South Cambridgeshire District Council

The Further Assessment of Nitrogen Dioxide and PM_{10} Along the A14 Corridor

South Cambridgeshire District Council

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Executive Summary

The Environment Act 1995, requires all local authorities to take a risk-based approach to reviewing air quality in their area, assessing pollutant concentrations against health based objectives prescribed in regulations. Where it is found that the objective levels are unlikely to be met, local authorities must declare Air Quality Management Areas (AQMAs) and draw up Air Quality Action Plans (AQAPs) for improving air quality in those areas.

In 2004 South Cambridgeshire District Council identified in their Progress Report a potential area of exceedence of the annual mean NO_2 objective adjacent to the A14. This exceedence was indicated by monitoring results from measurements undertaken in the vicinity of the A14 by both diffusion tube and continuous automatic techniques. A detailed assessment of emissions along the A14 was undertaken in 2006, which concluded that traffic emissions from the A14 are likely to cause an exceedence of the annual mean nitrogen dioxide objective at relevant locations. An Air Quality Management Area for nitrogen dioxide was formally declared in July 2007 along the A14 between Milton and Bar Hill.

In addition, the Progress Report of 2006 identified possible areas of exceedence of the 24-hour mean PM_{10} objective in areas adjacent to the A14 at Bar Hill and Impington. This was based on actual 2006 monitoring data. Therefore, in 2007, a detailed assessment of PM_{10} along the A14 corridor was carried out, which concluded that the national objective for 24-hour mean PM_{10} is not being met and that the existing Air Quality Management Area for nitrogen dioxide should be modified to include PM_{10}.

Both of the detailed assessments have shown that traffic emissions from the A14 are likely to cause exceedences of the daily PM_{10} objective and the annual mean NO_2 objective at relevant locations.

A further assessment of air quality must take place within 12 months of formal designation of an AQMA. It acts to ascertain the required improvement in air quality and to give more accurate detail on the sources of the exceedences of objectives in order that an Air Quality Action Plan can be written with specific targets in mind.

This further assessment concentrates on monitoring data obtained and changes in local circumstances since the detailed assessments, source apportionment and required improvement in air quality.

The major source of pollution along the A14 is undoubtedly traffic emissions with a large percentage contribution from Heavy Duty Vehicles (HDVs). This is not surprising given that the A14 forms part of the Trans Europe Highway linking the Midlands and the North of England to the ports of Harwich and Felixstowe and the sections around Cambridge experience a “higher than national average” flow of HDV).

Contents

Tables:

Figures:

Appendices:

1.0 Introduction

1.1 Policy Background

The Environment Act 1995 provides the legal framework for requiring Local Authorities in England and Wales to review the air quality in their area against national objectives including for some pollutants the number of times they must not be exceeded. Where a Local Authority predicts these objectives will be exceeded then they must declare an air quality management area in those locations.

The main elements of the NAQS can be summarised as follows:

- National Air Quality Standards and Objectives are based upon the health effects of the pollutants of concern.
- The use of policies by which objectives can be achieved and which include the input of important factors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with target dates for the achievement of objectives.

At the centre of the AQS is the use of national air quality objectives to enable air quality to be measured and assessed. These also provide the means by which targets and timescales for the achievement of objectives can be set. Most of the proposed objectives have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). The objectives for nitrogen dioxide were to be achieved by 31st December 2004 for PM_{10} and 31st December 2005 for nitrogen dioxide with the targets carrying on into future years. The objectives are presented in Appendix 1. This shows the standards in $\mu g/m^3$ with the number of exceedences that are permitted for the shorter-term objectives.

Specific objectives relate either to achieving the full, annual mean or where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as Bonfire Night, November 5th.

In addition, the Air Quality Standards Regulations 2007 have been introduced in the UK. These implement the UK limit values of pollutants in the ambient air and set out the Governments objectives.

Specifically, the 2007 Regulations transpose Directive 2004/107/EC (the Fourth Daughter Directive) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in the ambient air and to replace the Air

Quality Limit Values Regulations 2003 in order consolidate all the Daughter Directives and the Air Quality Framework Directive.

The Regulations set out target values for those pollutants mentioned in the ambient air and sets objectives for local authorities to continually improve air quality and maintain good air quality.

1.2 Nitrogen dioxide (NO_2)

The objectives adopted in the UK are part of the Air Quality Strategy published by the Government in January 2000 and incorporated into the Air Quality Standards Regulations 2007. For Nitrogen Dioxide these objectives are:

- An annual average concentration of 40 $\mu g/m^3$
- A maximum hourly concentration of 200 $\mu g/m^3$ not to be exceeded more than 18 times a year

Both were to be achieved by 31st December 2005 with the targets following into future years.

Modelling studies suggest that in general achieving the annual mean of 40 $\mu g/m^3$ is more demanding than achieving the hourly objective. If the annual mean is achieved, the modelling suggests the hourly objectives will also be achieved.

The main source of NO_x in the United Kingdom is road transport, which, in 2000 accounted for approximately 42% of emissions. Power generation contributed approximately 29% and domestic sources 5%.

National measures are expected to produce reductions in NO_x emissions and achieve the objectives for NO_2 in many parts of the country. However, the results of the analysis set out in the National Air Quality Strategy suggest that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures will be required to ensure that air quality objectives are achieved everywhere. Generally those locations that will require further measures in order to achieve the objectives include major roads, or highly congested roads that have the potential to result in elevated levels of NO_2 in relevant locations.

1.3 Particulates (PM_{10})

The national Air Quality Strategy set the objective for PM_{10} particulate material of 50$\mu g\ m^{-3}$, measured as the 99th percentile of the daily maximum running 24 hour mean (equivalent to 4 exceedences per year). The objective was based on measurements carried out using the TEOM analyser, or equivalent.

The Government published its proposals for review of the National Air Quality Strategy in early 1999 (DETR, 1999). The review presented proposals for revised and additional objectives for PM_{10}. Revised objectives for PM_{10} were proposed because:

- Work carried out by the Airborne Particles Expert Group (APEG) indicated that the original objective was unrealistic;

- The Common Position agreed on the Air Quality Daughter Directive (AQDD) at Environment Council in June 1998 included different objectives for PM_{10}.

These included a 24 hour limit value of 50 µg m^{-3}, not to be exceeded more than 35 times per year and an annual limit of 40 µg m^{-3} to be achieved by 31st December 2004 (EU Stage 1 objectives). The AQDD specifies that the transfer reference method for determining compliance is to be a gravimetric[1] measuring method.

The Air Quality Strategy replaced the original objective for PM_{10} with the AQDD objectives. The current Standards, incorporated into the Air Quality Standards Regulations 2007, to be achieved are:

- An annual average concentration of 40 µg m^{-3} (gravimetric);
- A 24 hour mean concentration of 50 µg m^{-3} (gravimetric) not to be exceeded more than 35 times a year.

1.4 Aims of the Further Assessment

This further assessment has the following aims:

- To confirm results of earlier review and assessment work and to show that the Council was right to declare the Air Quality Management Area in the first place;

- To calculate more accurately how much of an improvement in air quality will be required to deliver the air quality objectives within the Air Quality Management Area;

- To refine knowledge of the sources of air pollution so that an Air Quality Action Plan can be prepared;

- To take account of any local or national policy developments which have come to light since the Air Quality Management Area was declared;

[1] Comparison of UK monitoring data determined with TEOM instruments with the European Union Directive limit values is not straightforward since the EU limits are based on measurements of PM_{10} by other instrumental techniques which yield higher concentrations (APEG, 1999).

- To report on further real-time monitoring of air quality carried out in the borough

- To investigate whether the assumptions on which the Air Quality Management Area has been based are still valid

- To check whether or not the AQMA is still valid.

The further assessment supplements the information provided in earlier review and assessment work, specifically, The Detailed Assessment of Nitrogen Dioxide Along the A14 Corridor (2006) and The Detailed Assessment of PM_{10} Along the A14 Corridor (2007).

1.5 Summary of the Detailed Assessment of Nitrogen Dioxide along the A14 Corridor (2006)

In 2004, South Cambridgeshire District Council identified in their Progress Report a potential area of exceedence of the annual mean NO_2 objective in areas adjacent to the A14. This exceedence was indicated by monitoring results from measurements undertaken in the vicinity of the A14 by both diffusion tube and continuous automatic techniques. As required a detailed assessment of emissions in this area was undertaken employing atmospheric dispersion modelling to predict the extent of any possible exceedence.

The detailed assessment identified that traffic emissions from the A14 were causing an exceedence of the annual mean nitrogen dioxide objective at relevant locations and will do so in the foreseeable future. Therefore, it was necessary to declare an Air Quality Management Area for the extent of this exceedence. The AQMA for NO_2 is attached as Appendix 2a.

1.6 Summary of the Detailed Assessment of PM_{10} along the A14 Corridor (2007)

The annual Progress Report of 2006 identified that there was a possibility that receptors adjacent to the A14 would be affected by levels of PM_{10} above the national objectives. Monitoring of PM_{10} in 2005 and 2006 had shown that although the annual mean objective for PM_{10} was being met, the 24-hour mean objective was being exceeded.

The detailed assessment of fine particulate matter (PM_{10}) along the A14 corridor was completed in December 2007 and in accordance with the Council's statutory duties on local air quality management predicted that the air quality standard for the 24 hour mean PM_{10} objective is not being met in some areas adjacent to the A14. As there are residential properties within this location it may be assumed that some people may be exposed to levels of PM_{10} during their day-to-day activities which could potentially affect their health.

The detailed assessment recommended the declaration of an Air Quality Management Area for PM_{10} between Bar Hill and Histon. Given that the AQMA for PM10 sits inside the AQMA for NO_2, it was decided, with agreement from DEFRA, that the existing AQMA for NO_2 simply be modified to include PM_{10}. The areas of exceedence of the daily mean objective for PM_{10} is included within Appendix 2b.

As with the detailed assessment for NO_2, the detailed assessment for PM_{10} identified that traffic emissions from the A14 were the likeliest cause of the exceedence of the objective. Therefore, it was necessary to declare an Air Quality Management Area for the extent of this exceedence. The AQMA for PM_{10} is attached as Appendix 2a.

The objective for annual mean PM_{10} was assessed as not under threat of exceedence, a conclusion backed up by the results of continuous monitoring and detailed dispersion modelling.

2.0 Monitoring History and Monitoring Locations

2.1 Particulate Matter (PM_{10})

Continuous monitoring is undertaken at two locations for fine particulate matter: Bar Hill (OS Grid Reference 538685,263760) and Impington (OS Grid Reference 543740,261626) using Beta Attenuation Monitors (BAMs). The details of the monitors are shown in Table 1, below.

BAMs work by passing a small beta ray (^{14}C) transmission across a clean filter paper. The filter paper is then automatically passed through the sample inlet at which point, particulate matter is drawn onto the filter. The beta ray transmission is then re-measured and the particulate concentration is calculated using the difference between the 1st and 2nd beta ray transmission measurements.

The Bar Hill site has been in operation since 2001 and the Impington site since January 2003. Both locations were chosen due to the closeness to the A14. It is also considered that the sites are similar to the nearby receptors situated alongside the A14.

Table 1: The Continuous PM_{10} monitors within the District

Site name	**Monitor type**	**Detail**	**Easting**	**Northing**	**Distance to road (m)**
Bar Hill	Eberline FH62-IR Beta Attenuation	Heated inlet manifold held at 40°C to drive off volatile component. Results multiplied by 1.3 in line with Guidance Document LAQM TG(03)	538685	263760	8
Impington	Eberline FH62-IR Beta Attenuation		543739	261625	12

2.2 Nitrogen Dioxide (NO_2)

Nitrogen dioxide monitoring within South Cambridgeshire is carried out by two techniques: automatic real time monitoring and diffusion tube monitoring. Continuous monitoring is undertaken at the same two locations as the particulate matter detailed in Table 1. Both sites measure nitrogen dioxide by chemiluminescence.

Table 2: The Continuous NO_2 monitors within the District

Site name	Monitor type	Detail	Easting	Northing	Distance to road (m)
Bar Hill	Thermo 42C	Ozone Chemiluminescence	538685	263760	8
Impington			543739	261625	12

Ozone chemiluminescence is the reference method specified by the EC NO2 Directives. The analysers are calibrated with traceable gas mixtures certified to ISO17025 by the National Environment Technology Centres' (NETCEN) Gas Standards Calibration Laboratory. This provides traceability of measurement to recognised national standards held at NPL or equivalent organisations. The expected accuracy of the method for Nitrogen dioxide is approximately +/- 11% with a precision of +/- 3.5ppb. NETCEN undertake data audit management and audit of the real-time results using documented procedures.

Measurement of Nitrogen dioxide is also undertaken by diffusion tube monitoring with a network of locations across the district, which have been monitored since 1995. There are currently 19 sites throughout the District. The tubes are supplied and analysed by Harwell Scientifics a UKAS accredited laboratory (0322). The tube preparation method is 50% TEA in Acetone and analysis is by desorption with distilled water, and the extract analysed using a segmented flow auto analyser with ultraviolet detection. The exposure periods for the diffusion tubes are those of the UK Nitrogen Dioxide Diffusion Tube Network run by NETCEN which effectively is a four or five week duration. QA/QC procedures are as detailed in the UK NO2 Diffusion Tube Network Instruction Manual, this document can be found at www.airquality.co.uk/archive/reports/cat06/no2instr.pdf.

3.0 Monitoring Results

3.1 Continuous Monitors

Table 3 displays the results of the continuous monitoring of nitrogen dioxide at Impington. Data capture in 2007 was very good, achieving the standard required by DEFRA.

Until 2007, the results were indicating a fluctuating but generally downward trend with exceedences of the 1-hour mean in 2002, 2003 and 2005. Between 2002 and 2004, the annual mean of 40 µg/m3 was being exceeded but the concentrations were reducing. However, 2007 results show that the air quality objective for annual mean nitrogen dioxide at this site will not be met. There are no exceedences of the hourly mean in 2007.

Table 3: The NO_2 monitoring results at the Impington continuous monitoring station

	NO_2 2002	**NO_2 2003**	**NO_2 2004**	**NO_2 2005**	**NO_2 2006**	**NO_2 2007**	**National Air Quality Objectives**
Maximum hourly mean	236.7 µg/m^3	485.5 µg/m^3	299.5 µg/m^3	281.0 µg/m^3	160.0 µg/m^3	145.0 µg/m^3	
Hourly mean 99.8th percentile	184.3 µg/m^3	294.7 µg/m^3	250.7 µg/m^3	93.3 µg/m^3	106.4 µg/m^3	126.0 µg/m^3	**200 µg/m^3 <18 exceedences**
Number of exceedences of the AQS 200µg/m^3	2	141	0	1	0	0	**18**
Annual Recorded Mean	48.5 µg/m^3	52.2 µg/m^3	41.3 µg/m^3	31.0 µg/m^3	30.0 µg/m^3	41.0 µg/m^3	**40 µg/m^3**
Data Capture	72%	80.7%	86.4%	92.4%	76%	95.7%	**90%**
Annual Mean (Adjusted)	52.7 µg/m^3	52.2 µg/m^3	42.1 µg/m^3	N/a	30.6 µg/m^3	N/a	**40 µg/m^3**
Estimated Annual Mean in 2005	48.5 µg/m^3	49.5 µg/m^3	41.2 µg/m^3	N/a	N/a	N/a	**40 µg/m^3**
Estimated Annual Mean in 2010	39.9 µg/m^3	40.7 µg/m^3	25.4 µg/m^3	25.4 µg/m^3	26.0 µg/m^3	36.2 µg/m^3	

Table 4 displays the results of the continuous monitoring of nitrogen dioxide at Bar Hill. Data capture for 2007 was very good, achieving the standard required by DEFRA.

Since this site was established in 2001, there have been no exceedences of the hourly mean but the annual mean objective has been exceeded in every year between 2002 and 2006. The results for 2007 show a large drop in nitrogen dioxide concentrations. It is not clear what this decrease in concentrations may be attributed to.

Table 4: The NO_2 monitoring results at the Bar Hill continuous monitoring station

	NO_2 2001	**NO_2 2002**	**NO_2 2003**	**NO_2 2004**	**NO_2 2005**	**NO_2 2006**	**NO_2 2007**	**National Air Quality Objectives**
Maximum hourly mean	124.2 µg/m^3	145.2 µg/m^3	166.0 µg/m^3	161.0 µg/m^3	187.0 µg/m^3	157.0 µg/m^3	132.0 µg/m^3	
Hourly mean 99.8th percentile	109.0 µg/m^3	113.0 µg/m^3	132.0 µg/m^3	117.5 µg/m^3	118.3 µg/m^3	122.0 µg/m^3	110.0 µg/m^3	**200 µg/m^3 <18 exceedences**
Number of exceedences of the AQS 200µg/m^3			0	0	0	0	0	**18**
Annual Recorded Mean	38.2 µg/m^3	43.9 µg/m^3	49.7 µg/m^3	46.0 µg/m^3	42.0 µg/m^3	43.0 µg/m^3	34.0 µg/m^3	**40 µg/m^3**
Data Capture	72%	67%	91.7%	84.1%	90.4%	95.4%	93.5%	**90%**
Annual Mean (Adjusted)	40.5 µg/m^3	41.9 µg/m^3	N/a	44.6 µg/m^3	N/a	N/a	N/a	**40 µg/m^3**
Estimated Annual Mean in 2005	36.1 µg/m^3	38.6 µg/m^3	47.1 µg/m^3	43.5 µg/m^3	N/a	N/a	N/a	**40 µg/m^3**
Estimated Annual Mean in 2010	29.7 µg/m^3	31.7 µg/m^3	38.8 µg/m^3	35.8 µg/m^3	34.4 µg/m^3	36.5 µg/m^3	30.0 µg/m^3	

During 2007, the data capture for PM_{10} at Impington was very good, achieving the standard required by DEFRA. The annual mean objective for PM_{10} was achieved in all years except for 2005. Whereas the twenty-four hour mean objective was exceeded in 2006. In 2007, the same objective was met but only by 1 day.

Table 5: The PM_{10} monitoring results at the Impington continuous monitoring station

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**National Air Quality Objectives**
Measured Annual Mean (TEOM equivalent)	23 $\mu g/m^3$	30.2 $\mu g/m^3$	26 $\mu g/m^3$	32 $\mu g/m^3$	28 $\mu g/m^3$	26 $\mu g/m^3$	
Data capture of hourly means	80.2 %	88.1 %	72.2%	42%	81.1%	95.5%	**90 %**
Estimated Annual Mean (see below)	23 $\mu g/m^3$	30.1 $\mu g/m^3$	26 $\mu g/m^3$	31 $\mu g/m^3$	28 $\mu g/m^3$	34 $\mu g/m^3$	
Annual Mean (Gravimetric)	30 $\mu g/m^3$	39 $\mu g/m^3$	33 $\mu g/m^3$	42 $\mu g/m^3$	36 $\mu g/m^3$	N/a	**40 $\mu g/m^3$**
Number of exceedences of 24 hour mean > 50$\mu g/m^3$	22 (measured)	72 (measured)	6	37	42	34	**35**
90^{th} percentile (gravimetric)– reported where data capture is below 90%	54.6 $\mu g/m^3$	66.4 $\mu g/m^3$				N/a	

Table 6 shows the monitoring data for PM_{10} at Bar Hill. Data capture for this monitor in 2007 was excellent (above 99%). Continuous monitoring of PM_{10} at this site shows that there have been exceedences of the daily mean objective in 2003, 2006 and 2007 of 40 days, 51 days and 49 days respectively, whilst the monitored annual mean meets the objective in all years.

Table 6: The PM_{10} monitoring results at the Bar Hill continuous monitoring station

	2001	2002	2003	2004	2005	2006	2007	National Air Quality Objectives
Measured Annual Mean (TEOM equivalent)	22 µg/m^3	23 µg/m^3	25 µg/m^3	21 µg/m^3	22 µg/m^3	26 µg/m^3	27 µg/m^3	
Data capture of hourly means	75.2 %	96.5 %	92.4 %	84.7%	92.9%	98.2%	99.2%	**90 %**
Estimated Annual Mean (see below)	22.35 µg/m^3	N/a	N/a	20.4 µg/m^3	N/a	N/a	N/a	
Annual Mean (Gravimetric)	28.6 µg/m^3	29.9 µg/m^3	32.5 µg/m^3	27.3 µg/m^3	28.6 µg/m^3	34 µg/m^3	36 µg/m^3	**40 µg/m^3**
Number of exceedences of 24 hour mean > 50µg/m^3	(9) (measured)	27	40	17	25	51	49	**35**
90th percentile (gravimetric)– reported where data capture is below 90%	48.1 µg/m^3	N/a	N/a		N/a	N/a	N/a	

3.2 Diffusion Tube Results

Bias corrected diffusion tube results are presented in Appendix 3 for all the tubes within the district. The tubes that are affected by the A14 have been highlighted in bold. The bias correction factor used was the national figure obtained from the University of Western England (UWE). For 2007, the national bias figure was 0.8.

On use of the bias correction, no diffusion tube results exceeded the annual mean objective for nitrogen dioxide.

3.3 2007 Results Summary

- Data capture at the Bar Hill and Impington continuous monitoring stations was very good, both achieving the required percentage capture of >90%

- At the Bar Hill monitoring station, all objectives were achieved except the daily mean PM_{10} objective, which was exceeded by 14 days

- At the Impington monitoring station, all objectives were achieved except the annual mean objective for nitrogen dioxide, which was exceeded by 1µg/m^3. The daily mean objective for PM_{10} was achieved with only 1 day to spare.

- After bias correction, all diffusion tubes achieved the annual mean objective for nitrogen dioxide.

4.0 Summary of Changes Since the Detailed Assessments

4.1 New Part A Processes

No new Part A processes have been authorised since the last review in 2006/07.

Cemex have been granted a variation of their existing permit to burn Climafuel as part of their cement making process. Consultation raised concerns that emissions of $PM_{2.5}$ may increase owing to the use of this fuel and therefore in-stack monitoring of PM_{10} and $PM_{2.5}$ is being required by the Environment Agency for a minimum of 2 years. The Decision Document also included an improvement condition requiring the operator to update the air dispersion modelling for the installation to account for recent changes in the process. This will be considered in the next Review and Assessment but the PM_{10} standard is not thought to be at risk at this location.

4.2 New Part B Processes

Four new Part B Processes have been permitted since the last Progress Report. These are:

1 bulk cement process
2 respraying of road vehicle processes
1 surface degreasing process.

Each of the new processes will be inspected as required under the PPC Regulations and will be included in future review and assessment work. However, given the size of the operations and Permit conditions, it is not thought that they will have a significant impact on the local air quality.

4.3 New Retail Developments

There have been no new retail developments in the district over the previous twelve months.

4.4 New Road Schemes

No new road schemes have been completed since the last report.

4.5 New Mineral Developments

There have been no new mineral developments since the last review.

4.6 New Landfill Developments

There have been no new landfill developments within the district in the last twelve months.

4.7 Mixed Use Development

South Cambridgeshire District Council is within the eastern region growth area and is therefore subject to a significant amount of new mixed-use development.

All applications received are screened to ensure that any impacts on air quality are identified and mitigated as far as possible. Whilst applications are awaited for most of the growth area schemes, work is continuing in supplying information for the production of environmental statements and assessments.

The application for the Northstowe development was submitted to the Council in December 2007. This application relates to the redevelopment of 605 hectares of land previously used as the Oakington Airfield. The development is to comprise highway link improvements, a core area containing retail and businesses and approximately 9500 new homes to include associated open spaces and parkland.

The development will cover an area of approximately 605 Hectares with 22,800m^2 floorspace set aside for hotels and indoor leisure facilities, 49,500m2 floorspace for A1, A2, A3, A4 and A5 retail use and 156,000 m2 floorspace set aside for B1, B2, B8 and *sui generis* industrial and commercial uses.

An air quality impact assessment has been submitted by the developer with the application and its conclusions will inform the decision making process. It is thought likely that there will be an impact on local air quality but discussions are still taking place to determine its significance.

The potential for significant impact is magnified by the proximity to the development of the A14 corridor, subject of an AQMA for NO_2 and PM_{10}. It is the location of these transport links that led to the identification of the proposed site for development. Improvements to the road network are proposed by the Highways Agency, but may not be brought forward prior to commencement of development. In-depth negotiations are currently underway to determine the exact nature of the impact of both projects and to phase development accordingly to mitigate pressure on the highway and ensure that current service levels are maintained.

In addition, an outline planning application was submitted in 2007 for the development of Upper Cambourne. This is to include up to 950 dwellings, a community centre, open space and play areas. Owing to the recent improvements on the local network A428, it is thought that traffic movements will not cause a significant impact.

4.8 Traffic along the A14

The A14 trunk road, which passes through the South Cambridgeshire District Council area is a strategic route of national importance and also forms part of the trans European Highway, linking the Midlands and North of England to the ports of Felixstowe and Harwich and the M11 and Stansted to the south. Additionally it is the most important route for local traffic linking Huntingdon and Cambridge with St Ives and other villages along the A14 corridor. The route of the A14 through the District is shown in Figure 1, below.

Many sections of the A14 are currently operating close to capacity, with an average of 65 – 90,000 vehicles per day using the route. Up to 25% of the traffic is made up of heavy goods vehicles, far higher than the national average. The road is subject to severe congestion, particularly during peak hours on a regular basis.

The traffic flows along the A14 are the highest in the County. Over the past 5 years the Highways Agency have undertaken a programme of studies and consultation exercises in order to devise a strategy of improvements for the A14.

Substantial improvements are proposed for the A14 Cambridge Northern Bypass, which will comprise widening of the existing carriageway to 3 lanes in each direction creating local access roads alongside the widened A14 to separate local and strategic traffic.

The 2007 Traffic Monitoring Report confirms that the A14 continues to experience the highest volume of traffic. The stretch of this road between Bar Hill and Milton experiences the highest of these flows across the County with a 16 hour weekday average of 91,800 vehicles passing through the Air Quality Management Area at Bar Hill, 16% of which were HDV’s.

Tables 7 and 8, below show the traffic data obtained from Traffic Monitoring Reports (2005 – 2007) for Bar Hill and Impington, respectively. As can be seen, there has been an overall increase at Bar Hill but a large decrease at Impington. The largest decrease at Impington occurred during 2007.

The percentage of HDVs has not changed over the years at Bar Hill, accounting for 16% of the flow. At Impington, there has been a 1 % increase in the flow of HDVs.

Table 7: Bar Hill traffic data (combined flow)

	2005	2006	2007
16 Hour AAWF	90500	92000	91800
Absolute hourly traffic flow	4015	4081	4073
% HDV	16	16	16
% change in traffic		1.6 increase on 2005	0.2 decrease on 2006
Total % change in traffic (2005-2007)	Increase of 1.4%		

Table 8: Impington traffic data (combined flow)

	2005	2006	2007
16 Hour AAWF	66800	67900	63300
Absolute hourly traffic flow	2963	3012	2808
% HDV	15	16	16
% change in traffic		1.6 increase on 2005	7.0 decrease on 2006
Total % change in traffic (2005-2007)	Decrease of 5.2%		

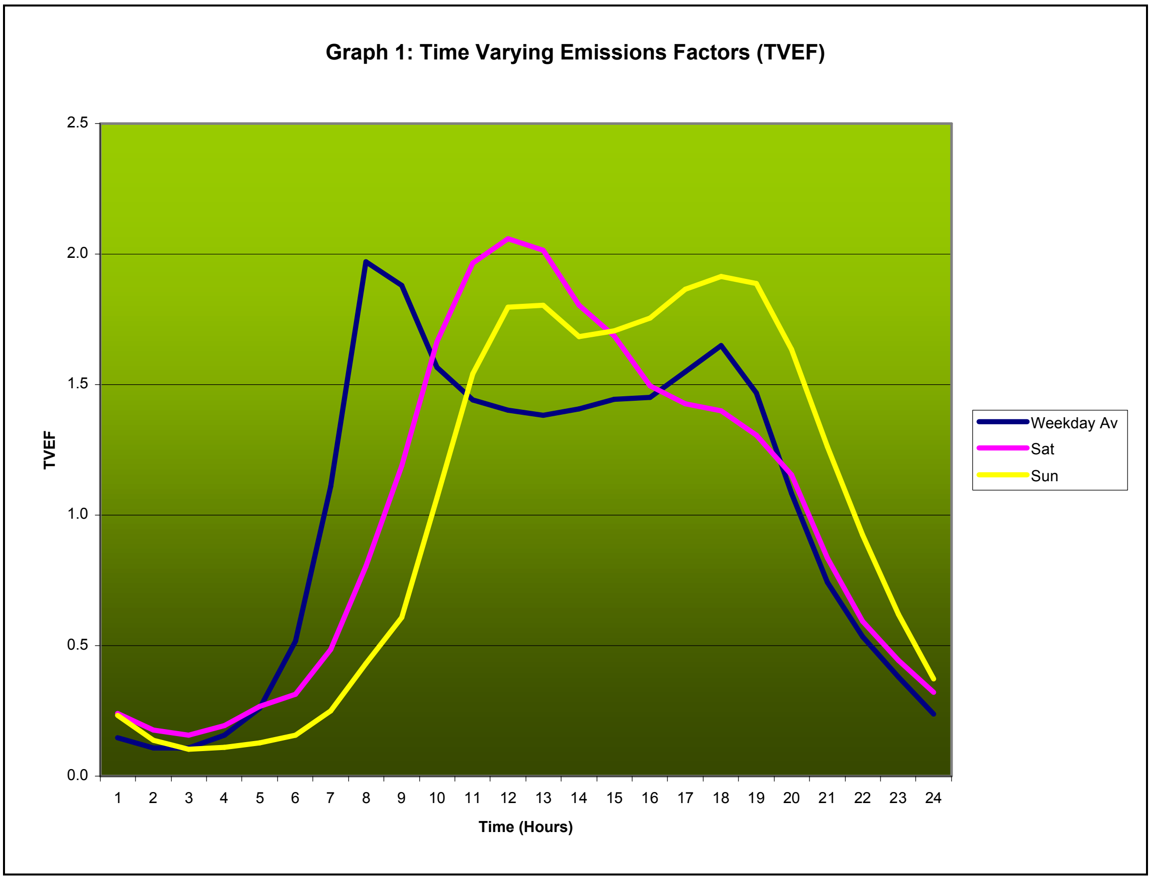
When modelling road sources, it is important to consider the variation in traffic flows, and therefore, the variations in emissions over a 24-hour period. This is known as the Time Varying Emissions Factor (TVEF). It allows the model to estimate the changes in emissions from the vehicles during this time. The road source under investigation and indeed, the main cause of poor air quality in South Cambridgeshire is the A14. With this in mind, hourly traffic data has been obtained from an automatic traffic counter based at Bar Hill. The data has allowed for the assessment of diurnal traffic flows along the busiest stretch of the A14. The calculated TVEF has been used in the model.

It is also important to calculate a TVEF for Saturdays and Sundays each separate to the average weekday TVEF. This allows for the change in driving patterns over the weekends.

The time varying flows have not changed significantly over the years. On average, there are 2 distinct peaks during the average weekday – one during the morning rush hour and one during the afternoon rush hour. At the weekends, there are 2 similar peaks but the first peak occurs later in the day.

Figure 1 displays the average time varying emissions factors for annual average weekday, Saturdays and Sundays. The actual data used to obtain these figures and the method of calculation is presented in Appendix 4.

Figure 1: Average Time Varying Emissions Factors for the A14 at Bar Hill



5.0 Source Apportionment

Source apportionment is described as being one of the most important elements of a stage 4 assessment. It allows for the consideration of how different sources contribute to the air quality problems within an Air Quality Management Area. The results of the source apportionment enables an action plan to target specific sources.

South Cambridgeshire District Council has used the ADMS Urban dispersion model to calculate source apportionment. Throughout the review and Assessment process, it has been apparent that elevated levels of NO_2 and PM_{10} are due to the heavy traffic flows along the A14 with congestion during the peak travel times in the mornings and afternoons. In addition, the A14 experiences a flow of HDV traffic that is greater than the national average.

Figure 2, below shows 1x1km grid emissions for PM_{10} obtained from the National Atmospheric Emissions Inventory website for the grid squares following the route of the A14 through South Cambridgeshire's AQMA. It can be seen that the greatest contribution of PM10, totalling 73% of emissions is from road traffic sources.

Figure 2: PM_{10} Grid Emissions between Bar Hill and Milton

Tonnes/KM2/Year													Road sources	Without road sources
		a01	a02	a03	a04	a06	a07	a08	a09	a10	a11		G/m2/s	G/m2/s
538500	263500	0	0.0321	0.00556	0.0908	0	2.77	0.35	0.174	0.0131	0.0609	3.49646	8.77779E-08	2.30206E-08
539500	263500	0	0.329	0.0096	0.0037	0	2.48	0.0197	0.00831	0.0324	0.00828	2.89099	7.85881E-08	1.30238E-08
538500	264500	0	0.152	0	0.0571	0	1.21	0.351	0.0232	0.0304	0.00636	1.83006	3.83434E-08	1.96489E-08
539500	262500	0	0.0461	0	0.00146	0	1.48	0.0164	0.00794	0.0296	0.00459	1.58609	4.68994E-08	3.36186E-09
540500	262500	0	0.118	0	0.00229	0	4.3	0.0133	0.0191	0.0357	0.00684	4.49523	1.36262E-07	6.1866E-09
541500	261500	0	0.228	0	0.00462	0	4.83	0.0315	0.0397	0.0135	0.00809	5.15541	1.53057E-07	1.03118E-08
542500	261500	0	0.0322	0.0191	0.0409	0.00597	1.32	0.142	0.167	0.00768	0.0338	1.76865	4.18292E-08	1.42172E-08
543500	261500	0	0.724	0	0.0373	0	2.12	0.179	0.0163	0.0327	0.0203	3.1296	6.71802E-08	3.1993E-08
544500	261500	0	0.0163	0.00003	0.056	0	1.96	0.185	0.137	0.0138	0.0471	2.41523	6.211E-08	1.44257E-08
545500	262500	0	0.295	0	0.0599	0	0.541	0.357	0.0323	0.0301	0.00911	1.32441	1.71436E-08	2.48253E-08
546500	262500	0	0.138	0	0.0743	0	1.99	0.453	0.0437	0.0227	0.00722	2.72892	6.30606E-08	2.34155E-08
546500	261500	0	0.0785	1.48	0.118	1.04	0.611	0.493	0.268	0.00185	0.064	4.15435	1.93618E-08	1.12284E-07
			2.1892	1.51429	0.54637	1.04597	25.612	2.5909	0.93655	0.26353	0.27659	34.9754		

			%
Percentage contribution from	a01	Energy	0.0
	a02	Commercial	6.3
	a03	Industrial combustion	4.3
	a04	Industrial production	1.6
	a06	Solvent use	3.0
	a07	**Road**	**73.2**
	a08	Other transport	7.4
	a09	Waste & recycling	2.7
	a10	Agriculture	0.8
	a11	Nature	0.8
			100

Figure 3, below shows 1x1km grid emissions for NO_2 obtained from the National Atmospheric Emissions Inventory website for the grid squares following the route of the A14 through South Cambridgeshire's AQMA. It can be seen that the greatest contribution to the annual mean NO_2, totalling 77.8% of emissions is from road traffic sources.

Figure 3: NO_2 Grid Emissions between Bar Hill and Milton

Tonnes/KM2/Year

		a01	a02	a03	a05	a07	a08	a09	a11		Road sources	Without road sources
538500	263500	0	1.1915E-07	1.15347E-08	0	1.78725E-06	1.16298E-07	5.10189E-10	3.51745E-10	2.03509E-06	1.78725E-06	2.47844E-07
538500	264500	0	4.88007E-09	0	0	7.57361E-07	1.15981E-07	1.03622E-10	4.21461E-11	8.78368E-07	7.57361E-07	1.21007E-07
539500	262500	0	2.0059E-09	0	0	8.61934E-07	5.19696E-09	7.63699E-11	3.1055E-11	8.69245E-07	8.61934E-07	7.31028E-09
539500	263500	0	7.41517E-09	1.84112E-09	0	1.61613E-06	6.30606E-09	6.36944E-11	5.19696E-11	1.63181E-06	1.61613E-06	1.5678E-08
540500	262500	0	4.15123E-09	0	0	2.5858E-06	4.24629E-09	9.85521E-11	4.27798E-11	2.59434E-06	2.5858E-06	8.53885E-09
541500	261500	0	7.12997E-09	0	0	2.94389E-06	1.00453E-08	1.2929E-10	6.02087E-11	2.96125E-06	2.94389E-06	1.73648E-08
542500	261500	0	7.38348E-08	3.29563E-09	0	7.51024E-07	4.72163E-08	4.81669E-10	2.01541E-10	8.76054E-07	7.51024E-07	1.2503E-07
543500	261500	0	2.17702E-08	0	0	1.24537E-06	5.9258E-08	8.68272E-11	1.22636E-10	1.32661E-06	1.24537E-06	8.12376E-08
544500	261500	0	6.36944E-08	5.76736E-11	0	1.17882E-06	6.17931E-08	4.05616E-10	2.72523E-10	1.30505E-06	1.17882E-06	1.26223E-07
546500	261500	0	1.6795E-07	3.07381E-06	0	2.81079E-07	1.63831E-07	7.63699E-10	3.64421E-10	3.6878E-06	2.81079E-07	3.40672E-06
545500	262500	0	8.77779E-09	0	0	3.35901E-07	1.18199E-07	1.28973E-10	5.6406E-11	4.63063E-07	3.35901E-07	1.27162E-07
546500	262500	0	3.92941E-09	0	0	1.22636E-06	1.49888E-07	1.52106E-10	4.59487E-11	1.38037E-06	1.22636E-06	1.54015E-07
			4.84689E-07	3.09054E-06	0	1.55709E-05	8.58259E-07	3.00061E-09	1.64338E-09	2.0009E-05		

			%
Percentage contribution from	a01	Energy	0.0
	a02	Commercial	2.4
	a03	Industrial combustion	15.4
	a05	Production/Distribution foissil fu	0.0
	a07	**Road**	**77.8**
	a08	Other transport	4.3
	a09	Waste & recycling	0.0
	a11	Nature	0.0
			100

South Cambridgeshire District Council do not have access to a detailed breakdown of Heavy Duty Vehicles (HDV's) and Light Duty Vehicles (LDV's) and there is only a minor contribution to emissions from sources other than roads, therefore, the source apportionment considers 4 categories:

- HDV
- LDV
- Other (grid emissions)
- Background

All background data has been taken from the projection maps on the Air Qulaity UK website (http://www.airquality.co.uk/archive/laqm/tools/projectionmaps_2004.pdf) and projected forward to the assessment years using the technical guidance LAQM. TG(03) – Box 6.8 for Oxides of Nitrogen and Box 8.7 for PM_{10}.

Emissions factors have been taken from the DMRB 2003 emissions database, which is built into the ADMS Urban dispersion model. Figure 4 shows the vehicle emissions as LDV and HDV categories at varying speeds.

Figure 4: Vehicle emissions calculated using ADMS Urban

Emissions Factors - Roads				
Speed	Emissions PM10		Emissions NOx	
k/p/h	LDV	HDV	LDV	HDV
20	0.021	0.404	0.377	11.806
30	0.018	0.304	0.354	9.654
35	0.017	0.274	0.346	9.017
40	0.016	0.251	0.341	8.544
50	0.014	0.218	0.336	7.928
55	0.014	0.207	0.337	7.739
60	0.013	0.199	0.341	7.611
70	0.013	0.188	0.356	7.507
80	0.015	0.184	0.383	7.573

Given that the A14 suffers congestion and heavy traffic flows throughout the day, modelling is carried out using average speeds of 50km/h for the stretch of road through the AQMA. This choice of speed is also backed up by local knowledge of travelling the A14 around Cambridge.

Two receptors were chosen for the source apportionment study. These are the continuous monitor at Bar Hill and the continuous monitor at Impington, both of which monitor NO_2 and PM_{10}.

5.1 Bar Hill

Figure 5: Source apportionment results – NO_2, Bar Hill

HDV Contribution µg m^{-3}	LDV Contribution µg m^{-3}	Background Contribution µg m^{-3}	Other (grid) µg m^{-3}
89.5	13.9	20.1	11.6
66.2%	10.3%	14.9%	8.6%

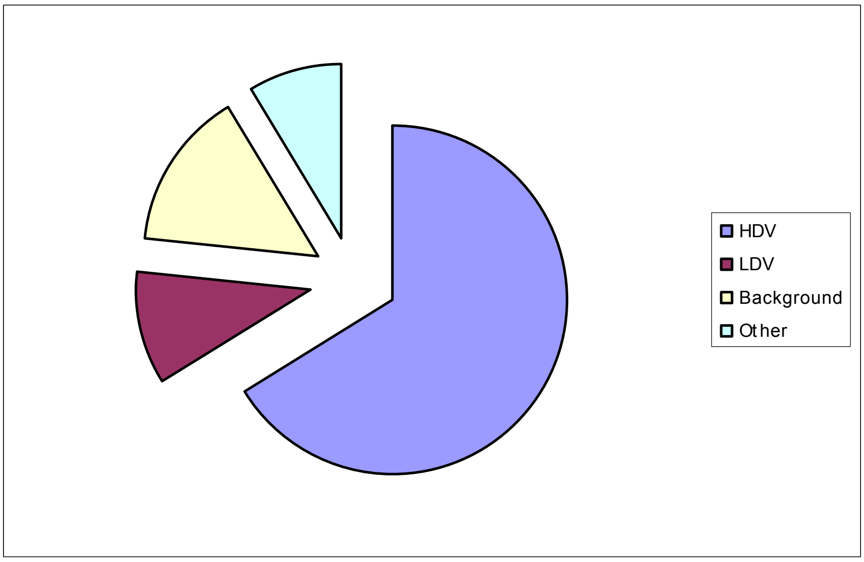
Oxides of Nitrogen Modelled annual mean = 135.1 µg m^{-3}

Contribution of road transport emissions to NO_2 (using Box 1 of "Deriving NO_2 from NO_x for Air Quality Assessments of Roads – Updated to 2006"):

$$NO_{2(road)} = ((-0.0719 \times Ln(NOx_{(total)})) + 0.6248) \times NOx_{(road)}$$

Where: $NOx_{(total)}$ = 135.1µg m^{-3}
$NOx_{(road)}$ = 103.4µg m^{-3}

Therefore: $NO_{2(road)}$ = 28.1µg m^{-3}



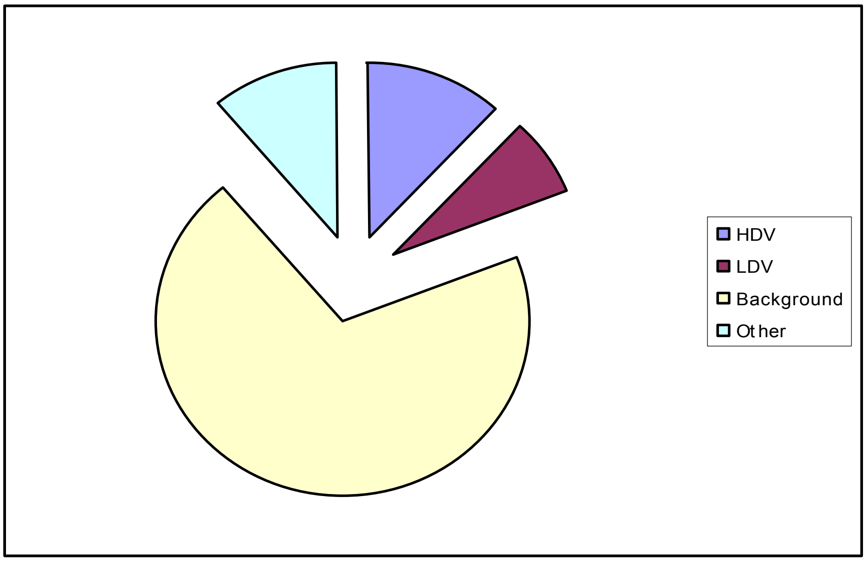
The pie chart above gives the visual breakdown of contributions to the annual mean NOx at Bar Hill. Traffic emissions give the largest contribution to the annual mean with 76.5% of the total, with heavy duty vehicles contributing to 66.2% of this.

The figure is approximately in line with the predicted grid emission sources given in Figure 3, which show a road traffic contribution of 77% of the total emissions.

Figure 6: Source apportionment results – PM_{10}, Bar Hill

HDV Contribution µg m^{-3}	LDV Contribution µg m^{-3}	Background Contribution µg m^{-3}	Other (grid) µg m^{-3}
3.2	1.9	18.6	3.0
12%	7%	70%	11%

PM_{10} Modelled annual mean = 26.7 µg m^{-3}



The pie chart above shows the annual contributions from the different sources of PM_{10} modelled at Bar Hill. The background concentration provides the largest contribution to the annual mean although traffic contributions provide 19% of the total, with heavy duty vehicles contributing to 12% of this.

The annual mean PM_{10} is currently being achieved at this site. It is the 24-hour mean objective that is not. It is possible that the exceedences of the 24-hour mean objective are caused by queuing and congested traffic.

The grid emissions data provided in Figure 2 shows that the contribution from road sources is approximated at 73%, however, the grid emissions table does not give a value for the background concentration.

5.2 Impington

Figure 7: Source apportionment results – NO_x and NO_2, Impington

HDV Contribution µg m^{-3}	**LDV Contribution µg m^{-3}**	**Background Contribution µg m^{-3}**	**Other (grid) µg m^{-3}**
72.1	31.7	20.1	6.0
55.5%	24.4%	15.5%	4.6%

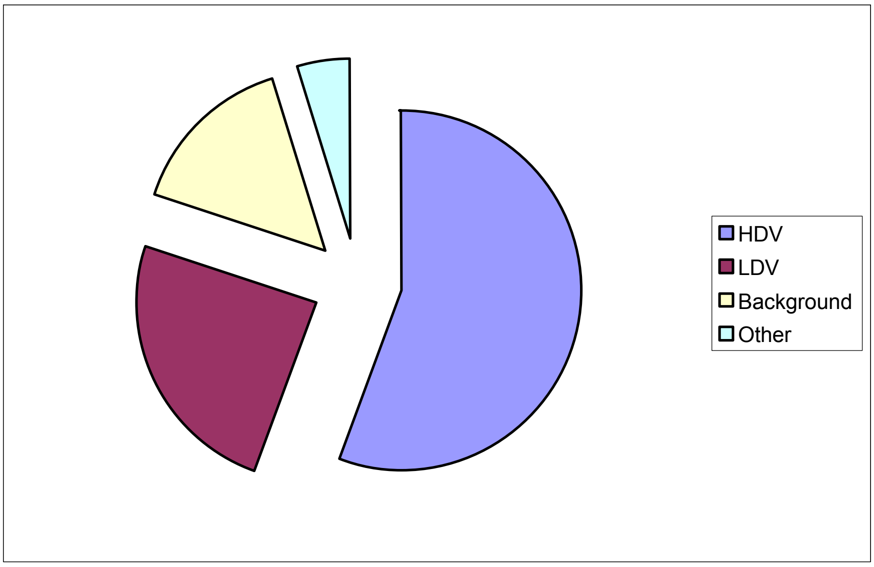
Oxides of nitrogen modelled annual mean = 129.9 µg m^{-3}

Contribution of road transport emissions to NO_2 (using Box 1 of "Deriving NO_2 from NO_x for Air Quality Assessments of Roads – Updated to 2006"):

$NO_{2(road)} = ((-0.0719 \times Ln(NOx_{(total)})) + 0.6248) \times NOx_{(road)}$

Where: $NOx_{(total)}$ = 129.9µg m^{-3}
$NOx_{(road)}$ = 103.8µg m^{-3}

Therefore: $NO_{2(road)}$ = 28.5µg m^{-3}



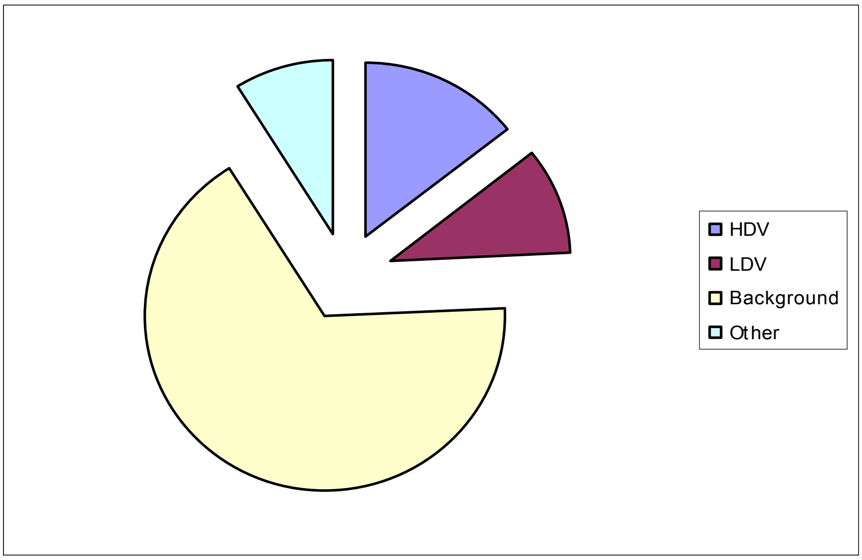
The pie chart above gives the visual breakdown of contributions to the annual mean NOx at Impington. Traffic emissions give the largest contribution 79.9% of the total with heavy duty vehicles contributing to 55.5% of this.

The figure is approximately in line with the predicted grid emission sources given in Figure 3, which show a road traffic contribution of 77% of the total emissions.

Figure 8: Source apportionment results – PM_{10}, Impington

HDV Contribution $\mu g\ m^{-3}$	LDV Contribution $\mu g\ m^{-3}$	Background Contribution $\mu g\ m^{-3}$	Other (grid) $\mu g\ m^{-3}$
4.0	2.7	18.6	2.5
14.4%	9.7%	66.9%	9%

PM_{10} modelled annual mean = 27.8 $\mu g\ m^{-3}$



The pie chart above shows the annual contributions from the different sources modelled. The background concentrations of PM_{10} provide the largest contribution to the annual mean although traffic contributions provide 24% of the total, with heavy duty vehicles contributing to 14.4% of this.

The annual mean PM_{10} is currently being achieved at this site. It is the 24-hour mean objective that is under threat. It is possible that the exceedences of the 24- hour mean objective are caused by queuing and congested traffic.

The grid emissions data provided in Figure 2 shows that the contribution from road sources is approximated at 73%, however, the grid emissions table does not give a value for the background concentration.

6.0 Degree of improvement

Before identifying the options it has available for improving air quality, the local authority will need to know the contribution of different source types to air pollution so that the effectiveness of different control options can be assessed.

In addition, the local authority will need to determine the overall level of improvement required. NSCA (2001a) provides guidance regarding calculation of this improvement in absolute and percentage terms.

Required improvement = Predicted Concentration – Objective % Improvement = (Required improvement/ Predicted Concentration) x 100

The guidance emphasises that the point of maximum concentration, where exposure is likely, is used to calculate the required improvement – and that consideration should be given to the need to allow for some headroom for future development or uncertainty in the overall assessment process.

6.1 Degree of improvement – nitrogen dioxide

The point of maximum concentration recorded at the continuously monitored sites in 2005 (the year for compliance) was 41µg/m^3 at Bar Hill.

Required improvement = 42 – 40 = 2µg/m^3
Percentage improvement = (2 / 42) x 100 = 4.8%.

However, the point of maximum concentration in 2006 was 43µg/m^3 at Bar Hill.
Required improvement = 43 – 40 = 3µg/m^3
Percentage improvement = (3 / 43) x 100 = 7%.

The point of maximum concentration in 2007 was 41ɥg/m^3 at the Impington continuous monitoring station.
Required improvement = 41 – 40 = 1µg/m^3
Percentage improvement = (1 / 41) x 100 = 2.4%

	Required improvement, µg/m^3	Required improvement, %
South Cambs DC	3	7

6.2 Degree of improvement – PM_{10}

The annual mean for PM_{10} at the Bar Hill and Impington continuous monitors has not been exceeded in recent years. It is the 24-hour mean objective that is currently exceeded. Degree of improvement cannot be calculated in the same way for this objective. South Cambridgeshire District Council will use the source apportionment calculations to target the most polluting source to achieve an improvement in PM_{10} concentrations.

7.0 Conclusions

7.1 Traffic

- Traffic flow through the District has fallen in some areas of the A14 but has increased in others.

- The percentage of heavy duty vehicles using the A14 around Cambridge and through South Cambridgeshire remains higher than the national average at approximately 16%.

- The A14 through South Cambridgeshire (especially around Cambridge) continues to experience congestion and slow moving traffic for much of the morning and late afternoon.

7.2 Nitrogen Dioxide

- 2007 monitoring shows that the annual mean objective for NO_2 is not being met within the AQMA.

- The maximum hourly average NAQS objective is still being achieved, as shown by the 2007 monitoring results.

- Source apportionment has shown that a large proportion of the NO_X emitted is from road traffic. Of this, HDVs contribute to 66.2% and 55.5% of the emissions at Bar Hill and Impington respectively.

- The results of the Stage 4 assessment support the findings of the Detailed Assessment of Nitrogen Dioxide Along the A14 corridor.

- The degree of improvement required, based upon the worst case year of 2006, is 3 $\mu g/m^3$ or a reduction of 7% of emissions.

7.3 Particulate Matter (PM_{10})

- It is recognised that the annual mean objective for PM_{10} is not being exceeded at the receptor points located along the A14 (and within the AQMA).

- Monitoring results for 2007 show that the daily mean objective for PM_{10} continues to be exceeded within the AQMA.

- Source apportionment has shown that a large proportion of the PM_{10} contribution is within the local background concentrations, however, there is also a large contribution from HDVs using the A14. At Bar Hill, emissions from HDVs contribute to 12% of the annual mean and at Impington, this figure rises to 14%.

- The results of the Stage 4 assessment support the findings of the Detailed Assessment of PM_{10} Along the A14 corridor.

7.4 The Air Quality Management Area

- The current boundaries of the AQMA should remain as originally designated

- Monitoring should continue at receptors along the A14 and possible expansion of the monitoring network should be considered. At the time of writing, a fourth continuous monitor has been purchased by the Council to monitor NO_x, NO_2, NO and PM_{10} within the new Arbury Park community along the South side of the A14 at Histon.

- The Further Assessment has highlighted that for maximum effect, the Air Quality Action Plan should focus on improving emissions from traffic, in particular freight, on the A14. As the Highways Agency is the body responsible for the A14, it is vital to engage with them in the development of appropriate actions to form the Plan.

8.0 Air Quality Action Plan

Initial work for the Air Quality Action Plan is underway. It is being carried out jointly by South Cambridgeshire District Council, Cambridge City Council and Huntingdonshire District Council in close liaison with Cambridgeshire County Council and the Highways Agency.

The purpose of taking part in a joint AQAP is that all 3 local authorities are directly and indirectly impacted by emissions from the A14. Huntingdonshire District Council has 3 Air Quality Management Areas due to the A14 and Cambridge City Council has an Air Quality Management Area in the City Centre. The A14 is a major route for traffic entering and leaving the City. Any actions taken by any one of the local authorities involved is likely to impact on the Air Quality Management Area of the neighbouring 2 Authorities given that they are linked by the A14.

Actions to be considered will be focussed primarily on traffic emissions although it is recognised that not all measures will be appropriate or feasible to all 3 Authorities.

The actions considered in the preliminary work are broken down into sections and subsections as in the examples provided in Appendix 4. The list is not detailed in full but is provided to give an indication of the kind of measures that are being considered for cost and feasibility.

Early liaison has taken place between the bodies involved and it is estimated that work will continue on the Air Quality Action Plan throughout 2008.

Some of the actions considered to date are attached as Appendix 5.

9.0 References

Deriving NO_2 from NO_x for Air Quality Assessments of Roads – Updated to 2006
Air Quality Consultants

The Environment Act 1995

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2000)
Department for Environment, Food and Rural Affairs

Air Quality Regulations 2000 and (Amendment) regulations 2002

Local Air Quality Management, Policy Guidance LAQM. PG(03) (2003)
Department for Environment, Food and Rural Affairs

Local Air Quality Management, Technical Guidance LAQM. TG(03) (2003)
Department for Environment, Food and Rural Affairs

The Detailed Assessment of Nitrogen Dioxide Along the A14 Corridor (2006)
South Cambridgeshire District Council

The Detailed Assessment of PM_{10} Along the A14 Corridor (2007)
South Cambridgeshire District Council

Cambridgeshire Authorities Progress Report 2007
South Cambridgeshire District Council, Huntingdonshire District Council, East Cambridgeshire District Council, Cambridge City Council, Fenland District Council, Cambridgeshire County Council

Traffic Monitoring Report 2005
Cambridgeshire County Council

Traffic Monitoring Report 2006
Cambridgeshire County Council

Traffic Monitoring Report 2007
Cambridgeshire County Council

Appendix 1: The National Air Quality Objectives

Summary of objectives of the National Air Quality Strategy			
Pollutant	**Objective**	**Measured as**	**To be achieved by**
Benzene All Authorities	16.25 $\mu g/m^3$	Running Annual Mean	31 December 2003
Benzene Authorities in England and Wales only	5 $\mu g/m^3$	Annual Mean	31 December 2010
Benzene Authorities in Scotland and Northern Ireland only	3.25 $\mu g/m^3$	Running Annual Mean	31 December 2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running Annual Mean	31 December 2003
Carbon monoxide Authorities in England, Wales and Northern Ireland only	10.0 mg/m^3	Maximum daily running 8 Hour Mean	31 December 2003
Carbon monoxide Authorities in Scotland only	10.0 mg/m^3	Running 8 Hour Mean[a]	31 December 2003
Lead	0.5 $\mu g/m^3$	Annual Mean	31 December 2004
	0.25 $\mu g/m^3$	Annual Mean	31 December 2008
Nitrogen dioxide[b]	200 $\mu g/m^3$ Not to be exceeded more than 18 times per year	1 Hour Mean	31 December 2005
	40 $\mu g/m^3$	Annual Mean	31 December 2005
Nitrogen Oxides**	(V) 30 $\mu g/m^3$	Annual Mean	31 December 2000
Ozone*[*]	100 $\mu g/m^3$	Running 8 hour Mean Daily maximum of running 8 hr mean not to be exceeded more than 10 times per year	31 December 2005
Particles (PM10) (gravimetric)[c] All authorities	50 $\mu g/m^3$ Not to be exceeded more than 35 times per year	24 Hour Mean	31 December 2004
	40 $\mu g/m^3$	Annual Mean	31 December 2004
Particles (PM10) Authorities in Scotland only[d]	50 $\mu g/m^3$ Not to be exceeded more than 7 times per year	24 Hour Mean	31 December 2010
	18 $\mu g/m^3$	Annual Mean	31 December 2010
Poly aromatic hydrocarbons[e]	0.25 ng/m^3 B(a)P	Annual Mean	31 December 2010
Sulphur dioxide	266 $\mu g/m^3$ Not to be exceeded more than 35 times per year	15 Minute Mean	31 December 2005
	350 $\mu g/m^3$ Not to be exceeded more than 24 times per year	1 Hour Mean	31 December 2004

	125 µg/m³ Not to be exceeded more than 3 times per year	24 Hour Mean	31 December 2004
	(V) 20 µg/m³	Annual Mean	31 December 2000
	(V) 20 µg/m³	Winter Mean (01 October - 31 March)	31 December 2000

Notes:

a. The Quality Objective in Scotland has been defined in Regulations as the running 8-hour mean, in practice this is equivalent to the maximum daily running 8-hour mean.

b. The objectives for nitrogen dioxide are provisional.

c. Measured using the European gravimetric transfer sampler or equivalent.

d. These 2010 Air Quality Objectives for PM 10 apply in Scotland only, as set out in the Air Quality (Scotland)Amendment Regulations 2002.

e. Not included in vegulations

µg/m³ - micrograms per cubic metre

mg/m³ - milligrams per cubic metre

*Ozone is not included in the Regulations

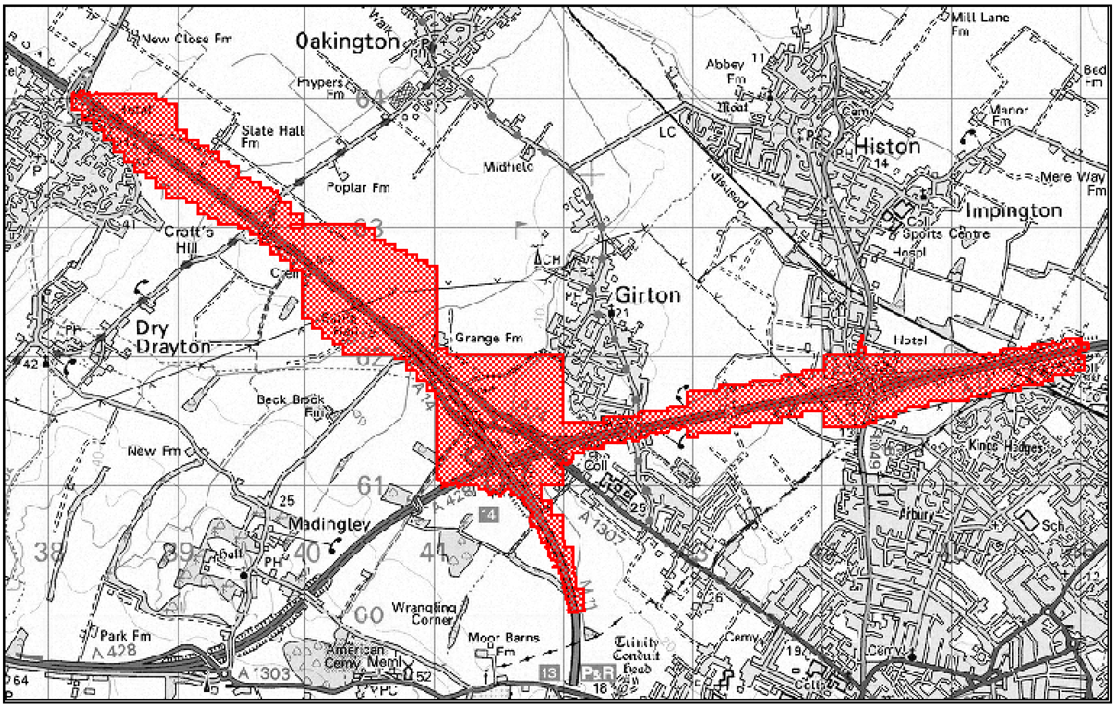
** Assuming NOx is taken as NO2

(V) These standards are adopted for the protection of vegetation and ecosystems. All of the remainder are for the protection of human health.

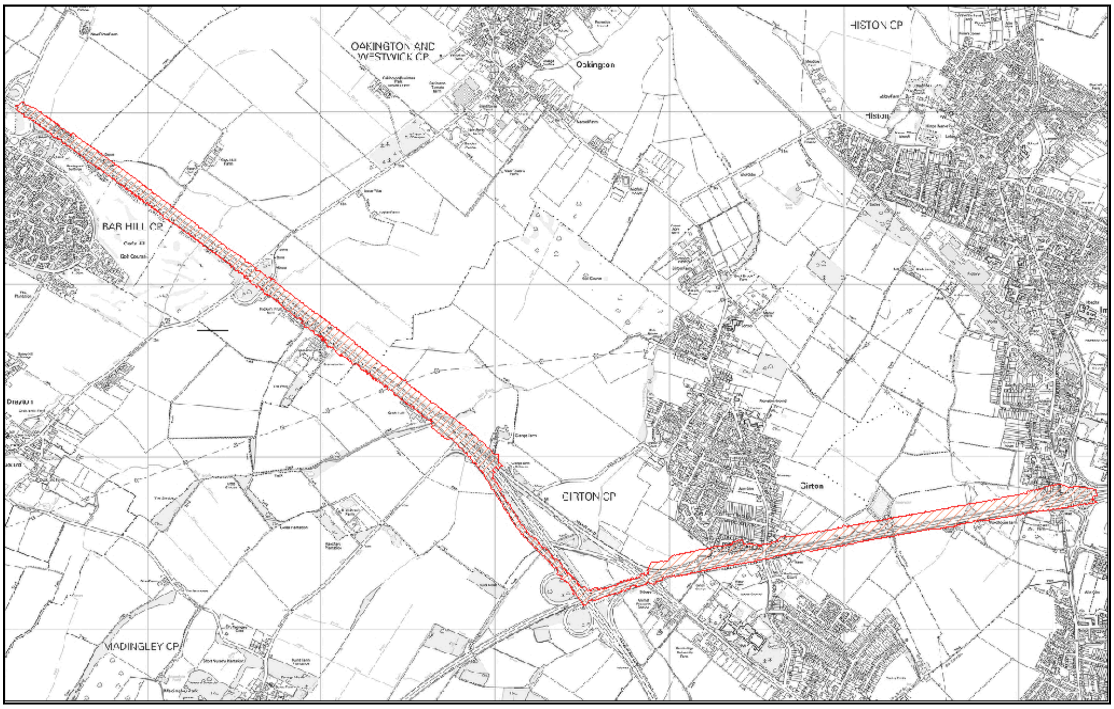
New particle objectives for England, Wales, Northern Ireland and Greater London not included in Regulations

Region	Objective	Measured as	To be achieved by
Greater London	50 µg/m³ not to be exceeded more than 10 times per year	24-hour Mean	31 December 2010
Greater London	23 µg/m³	Annual Mean	31 December 2010
Greater London	20 µg/m³	Annual Mean	31 December 2015
Rest of England, Wales and Northern Ireland	50 µg/m³ not to be exceeded more than 7 times per year	24-hour Mean	31 December 2010
Rest of England, Wales and Northern Ireland	20 µg/m³	Annual Mean	31 December 2010

Appendix 2a: The Air Quality Management Area for NO_2 and PM_{10}



Appendix 2b: the extent of exceedence of the 24 hour mean objective for PM_{10}



Appendix 3: 2007 Diffusion Tube Monitoring Data

Diffusion Tube Site	Site Designation	Annual Mean 2007 µg/m³	Corrected for bias µg/m³	Estimated to 2010
High Street, Histon. TL439 637	**Roadside**	**47.1**	**21.9**	**19.3**
Narrow Lane, Histon. TL441 641	Background	25.1	20.1	17.7
High Street, Sawston. TL486 490	Roadside	41.8	33.4	29.4
Paddock Way, Sawston TL487 493	Background	23.3	18.6	16.4
The Coppice, Histon. TL442 620	**Background**	**27.4**	**21.9**	**19.3**
Lone Tree Ave., Histon. TL441 618	**Background**	**28.1**	**22.5**	**19.8**
A505, Thriplow. TL440 445	Roadside	28.4	22.7	20.0
High Street, Linton. TL561 468	Roadside	32.7	26.2	23.1
High Street, Tadlow. TL281 474	Background	27.9	22.3	19.6
High Street, Harston. TL425 510	Roadside	40.5	32.4	28.5
Garner Close, Milton. TL475 631	Background	28.4	22.7	20.0

Diffusion Tube Site	Site Designation	Annual Mean 2007 µg/m³	Corrected for bias µg/m³	Estimated to 2010
Cambridge Rd, Girton. TL425 614	**Roadside**	**40.5**	**32.4**	**28.5**
Brook Close, Histon TL439635	**Roadside**	**32.2**	**25.8**	**22.7**
Water Lane, Histon TL440633	**Roadside**	**42.9**	**34.2**	**30.1**
Cambridge Rd, Impington TL442618	**Background**	**34.2**	**27.4**	**24.1**
New Rd, Sawston TL484497	Roadside	31.6	25.3	22.3
Mill Lane, Sawston TL485493	Roadside	23.5	18.8	16.5
Elms Drive, Haslingfield TL410520	Background	21.2	17.0	15.0
Crafts Way, Bar Hill TL386637	**Background**	**28.9**	**23.1**	**20.3**

Appendix 4: Example TVEF Calculation

TVEF Example Calculations

Site No: 00000923 Site Reference: 00000923
A14 BAR HILL, CAMBRIDGESHIRE (EASTBOUND)
Vehicle Count Summary From 01/04/2007 To 01/05/2007 Channel: E/B

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Weekday Av	Sat	Sun
00:00	306	310	326	310	371	400	373	0.1	0.1	0.1	0.1	0.2	0.1	0.24	0.23
01:00	173	227	273	253	273	294	221	0.1	0.1	0.1	0.1	0.1	0.1	0.18	0.14
02:00	167	223	276	256	276	262	164	0.1	0.1	0.1	0.1	0.1	0.1	0.16	0.10
03:00	276	345	358	384	378	323	178	0.1	0.2	0.2	0.2	0.2	0.2	0.19	0.11
04:00	497	596	597	604	562	447	204	0.2	0.3	0.3	0.3	0.3	0.3	0.27	0.13
05:00	1129	1202	1210	1194	970	523	250	0.5	0.5	0.5	0.5	0.5	0.5	0.31	0.16
06:00	2427	2603	2624	2573	2004	811	399	1.2	1.2	1.2	1.1	0.9	1.1	0.49	0.25
07:00	3941	4609	4746	4639	3783	1340	686	1.9	2.1	2.1	2.0	1.8	2.0	0.80	0.43
08:00	3815	4386	4520	4478	3526	1984	967	1.8	2.0	2.0	1.9	1.6	1.9	1.19	0.61
09:00	3316	3700	3572	3605	3061	2776	1699	1.6	1.7	1.6	1.6	1.4	1.6	1.66	1.07
10:00	3255	3176	3210	3118	3083	3278	2452	1.6	1.4	1.4	1.4	1.4	1.4	1.97	1.54
11:00	3229	2992	3014	2996	3165	3432	2861	1.5	1.4	1.3	1.3	1.5	1.4	2.06	1.80
12:00	3012	2949	3022	3009	3199	3359	2873	1.4	1.3	1.3	1.3	1.5	1.4	2.01	1.80
13:00	2967	3057	3057	3122	3272	3007	2679	1.4	1.4	1.4	1.4	1.5	1.4	1.80	1.68
14:00	3116	2965	3074	3236	3472	2814	2715	1.5	1.3	1.4	1.4	1.6	1.4	1.69	1.71
15:00	2883	3160	3224	3364	3335	2495	2795	1.4	1.4	1.4	1.5	1.6	1.5	1.50	1.76
16:00	3051	3480	3554	3534	3447	2381	2970	1.5	1.6	1.6	1.5	1.6	1.5	1.43	1.87
17:00	3399	3620	3851	3850	3454	2334	3048	1.6	1.6	1.7	1.7	1.6	1.6	1.40	1.91
18:00	3067	3185	3354	3405	3156	2178	3003	1.5	1.4	1.5	1.5	1.5	1.5	1.31	1.89
19:00	2202	2198	2414	2644	2483	1926	2603	1.1	1.0	1.1	1.1	1.2	1.1	1.15	1.64
20:00	1587	1431	1588	1814	1760	1395	2010	0.8	0.7	0.7	0.8	0.8	0.7	0.84	1.26
21:00	1213	1048	1116	1330	1179	990	1472	0.6	0.5	0.5	0.6	0.5	0.5	0.59	0.92
22:00	772	808	826	975	824	742	987	0.4	0.4	0.4	0.4	0.4	0.4	0.44	0.62
23:00	481	476	532	594	540	537	595	0.2	0.2	0.2	0.3	0.3	0.2	0.32	0.37
	50281	52746	54338	55287	51573	40028	38204	24.0						24.00	24.00
	2095	2198	2264	2304	2149	1668	1592	120.0							

Calculation of the TVEF

1. Add the hourly figures for a particular day
2. Divide (1) above by 24
3. Divide each of the hourly figures for that day by (2) above to give the TVEF
4. The TVEF's should total 24 for any one day

Appendix 5: Air Quality Action Plan – Some Options for Consideration

- Managing the network
    - *[1] Improvements to the A14
    - Congestion charging
    - Introduction of light trams/rail
    - *[2] Opening and operation of the Cambridgeshire Guided Busway
    - Improve and increase bus priority measures
    - Improve the bus information service

*[1] Improvements to the A14 are already proposed, including widening the carriageway to 3 lanes around Cambridge

*[2] The Cambridgeshire Guided Busway is due to begin operation in 2009. It will run from Huntingdon to Cambridge city centre and is predicted to remove 23% of private cars from this stretch of the A14.

- Lowering vehicle emissions
    - Carry out roadside emissions testing
    - Improve vehicle fleet emissions standards
    - Ensure taxi fleet compliance with improved standards
    - Improve quality of buses
    - Review school bus contracts depending upon performance against standards
    - Establish freight quality partnership
    - Introduce car scrappage schemes
    - Improve parking management

- Lowering commercial and domestic emissions
    - Energy efficiency audit of Council premises
    - Improve energy efficiency of private sector housing
    - Improve energy performance of public sector housing

- Raising awareness
    - Publicity for cycling and walking routes
    - Introduce and publicise annual bike week
    - Health benefits campaigns

- Promoting smarter choices
    - Increase bus patronage
    - Increase and publicise cycling and walking routes
    - Encourage car sharing

- Development control
    - To not allow new development to adversely impact on the AQMA's
    - Introduction of car clubs
    - Travel for Work and Travel for School

Appendix 6: Glossary of Terms

AADT – Annual Average Daily Traffic

AAWF – Annual Average Weekday Flow (Mon-Thurs)

ADMS – Atmospheric Dispersion Model Simulation

AQMA – Air Quality Management Area

CERC – Cambridge Environmental Research Consultants (creators of ADMS)

Continuous monitor – electronically operated pollutant monitor that logs data to a set or specified time scale (e.g hourly data)

DEFRA – Department for the Environment, Food and Rural Affairs

DETR – Department of the Environment, Transport and Regions

Discrepancy – Difference between the modelled and monitored data

DMRB – Design Manual for Roads and Bridges. A tool used for the prediction of current and future pollutant levels

GIS – Geographical Infomration System

NAQS – National Air Quality Strategy

NAQSO – National Air Quality Strategy Objectives

PM_{10} – Fine Particulate Matter no bigger than 10 microns

NAEI – National Atmospheric Emissions Inventory

NO_2 – Nitrogen Dioxide

NRTF – national Road Traffic Forecast

TVEF – Time Varying Emissions Factors

Validation – Comparison of predicted (modelled) and observed (measured) data

$\mu g/m^3$ – Micrograms per cubic metre