outdoor location given that exposures over such short averaging times are potentially likely

- For objectives with longer averaging times (lead, benzene, 1,3-butadiene, carbon monoxide, PM10 and the annual objective for NO_2) reviews and assessments should be focused on the following near ground level outdoor non-occupational locations: background locations, roadside locations and other areas of elevated pollutants concentrations where a person might reasonably be exposed (e.g. in the vicinity of housing, schools or hospitals, etc) over the relevant averaging time of the objective.

2.4 The general approach adopted in this report is that of a precautionary approach, as required in the above Pollutant Specific Guidance (LAQM.TG4 (98)).

2.5 The revised Highway Agency's Design Manual for Roads and Bridges (DMRB)[(2)] model was used for the screening of the road transport sources. A brief outline of the screening method is given below.

2.6 Several smaller Part B industrial sources were identified in the Stage 1 Review and Assessment as having the potential to impact upon Reigate and Banstead Borough Council. These sources however could not be modelled using the GN-24 since that methodology only deals with point sources. (Further details are given in the section 7 on PM10).

3.0 Design Manual for Roads and Bridges (DMRB) Methodology

3.0.1 The DMRB includes a simple methodology for estimating the concentrations of air pollutants in the vicinity of roads. This methodology has been used for many years as a screening tool, primarily in support of assessments of new road building projects. It consists of a number of tables which allow the user to input vehicle flows of heavy and light vehicles, vehicle speed and the year being considered. A series of look-up tables are used to correct for vehicle speed, the year and concentration calculations, to provide estimates of concentrations up to 200m from a road. The methodology is attractive as it implicitly includes the change in vehicle technologies year by year. The methodology has recently been updated as described below.

3.1 Revised Methodology

3.1.1 The Highways Agency has recently released the final version of the revised methodology, and this provides the basis of the calculations made here. The most significant changes are:

- Revision of the emission factor database to reflect emerging emissions legislation;
- Direct application to the NAQS, with predictions over consistent time scales e.g. maximum running 8 hour average for carbon monoxide;
- The background concentrations are now considered separately, allowing the user to use the most relevant background data available e.g. from an air pollution monitoring network or pollution climate mapping;
- A single relationship is used for the variation of NO_2 with oxides of nitrogen (NO_X) concentrations. Previously three different locations were considered: urban, suburban and rural.

3.2 Use of DMRB in Stage 2 Predictions

3.2.1 The data inputs used include annual average daily traffic flows, percentage of Heavy Goods Vehicle (HGV) daily flows and vehicle speed. Predictions have been made for the base year 2005. Background concentrations for 2005 have been calculated using a pollution climate mapping technique and were obtained from the DETR Internet site (http:\environment.detr.gov.uk/airq/aqinfo). The annual average background estimates have been combined with the annual average roadside predictions from the DMRB to derive the final estimated concentration.

3.2.2 Having calculated the total annual mean concentration, a series of correction factors are used to estimate concentrations required in the NAQS. These factors are given in the following table:

Table 1 Calculation of NAQS Concentrations Using DMRB

To get	Multiply	By
Maximum 8 hour mean CO (ppm)	Annual mean CO (ppm)	10
Annual mean NO_2 (ppb)	Derived from NO_X-NO_2 curve	
Peak hour NO_2 (ppb)	annual mean NO_2	5
99^{th} percentile of 24 hour rolling mean PM10	annual mean PM10	3

(Note

1) ppm = parts per million, ppb = parts per billion

2) for benzene - the background benzene concentration (ppb) should be added after the calculation.)

3.2.3 DMRB deals with junctions of major links through the addition of the predicted pollutant concentrations at the same receptor point for each link.

3.2.4 The proposed NAQS PM10 objective is also assessed from the total annual mean concentration, with road sources being compared against an annual mean concentration value of 28$\mu g/m^3$. Where this value is exceeded it is necessary to proceed to the third stage of the review and assessment. This annual mean value is derived from data showing the relationship between PM10 90^{th} percentile of daily means against PM10 annual for UK Automatic Network sites between 1992-97 [(3)].

3.2.5 In line with LAQM.TG4 for roadside locations, the DMRB methodology has been used where the public is likely to be exposed. In this instance it has been assumed, as a precautionary approach, that exposure is at all roads (even though in reality there are some instances where the public does not generally have access and therefore cannot be exposed over the relevant averaging time).

4.0 The following sections relate to the specific pollutants identified in the Stage 1 report as requiring further investigation in the second stage review and assessment:

References:

1. DETR (1998); LAQM.TG4(98) Pollutant Specific Guidance – advice on review and assessment.
2. Highways Agency (1999); Design Manual for Roads and Bridges Vol. 11 (revised version)
3. Stanger SE, Air Quality Consultants, NETCEN (1999) Assistance with the review and assessment of PM10 concentrations in relation to the proposed EU Stage1 Limit Values

5.0 Second Stage Review and Assessment of Carbon Monoxide

The Government has adopted a running 8 hour mean of 10 ppm as an air quality standard for carbon monoxide, with an objective for the standard to be achieved as the maximum 8-hour running average by the end of 2005. The focus of the authority's review and assessment for CO should be non-occupational, near ground level outdoor locations; background locations; roadside locations and other areas of elevated CO concentrations where a person might reasonably be expected to be exposed over an 8-hour period. This has been based on the recommended standard proposed by the Expert Panel on Air Quality Standards (EPAQS).

5.1 Introduction

5.1.1 The Council will need to conduct a third stage review and assessment of carbon monoxide if the second stage indicates that there is a significant risk of the prescribed objective not being achieved by the end of 2005.

5.1.2 To undertake the second stage the guidance suggests that the following parameters need to be considered (from LAQM.TG4):

- the annual mean and annual 90th percentile of 8-hour mean urban background concentration;
- the maximum 8-hour concentration for the end of 2005 at the roadside locations of concern.

5.1.3 The guidance for carbon monoxide highlights that road links with existing or projected annual average daily traffic flows greater than 50,000 vehicles (or combinations of high traffic levels with other major sources) and certain Part A industrial processes are of most significance. (The Pollutant Specific guidance LAQM.TG4 (98) revised the previous draft guidance and confirmed that Part B processes need not be considered potentially significant sources for the purposes of the review and assessment).

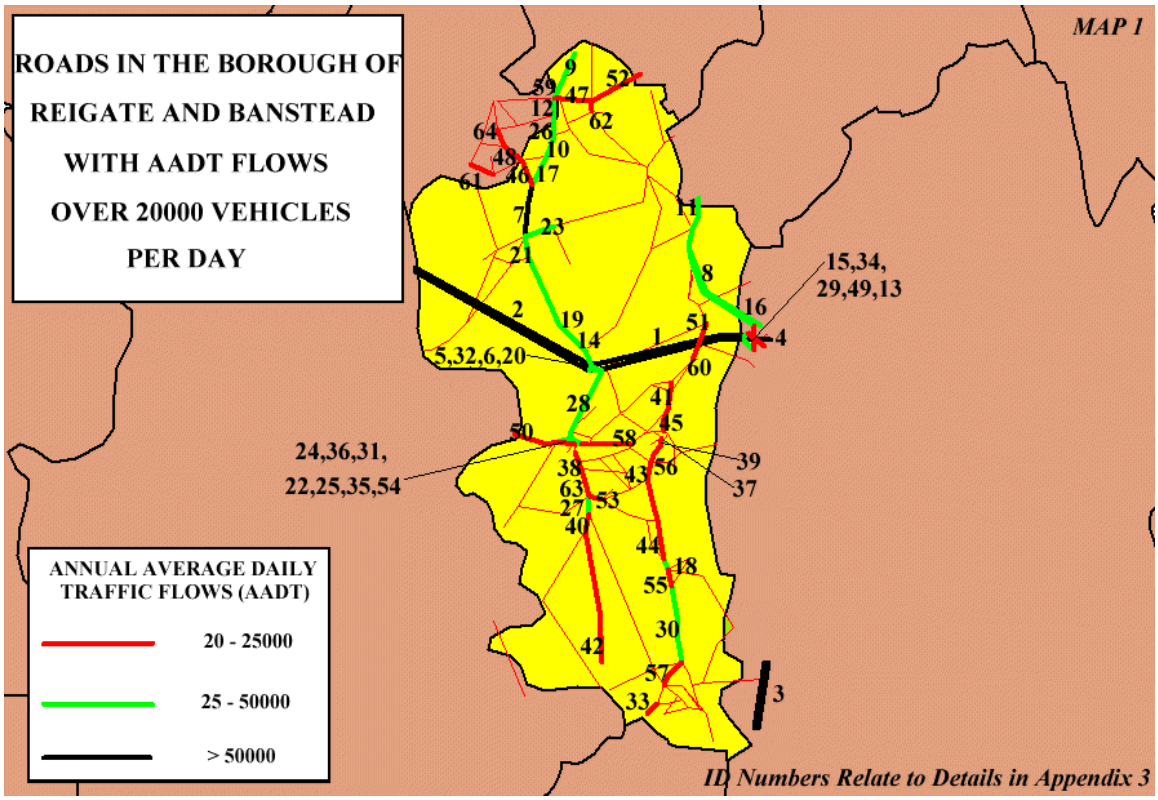
5.2 Sources identified from the first stage review and assessment

5.2.1 From the Council's Stage 1 report those roads identified as being potentially significant sources of carbon monoxide included;

- The M25, M23 and the A217

(See Map 1 overleaf and Table 4 in Appendix 3).

(The road data were supplied by Surrey County Council)



5.2.3 No potentially significant Part A industrial emission sources of carbon monoxide were identified in Stage 1 (using LAQM.TG4 – Annex 1) within the Council's area or within sufficient distance to impact upon it.

5.3 Second stage review and assessment

5.3.1 *Roadside Locations*

5.3.2 Estimations of the annual mean and maximum 8-hour mean CO concentrations for the end of 2005 were prepared using the revised DMRB methodology. DMRB requires annual average vehicle flow, annual average speed, fraction of heavy-duty vehicles and the distance from the road to receptor in order to calculate these concentrations.

5.3.3 Table 4 in Appendix 3 gives the results of the revised DMRB assessment for the road links, with estimated concentrations at 10-30m from the road centre line. Concentrations are predicted for each link at 10, 15 or 30m from the road centre line, dependant on the road link type. (Note - this distance has been chosen to represent the distance where the exposure to the pollutant can be considered at its maximum.)

5.3.4 The results of the DMRB assessment highlight that the predicted maximum 8-hour concentrations for carbon monoxide at the busiest road in the Council's area is 6.6 ppm at an exposure distance of 10-30m from the road centre line. (See Table 4 in Appendix 3).

5.3.5 However, concentrations of carbon monoxide are likely to be higher at road junctions. To assess this, concentrations of carbon monoxide were summed at the busiest junctions. Results of this assessment for the junction of the A217 and the B2032 give a summed concentration of 10.3 ppm, above the objective level of 10 ppm. Therefore, more

investigation is needed within Stage 3 to assess the extent of exceedences of carbon monoxide at junctions.

5.3.6 Industrial Locations

5.3.7 LAQM.TG4 (released in October 1998) advised that only certain specific large Part A processes have the potential to release significant amounts of carbon monoxide. No such Part A processes were highlighted as being potentially significant sources to the Council's area.

5.3.8 Paragraph 2.12 of the revised guidance (LAQM. TG 4(98)) confirms that industrial sources are unlikely to make a significant contribution to 8-hour maximum carbon monoxide concentrations, as the concentrations in stack gases are typically low in the range 10-100 ppm. Hence no Part B process need considered to be a significant source for the purposes of the review and assessment.

5.4 Conclusion

5.4.1 This second stage review and assessment has followed the Government's guidance for carbon monoxide through the use of the recommended screening model and methodology. The guidance also indicates that existing national policies are expected to deliver the national air quality objective by the end of the year 2005 with the possible exception, of the near vicinity of heavily trafficked roads or in the vicinity of certain stationary sources (para. 2.4 of LAQM.TG4).

This second stage review and assessment of the Council's area has indicated that the risk of the carbon monoxide air quality objective being exceeded by the end of 2005 in localities where there might be exposure is not negligible.

Therefore, Reigate and Banstead Borough Council need to undertake a third stage review and assessment of carbon monoxide.

6.0 Second Stage Review and Assessment of Nitrogen Dioxide

The Government has adopted a 1-hour average of 150 ppb as an air quality standard for nitrogen dioxide (NO_2), with an objective for the standard to be achieved as the hourly maximum by the end of 2005. The Government has also adopted an annual average of 21 ppb as air quality standard with an objective to achieve this by the end of 2005. The focus of an authority's review and assessment for the annual average objective should be non-occupational, near ground level outdoor locations with elevated NO_2 concentrations in areas where a person might reasonably be expected to be exposed over a year (e.g. in the vicinity of housing, schools or hospitals etc.). The focus of the authority's review and assessment for the hourly objective should be any non-occupational, near ground level outdoor location given that exposures over one hour are potentially likely in these locations.

6.1 Introduction

6.1.1 The Council will need to conduct a third stage review and assessment of nitrogen dioxide, if the second stage indicates that there is a significant risk of the prescribed objectives (i.e. either the annual mean or the one hour maximum concentration) not being achieved in a relevant location, by the end of 2005.

6.1.2 The guidance for the nitrogen dioxide objective highlights road links with existing or projected annual average daily traffic flows greater than 20,000, certain large relevant industrial processes, or combinations of high traffic levels with other major sources as potentially significant sources.

6.2 Sources identified from the first stage review and assessment

6.2.1 The first stage review and assessment of nitrogen dioxide has indicated that the risk of the nitrogen dioxide air quality objectives being exceeded by the end of 2005 is significant.

6.2.2 The traffic sources identified for those roads in Stage 1 with more than 20,000 vehicles annual average daily traffic flow include:

- M25, M23, A217, A23, A2044, B2221, A25.

(The road data were supplied by Surrey County Council)

Those roads with more than 20,000 vehicles annual average daily traffic flow are as presented in Map 1 on page 12 and Table 4 in Appendix 3.

6.2.3 No potentially significant industrial emissions were identified in the Stage 1 report (based on LAQM.TG4(98) Annex 1) and therefore no further screening has been undertaken.

6.3 Second stage review and assessment

6.3.1 *Roadside Locations (annual average concentrations)*

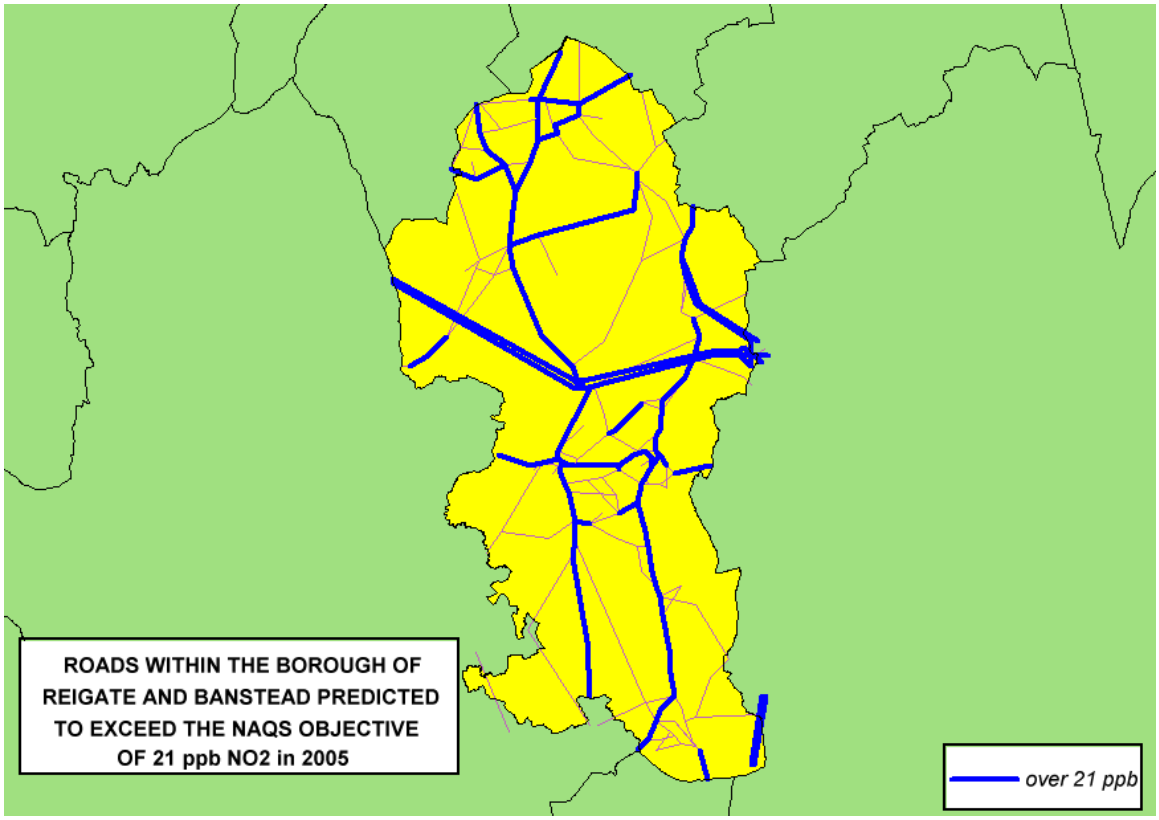
6.3.2 Estimations of the annual mean NO_x concentration for the end of 2005 were prepared using the DMRB methodology. DMRB requires annual average vehicle flow, annual average speed, fraction of heavy-duty vehicles and the distance from the road to receptor

in order to calculate these concentrations. Subsequent conversion to NO_2 is undertaken using empirical methods.

6.3.3 Table 4 in Appendix 3 gives the results of the revised DMRB assessment for those road links with flows greater than 20,000 AADT, with estimated concentrations at 10-30m from the road centre line.

6.3.4 The roads shown in Map 2 below are predicted to exceed the 2005 NAQS annual mean objective for NO_2, (i.e. 21 ppb).

MAP 2



6.4 Conclusion

6.4.1 This second stage review and assessment has followed the Government's guidance for nitrogen dioxide through the use of the recommended screening model and methodology. The guidance indicates that the existing national policies will not, in isolation, ensure that the national air quality objectives will be achieved by the end of the year 2005 for all areas. It further advises that those local authorities with major or heavily congested roads and the potential to result in elevated levels will need to progress to the third stage review and assessment.

The second stage review and assessment has indicated that the risk of the nitrogen dioxide air quality objectives being exceeded by the end of 2005 is not negligible in the Council's area.

Reigate and Banstead Borough Council will therefore need to undertake a third stage review and assessment of nitrogen dioxide.

7.0 Second Stage Review and Assessment of PM10

The Government has adopted a running 24-hour average of 50 µg/m^3 as an air quality standard for PM10, with the objective for the standard to be achieved as the annual 99th percentile of daily maximum running 24-hour averages (that is no more than 4 days exceeding the standard in any one year), by the end of 2005. The focus of an authority's review and assessment for PM10 should be non-occupational, near ground level outdoor locations with elevated PM10 concentrations in areas where a person might reasonably be expected to be exposed over a 24 hour period (e.g. in the vicinity of housing, schools or hospitals etc.). This standard has been based on the recommended standard proposed by the Expert Panel on Air Quality Standards (EPAQS).

The DETR have advised that this objective is likely to change in the light of further research and suggested that it be revised to 40 µg/m^3, measured as the annual mean, and 50 µg/m^3, as a fixed 24 hour mean, with a maximum of 35 exceedences per year (approximately equivalent to the 90th percentile) to be achieved by 31.12.2004. This is based on the proposed EC Air Quality Daughter Directive Stage 1 level.

7.1 Introduction

7.1.1 The Council will need to conduct a third stage review and assessment of PM10 if the second stage review and assessment indicates that there is a significant risk of the prescribed objective not being achieved by the end of 2005. The Government has previously advised that most local authorities will need to progress to a third stage review for this pollutant.

7.1.2 There has been a significant improvement in the understanding of PM10 since the publication of the NAQS, mostly as a result of the publication of a report by the Airborne Particulate Group (APEG) [(1)]. As a result the Government is considering as part of the review of the NAQS, a revision of the PM10 objective in line with the proposed EC Air Quality Daughter Directive Stage 1 level for PM10. To assist with the process informal assistance has been produced and this has also been followed in this section [(2)].

7.1.3 To undertake the second stage the following parameters are considered;

- roadside concentrations of PM10 for the road links identified
- estimated background concentrations of the primary, secondary and coarse components of PM10

7.2 Sources identified from the first stage review and assessment

7.2.1 The first stage review and assessment has indicated that the risk of the PM10 air quality objective being exceeded by the end of 2005 is significant across the whole of the Council's area.

7.2.2 The roads with daily vehicle flow greater than 25,000 identified from Stage 1 include the M25, M23, A217, A23. (The road data were supplied by Surrey County Council).

7.2.3 No Part A industrial processes were identified as being potentially significant within the Council's area or close enough to impact significantly on its area. Part B processes were identified however and a sand drying process, concrete crushing process and quarry process were identified as potential sources of PM10. Further investigation of these processes has confirmed that the likelihood of exposure is minimal as their locations are

remote from the receptor locations and dust control measures are incorporated as part of the authorisation conditions.

7.3 Second stage review and assessment

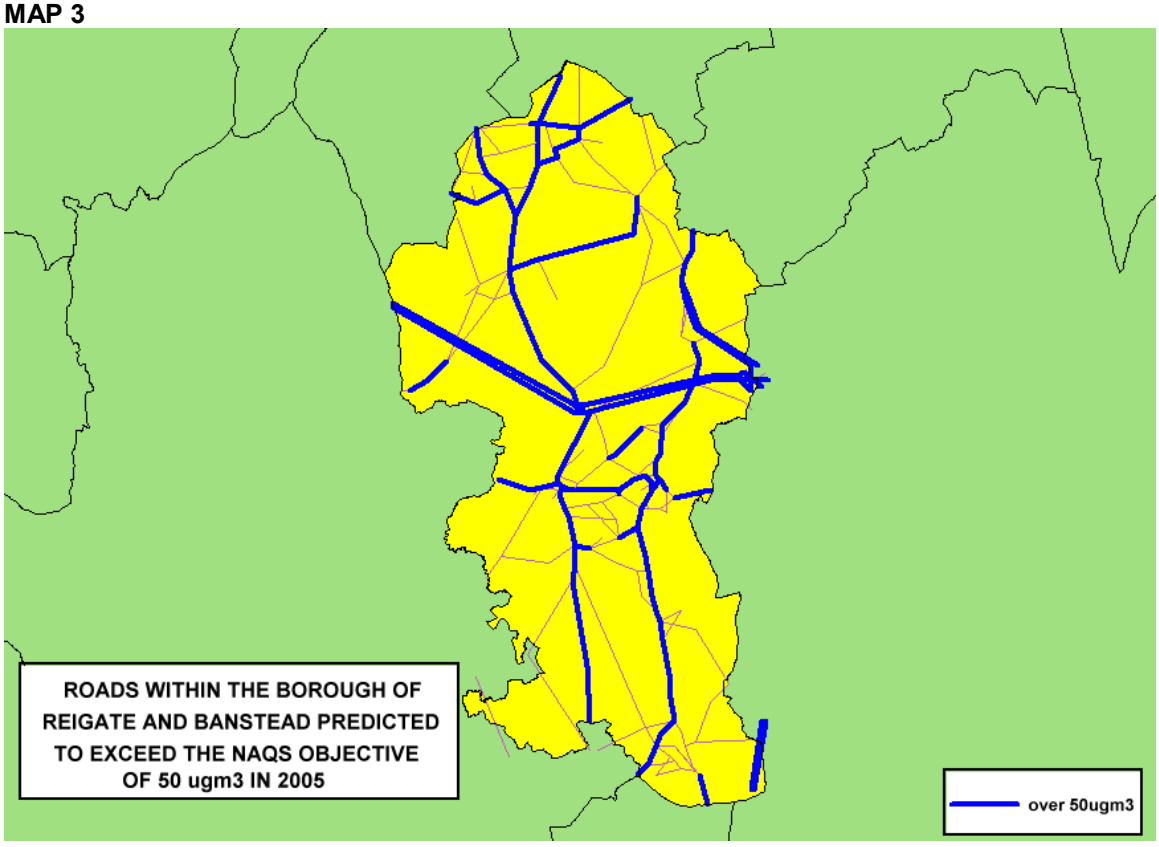
7.3.1 Roadside locations

7.3.2 Details of major roads were collated and from this the roads with daily vehicle flow greater than 25,000 were identified as well as local areas of concern (see also Map 3 on page 18 and Table 4 in Appendix 3).

7.3.3 Following screening of those road sources identified as having AADT flows over 25,000, using DMRB methodology, it was found that the roads shown in Map 3 below and in Table 4 in Appendix 3 are predicted to exceed the 2005 NAQS standard for PM10 (i.e. 50μgm^{-3}).

7.3.4 Testing of the road links using vehicle flows for 2005 with the informal assistance guidance indicates that the total annual mean of 28μgm^{-3} will not be exceeded (see paragraph 3.2.4 and Table 4 in Appendix 3) except on parts of the M25 and A23.

MAP 3



7.4 Conclusion

7.4.1 The second stage review and assessment of the Council's area has indicated that the risk of the current PM10 air quality objective being exceeded by the end of 2005 is not negligible. This confirms the view of the Government, referred to above in 7.1.1, that the national air quality objectives across much of the country will not be achieved by the end of the year 2005.

However, the Department of the Environment, Transport and Regions has written to all local authorities (letter dated 12 March 1999) advising that the objective for PM10 is likely to be revised next year following consultation. The DETR has also advised that the likelihood that Air Quality Management Areas would have to be declared for PM10 would be significantly reduced.

The further testing undertaken using the informal assistance confirms that there are several locations where the total annual mean prediction exceeds 28μgm^{-3}. Thus there is a need to proceed to a third stage review and assessment for PM10.

References:

1. APEG (1999); Report of the Airborne Particles Expert Group
2. Stanger SE, Air Quality Consultants, NETCEN (1999) Assistance with the review and assessment of PM10 concentrations in relation to the proposed EU Stage1 Limit Values

8.0 Local Areas of Concern

8.1 Gatwick Airport

8.2 In the Stage 1 report for the Reigate and Banstead Borough Council, Gatwick Airport was identified as a potentially significant source of PM10 and NO_2. Separate studies of air quality around Gatwick Airport have focused on NO_2 and PM10, as it is widely recognised that these are the two pollutants which are least likely to achieve the NAQS objective in 2005, both around Gatwick Airport and nationally.

8.3 By way of confirmation studies have also shown that concentrations of carbon monoxide around Gatwick were below the NAQS standard in 1996/97. The studies undertaken for the Heathrow T5 public enquiry suggest that the objectives for CO, benzene and 1,3-butadiene will also be met by the end of 2005. It is therefore considered that as there is higher aircraft and road vehicle activity at Heathrow than at Gatwick, the objectives should also be met at Gatwick.

8.4 Pollutant predictions were carried out for 1996/97 concentrations of carbon monoxide, nitrogen dioxide and particulate matter around the airport and for 2008 for nitrogen dioxide and particulate matter only and the results are summarised below:

NAQS Nitrogen Dioxide annual average

Present Day:
Predicted exceedences of the objective near Gatwick are confined to within the airport boundary, except in the northeast where part of Horley is predicted to exceed. The contribution from airport related sources to emissions in this area is approximately 50%.

Future predictions:
Similar exceedences are predicted in 2008, although a smaller area of Horley is predicted to exceed. This reflects the expected reductions from road vehicle emissions.

NAQS PM10 99^{th} percentile running 24hr means

Present Day:
The objective is currently exceeded in many urbanised areas of the UK, and much of the area in and around Gatwick Airport is above the NAQS objective. The majority of Horley is above the NAQS objective for PM10, of $50\mu gm^{-3}$ measured as the 99^{th} percentile of running 24 hour means.

Future predictions:
Concentrations of PM10 in 2008 are predicted to be lower than those experienced at present. Significantly less of Horley is expected to exceed the NAQS objective level of $50\mu gm^{-3}$.

8.5 Proposed Expansion of Gatwick Airport

8.6 If the proposed expansion of Gatwick Airport goes ahead, air quality in Horley is set to be worse in 2008 than at present as aircraft numbers, and therefore total emissions are set to increase. At 85% thrust, aircraft currently produce 2190 tonnes of NO_x per annum, which is predicted to rise to 4571 tonnes per annum by 2008. The majority of this NOx will be discharged in the direction of the prevailing wind from the South West, over Horley. PM10 emissions are predicted to remain much the same as at present, even given the increase in aircraft movements at Gatwick Airport.

8.7 From the limited evidence presented so far, it seems that the only effective way of limiting NO_x pollution in this area is to limit pollution from aircraft. This will present a real challenge to both the aircraft operators and the airport alike.

8.8 The Council feels that it is almost inevitable that an air quality management area will need to be designated for the whole of Horley. However, as Gatwick Airport is not within Reigate and Banstead Borough Council it is therefore out of the Council's control. Nevertheless, traffic movements to and from the Airport can be tackled by the Council to some extent, which may help to improve local air quality.

8.9 There are substantial implications regarding the designation of air quality management areas in this region. Reigate and Banstead Council will need to work closely with neighbouring authorities and other stakeholders when formulating their detailed action plans and also when designating their AQMA's, if this issue is to be tackled effectively.

8.10 In order to aid this process, it is recommended that a more detailed study of this area be undertaken in the Stage 3 review and assessment.

9.0 Conclusion and Recommendation

9.1 This report suggests that further investigation is needed for carbon monoxide and nitrogen dioxide. The Council is therefore recommended to undertake a detailed Stage 3 of the Local Air Quality Management Review and Assessment process for these pollutants.

9.2 The resultant outcome for PM10 partly depends on the Government's consultation process concerning the Review of the Air Quality Strategy. Although the Council will need to progress to a third stage review and assessment for PM10 regardless of which objective is assessed. On the basis of the existing NAQS objective, all roads assessed need to be taken through to a further assessment. However, based on the EU Stage 1 limit value of 28 μgm^{-3}, only 10 road links will need to be assessed further.

List of Appendices

1. List of UK National Air Quality Strategy standards/objectives
2. Summary of Stage 2 Review and Assessment derived from LAQM TG4 (98)
3. Details of Traffic Flows and DMRB derived roadside pollutant concentrations.

APPENDIX 1

Air quality objectives from the Air Quality Regulations 1997 (SI No. 97/3043)

Pollutant	***Standard***	***Objective for 2005***
Benzene	*5ppb running annual mean*	*5ppb running annual mean*
1,3-butadiene	*1ppb running annual mean*	*1ppb running annual mean*
Carbon monoxide	*10ppm running 8 hour mean*	*10ppm running 8 hour mean*
Lead	*0.5µg/m^3 annual mean*	*0.5µg/m^3 annual mean*
Nitrogen dioxide	*150ppb - one hour mean* *21ppb - annual mean*	*150ppb - one hour mean* *21ppb - annual mean*
PM10	*50µg/m^3 running 24 hour mean*	*50µg/m^3 running 24 hour mean (measured as 99th percentile)*
Sulphur dioxide	*100ppb - 15 minute mean*	*100ppb - 15 minute mean (measured as 99.9th percentile)*
Ozone	*50ppb running 8 hour mean*	*50ppb running 8 hour mean (measured as 97th percentile)*

Existing NAQS Objective	**Proposed NAQS Objective**
50 µg/m^3, measured as the 99th percentile of the daily maximum running 24 hour mean (equivalent to 4 exceedences per year), to be achieved by 31.12.2005 *Objective is based on measurements carried out using the TEOM analyser, or equivalent*	*40 µg/m^3, measured as the annual mean, and 50 µg/m^3, as a fixed 24 hour mean, maximum of 35 exceedences per year (approximately equivalent to the 90th percentile) to be achieved by 31.12.2004* *Objectives are based on the European gravimetric transfer reference sampler or equivalent*

(Note the proposed NAQS objective is based on proposed EC Stage 1 Limit Values)

APPENDIX 2

Summary of Stage 2 Review and Assessment

These are derived from the DETR Pollutant - Specific Guidance (paragraph 1.11 of LAQM TG4 (98)) -

General

"The aim of the second stage review and assessment is to provide a further screening of pollutant concentrations in the local authority areas. It is not intended that it should provide an accurate prediction of levels of current or future air quality across the whole of the authority's area. The second stage does not require a local authority to estimate every area of exceedence within its locality for each pollutant in question or to estimate the geographical extent of potential exceedences."

The screening for Stage 2 involves the selection of a number of locations, where the highest likely concentrations are likely. These need review and assessment as to whether there is a significant risk of the NAQS objective not being achieved. If Stage 2 indicates that the levels will not be achieved the Council will need to undertake a detailed and accurate third stage air quality review and assessment.

The Stage 2 will also have regard to locations where individuals are likely to be exposed over the averaging time of the prescribed objective, as follows:

- For short averaging times (SO_2 and hourly NO_2) the focus is on any non-occupational, near ground level outdoor location given that exposures over such short averaging times are potentially likely
- For longer averaging times the focus should be near ground level outdoor non-occupational locations, including background locations, roadside locations and other areas of elevated pollutants concentrations where a person might reasonably be expected to be exposed over the relevant averaging time of the objective

For each of the following pollutants the following investigations will be undertaken:

Benzene

Only areas affected by industrial ground level or point sources alone or in combination with road sources are likely to be at risk of exceedence.

TG4 guidance advises that simple modelling may not be relevant – therefore it suggests the use of passive diffusion tube sampling for existing sources to determine annual mean > 5ppb.

Carbon monoxide

Screening modelling can be applied for areas where the risk of exceedence is not negligible it is necessary to consider mainly roadside locations and some industrial locations and also where applicable a combination of such locations should be considered. In all cases an urban background concentration should be applied.

Alternatively monitoring can be undertaken (although measurements should have < 30% uncertainty). Where road transport is the dominant source during episodes then the ratio of current to 2005 fleet emission factors, times a factor based on road traffic growth forecast, can be used to predict max 8 hour concentration.

Roadside locations – for the current year and 2005 near busy existing and planned roads where public likely to be exposed, use DMRB (note - NRTF can be used, where local traffic data are unavailable). Both annual mean and max 8-hour concentrations can be predicted and a background should also be added.

Industrial locations – typical concentrations likely to be low 10-100ppm in stack gas. Use EA method for max 8 hour concentration and add background concentration (either annual average or more conservatively the 90th percentile of 8 hour values, which can be assumed to be twice annual mean).

Urban background locations - concentrations can be derived from suitable monitoring sites or DETR WWW site. For 2005 annual average concentration can be assumed to be half 1996 value. (Note – annual average correlates poorly with max 8-hour mean).

Overlapping road and industrial sources – the overall maximum 8 hour maximum concentration can be estimated from the sum of:

i) The maximum 8 hour concentration from industrial sources and the 90th percentile of 8 hour averages at urban background and major road sources. OR
ii) The annual mean concentration from industrial sources and the maximum 8 hour concentration due to urban background/ major road sources.

(Note -the precautionary approach requires that the larger be selected.)

Nitrogen dioxide

The screening models use concentrations of the primary pollutant (NO_x), with subsequent conversion to NO_2 using empirical methods. The prediction of annual mean NO_2 should be based on the DMRB methodology for roads, and either EA method. Appropriate continuous monitoring data can be used to assess background concentrations.

As an alternative to screening monitoring can be used (although measurements should have < 30% uncertainty). Where road transport is the dominant source during episodes then the ratio of current to 2005 fleet emission factors of NO_x, times a factor based on road traffic growth forecast can be used to predict max hour concentration

<u>For annual mean NO_2 concentrations</u>:

Roadside locations use DMRB to calculate NO_x and add background NO_x then compare to NO_2 using TG4

Industrial locations use EA method to derive NO_2 with overlapping sources added. Assumed average ratio of NO_2 /NO_x at point of maximum impact is 0.2. (Where higher concentrations of NO_2 emitted then add NO_2 + 0.2NO)

Urban background concentrations can be obtained from monitoring data, for 2005 assume NO_x is 0.5 of 1996 value or 0.6 of 1998 value and NO_2 is 0.7 of 1996 value or 0.75 of 1998 value. (Note this assumes no change in ozone concentrations over this time period)

Combined sources add roadside, industrial and background NO_x and compare to NO_2 (although it should be noted that the industrial NO2 will be overestimated).

<u>For max 1 hour concentrations</u>:

Roadside locations use DMRB then multiply annual mean NO_2 by 6

Industrial locations use the smaller of
max 1 hour NO_x max, plus background (assumed as twice annual mean NO_2) OR
max oxidant (ozone + NO_2) measured nearest national AMN site.
(For multiple sources only sum if close together e.g. on same site)

Urban background multiply annual mean NO_x by 16 (although care is needed see TG4)
Combined sources add roadside 1 hour max NO_x, annual mean background NO_x determined by DMRB (x10) and largest annual mean industrial NO_x from stack of concern. Then compare resultant concentration to $N0_2$ using TG4.

PM10

TG4 advises that most local authorities will need to progress to a second and third stage review for this pollutant, with the exception of some local authorities in the north and west of the U.K. If low level combustion sources other than road transport are significant, then LAs can undertake a second stage R&A, but should also undertake a third stage. The second stage is also inadequate for estimation of large fugitive or uncontrolled dusts.

Sulphur dioxide

The 99.9^{th} percentile of 15-min average concentrations should be estimated for the current year and 2005. As an alternative it is possible to use the number of exceedences. Where sources do *not* overlap use the sum of the industrial source estimate, twice the annual average background and roadside concentration, if appropriate. Where sources do overlap the number of exceedences should be estimated for each source by summing the number of exceedences.

Alternatively monitoring data can be used if appropriate to exposure of public (use EA method), although > 3 years data are needed. Bubblers can be used for annual daily max, and to obtain annual 99.9^{th} percentile of 15-min averages (use Willis formula see TG4).

Roadside locations – represents a small source, it is estimated that 2 ppb per 10,000 vehicles AADT should be added to the 99.9^{th} percentile of 15 min averages.

Urban background locations - concentrations can be derived from suitable monitoring sites or DETR WWW site.

Industrial locations – Part A processes- apply EA method for annual mean and 99.9^{th} percentile of 15-min average concentrations around each stack. Impact footprint should also estimated, and where footprints overlap, it should be assumed that plumes do not impact simultaneously. EA method does not provide estimate of number of exceedences, although does give estimate of 99.9^{th} percentile and max hourly average. Interpolation should be used from exceedences of 1 hour 75ppb, although the risk of exceedence where number of hours is < 9 is negligible (see TG4). Mean urban background should be included (the precautionary approach is to use x2 value). Overlapping footprints should be added.

Part B/ solid fuel/oil combustion processes > 5MW use EA method to obtain 99.9^{th} percentile. (Note overlapping sources are not likely to be problem.

Note – an "impact footprint" can be drawn from a circle centred on a stack, with a radius of twice the distance to point of maximum impact.

APPENDIX 3

N.B. The DMRB method is a screening tool and therefore the results given are a conservative prediction in line with the precautionary approach.

A fuller explanation is given in the DMRB methodology section in the main body of the report.

Appendix 3

Table 1 Traffic flows and DMRB Derived Roadside Pollutant Concentrations along Major Roads in Reigate and Banstead Borough Council
(AADT - data supplied by the Surrey County Council)

MAP ID	Road Description 1	Road Description 2	AADT Flow (1995)	AADT Flow 2006	NO_2 Annual Mean Concentration (ppb)	NOx Concentration (ppb)	Max 8hr Mean CO Concentration (ppm)	99th %ile 24 ave PM10 Conc. ugm^3	PM10 Annual Mean (ugm^3)
1	Junction 7 M25 / Junction 8 M23	Junction 8 M25	115034	138875	47.20	190.10	5.39	95.30	31.77
2	Junction 8 M25	BDY Reigate and Banstead (M25)	106169	127532	46.60	182.80	5.14	94.10	31.36
3	Junction 10 M23	M23 / B2036	80984	91957	38.80	108.10	4.41	84.60	28.21
4	Junction 7 M25 Across the Junction		76601	92465	43.90	151.80	4.37	89.30	30.04
5	Junction 8 M25 Across the Junction		69771	87729	44.30	155.60	4.26	89.60	29.86
6	Junction 8 M25 Slip		56555	59327	30.10	60.10	3.72	78.10	26.24
7	A217/B2032	A217/A240	55180	56295	34.50	80.80	3.61	82.00	26.26
8	Junction 7 M23	BDY Reigate and Banstead (A23)	45959	50051	43.50	148.10	5.76	94.80	31.62
9	A217/A2022	BDY Reigate and Banstead (A217)	43832	47815	32.40	70.10	3.71	81.30	27.01
10	A217/B2221	A217/B2219	42956	45127	31.20	64.70	3.52	80.30	31.07
11	BDY Reigate and Banstead A23	Junction 7 M23	42103	45792	42.70	140.00	5.48	93.20	31.07
12	A217/A2022 (over Junction)		39778	42795	31.60	66.40	3.46	80.30	27.05
13	Junction 8 M23 Across the Junction		36835	41639	29.90	59.10	3.31	77.30	25.81
14	Junction 8 M25	A217/Babylon Lane	36162	42512	33.60	75.90	3.77	80.00	26.78
15	Junction 8 M23 Across the Junction		35416	41264	28.50	54.00	3.31	76.80	25.81
16	Junction 7 M25 / Junction 8 M23	?	33593	36402	30.10	60.20	3.19	77.20	26.30
17	A217/A240	A217/B2221	33551	33985	30.10	60.20	3.24	78.90	26.17
18	A23 ?	A23/A2044	33288	41211	38.50	105.40	5.18	87.60	26.95
19	A217/Junction 8 M25	A217/B2032	33047	37281	31.50	66.10	3.24	79.80	26.63
20	Junction 8 M25/A217	?	32908	37427	32.40	70.20	3.21	79.70	26.89
21	A217/B2032 Junction		29726	33634	31.20	64.80	3.16	79.40	26.55
22	A25/A217 Junction		29155	35185	30.60	62.30	3.64	79.60	25.83
23	A217/B2032	Along the B2032	28392	29032	40.50	120.90	6.66	95.20	26.04
24	A25/A217 Junction	Along the A217	27749	37270	29.00	55.50	3.72	78.90	26.70
25	A25/A217 Junction	Along the A25	27369	43741	32.40	70.20	3.75	81.10	26.76
26	A217/B2219	A217/A2022	27317	29086	28.40	53.30	3.12	77.70	25.99
27	A217/A2044 Junction	Along the A217	27231	29063	29.10	56.00	3.19	78.10	26.05
28	A25/A217 Junction	Junction 8 M25/A217	26176	30345	29.80	47.90	3.34	78.70	25.50
29	M25/M23 Junction		26130	29891	29.50	57.80	3.36	78.10	25.80
30	A23/B2036	A23/A2044	25605	32466	30.60	62.30	3.40	79.30	26.48
31	A25/A217 Junction	Along the A25	25472	23933	27.60	49.30	3.05	77.10	25.67
32	Junction 8 M25		25107	31621	27.80	51.30	3.09	76.10	26.43
33	A217/A23	?	24793	30689	30.00	48.60	3.25	78.70	25.50
34	Junction 7 M25	Junction 8 M3	24402	28933	24.70	41.30	2.80	75.20	26.09
35	A25/A217 Junction	Along the A217	24314	29913	28.20	52.70	3.46	77.90	26.23
36	A25/A217 Junction	Along the A25	24065		**Link not include in Surrey County Council Traffic Model for 2005**				
37	A23/A25		23920	25980	28.10	52.30	3.18	77.60	26.12
38	A25/A217 Junction	Along the A217	23804	29045	28.70	54.40	3.58	78.20	25.90
39	A25/A23		23687	25562	32.60	71.00	4.30	81.30	25.92
40	A2044/A217		23424	24278	28.30	53.20	3.06	77.50	25.63
41	A242/A23	A25/A23	23373	25877	29.30	56.70	3.18	78.10	25.76
42	A2044/A217	A217 Hookwood	22991	23860	27.90	51.70	2.95	77.10	24.00
43	A23/A25	Along the A23	22919	25865	29.80	58.80	3.11	78.30	25.95
44	A23/A25	A23/A2044	22615	28068	29.90	59.20	3.03	77.90	32.51
45	A23/A25	Along the A23	22403	25453	28.30	52.90	3.17	77.60	25.89
46	A217/A240	A240/B2221	22311	23420	26.90	48.30	2.98	76.70	25.56
47	A217/A2022	A2022/B2218	22018	22584	27.20	49.00	2.92	76.70	25.57
48	A240/B2221	A240/B284	21997	23634	27.80	51.70	3.05	77.20	26.24
49	Junction 7 M25	Junction 8 M23	21164	22727	28.10	52.50	2.89	75.90	25.40

Appendix 3

Table 1 Traffic flows and DMRB Derived Roadside Pollutant Concentrations along Major Roads in Reigate and Banstead Borough Council
(AADT - data supplied by the Surrey County Council)

MAP ID	Road Description 1	Road Description 2	AADT Flow (1995)	AADT Flow 2006	NO_2 Annual Mean Concentration (ppb)	NOx Concentration (ppb)	Max 8hr Mean CO Concentration (ppm)	99th %ile 24 ave PM10 Conc. ugm^{-3}	PM10 Annual Mean (ugm^{-3})
50	A25/A217 Junction	Along the A25	20829	25145	27.80	51.20	3.16	77.40	25.61
51	A23/M25		20723	24919	25.20	42.60	3.02	76.10	25.69
52	A2022/B2218	A2022/B278	20723	24007	30.10	60.30	3.12	78.40	25.25
53	A2044/A217 Junction	Along the A2044	20478	22670	30.70	62.60	3.02	78.60	27.54
54	A25/A217 Junction	Along the A25	20472	30331	27.20	49.00	3.34	77.40	26.24
55	A2044/A23	A23 Salfords	20443	26445	29.90	59.30	3.06	78.40	25.92
56	A23/A25 Junction	Along the A23	20350	21738	25.60	44.00	2.94	76.00	25.43
57	A23/B2036	A23 Horley	20194	25639	29.50	57.50	3.17	78.20	25.69
58	A25/A217 Junction	Along the A25	20067	24402	26.20	45.90	3.07	76.50	25.63
59	A217/A2022	A2022/B2219	19997	22911	26.60	47.00	3.09	76.60	25.58
60	A23/M25		19782	23098	28.80	54.90	3.03	77.60	25.56
61	B2221/B290		19675	22863	30.50	61.80	6.09	82.50	25.45
62	A2022/B2218 Junction	Along the B2218	19610	23868	29.30	56.80	3.87	78.70	25.95
63	A25/A217 (A2944)		19231	22215	27.10	49.00	3.07	76.80	25.34
64	A240/B284	A240/A2022	19100	21423	24.90	41.80	2.88	75.60	25.59