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# Local Air Quality Management: Central Oxford Air Quality Action Plan

A requirement under part IV of the  
Environment Act 1995

April 2006





## Executive Summary

This Air Quality Action Plan (AQAP) sets out the measures that Oxford City Council and Oxfordshire County Council intend to take to improve air quality in the Central Oxford Air Quality Management Area (AQMA). The AQMA was declared because assessments of air quality predicted that the annual mean objective for nitrogen dioxide of  $40 \mu\text{g}/\text{m}^3$  would not be met by the target date of December 2005.

Nitrogen dioxide pollution arises primarily from emissions of a mixture of nitrogen dioxide and nitric oxide from combustion processes such as vehicle engines. When mixed with ambient air nitric oxide is converted to the pollutant nitrogen dioxide. Together, nitrogen dioxide and nitric oxide are referred to as oxides of nitrogen (NO<sub>x</sub>). The draft AQAP therefore puts forward a range of actions aimed at reducing NO<sub>x</sub> emissions in order to achieve the air quality objective for nitrogen dioxide.

An average reduction in NO<sub>x</sub> emissions of 68% is required in order to meet the air quality objective, although the amount varies from street to street (32% - 90%). In Queen Street, New Road, St Aldate's, George Street and the High Street buses contribute the largest proportion. Whereas in Beaumont Street, Longwall Street, Worcester Street and Hythe Bridge Street cars are the largest single contributor. Action plan measures have therefore been considered on a street-by-street basis where possible.

The measures in this AQAP are those that are currently considered to be the most cost effective and appropriate for Oxford. They have been identified following consultation with key stakeholders and members of the public and have been reviewed by the Council's Executive Board.

The main source of the pollution in the AQMA is from road traffic and so extensive consultation has taken place with Oxfordshire County Council who are responsible for the Local Transport Plan (LTP). Most of the measures outlined in this AQAP have been integrated in the LTP for 2006 – 2011.

The action plan measures aim to improve air quality at a local level whilst maintaining the level of access and development needed for the economic growth of the city.

The main action proposed is that a feasibility study should be carried out for the introduction of a Low Emission Zone (LEZ) for certain streets in the AQMA. This would ensure that only vehicles meeting minimum emission standards would be allowed to enter designated parts of the city centre. The action plan measures are detailed in section 9.

Oxford City Council has a statutory duty to review and assess air quality and improvements in the AQMA will be assessed against the current baseline data linked to traffic emission data, and the air quality targets in the Local Transport Plan.

Oxford City Council  
Draft Air Quality Action Plan

## Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Background .....	1
1.2	Air Quality Action Plan .....	2
1.3	Local Transport Plan.....	3
1.4	Transport and Environment Policy Issues .....	3
<b>2</b>	<b>Air Quality and Transport .....</b>	<b>5</b>
2.1	What is Nitrogen Dioxide? .....	5
2.2	Why is Nitrogen Dioxide of concern? .....	5
2.3	Short-Term Effects of Nitrogen Dioxide .....	5
2.4	Long-Term Effects of Nitrogen Dioxide.....	5
2.5	Where does the Pollution come from?.....	6
2.6	Passenger movements in central Oxford.....	7
2.7	How much does pollution need to be reduced?.....	8
2.8	What has been done already? .....	9
2.8.1	Oxford Transport Strategy .....	9
2.8.2	Bus Quality Partnership.....	9
2.8.3	Alternative Fuels.....	10
2.8.4	Other actions for road traffic reduction .....	10
2.9	Impact on emissions and air quality.....	11
<b>3</b>	<b>Trends in Air Quality .....</b>	<b>12</b>
<b>4</b>	<b>Central Oxford AQMA Summary .....</b>	<b>14</b>
<b>5</b>	<b>Options for reducing NOx emissions .....</b>	<b>15</b>
5.1	Introduction.....	15
5.2	Oxford Transport Strategy (OTS) .....	15
5.2.1	Bus Gate Enforcement .....	15
5.2.2	Traffic Signal phasing .....	15
5.2.3	Bus Quality Partnership.....	16
5.2.4	Freight Quality Partnership.....	16
5.2.5	Taxi Quality Partnership .....	17
5.2.6	Review of Parking Policy .....	17
5.2.7	Work Place Travel Plans .....	17
5.2.8	More School Travel Plans .....	18
5.2.9	Car Clubs / Car Pools.....	18
5.2.10	High Volume Occupancy of Vehicles.....	18
5.2.11	Encouraging Cycling and Walking .....	18
5.2.12	Engine Switch Off when Stationary .....	19
5.3	Roadside Testing of Emissions .....	19
5.4	Scrapage Schemes .....	19
5.5	Retro-fitting of Tail Pipe Technology.....	20
5.6	Greater use of Cleaner Fuels .....	20
5.7	Low Emission Zone (LEZ) .....	21
5.8	Campaign to Raise Awareness of Air Pollution .....	22
<b>6</b>	<b>What else must be considered?.....</b>	<b>24</b>

<b>7</b>	<b>Consultation on the Action Plan Options</b>	<b>25</b>
7.1	Consultees	25
7.2	Response to Consultations	25
7.2.1	Statutory Consultees	25
7.2.2	Environmental Scrutiny and Area Committees	26
7.2.3	Bus Companies	26
7.2.4	Other Consultees	27
7.2.5	General Public	28
<b>8</b>	<b>Which Options to Include in the AQAP?</b>	<b>29</b>
<b>9</b>	<b>Action Plan Measures</b>	<b>31</b>
9.1	Reducing emissions from buses and heavy goods vehicles	31
9.2	Improving traffic management and reducing congestion	33
9.3	Encouraging the use of public transport	35
9.4	Other Measures	38
<b>10</b>	<b>Assessing Improvements in Air Quality</b>	<b>40</b>
10.1	Oxford City Council	40
10.2	Oxfordshire County Council	40
	<b>Appendix 1 Completed stages in LAQM</b>	<b>41</b>
	<b>Appendix 2 Future stages in LAQM</b>	<b>42</b>
	<b>Appendix 3 Air Quality Objectives</b>	<b>43</b>
	<b>Appendix 4 Where the Air Quality Objectives apply</b>	<b>44</b>
	<b>Appendix 5 Glossary</b>	<b>45</b>

### List of Tables

Table 1:	NO <sub>x</sub> Reduction by Street and Contribution by Vehicle Type	8
Table 2:	Impact of an introduction of lower NO <sub>x</sub> emitting buses and HGV's	22
Table 3:	Summary of Action Plan Options	23
Table 4:	Measures for Reducing Emissions from Buses and HGV's	32
Table 5:	Measures For Improving Traffic Management And Reducing Congestion	34
Table 6:	Measures Aimed At Encouraging The Use Of Public Transport	36
Table 7:	Measures Outside The AQMA Aimed At Encouraging The Use Of Public Transport	37
Table 8:	Other Measures	39

### List of Figures

Figure 1:	Central Oxford Air Quality Management Area (shown in black)	2
Figure 2:	Traffic flow by vehicle type in the AQMA	6
Figure 3:	NO <sub>x</sub> emissions by vehicle type in the AQMA	6
Figure 4:	Modal split for journeys to work in Oxford	7
Figure 5:	Average Diffusion Tube Data for the AQMA	12
Figure 6:	Trends in Continuous Monitoring data 1998-2004	13

## 1 Introduction

### 1.1 Background

The Environment Act 1995 places a statutory duty on Local Authorities to carry out a programme of Local Air Quality Management (LAQM) including the periodic review and assessment of air quality in their area. The LAQM process to date and future programme is summarised in Appendices 1 and 2.

The review and assessment is made against air quality objectives for seven pollutants prescribed in the Air Quality (England) Regulations 2000 as amended. The objectives are expressed as air quality standards with target dates for compliance, for example annual mean nitrogen dioxide of 40 microgrammes per cubic metre ( $\mu\text{g}/\text{m}^3$ ) to be achieved by December 2005. The objectives for each pollutant, see Appendix 3, have been set with regard to the impact of the pollutants on health, World Health Organisation Air Quality Guidelines, and European Union Directives. Appendix 3 shows the relationship between the objectives and the relevant exposure to the public. If the review and assessment concludes that an air quality objective is not likely to be met by the target date, then the Local Authority must declare an Air Quality Management Area (AQMA) for that area of its district. AQMA's are therefore pollutant specific. An Air Quality Action Plan (AQAP) must then be produced for each AQMA setting out actions and projects to improve air quality in that area.

In September 2001 Oxford City Council designated an AQMA, known as the Central Oxford Air Quality Management Area, covering part of the city centre. The designated area was extended in September 2003 (Figure 1).

The AQMA was declared because assessments of air quality predicted that the annual mean objective for nitrogen dioxide of 40  $\mu\text{g}/\text{m}^3$  is not likely to be met by the target date of December 2005.

The annual mean is the average concentration measured over a period of one calendar year. For an air quality objective not to be met members of the public must be regularly exposed over the averaging period of the objective. Nitrogen dioxide is thought to have both acute and chronic effects on airways and lung function, particularly in people with asthma. Examples of where the air quality objectives should or should not apply are summarised in Appendix 4.

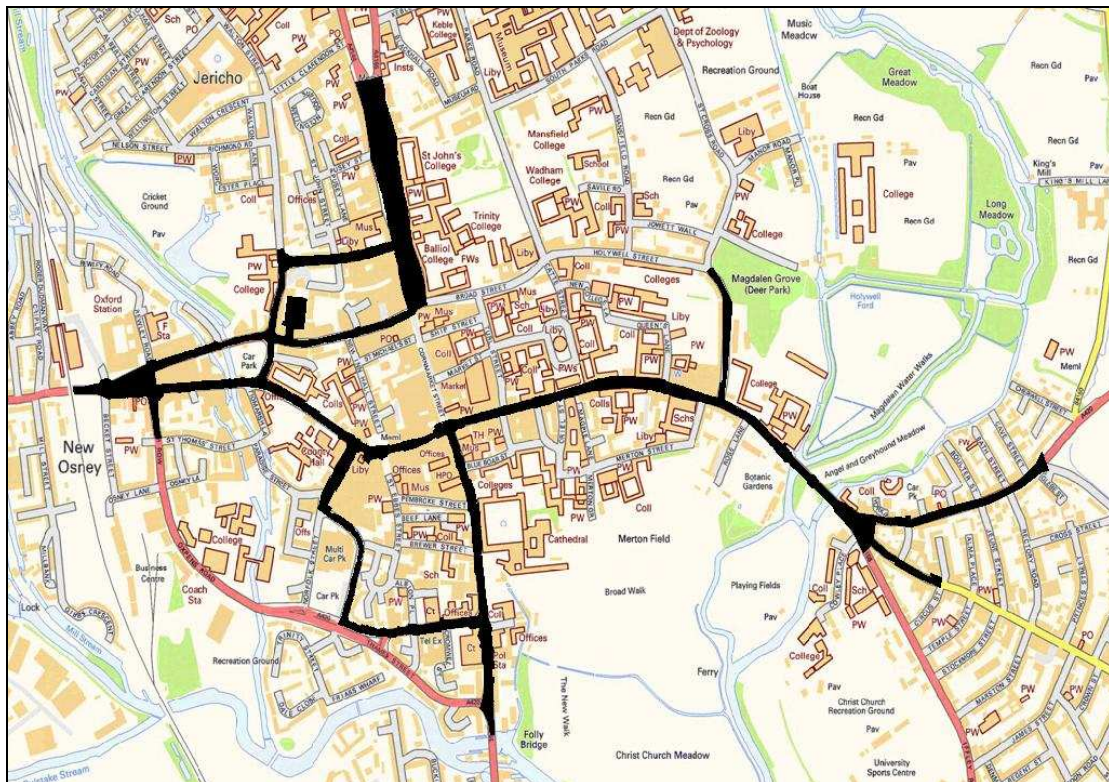
The AQMA was based on computer model predictions of likely air quality in the future taking account of matters such as traffic flows, new vehicle technology and weather data. Modelled predictions are validated against measured data from air quality monitoring sites. Air quality assessments will be repeated every three years and if air quality has improved or worsened, or if the air quality objectives change the AQMA may be revoked or modified.

## 1.2 Air Quality Action Plan

This Air Quality Action Plan (AQAP) outlines a package of actions that are considered to be the most appropriate way of reducing nitrogen dioxide pollution in central Oxford. Many actions that will result in a reduction in nitrogen dioxide will also reduce other pollutants and the greenhouse gas carbon dioxide.

In central Oxford vehicles have been shown to account for up to 80% of nitrogen oxide (NO<sub>x</sub>) emissions<sup>1</sup>. Where road transport emissions are the largest single contributor to the pollution in the AQMA, it is recommended that the AQAP be integrated with the Local Transport Plan<sup>2</sup>. Oxfordshire County Council as the authority responsible for transport planning is required to develop the LTP. The Environment Act 1995 places a duty on Oxfordshire County Council to propose actions that works towards meeting the air quality objectives within the AQMA.

Figure 1: Central Oxford Air Quality Management Area (shown in black)



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To find out more information about air quality management in Oxford visit our website: <http://www.oxford.gov.uk/services/air-quality-management.cfm>

<sup>1</sup> Air Quality Review and Assessment – Stage 1&2 for Oxford January 1999

<sup>2</sup> Local Air Quality Management Policy Guidance LAQM PG(03) DEFRA 2003



### **1.3 Local Transport Plan**

The Local Transport Plan (LTP) sets out a five-year strategy for the co-ordination and improvement of transport policy for Oxford City from April 2006 until 2011. There are five priority objectives; tackling congestion, delivering accessibility, safer roads, better air quality, and improving the quality of the street environment in the LTP. Air quality as a priority objective has been introduced into the LTP for the first time. To identify priorities for investment the objectives are weighted such that some are afforded greater priority than others.

The County Council identified over 500 transport problems that were assessed under the five priority objectives to determine the relative severity of each. Oxford city centre's air quality problem was rated as 'High Priority' giving it the highest possible priority for action in the LTP.

### **1.4 Transport and Environment Policy Issues**

The Government White Paper, "The Future of Transport" a network for 2030 acknowledges the need for a good transport system as essential for a successful economy and society. It also acknowledges that we must balance the increasing demand for travel against our goal of protecting the environment by delivering faster, greener and more reliable journeys, especially in urban areas.

In the UK, transport is currently estimated to produce a quarter of the total UK emissions of CO<sub>2</sub>. Cost-effective measures to reduce emissions from transport are therefore very important if the UK is to meet its climate change objectives.

Transport policies that aim to reduce congestion or CO<sub>2</sub> emissions, will also help to improve air quality. At the national and European level tighter emission standards for new vehicles and fuels have been the most effective measures to reduce total levels of vehicle emissions.

A new car today produces 20 times less emissions than an equivalent vehicle in the mid-1980s. As a result NO<sub>x</sub> emissions from road transport have fallen by 50 per cent despite traffic growth.

There is an increased awareness within the Department for Environment Food and Rural Affairs (DEFRA) and the Department for Transport (DfT) of the close links that exist between actions that are broadly considered as transport management actions, and actions that are required to reduce polluting emissions, improve local air quality and limit the contributions to climate change.

Limiting the access of private vehicles to urban centres in historic cities is an increasing focus not only in the UK but Europe wide. Some cities are considering using area management schemes such as Low Emission Zones

(LEZ). A LEZ enables priority access to designated urban areas by low emission vehicles.

School travel plans, workplace travel plans and personalised journey planning have helped prompt people to consider, and take up, alternatives to the routine use of their own car, especially for journeys at peak hours. These measures, often referred to as “Smart Choices”, involve personal choice, and contribute to local road traffic reduction. It is considered that active promotion of these options can be a cost effective approach to changing travel behaviour and contribute towards limiting urban traffic growth.

## **2 Air Quality and Transport**

### **2.1 What is Nitrogen Dioxide?**

The pollutant currently of concern in Oxford is nitrogen dioxide. Nitrogen dioxide pollution arises primarily from the emissions of a mixture of nitrogen dioxide (NO<sub>2</sub>) and nitric oxide (NO) from combustion processes such as vehicle engines. When mixed with air some of the nitric oxide is converted into the pollutant nitrogen dioxide. Nitrogen dioxide and nitric oxide are together referred to as nitrogen oxides (NO<sub>x</sub>). Reductions in NO<sub>x</sub> emissions need to be made in order to reduce nitrogen dioxide concentrations in the air. Improvements in nitrogen dioxide pollution concentrations should therefore be expressed in terms of equivalent NO<sub>x</sub> level emissions, which in turn can be linked to traffic generated NO<sub>x</sub> emissions.

### **2.2 Why is Nitrogen Dioxide of concern?**

Nitrogen dioxide is a brown gas that acts as an irritant to the eyes, nose, throat and respiratory tract. Nitrogen dioxide can have both short-term 'acute' effects and long-term 'chronic' effects.

### **2.3 Short-Term Effects of Nitrogen Dioxide**

The short-term 'acute' effects are irritation of the eyes, nose and throat and an increase of the symptoms of existing respiratory conditions such as asthma, bronchitis or emphysema. Because of the short-term health impacts the government has set a short-term hourly air quality objective (see Appendix 3).

In Oxford the short-term concentrations of nitrogen dioxide are unlikely to give rise to acute health impacts even amongst the most vulnerable.

### **2.4 Long-Term Effects of Nitrogen Dioxide**

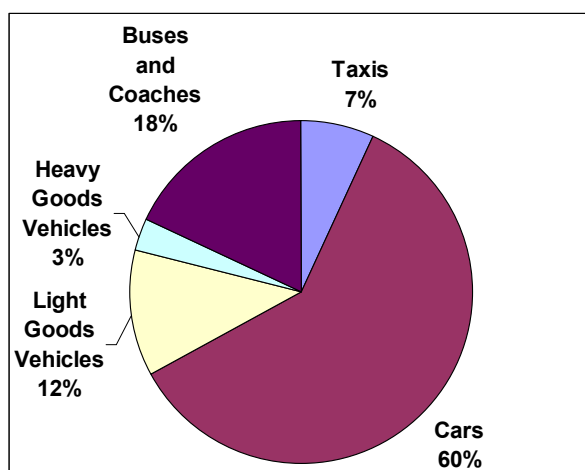
The long-term 'chronic' effects of nitrogen dioxide are associated with a gradual deterioration in the health of people who are already suffering from lung diseases, and an increased susceptibility to respiratory infections. Due to these debilitating health effects of long-term exposure the government has also set a long-term annual average objective for nitrogen dioxide (see Appendix 3).

In Oxford it is the annual average nitrogen dioxide air quality objective that is being exceeded in the AQMA and likely to be having an adverse impact on the long-term health of the more vulnerable members of Oxford's population. There is a mixture of commercial and residential properties (including University accommodation) within the AQMA where there is relevant public exposure.

## 2.5 Where does the Pollution come from?

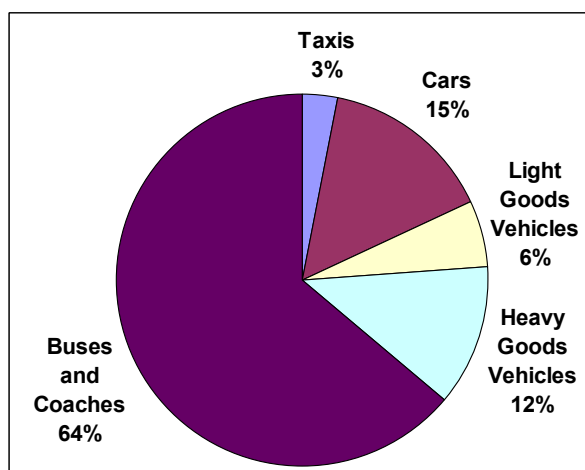
Within the AQMA approximately 60-65% of NO<sub>x</sub> emissions are from road traffic although within particular streets the figure may be higher. At the monitoring site in St Aldate's, for example, emissions from traffic accounted for approximately 80% of the measured NO<sub>x</sub> levels<sup>3</sup>. In line with the national picture the major traffic emissions in Oxford are from diesel powered heavy vehicles, including buses and coaches. This is despite the fact that over a 24hour period the majority of vehicle movements are due to cars. See Figure 2.

Figure 2: Traffic flow by vehicle type in the AQMA



A breakdown of NO<sub>x</sub> emissions by vehicle type shows the dominance of buses and coaches, and heavy vehicles. In the Oxford AQMA 76% of road traffic generated NO<sub>x</sub> is from the combined emissions from these sources, see figure 3. This illustrates that a relatively small number of vehicles can contribute significantly to the NO<sub>x</sub> emissions.

Figure 3: NO<sub>x</sub> emissions by vehicle type in the AQMA



<sup>3</sup> Air Quality Review and Assessment – Stage 1&2 for Oxford January 1999

## 2.6 Passenger movements in central Oxford

The figures within the chart below demonstrate that the majority of journeys to work in Oxford are not made by car, although car transport is still the largest single mode of transport.

The breakdown of passenger transport for travel to work is as follows:

Car and van (driver and passenger) 42%

Bus/Mini-bus, Coach 16%

Bicycle 15%

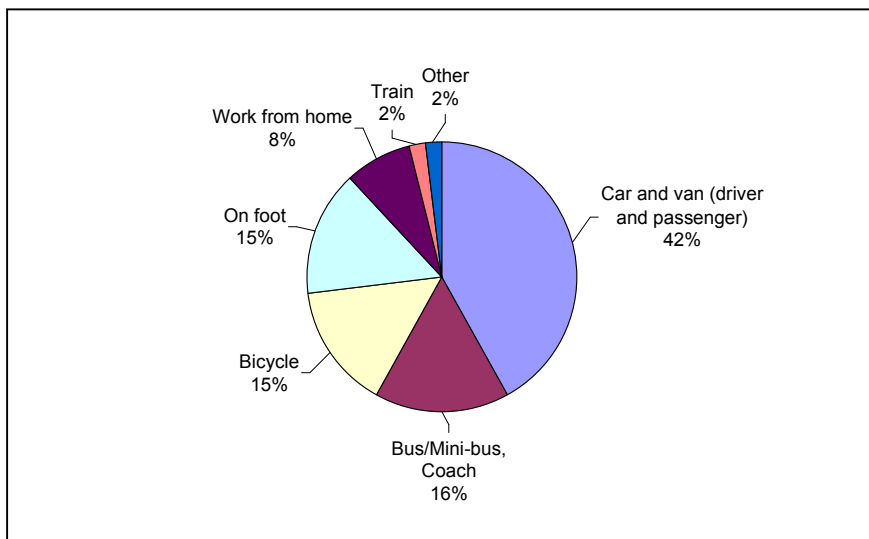
On foot 15%

Work from home 8%

Train 2%

Other 2%

Figure 4 Modal split for journeys to work in Oxford



## 2.7 How much does pollution need to be reduced?

The objective level for nitrogen dioxide is  $40\mu\text{g}/\text{m}^3$ . For the period 2000 to 2004 the average background concentration of nitrogen dioxide, that is the level in the atmosphere away from any pollution sources, measured  $22\mu\text{g}/\text{m}^3$ . Therefore, to achieve the objective level the maximum nitrogen dioxide contribution from traffic sources must not be greater than  $18\mu\text{g}/\text{m}^3$ . This is calculated by taking the background level from the objective level.

For the same period 2000 to 2004 the average roadside concentration of nitrogen dioxide measured within the AQMA from traffic sources was  $45\mu\text{g}/\text{m}^3$ , this is  $27\mu\text{g}/\text{m}^3$  above the required level of  $18\mu\text{g}/\text{m}^3$ .

Based on the measured  $\text{NO}_2:\text{NO}_x$  conversion relationship a  $27\mu\text{g}/\text{m}^3$  reduction in nitrogen dioxide equates to a  $64\mu\text{g}/\text{m}^3$  reduction in  $\text{NO}_x$ , which represents a 68% reduction in  $\text{NO}_x$  emissions.

This is an average figure for the whole AQMA. Where monitoring data is available for individual streets the total  $\text{NO}_x$  reduction by street has been calculated. This was based on the predicted 2005 nitrogen dioxide level for that street. The figures in Table 1 give the percentage  $\text{NO}_x$  reduction for individual streets for which monitoring data (diffusion tube data) was available. The contribution to the total  $\text{NO}_x$  emissions by vehicle type within those streets is also given.

Table 1:  $\text{NO}_x$  Reduction by Street and Contribution by Vehicle Type

Location	2005 Predicted $\text{NO}_2$ ( $\mu\text{g}/\text{m}^3$ )	% $\text{NO}_x$ Reduction Required	Percentage $\text{NO}_x$ Emissions by Vehicle Type				
			Car	Taxi	LV	Bus	HGV
Beaumont Street	51	49	43	4	16	18	19
High Street	81	83	1	4	1	71	23
Longwall Street	60	67	43	2	13	16	26
Queen Street	98	90	0	0	0	95	5
George Street	81	83	2	5	3	80	10
Frideswide Square	72	80	32	3	14	26	24
New Road	67	75	3	3	2	87	5
Park End Street	62	69	8	6	5	82	0
Speedwell Street	46	32	8	6	4	72	10
St Aldate's	58	63 (76)*	4	4	3	81	8
St Giles	58	63	25	1	8	54	11
Worcester Street	55	58	44	4	17	24	11
St Clements Street	85	86	25	1	8	56	10
Hythe Bridge Street	48	40	43	4	17	25	11

\*Two figures are given for St Aldate's. The higher figure in brackets was calculated using continuous monitoring, and not diffusion tube data.

Continuous monitoring data are accurate measurements using pollutant specific monitors, subject to strict quality assurance control. The measurements are recorded at least hourly.

Diffusion Tube Data is less accurate than continuous monitoring. The diffusion tube contains a chemical that absorbs nitrogen dioxide over the sampling period, normally one month.

These results highlight that measures to reduce NO<sub>x</sub> emissions in the AQMA have to be considered on a street-by-street basis. In Queen Street, New Road, St Aldate's, George Street and the High Street buses contribute the largest proportion. Whereas in Beaumont Street, Longwall Street, Worcester Street and Hythe Bridge Street cars are the largest single contributor.

## **2.8 What has been done already?**

Some actions such as Park & Ride have been in place for over 30 years, and further developed through the Balanced Transport Strategy adopted in 1973. This policy had five key elements; control of city centre parking, residents parking schemes, bus priority measures, and facilities for pedestrians and cyclists.

### **2.8.1 Oxford Transport Strategy**

The central area restrictions of the Oxford Transport Strategy (OTS) were implemented in 1999 and further developed the strong foundations of the Balanced Transport Policy by increasing bus priority, accessibility and modal shift towards greater use of public transport. Key features of this included:

- Increased bus priority on radial routes into the city
- Introduction of a system for smoothing traffic signal control (SCOOT)
- Improvements to the cycling infrastructure
- Continual review of on-street parking controls and enforcement
- Traffic calming on residential roads close to the city centre
- Parking restrictions in residential roads
- High parking charges
- Expansion of the Park & Ride
- Exclusion of through traffic in central Oxford
- Pedestrianisation of Cornmarket Street

### **2.8.2 Bus Quality Partnership**

The Bus Quality Partnership (BQP) introduced in 1998 is an agreement between Oxford City Council and Oxfordshire County Council, and the two main bus operators (Oxford Bus Company and Stagecoach). This agreement included a commitment from them to upgrade at least 85% of their buses on high frequency city bus routes to Euro 2 standard or better by summer 1999.

The agreement also included issues such as the operation of the bus priority route, location of bus stops and layover points for buses.

Unnecessary idling of engines causes needless pollution. The BQP therefore includes a code of practice that bus engines will be switched off when the vehicle is likely to be stationary for any length of time. This practice covers the bus priority routes in the city centre, mainly Queen Street, St Aldate's, High Street, Castle Street, Magdalen Street, Butterwyke Place, Speedwell Street and New Road. The code is voluntary, has no statutory basis and therefore relies on the goodwill of the bus operators for its success.

Good information and awareness of public transport routes and timetables all help to encourage bus use as opposed to the car as a means of transport into Oxford.

### **2.8.3 Alternative Fuels**

There are a number of alternative technologies on the market that have lower emissions than petrol or diesel. Oxford City Council believes it is important to lead by example and has implemented a clear policy to employ the cleanest technologies wherever possible. Up to 80% of the refuse trucks and road sweepers, and over half of all the vans in the fleet have either been replaced with low or zero emission vehicles, or had emissions abatement devices retrofitted where the duty cycle allows. Oxford City Council is also actively investigating going over to 5% bio-diesel fuelled vehicles where possible and a trial will begin in February/March 2006. A trial is also to be carried out using a diesel additive that increases fuel economy and reduces emissions. An independent report<sup>4</sup> of fleet emissions concluded that for the period 2000-2001 NOx emissions were reduced by 17%, along with more significant reductions in other pollutants. A further inventory of fleet emissions is to be completed by the end of March 2007.

In 1994 the Oxford Bus Company in partnership with Oxfordshire County Council and Southern Electric operated four electric buses on routes serving environmentally sensitive parts of the city centre. The trial was ended because of the poor reliability and the low carrying capacity of the vehicles.

### **2.8.4 Other actions for road traffic reduction**

These include initiatives such as Travelwise, Betterways to School, Corporate Travel Plans and Homezones. All these help to encourage or promote matters such as encouraging car sharing, providing pool cars, cycling incentives, cycle parking, showers and changing facilities, flexible working, homeworking, discounted bus and train tickets, and safer routes to school. These initiatives are generally referred to as 'smart choices' involve promoting changing travel behaviour in favour of reducing private car usage. Oxford City Council has already adopted a work place travel plan.

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<sup>4</sup> An Emissions Inventory of Oxford City Council's Vehicle Fleet 2000-1. AEA Technology Jan 2002



## **2.9 Impact on emissions and air quality**

Looking at measured pollution data and modelling changes in traffic flows the impact in the AQMA of the OTS and accompanying measures outlined above have been assessed. As a result, since 1999 the AQMA has seen:

- a 35% reduction in total vehicle movements
- an 8% reduction in NO<sub>x</sub> emissions
- a 14% increase in bus movements

At the same time as the changes have been made in the central area of Oxford, growth in employment and education has increased traffic flows and emissions in some areas of Oxford outside the AQMA, however this will be assessed in future reviews and assessments of air quality.

### 3 Trends in Air Quality

Diffusion tube data from roadside locations within the AQMA has been used to examine the trends over the last ten years, see Figure 4. From 1995 to 2000 the data shows that nitrogen dioxide levels within the AQMA were falling by on average 4% per year. More recently however the trend shows levels to be increasing by on average 1.3% per year.

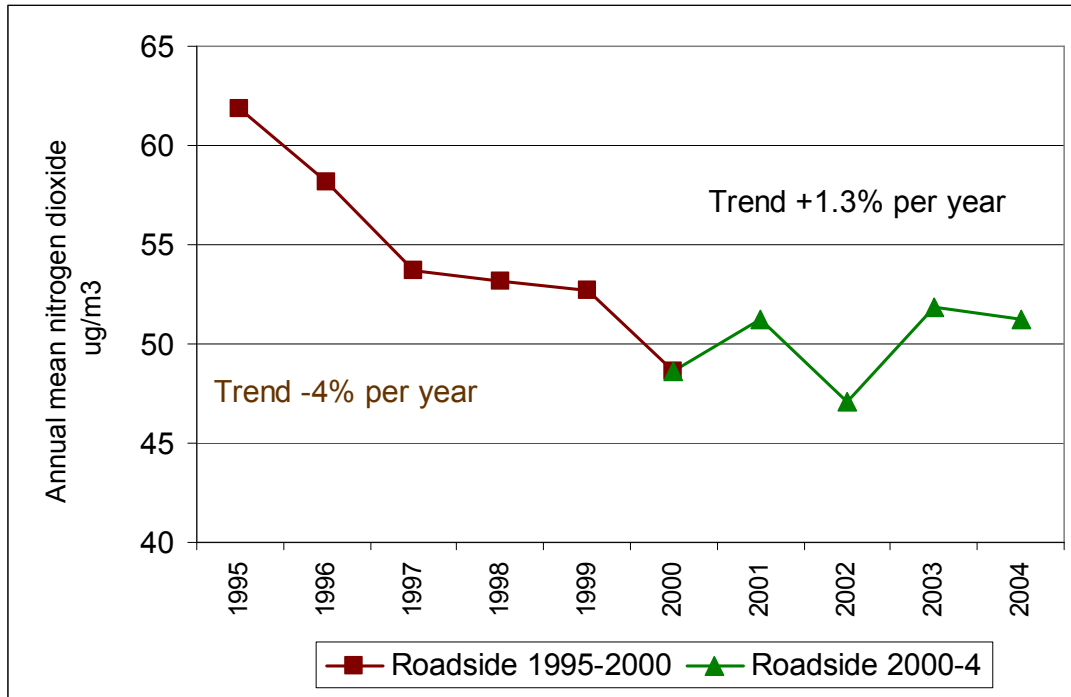


Figure 5: Average Diffusion Tube Data for the AQMA

Whilst this is the average trend across the whole AQMA the continuous monitoring data from the St Aldate's monitoring site shows a different picture, see Figure 5. The trend has on average, been a 5% per year increase in the annual mean nitrogen dioxide levels since 1998 for this one street. It is expected that this trend would be the same in other streets on the bus priority route (Queen Street, New Road, George Street and the High Street) where road traffic is dominated by buses. This increase has to be set against a small increase (approximately 1% per year) in the measured background levels of nitrogen dioxide.

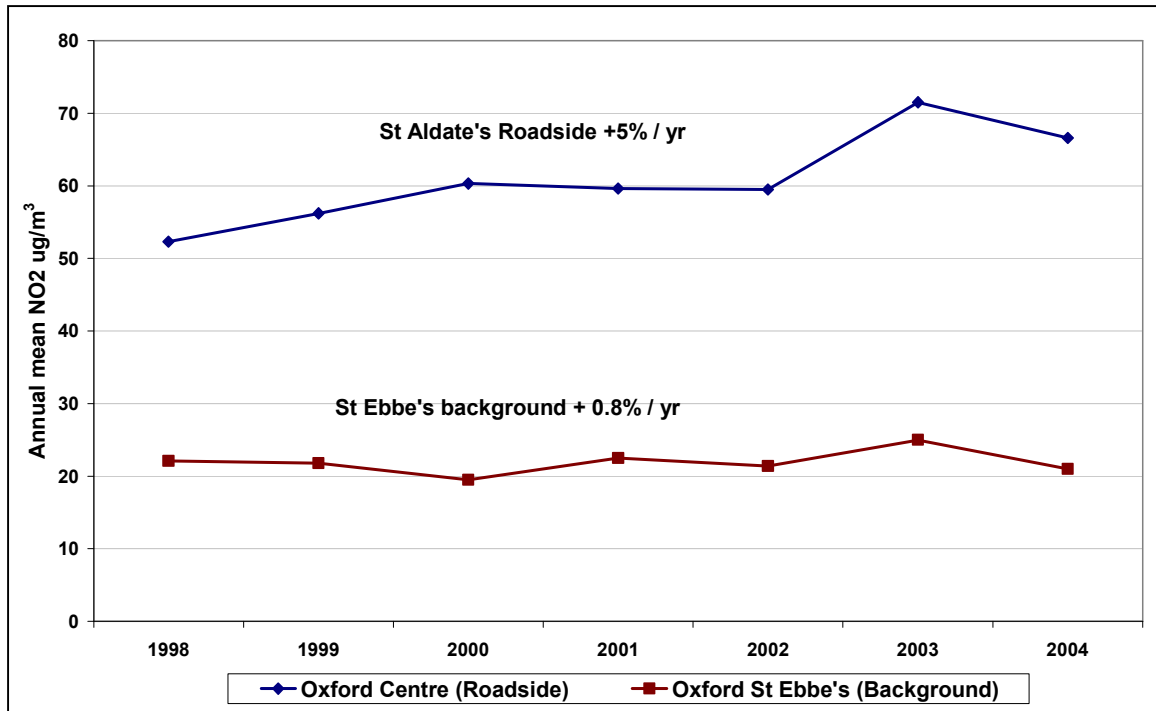


Figure 6: Trends in Continuous Monitoring data 1998-2004

These trends highlight that despite the measures taken to date, and the natural improvement in the vehicle fleet, the air quality objective for nitrogen dioxide will not be met without further intervention through the action plan.

Recently the speed limit in the city centre was reduced from 30mph to 20mph as an action to improve road safety. In some parts of the AQMA vehicle speeds will be even lower than this due to congestion. Whilst the speed limit has quite rightly been reduced for road safety reasons, buses and HGV's produce high levels of NO<sub>x</sub> at low speed and in stop-start traffic. For a vehicle fleet mix comprising 10% of heavy vehicles, a speed reduction from 30mph to 20mph is predicted to increase average NO<sub>x</sub> emissions by 27%<sup>5</sup>.

The use of particulate traps for the reduction of fine particulate matter has increased the concentration of nitrogen dioxide that is emitted directly from bus vehicle exhausts. Despite this negative impact on nitrogen dioxide emissions, it is considered a net health benefit because the health risks of increased levels of particulate matter are greater than that for nitrogen dioxide.

<sup>5</sup> W S Atkins report 2001 Determination of the Potential Synergies and Conflicts Between Noise and Air Quality Action Plans

## 4 Central Oxford AQMA Summary

1. The air quality objective for nitrogen dioxide of  $40 \mu\text{g}/\text{m}^3$  is not likely to be met by the target date of December 2005.
2. To meet the air quality objective for nitrogen dioxide, emissions of NOx need to reduce by an average of 68% in the AQMA, although the amount required varies from street to street (32% to 90%).
3. Buses generate the majority of emissions on the bus priority route within the AQMA. Cars, taxis and light goods vehicles are the main source of emissions on other roads in the AQMA.
4. Actions introduced under the Oxford Transport Strategy (OTS) reduced total traffic flows in the AQMA by as much as 35%.
5. The OTS (and other) actions introduced to date have reduced traffic generated NOx emissions by approximately 8% in the AQMA, although in some streets there has been an increase.
6. Despite the actions taken up to 1999, trends in air quality measurements indicate that there has been no significant improvement in air quality in the AQMA over the last 5 years.
7. Speed reductions (from 30mph to 20mph) imposed in the city centre, and the increased use of particulate traps may have increased NOx emissions from heavy vehicles, including buses and coaches.
8. Without further intervention through the action plan the air quality objective for nitrogen dioxide will not be met.
9. Measures in the action plan need to focus on emissions from buses for streets on the bus priority route, and congestion due to the general traffic for other streets
10. Oxfordshire County Council is responsible for the Local Transport Plan (LTP). Most of the measures outlined in this AQAP will therefore be integrated in the LTP for 2006 – 20011

## **5 Options for reducing NOx emissions**

### **5.1 Introduction**

It is not a requirement that the objective for nitrogen dioxide is achieved by the target date of December 2005. It is however a requirement that the AQAP identifies actions, with a timescale for implementation, which show that Oxford City Council and Oxfordshire County Council are doing all they reasonably can to work towards achieving the objective.

The following actions and projects were considered as options to deliver improved air quality in the AQMA. The majority of the actions are based on the recommendations of the Oxford City Council and Oxfordshire County Council Joint Scrutiny Review Group.

### **5.2 Oxford Transport Strategy (OTS)**

Some of the actions introduced through Oxford Transport Strategy (OTS) can be further enforced or developed to reduce congestion and restrict traffic growth.

#### **5.2.1 Bus Gate Enforcement**

The Oxford Transport Strategy restricted through traffic on the High Street and St Aldate's between 07.30 hours and 18.30 hours. Since this measure was introduced there has been no formal enforcement of the restriction other than ad-hoc police checks. The Oxfordshire County Council Executive Board has approved funding and the measure has been enabled by the Department for Transport (DfT).

This is predicted to further reduce daytime traffic (mainly cars) through the High Street and St Aldate's by 20% resulting in an estimated reduction in NOx emissions of between 2% and 5%.

#### **5.2.2 Traffic Signal phasing**

Queuing and congested traffic create local pollution hot spots. They can be reduced or relocated, by phasing of traffic flows to allow for the smooth passage of traffic through a particular street or location. Although this is already in place, improved phasing of traffic lights in and around the AQMA may reduce NOx emissions by a further 1% or 2%.

It is currently planned for the re-phasing of traffic signals to reduce congestion on the bus priority route in Central Oxford and London Road from The Plain to Green Road Roundabout.

Policy will be reviewed to ensure consistency across the network. Signals engineers will look at detailed performance to assess potential for improved flow particularly for the benefit of public transport.

### **5.2.3 Bus Quality Partnership**

This is currently a voluntary agreement between Oxford City Council and Oxfordshire County Council and the two main bus operators (Oxford Bus Company and Stagecoach). The Government have committed to the introduction of Statutory Quality Partnerships. It is considered that this will give local authorities greater influence over the provision of bus services and their marketing, and will enable them to encourage the provision of easy access buses.

The current agreement could be extended to all operators and used to set targets within two years for the minimum percentage of buses (for each operator) to conform to the highest emission reduction technology. The Royal Commission on Environmental Pollution have recommended that new buses with a high standard of comfort, low floors for easy boarding, must meet as a minimum Euro 3 standards for emissions. Upgrading of all bus services to Euro 3 standards is expected to result in a 20% reduction in NOx emissions.

The deregulation of bus services has been recognised as having a negative effect on air quality<sup>6</sup>. The introduction of more cross-operator ticketing would however reduce over-capacity, and ultimately the number of buses on some routes in the AQMA. It is difficult to assess the reduction in NOx emissions but it could be as much as 5% as buses are the main source of NOx emissions in the AQMA.

Increasing the availability of through tickets and off-board ticketing would speed up bus boarding times and therefore reduce congestion. It is difficult to assess the reduction in NOx emissions but it could be about 1%.

The Continued improvement of interchange facilities, connecting services, public information, electronic timetabling at bus stops, route planning and fare information could help increase bus use.

### **5.2.4 Freight Quality Partnership**

Further restrictions on permitted hours for making deliveries along with better enforcement would reduce congestion. This could be significant in streets on the bus priority route such as Queens Street, St Aldate's and the High Street, but also in Beaumont Street where traffic congestion is the main cause of high emissions.

Transshipment centres at the edge of the city where freight is transferred to smaller vehicles could reduce the number of HGV vehicles in the AQMA, particularly at peak times. Experience from across Europe suggests that it can

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<sup>6</sup> Royal Commission on Environmental Pollution 20<sup>th</sup> Report

be difficult to make 'smart city' logistics schemes effective. However where large numbers of retail units, large-scale construction sites, or industrial premises are grouped together then the schemes may offer advantages. The reduction in NO<sub>x</sub> emissions as a result of a transshipment centre in Oxford is difficult to assess, but could be about 2%.

Minimum emission standards could be set for HGV's entering the AQMA. It is difficult to assess the reduction in NO<sub>x</sub> emissions but it could be about 5%. (See figures listed under LEZ).

### **5.2.5 Taxi Quality Partnership**

Oxford City Council licences hackney carriages and private hire vehicles. Further discussions are therefore needed between the City Council and the taxi operators to consider what would be achievable through a Taxi Quality Partnership. The taxi fleet in Oxford is relatively small and contributes only 3% to the NO<sub>x</sub> emissions in the AQMA, so the reduction in NO<sub>x</sub> emissions would probably be less than 1%.

### **5.2.6 Review of Parking Policy**

It only takes one illegally parked vehicle particularly at peak times to increase congestion problems. Better enforcement of parking restrictions in the AQMA would minimise this.

Increasing city centre parking charges could be used to encourage further bus usage, especially the use of the Park and Ride and reduce the number of vehicles coming in to the city centre. This could potentially reduce congestion in the AQMA particularly on streets such as Beaumont Street, Longwall Street, Worcester Street and Hythe Bridge Street where cars are the largest single contributor to NO<sub>x</sub> emissions.

It is difficult to assess the reduction in NO<sub>x</sub> emissions of these actions but it could be about 2%.

### **5.2.7 Work Place Travel Plans**

Work place travel plans help companies reduce the traffic impacts of their businesses by reducing work-related car trips. Work place parking charges (with discounts for low emission vehicles) would also help encourage more use of public transport.

There are already Staff Travel Plans established for all major employers in Oxford. These include the City and County Councils' own staff, Oxford University, Brookes University, Oxford Radcliffe Hospital Trust and other Hospitals in the Headington area, and BMW.

More effective travel plans would reduce the number of vehicle movements into and around Oxford generally and should be encouraged wherever

possible. It is also a requirement of any new development above a certain size to include a travel plan at the planning application stage. The impact on NO<sub>x</sub> emissions in the AQMA however, would probably only be about 1%.

### **5.2.8 More School Travel Plans**

A high proportion of school children are driven to school by car. School traffic adds significantly to rush hour traffic, congestion and pollution. School travel plans would look at matters such as safety improvements and traffic calming on the main routes to schools to encourage more children to walk or cycle to school.

More school travel plans would reduce the number of vehicle movements and localised congestion, particularly during peak periods. Most of the schools are located outside the AQMA although the journey to them may be affecting St Clements. The impact on NO<sub>x</sub> emissions in the AQMA would probably be minimal (<0.5%).

### **5.2.9 Car Clubs / Car Pools**

Some cities have begun to introduce membership based City Car Clubs, which enable the use of a car from a centrally maintained car pool. These vehicles are likely to be newer less polluting vehicles, or even alternatively fuelled vehicles.

Oxford City Council and Oxfordshire County Council have supported residential car clubs in the last 5+ years, and will continue to do so by providing specific on-street parking space for them. There is one existing in Oxford. Neither Council provides any financial support to car clubs as they are operated on a commercial basis. It is difficult to assess the reduction in NO<sub>x</sub> emissions within the AQMA but it could be about 1%.

### **5.2.10 High Volume Occupancy of Vehicles**

High volume occupancy can be promoted by giving priority use of dedicated traffic lanes to vehicles of certain occupancy and by incentives such as reduced parking charges. The scope for the former would be very limited in Oxford and certainly within the AQMA. Reduced parking charges for high occupancy could have some impact although the reduction in NO<sub>x</sub> emissions would probably be no more than 1%.

### **5.2.11 Encouraging Cycling and Walking**

Healthy exercise by walking and cycling represents a zero pollution alternative to a motor vehicle journey. Many people do not cycle in cities due to safety concerns. The continued promotion of safer cycling, including safer crossings and cycle lanes are therefore needed. Also the continued improvement of secure cycle facilities and changing facilities in the workplace can promote cycling. Local employers can consider incentives for employees travelling to



work without the use of a private vehicle. Streetscape design can influence the safety of pedestrians where shared use takes place between pedestrians and vehicle users. A crucial factor in the attractiveness of alternative modes of transport is the priority they receive at junctions<sup>10</sup>.

It is difficult to assess the reduction in NOx emissions that promoting cycling and walking would have in the AQMA but it could be about 1%.

### **5.2.12 Engine Switch Off when Stationary**

The Road Traffic (Vehicle Emissions) (Etc) Regulations 2002 permit local authorities to request drivers to switch off vehicle engines being run unnecessarily when parked and to issue fixed penalties of £20 to those drivers that refuse. Oxford City Council would need to apply to the Secretary of State to become a designated authority to issue fixed penalties.

There is already a voluntary agreement with the bus companies through the bus quality partnership to switch off vehicle engines when stationary. This however would make it a statutory requirement and extend the provision to all vehicles in the AQMA. There would be a revenue cost for enforcement but the estimated reduction in NOx emissions could be about 1%.

### **5.3 Roadside Testing of Emissions**

Under the Road Traffic (Vehicle Emissions)(Etc.) Regulations 2002 local authorities that have designated an AQMA can apply to the Secretary of State for powers to conduct roadside testing of vehicle emissions and issue fixed penalties of £60 to drivers whose vehicles fail.

There would be a revenue cost for enforcement and the estimated reduction in NOx emissions on the bus priority route would be small. There could be a benefit in some streets (Beaumont Street, Longwall Street, Worcester Street and Hythe Bridge Street) where cars are the largest single contributor but again the reduction would be small probably no more than 0.5%.

Although emission testing would only have a small impact on NOx emissions in the AQMA, it would be seen as a statement of Oxford City Council's intent to tackle the problem across the city generally. A better option might however be to exclude older more polluting vehicles from the AQMA, see LEZ and scrappage schemes.

### **5.4 Scrappage Schemes**

The average age of vehicles is increasing. Older vehicles pollute more than newer ones particularly those manufactured before 1993 (pre Euro 1 standard). However, encouraging drivers to replace older vehicles by financial incentives would need to be provided at a national and not local level. Schemes to exclude older, more polluting vehicles from the AQMA may lead to some small reductions in NOx emissions. Most of the busses are already Euro 2 standard, see comments under LEZ, and so the reduction on streets

on the bus priority route would be very small. On streets where cars are the largest single contributor (Beaumont Street, Longwall Street, Worcester Street and Hythe Bridge Street) the reduction might be slightly higher.

It is difficult to assess the reduction in NO<sub>x</sub> emissions in the AQMA from a vehicle scrappage scheme but it could be about 1%. The benefits however would extend beyond the AQMA.

## **5.5 Retro-fitting of Tail Pipe Technology**

Grants exist through the Energy Savings Trust, Transport Energy Clean-Up programme towards the costs of retrofitting particulate filters and devices to reduce NO<sub>x</sub> emissions. There has been a significant introduction of particulate filters by one bus company that should be extended to all bus companies. Options exist under this scheme to retrofit Exhaust Gas Re-Circulation (EGR), or Selective Catalytic Reduction (SCR) Technology. EGR systems typically reduce emissions per vehicle by 40%. It typically costs in the region of £6,000 to fit an EGR system to a bus.

A local trial of a bus fitted with SCR technology (Equivalent to Euro IV), delivered a reduction in bus generated NO<sub>x</sub> levels in excess of 70%. SCR technology is still under development and is likely to be available in the near future. The overall reduction in NO<sub>x</sub> emissions is estimated at 35% if applied to all buses and coaches, with some further reductions (an additional 5% reduction) possible if applied to other vehicles.

## **5.6 Greater use of Cleaner Fuels**

A number of European Cities have joined together in programmes such as CIVITAS. The goal of the CIVITAS Initiative is to achieve a significant change towards the use of cleaner transport such as hybrid vehicles, electric vehicles, and natural or biogas vehicles.

Oxford City Council believes local authorities should lead by example and already has a clear policy to employ the cleanest technologies for all its vehicles.

This development would be necessary as a means to encourage the uptake of higher levels of clean-fuelled transport. Oxford City Council is actively investigating going over to 5% biodiesel for some of its fleet vehicles.

Low emission or non-polluting fuels could theoretically reduce traffic emissions to near zero. However, this is unlikely and the reduction in NO<sub>x</sub> emissions in the AQMA could be up to 50% in the long term. There would also be a benefit outside the AQMA wherever the vehicles are driven.

Oxfordshire County Council has a cost incentive scheme for contracted bus services to provide a vehicle of higher emission standard. The County Council owns roughly 500 vehicles of which very few ever operate in Oxford city centre. The Council's fleet includes fire appliances,

library vans, special minibuses, ordinary minibuses, cars and vans. These are managed by the Council's Fleet Managers who are working to improve the overall environmental performance of the fleet, not only regarding initial purchase, but also looking at maintenance, driving style, and disposal each of which have major impacts on the environment in general and air quality in particular. Not all these vehicles are controlled from the centre, so guidance on the purchase, management and maintenance of vehicles was produced as part of the Fleet Review. This note specifically advises against the use of LPG which has no air quality benefits over petrol and is unsuitable for certain vehicles traditionally run on diesel, such as minibuses. In general the Euro emissions standards will take care of the replacement of vehicles, and in view of the localised nature of Oxford's air quality target exceedences, there is no reason to accelerate the process.

## **5.7 Low Emission Zone (LEZ)**

The aim of a LEZ is to restrict access to an area based upon the environmental standard of a vehicle and is potentially the most effective method of cleaning up the vehicle fleet. LEZ's are normally considered by establishing a required Euro engine standard for vehicles to enter the restricted area. There would be no charge for vehicles to enter a LEZ, the primary aim is to 'clean up' vehicles not reduce traffic levels.

On the bus priority route in the AQMA the majority of NO<sub>x</sub> emissions are due to buses and coaches. A scheme could be phased in with standards initially introduced for buses and coaches, then HGV's, and then cars at later dates if necessary.

The benefits of an LEZ would extend beyond the actual zone because vehicles that are cleaned up or replaced would produce lower emissions wherever they are driven.

In Oxford there are two main companies, the Oxford Bus Company and Stagecoach that provide bus services. Up to 90% of their vehicle fleet is already at least Euro 2 standard. This figure is much less amongst the smaller companies; none of the tour-buses for example meet any Euro standards. Based on estimates and figures from the Oxford Bus Company and Stagecoach of the bus fleet composition in the city centre, the impact of the progressive introduction of higher Euro engine standards to the local bus company fleets, and also HGV vehicles is shown in Table 2.

A LEZ phased in for buses and HGV's could result in a 58% reduction in NO<sub>x</sub> emissions in streets on the bus priority route (High Street, Queen Street, George Street, New Road, and St Clements Street) where the greatest reductions are required.

In other streets it is difficult to assess the reduction in NO<sub>x</sub> emissions, but it could be as much as 10% and up to 14% if the LEZ also included cars.

Table 2: Impact of an introduction of lower NOx emitting buses and HGV's

Measure	% Reduction in NOx Emissions
(1) All buses and coaches to Euro 2 standard.	3
(2) As (1) above plus all HGV's to Euro 2 standard	3
(3) As (2) above but all buses and coaches to Euro 3 standard	20
(4) As (3) above plus all HGV's to Euro 3 standard	22
(5) As (3) above but all buses and coaches to Euro 4 standard	35
(6) As (5) above plus all HGV's to Euro 4 standard	40
(7) As (6) above and adoption of enhanced Euro 4 2008 standards on buses	50
(8) As (7) above with adoption of enhanced Euro 4 2008 on HGV's	58

## 5.8 Campaign to Raise Awareness of Air Pollution

The decisions people make about the way they travel have an impact on air quality in the city and even small changes could help reduce pollution. If people are well informed about the air pollution problem and the solutions they will be more likely to do their bit to help improve air quality. Building public support to improve air quality must be an integral part of the AQAP. It is considered that when personal travel choices are taken in isolation they may appear ineffective. However, it is starting to be recognised that the widespread adoption of 'smart choices' for alternative travel can offer genuine long-term benefits in their contribution to pollution reduction. National initiatives such as the annual, "In Town without My Car Day" offer a means of raising the profile on alternatives to travel by car, and helping the wider public to recognise the choices we all face that can have an impact on the environment.

Table 3: Summary of Action Plan Options

<b>Paragraph Number</b>	<b>Option for Reducing NOx Emissions</b>	<b>Reduction in NOx Emissions %</b>
5.2.1	Bus Gate Enforcement	2-5
5.2.2	Traffic light location and phasing	1-2
5.2.3	Bus Quality Partnership: - All buses to Euro 3 - Cross-operator ticketing	Up to 20 5
5.2.4	Freight Quality Partnership - All HGV's to Euro 3 - Transhipment Centres	5 2
5.2.5	Taxi Quality Partnership - All Taxis to Euro 3	Less than 1
5.2.6	Review of Parking	2
5.2.7	Work Place Travel Plans	1
5.2.8	School Travel Plans	Less than 0.5
5.2.9	Car Clubs	1
5.2.10	High Volume Occupancy	1
5.2.11	Cycling and Walking	1
5.2.12	Statutory Engine Switch-Off	1
5.3	Roadside Emission Testing	Less than 0.5
5.4	Scrappage schemes	1
5.5	Retro-fitting	Up to 40
5.6	Cleaner Fuels	Up to 50
5.7a	LEZ (Buses, Coaches & HGV's)	Up to 58
5.7b	LEZ (5.7(a) plus all other vehicles)	Up to 70

## **6 What else must be considered?**

Although the principal aim of the AQAP is to improve local air quality the measures contained within it must support the wider council policies such as the Oxford Plan and the Oxford Community Strategy.

The Oxford Plan is an annually reviewed plan outlining the Councils objectives and priorities for the next three years. One of the priorities identified is to improve the quality of our environment.

The Oxford Community Strategy, approved in 2004, contains the objectives and priorities that Oxford City Council has agreed for the area in partnership with other organisations in the city. One of the five key themes of the Oxford Community Strategy is a better living environment.

The priority for improving the quality of the environment identified in the Oxford Plan therefore links to the Councils strategic priority to improve the environment where we live and work, and the Community Strategy theme of a better living environment. The Council aims to achieve this by amongst other things:

- Seeking to influence the development of the County Council LTP for 2006 – 2011 to provide more cost effective and less environmentally damaging ways of promoting increased numbers of journeys into and within the City by public transport, cycling and walking in order to improve air quality, reduce traffic congestion and parking pressures and promote a healthy lifestyle.
- Develop initiatives to tackle fuel poverty, to promote alternative energy sources and to maximise fuel efficiency in all types of property, all routed through a Comprehensive Climate Change Prevention Action Plan for the city (to be drafted as soon as possible).

The planning system also has a role to play in the protection of air quality by ensuring that land use decisions do not adversely affect the air quality in an AQMA, or in other areas where air quality objectives are unlikely to be met. Developments will be assessed against its direct effect on air quality, and also the effect of the traffic it generates. The relevant policy in the Oxford Local Plan 2001-2016 (adopted in November 2005) is CP.23 which states that: 'Planning permission will not be granted for development which would have a net adverse impact upon the air quality in the Air Quality Management Area, or in other areas where air quality objectives are unlikely to be met'.

## **7 Consultation on the Action Plan Options**

### **7.1 Consultees**

Consultation on the AQAP options for reducing NO<sub>x</sub> emissions in the AQMA was timed to coincide with Oxfordshire County Council's consultation on the Local Transport Plan (LTP) as the two documents are closely linked. Consultation took place over a twelve week period ending on the 2<sup>nd</sup> December 2005.

Copies of the draft AQAP were sent to the following bodies and organisations:

DEFRA; the Environment Agency; the Highways Authority; Oxfordshire County Council; Cherwell, South Oxfordshire, West Oxfordshire and the Vale of White Horse District Councils; the Government Office for the South East; NHS Executive; Oxford Bus Company, Stagecoach; National Federation of Bus Users; Licensed Taxi Association; Arriva and the Shires Ltd; Oxford Civic Society; Oxford Preservation Trust; Oxford Pedestrians Association; Thames Valley Police; Oxfordshire Fire Service; University of Oxford; Oxford Brookes University; CYCLOX; Friends Of the Earth; Oxfordshire Environment Group; National Asthma Campaign; Oxford Civic Society; Oxford Times Newspaper; OX1; Oxford Covered Market Traders Association; Oxfordshire Chamber of Commerce & Industry; Oxford & District Trades Council; Blackbird Leys, Horspath, Littlemore, Marston, North Hinksey, and Risinghurst and Sandhills Parish Councils; Central Ward, South Quarter, York Place, Rewley Park, St John's Street, St Ebbe's Tenants, St Ebbe's New Development, and West Quarter Residents' Associations; Folly Bridge Management Committee.

A summary booklet of the action plan with a questionnaire was also available at the Main and Local Libraries in Oxford, Sainsbury's supermarket in the Westgate Centre, and Oxford Railway Station.

Displays on the draft AQAP and the LTP were set up in the receptions of Ramsay House and Speedwell House (County Highways). A display was also set up in the Westgate Centre between Friday 25<sup>th</sup> November and Tuesday 29<sup>th</sup> November 2005.

### **7.2 Response to Consultations**

#### **7.2.1 Statutory Consultees**

Responses were received from three of the statutory consultees, DEFRA, Oxfordshire Primary Care Trust, and Oxfordshire County Council. The Oxfordshire NHS Primary Care Trust have commented that the AQAP should incorporate a formal health impact assessment to account for health inequalities and quality of life issues, including the impact of transport policy upon the most disadvantaged. A wider view should include informed travel choices and pedestrianisation as positive health impacts, and include impacts on accessibility for all.

Oxfordshire County Council are proposing to agree the contents of the AQAP with Oxford City Council through officer liaison.

### **7.2.2 Environmental Scrutiny and Area Committees**

The Environmental Scrutiny considered the draft AQAP and recommended that:

- Air quality objectives be clearly integrated into the LTP
- The LTP has air quality as top priority for weighting measures in the City
- Bus Gate Enforcement, the Bus Quality Partnership, Retro fitting, Clean Fuels and an LEZ, (including a feasibility study) should be included in the LTP as a priority
- Measures in the AQAP should be implemented immediately with a timetable for action and implementation
- A discussion paper setting out the options for nitrogen dioxide targets is submitted at a future meeting of the Environment Scrutiny Committee
- The Environmental Impact Assessment of the Westgate Centre development is submitted to the Environment Scrutiny Committee as part of the consultation on the development

The areas covered by the Central, South & West Area Committee and the East Area Parliament are likely to be most affected by the proposals in the draft AQAP. Both Committees recommended that a LEZ should be implemented in central Oxford. The East Area Parliament and the North Area Committee also recommended that the powers to allow roadside testing of vehicles should be adopted.

### **7.2.3 Bus Companies**

A detailed response consisting of a 31-page report was received from the Oxford Bus Company (OBC) the largest operator in Oxford. None of the other bus companies responded to the consultation.

The OBC state that according to the National League Table for Regulated Pollutants (particulates, CO, HC and NOx) they already have one of the cleanest bus fleets in the UK. This is because in 1995 they embarked on an ambitious programme to replace their entire fleet within 5 years with vehicles meeting the latest Euro standards at the time. To date their fleet comprises 17 vehicles to Euro 2 standard, 19 to Euro 2 + particulate traps, and 45 to Euro 3 + particulate traps, and the average age of their vehicles is 6 years compared to the government target of 8 years.

With regard to alternative fuels the OBC has undertaken trials with other bus companies on electric and gas propelled vehicles. Electric vehicles were not reliable or robust enough for intensive urban use, and gas buses, which were also less reliable than diesel equivalents, have higher emissions of carbon dioxide. There are also concerns about safety with gas vehicles.



They claim that the issue of NOx emissions is a more difficult one to tackle but that their ongoing vehicle replacement policy, from 2006 all new vehicles will be to Euro 4 standard and then to Euro 5 when available, is the way forward. They estimate that this policy should reduce their NOx emissions by approximately 29% over the next five years. Because of this the OBC supports the principle of an LEZ for central Oxford but suggests that it is considered as one of a series of measures to control emissions.

The OBC does not agree that the deregulation of bus services has had a negative effect on air quality, nor do they agree that cross ticketing would reduce over capacity because this assumes operators have an equal share of the market.

The enforcement of the bus-gate on the High Street should be introduced as soon as possible because the OBC believe that as much as 50% of the traffic on the Bus Priority Route is extraneous traffic which contributes to higher emissions, both from the vehicles themselves and also from allowed vehicles because of the additional congestion caused. They welcome the bus engine switch off and hope to be more proactive themselves in enforcing this. They say that the Taxi Quality Partnership should be encouraged because these vehicles are a significant user of the central area. The OBC will also be introducing a smartcard ticketing system in 2006, which should reduce bus dwell times and improve air quality.

The OBC would like the Bus Priority Route (BPR) to function in the way it was designed, that is allowing a steady, unimpeded passage to buses around the central area. The non-enforcement of the Bus Gate, illegal or unsympathetic parking and additional traffic light controlled junctions in some streets means that buses are constantly required to accelerate and brake along the BPR causing increased emissions. They feel that this requires a proper study.

The OBC will also be introducing a vehicle-labelling scheme that will enable the public to easily identify the relative emissions of a bus. Under the scheme each individual bus will be given a star rating according to the Euro standard of the engine for example, pre-Euro no stars and three stars for Euro III.

#### **7.2.4 Other Consultees**

OX1, representing the business community said there is a need to link the environmental and economic impacts of the measures within the assessment process. They suggest a full economic impact assessment of the air quality measures is required, and the timescales for implementation should be realistic. In their opinion bus deregulation is working against environmental improvements. They are concerned by options to ban traffic from central Oxford and alternative means to access the city centre should be examined. They recommend full consultation with the business community before decisions are taken.

The Bus Users Group oppose a central LEZ because it would impact on bus services, result in loss of amenity to bus users and increase private traffic. They think that the impact of parking measures needs to be considered in more depth because they suspect the estimates in the AQAP are too low.

Cyclox have said that more emphasis is required on non-motorised travel options; reductions in motorised vehicle use need to be embedded in the AQAP. There is no mention of the impact of the Westgate development, which is likely to generate more traffic. In their view the action plan is unbalanced based on technical fixes, ignoring the impact of smart choices of non-motorised travel, which should come first.

The Oxford Pedestrians Association strongly support the measures in the AQAP particularly a LEZ, a reduction in the numbers of vehicles, a 20mph zone, the Bus Gate Enforcement, less duplication of bus services, better management of commercial loading, and a reduction in central area parking. They also suggested that there should be more investment in walking and cycling strategies to reduce the need for private car use.

The St John's Area Residents Association think that the low priority given to Air Quality as a shared priority within the LTP is unacceptable. There should be more focus on reducing bus and HGV pollution, and buses should be relocated as part of the Westgate proposals. No mention is made of Vehicle congestion charging or of the rat-runs in the City to avoid the A34. They suggest that busses should be to Euro 3 standard by 2007, and Euro 4 by 2009.

A response was received from North Hinksey Parish Council encouraging the City to take appropriate actions to improve air quality in the AQMA.

### **7.2.5 General Public**

A total of 91 responses were received to the questionnaire. The general consensus is that air quality in Oxford City is poor, and that good air quality is important to health and for making the City a good place to live and work. To improve air quality the following measures were all considered important; promoting alternative means of travel; limiting access to the city centre only to cleaner vehicles; restricting traffic access to the city centre during busy periods; improvements to public transport service; development of intelligent transport systems for congestion control; and reviewing parking charges.

A total of 8 individual written responses and 26 sets of comments appended to questionnaires were received. There was overwhelming support for taking measures to improve air quality including; the setting of environmental targets; the need for coordinated development and planning policies; promotion of walking and cycling including better facilities such as improved cycle lanes and more cycle parking; cleaner buses; less empty or near empty buses; enforcement of bus engine switch off; a ban on diesel buses in the city centre; intelligent traffic light systems; congestion charging; increase parking charges; more pedestrianisation; and car sharing.

## **8 Which Options to Include in the AQAP?**

A wide range of measures for improving air quality in the AQMA were suggested in section 5 and consulted upon. Some of the measures have already been introduced or approved for implementation following the OTS. The scope for additional actions to further improve air quality in the AQMA is therefore limited.

Following the consultation process a report summarising the responses received was taken to a meeting of the Executive Board on the 16<sup>th</sup> January 2006 and the following actions were recommended:

1. Agree to the establishment of a working group between Oxford City Council Environmental Health and Oxfordshire County Council Transport Planning Departments to oversee the integration and co-ordination of measures to improve air quality and the environment in Oxford, for long term sustainable development city-wide, including the following:
  - a. Agree a mandatory air quality target to be included in the LTP
  - b. Agree an intermediate transport emission indicator to be included in the LTP
  - c. The integration of AQAP measures into the LTP
  - d. Ensure all measures are introduced subject to time related targets for reducing transport emissions and improving air quality
  - e. The continued assessment of LTP indicators throughout (and beyond) the period of the next LTP as a means of determining the effectiveness of measures
  - f. The re-assessment and consideration of further measures if time related targets for improvements in emissions and air quality are not being met
  - g. Incorporation of an Environmental Impact Assessment of Air Quality for all major developments, such as the Westgate Centre, in Oxford
  - h. The development with Oxfordshire Primary Care Trust of a Health Impact Assessment of proposed measures
2. Approve a feasibility study for an LEZ for the Central Oxford AQMA, and support the development of the terms and conditions applying to an LEZ for central Oxford
3. Support the enforcement of the bus-gate by the County Council as a measure to reduce daytime congestion on the bus priority route and AQMA (funding already approved by Oxfordshire County Council to introduce this).
4. Agree a package of measures with the County Council to reduce congestion in the Central Oxford AQMA, in addition to the bus gate enforcement, (including improved phasing of traffic lights on the bus priority route to enable smoother traffic flows; a review of on street parking and enforcement; a review of commercial deliveries; advanced ticketing to reduce bus waiting times).

5. Require Environmental Health to review the statutory powers under The Road Traffic (Vehicle Emissions Etc) Regulations 2002 to request drivers to switch off vehicle engines being run unnecessarily, to decide if this will be a feasible option for reducing traffic emissions within the AQMA.
6. Require Environmental Health to review the statutory powers under the Road Traffic (Vehicle Emissions Etc.) Regulations 2002 to conduct roadside testing of vehicle emissions, to decide if this will be a feasible option for reducing traffic emissions within the AQMA.
7. Require Environmental Health, in consultation with Oxfordshire County Council where necessary, to assess the cost effectiveness of the measures agreed, the time scales for implementation, and confirm who would ultimately be responsible for implementation.

These actions can be grouped under the following headings:

- Reducing emissions from buses and heavy goods vehicles
- Improving traffic management and reducing congestion
- Encouraging the use of public transport
- Other measures

## **9 Action Plan Measures**

### **9.1 Reducing emissions from buses and heavy goods vehicles**

The source apportionment of NO<sub>x</sub> emissions in the Central Oxford AQMA has shown that around two-thirds are from buses and coaches. Typically these vehicles make up less than 20% of the total traffic flow showing that they give rise to a disproportionately high level of NO<sub>x</sub> emissions. Although buses and coaches contribute significantly to NO<sub>x</sub> emissions they also play an essential role transporting around 45% of the people travelling into and out of Oxford.

The Oxford Bus Company (OBC), the largest operator in Oxford has already made a considerable investment in new buses and has one of the cleanest bus fleets in the UK. From 2006 all their replacement vehicles will be to Euro 4 standard and then to Euro 5 when available. It is because of this that the OBC supports the principle of a LEZ. An LEZ for the AQMA would also ensure that other bus and coach operators invest in the latest low emission vehicles.

The OBC has introduced a vehicle-labelling scheme so that the public can easily identify the relative emissions of their vehicles, and this could be extended to all bus operators through the Bus Quality Partnership.

HGV's also contribute significantly to NO<sub>x</sub> emissions given the size of the fleet operating within the AQMA. They play an essential role in delivering goods to city centre shops and businesses and so cannot simply be removed. OX1 representing the business community would be concerned if such traffic was banned from central Oxford. Transshipment centres at the edge of the city to reduce the number of HGV's in the AQMA is not to be a cost effective measure for the size of the city. A better option would be to consider looking at extending the provisions of a LEZ, if introduced, to include HGV's.

Alternative fuelled vehicles would not be an option for reducing NO<sub>x</sub> emissions in the AQMA. The OBC have undertaken trials with electric and gas fuelled vehicles. The electric vehicles were not reliable or robust enough for intensive urban use and gas, which were also less reliable, produce higher emissions of carbon dioxide.

City Works who manage the City Councils transport fleet have said that they now have a problem with the supply of vehicles fuelled by LPG. All the major manufactures that were offering factory fit LPG vehicles have dropped them from their range since the suspension of the Powershift grants. In fact no grants have been available since April 2005 towards the extra cost of alternatively fuelled vehicles such LPG and electric vehicles.

Table 4 on the following page details the AQAP measures aimed at reducing emissions from buses and HGV's.

Table 4: Measures for Reducing Emissions from Buses and HGV's

Measure	Responsible Authority	Implementation Date	Cost	Cost Benefit
Low Emission Zone	Oxford City Council and Oxfordshire County Council	Feasibility study to be commissioned in 2006  Outcome of the feasibility study to be reported back to the City and County Executive Boards in 2006/2007.	£30,000 (estimated) to be met jointly by the City and County Councils  Set up costs estimated at £50,000  Running / Enforcement costs not known	Most cost effective measure to achieve the required reduction in NOx emissions.  Compatible with the wider Council policies. Would be perceived as a positive measure by the public.
Adopt statutory powers to request drivers to switch off vehicle engines	Oxfordshire County Council	2007/8	Adopt powers - drafting traffic orders, signing £10-20,000  Enforcement costs could be covered in existing staffing of parking enforcement costs.	Would enforce the voluntary agreement with the main bus companies and extend the provision to all vehicles in the AQMA. Would be less significant if a LEZ is introduced.  Compatible with the wider council policies. Would be perceived as a positive measure by the public.
Adopt statutory powers for roadside testing of emissions	Oxford City Council	2006	Adopt powers £5,000 (estimated)  Cost of testing £65,000 per annum.	Little impact on NOx emissions in the AQMA. Not considered cost effective more a statement of intent being seen to be tackling emissions.  VOSA are currently carrying out free emission testing within the AQMA, but little effective impact.
Bus Quality Partnership	Oxfordshire County Council, Oxford City Council and the main bus operators	2006/7	Admin costs.	Effective forum for promoting good practice and measures for reducing emissions with the main bus operators. A quality partnership is being agreed with the two main bus operators to submit with the LTP.

## **9.2 Improving traffic management and reducing congestion**

Another factor influencing the level of traffic emissions is the degree of congestion faced by vehicles as they travel through the AQMA. Congestion results in stop / start traffic increasing emissions and travel time.

The OBC would like the Bus Priority Route (BPR) to function in the way it was designed, that is allowing a steady, unimpeded passage to buses around the central area. The non-enforcement of the Bus Gate, illegal or unsympathetic parking and additional traffic light controlled junctions in some streets means that buses are constantly required to accelerate and brake causing increased emissions.

Oxfordshire County Council have confirmed that enforcement of the bus-gate, which will restrict through traffic on the High Street and St Aldate's will take place in 2006. Excluding certain vehicles should also reduce emissions from permitted vehicles as a result of less congestion.

Oxfordshire County Council have also planned to look at the re-phasing of traffic signals to reduce congestion on the BPR in central Oxford and the London Road from the Plain to Green Road Roundabout, a key radial route into Oxford.

A review of parking enforcement and delivery times for commercial vehicles is required to reduce congestion and emissions. The Freight Quality Partnership is likely to include changes that reduce the impact of unloading and loading on congestion. Discussions with business representatives in Oxford will continue with changes programmed for 2006/7 and 2007/8.

Table 5 on the following page details the AQAP measures aimed at improving traffic management and reducing congestion.

Table 5: Measures For Improving Traffic Management And Reducing Congestion

Measure	Responsible Authority	Implementation Date	Cost	Cost Benefit
Bus Gate Enforcement	Oxfordshire County Council	Procurement and detailed installation of enforcement cameras are expected to take place during 2006, with implementation programmed for December 2006.	£200,000	Considered a necessary measure to reduce extraneous traffic flows and congestion on the High Street and St Aldate's. The benefit should be reduced emissions from both extraneous vehicles excluded and also allowed vehicles as a result of less congestion.
Improved phasing of traffic lights on bus priority route (BPR) and key radial routes into Oxford	Oxfordshire County Council	Detailed performance review for London Road in 2006 (brief to be commissioned in April); and for the central area BPR in 2006/7  Implementation 2007-11	Within network management budget	Considered a necessary measure to reduce traffic congestion and queuing particularly for the benefit of public transport
Review of commercial delivery times	Oxfordshire County Council	High Street 2006/7  George Street 2007/8	£6k for surveys and traffic order changes  Admin costs	Considered a necessary measure to reduce peak daytime congestion  Effective forum for promoting good practice and measures, for reducing congestion and emissions, with Oxford business representatives.
Freight Quality Partnership	Oxfordshire County Council, Oxford City Council and business representatives			
Bus Quality Partnership. Advanced bus ticketing	Oxfordshire County Council, Oxford City Council and the main bus operators	Dependent on bus operators.  OBC introducing a smart card ticketing system in 2006.	Main cost to bus operators.	Considered a necessary measure to reduce bus waiting times
Review of On-street Parking in Central Oxford	Oxford City Council and Oxfordshire County Council.	Ongoing through joint City and County working group.	Admin costs. Additional costs of enforcement could be covered in existing staffing of parking enforcement.	Considered a necessary measure to reduce congestion and emissions by enforcement of on-street parking during peak periods.



### 9.3 Encouraging the use of public transport

Both Oxford City Council and Oxfordshire County Council retain the principal of providing a limited amount of short term parking in the City Centre, and appropriate charging levels to encourage long term parking at park and ride sites. The total number of public parking spaces in central Oxford is not planned to change. Both Councils need to ensure that their policies are in line and do not conflict with the requirement to reduce vehicle emissions in the AQMA by for example, one offering free parking in the city centre.

Improvements to the bus priority route (BPR) on the main radial routes into Oxford will both reduce bus journey times and improve bus reliability. Oxfordshire County Council is implementing several schemes.

Workplace and school travel plans can also reduce the number of vehicle journeys into Oxford and promote the use of public transport. The major employers in Oxford, including Oxford City and Oxfordshire County Councils, Oxford University, Oxford Brookes University, Oxford Radcliffe Hospital Trust, and BMW already have Workplace Travel Plans. It is also a requirement in the Oxford Local Plan 2001-2016 (adopted in November 2005) that travel plans are submitted alongside planning applications if the development:

- is likely to generate significant amounts of travel in or near the City centre AQMA;
- is for new or expanded school facilities; and
- would be refused on local traffic grounds but where the travel plan sets out to overcome any adverse impacts;
- is over 1,000m<sup>2</sup> for commercial and retail developments, and over 2,500m<sup>2</sup> for hospitals, and higher and further education developments.

Oxfordshire County Council's programme for School Travel Plans in the next LTP will include all County Schools by the end of 2010. The targets are as follows:

Existing as at December 2005	81 schools	23%
By March 2007	144 schools	41%
By March 2010	347 schools	100%

Although most schools are outside the AQMA further travel plans for those in and around Oxford will have a benefit on the air quality in Oxford as a whole.

Tables 6 and 7 on the following pages detail the AQAP and LTP measures aimed at encouraging the use of public transport.

Table 6: Measures Aimed At Encouraging The Use Of Public Transport

<b>Measure</b>	<b>Responsible Authority</b>	<b>Implementation Date</b>	<b>Cost</b>	<b>Cost Benefit</b>
Review of city centre parking policy	Oxford City Council and Oxfordshire County Council	2006-2011	Internal cost	Contribution to reducing emissions by limits to on-street parking during peak periods
Development of bus priority improvements	Oxfordshire County Council	Summertown 07/8-08/9	£826,000	Improved bus journey times, bus reliability.
On radial routes into Oxford		London Road 07/08 – 09/10	£3.1m	Promoting better bus services
Residents/Controlled parking zones In residential areas	Oxfordshire County Council	2006-2011	£1.2m	Limiting non-residents parking. Encouraging use of public transport
Travel Plans – School and Workplace  In all County Schools; and most major employers	Oxford City Council and Oxfordshire County Council	Ongoing  2006-2011 LTP	  £5m	Providing alternatives to use of private vehicles

Table 7: Measures Outside The AQMA Aimed At Encouraging The Use Of Public Transport

Measure	Responsible Authority	Implementation Date	Cost	Cost Benefit
A40 Green Road congestion improvements	Oxfordshire County Council	2006/7	£2.8m	Improved bus journey times, bus reliability.  Promoting better bus services
Intelligent Transport Systems	Oxfordshire County Council	2007-2010	£816,000	
Thornhill P & R interchange	Oxfordshire County Council	2008/9	£2.25m	
Marston Rd bus gate	Oxfordshire County Council	2008/9	£338,000	
Bus Lane enforcement cameras/radial routes	Oxfordshire County Council	2007-2010	£241,000	
Kidlington Premium Route public transport enhancement	Oxfordshire County Council	2007/8	£358,000	
Eynsham Premium Route (Ph1) public transport enhancement	Oxfordshire County Council	2007/8	£498,000	
Real Time Information System for public transport	Oxfordshire County Council	2006-2011	£1.6m	
Rail Stations Development	Oxfordshire County Council	2006-2011	£733,000	
Oxford Southern approaches bus priority	Oxfordshire County Council	2007-2010	£770,000	
Oxford – Bicester A34/A41 bus priority and remote P&R	Oxfordshire County Council	2010/11	£129,000	
Fairfax Rd/Purcell Rd cycle link	Oxfordshire County Council	2009/10	£257,000	
Marston Road cycle measures	Oxfordshire County Council	2007/8	£75,000	
Thames towpath cycle route	Oxfordshire County Council	2007/8	£129,000	
Headington pedestrian/cycle measures	Oxfordshire County Council	2006-2010	£290,000	
A40 north of Oxford congestion improvements	Oxfordshire County Council	LTP3 (after 2011)		

## **9.4 Other Measures**

The taxi fleet in Oxford is relatively small and contributes only 3% to the NO<sub>x</sub> emissions in AQMA; even so the benefits of a cleaner Taxi fleet would be citywide. Further discussions will take place between Oxford City Council and the taxi operators to consider what could be achieved through a taxi quality partnership.

Many trips made by motorised vehicle are of short enough distances to make walking or cycling realistic alternatives. As well as helping to improve local air quality, walking and cycling offer considerable health benefits and can help reduce congestion. Cyclox and The Oxford Pedestrians Association would welcome more investment in walking and cycling strategies to reduce motorised travel.

Oxfordshire County Council is aiming to increase the number of walking and cycling trips into the AQMA. In addition there are numerous schemes programmed for Oxford within the next LTP that will contribute towards the overall aim of improving conditions for walking and cycling.

Table 8 on the following page details other AQAP measures aimed at reducing NO<sub>x</sub> emissions.

Table 8: Other Measures

Measure	Responsible Authority	Implementation Date	Cost	Cost Benefit
Taxi Quality Partnership	Oxford City Council	2006	Admin costs	Forum for promoting good practice and measures for reducing emissions with the taxi operators.
<p>High Street including pedestrian and safety measures</p> <p>Cycle network improvements including HAMATS programme</p> <p>Fairfax Road cycle link</p> <p>Marston Road cycle improvements</p> <p>Thames Towpath pedestrian/cycle Link</p> <p>The Plain Roundabout cycle safety improvements</p>	Oxfordshire County Council	2006 – 2011 period of the next LTP		Cycling and walking schemes will reduce motorised travel and emissions.

## **10 Assessing Improvements in Air Quality**

### **10.1 Oxford City Council**

Oxford City Council has a statutory duty to review and assess air quality in its area and this ongoing process is summarised in Appendix 2.

Improvements in air quality in the AQMA will be assessed against the following baseline data:

- A 68% reduction in oxides of nitrogen emissions across the whole AQMA
- A 32% to 90% reduction in oxides of nitrogen emissions in individual streets as specified in Table 3
- The trends in measured nitrogen dioxide levels at the St Aldate's monitoring site when compared to the background nitrogen dioxide levels measured at the St Ebbe's monitoring site (figure 5)
- The average trend in nitrogen dioxide levels (from diffusion tube data) across the AQMA (figure 4).

### **10.2 Oxfordshire County Council**

Oxfordshire County Council is required to set a local pollutant concentration target for 2006/2011 in the LTP against which air quality improvements can be assessed. Air quality has been allocated indicator LTP8. For Oxford City this target level will be set with regard to the air quality improvements required in the AQMA.

Intermediate outcomes will be established in the LTP against which progress on achieving the LTP8 target can be assessed. For the Central Oxford AQMA the following intermediate outcomes will be adopted in LTP:

- Total road transport emissions within the AQMA
- Vehicle mileage within the AQMA
- Traffic flows within the AQMA
- Vehicle passenger movements in the AQMA  
(all by street and vehicle type)

## Appendix 1 Completed stages in LAQM

<b>Review Process</b>	<b>Objectives likely to be met</b>	<b>Objectives not likely to be met</b>	<b>Comments</b>
Stages 1&2 January 1999.	Carbon Monoxide, Benzene, 1,3 Butadiene, Lead.	Nitrogen Dioxide, Particulate Matter, Sulphur Dioxide.	Main emission source is road traffic for nitrogen dioxide and particulate matter. Possibility of short-term exceedences of 15 min SO <sub>2</sub> objective due to Didcot Power Station. Further review of SO <sub>2</sub> emissions from small boilers Stage 3 required for NO <sub>2</sub> .
Stage 3 January 2001.	Carbon Monoxide, Benzene, 1,3 Butadiene, Lead, Sulphur Dioxide, PM <sub>10</sub> Particulate Matter.	Nitrogen Dioxide.	Recommended declaration of AQMA for the city centre based upon exceedence of annual NO <sub>2</sub> objective, mainly due to road traffic emissions. PM <sub>10</sub> Particulate Matter and SO <sub>2</sub> examined at this stage. Not considered necessary to proceed further.
Stage 4 July 2003.	Carbon Monoxide, Benzene, 1,3 Butadiene, Lead, Sulphur Dioxide, PM <sub>10</sub> Particulate Matter.	Nitrogen Dioxide.	Confirmation of existing AQMA, with some geographical additions. Highlights the impact of streets with high proportion of buses and HGV's, and the significance of bus stops and congested traffic in the central area.
Updating and Screening Assessment Report November 2003.	Carbon Monoxide, Benzene, 1,3 Butadiene, Lead, Sulphur Dioxide.	Nitrogen Dioxide, PM <sub>10</sub> Particulate Matter.	Concluded that a detailed assessment was required for nitrogen dioxide outside the AQMA, and for PM <sub>10</sub> particulate matter inside the AQMA.
Detailed Assessment Report June 2004.	Carbon Monoxide, Benzene, 1,3 Butadiene, Lead, Sulphur Dioxide.	Nitrogen Dioxide, PM <sub>10</sub> Particulate Matter.	Recommended declaration of AQMA for Green Road roundabout based upon exceedence of annual NO <sub>2</sub> objective, mainly due to road traffic emissions. Further review of PM <sub>10</sub> Particulate Matter for 2010.

## Appendix 2 Future stages in LAQM

<b>Activity</b>	<b>Completion Date</b>	<b>Responsible Authority</b>
Progress Report	End of June 2005	All Local Authorities (Oxford City Council)
Updating and Screening Assessment Report	End of April 2006	All Local Authorities (Oxford City Council)
Detailed Assessment Report	End of April 2007	Those Local Authorities (Oxford City Council) that identified a need for one in their April 2006 USA report
Progress Report	End of April 2007	Those Local Authorities (Oxford City Council) that identified that there was <u>no</u> need for a DA report in their April 2006 USA report
Progress Report	End of April 2008	All Local Authorities (Oxford City Council)
Updating and Screening Assessment Report	End of April 2009	All Local Authorities (Oxford City Council)
Detailed Assessment Report	End of April 2010	Those Local Authorities (Oxford City Council) that identified a need for one in their April 2009 USA report
Progress Report	End of April 2010	Those Local Authorities (Oxford City Council) that identified that there was <u>no</u> need for a DA report in their April 2009 USA report



### Appendix 3 Air Quality Objectives

Air Quality Objectives (taken from the Air Quality Regulations 2000 and (Amendment) Regulations 2002)

<b>Pollutant</b>	<b>Standard Measured as Concentration</b>	<b>Specific objective to be achieved</b>
Carbon monoxide	116 mg/m <sup>3</sup> (10ppm) running 8-hour mean	By 31/12/03.
Benzene	16.25 µg/m <sup>3</sup> running annual mean	By 31/12/03.
1,3 Butadiene	2.25 µg/m <sup>3</sup> running annual mean	By 31/12/03.
Lead	0.5 µg/m <sup>3</sup> annual mean	By 31/12/04.
Sulphur Dioxide	266 µg/m <sup>3</sup> 15 minute mean  125 µg/m <sup>3</sup> 24-hour mean  350 µg/m <sup>3</sup> hour mean	Not to be exceeded more than 35 times a year by 31/12/04.  Not to be exceeded more than 24 times a year by 31/12/04.  Not to be exceeded more than 3 times a year by 31/12/04.
Nitrogen dioxide.	200µg/m <sup>3</sup> (104.6ppb) 1 hour mean.  40µg/m <sup>3</sup> (21ppb) annual mean.	Not to be exceeded more than 18 times a year by 31/12/05.  By 31/12/05.
Particles PM <sub>10</sub> .	50µg/m <sup>3</sup> 24-hour mean.  40µg/m <sup>3</sup> annual mean.	Mean not to be exceeded more than 35 times a year by 31/12/04  By 31/12/04.

#### Appendix 4 Where the Air Quality Objectives apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual Mean	All locations where members of the public might be regularly exposed. Includes building facades of residential properties, schools, hospitals, libraries, etc	Building facades of offices or other places of work where public do not have regular access. Gardens of residential properties. Kerbside sites, or any other location where public exposure is expected to be short term.
24-hr / 8hr mean	As above, plus gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1 hr mean	As above, plus kerbside sites (inc busy shopping streets). Parts of car parks, bus stations and rail stations not fully enclosed, where public may spend 1hr or longer. Any outdoor locations where the public spend an hour or more.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where public may spend 15 mins or longer	

## Appendix 5 Glossary

<b>AQMA</b>	Air Quality Management Area
<b>AQAP</b>	Air Quality Action Plan
<b>BQP</b>	Bus Quality Partnership
<b>CIVITAS</b>	European initiative looking at urban transport including cleaner fuels
<b>Clear Zones</b>	DfT initiative for promoting pollution free urban centres
<b>DEFRA</b>	Department for Environment Food and Rural Affairs
<b>DfT</b>	Department for Transport
<b>Euro Standards</b>	European Auto Oil programme exhaust emission limits for new vehicles.
<b>HGV</b>	Heavy Goods Vehicle
<b>LAQM</b>	Local Air Quality Management
<b>LEZ</b>	Low Emission Zone
<b>LGV</b>	Light Goods Vehicle
<b>LPG</b>	Liquefied Petroleum Gas
<b>LTP</b>	Local Transport Plan
<b>NO</b>	Nitrogen monoxide, also termed nitric oxide.
<b>NO<sub>2</sub></b>	Nitrogen dioxide
<b>NO<sub>x</sub></b>	Nitrogen Oxides (a collective term for NO and NO <sub>2</sub> )
<b>OTS</b>	Oxford Transport Strategy
<b>µg/m<sup>3</sup></b>	Microgrammes per metre cubed