AIR QUALITY ACTION PLAN APPENDICIES

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APPENDIX 1 CONSULTATION PROCESS

1. List of consultees

1) Statutory

- London Boroughs (Barnet, Brent, Corporation of London, Croydon, Hackney, Haringey, Islington, Kensington and Chelsea, Lambeth, Newham, Southwark, Westminster)
- Greater London Authority
- Transport for London
- DEFRA
- DTLR (now DFT)
- Association of London Government
- Casella Stanger
- Environment Agency
- London Borough of Camden Council Officers and Councillors

2) Other

- Chartered Institute of Environmental Health
- National Society for Clean Air
- Camden and Islington Health Authority (now Primary Care Trusts)
- Camden and Islington Groundwork
- Camden Local Agenda 21 core group
- Walking, Cycling and Road Safety Advisory Group
- Camden Cycling Campaign
- Sustainable London Trust
- Imperial College
- University College London
- Freight Transport Association
- Road Haulage Association
- Victoria Coach station
- Murphy Group
- Royal Mail
- Local organisations including Sainsbury, Safeway, Travis Perkins, Consignia, UPS, Biffa, van rental companies, Parcelforce, Part B industries, major contractors and developers of the Kings Cross project
- Local residents and smaller businesses through CINDEX mailing, door-door leaflets, information provided in local libraries and on the internet, local press articles and a leaflet in the business tax mailing

2. Survey results

Results from a few major MORI (market opinion research international) surveys in London are summarised here. The surveys generally indicate that people would like to see major improvements in public transport and many are willing to see the introduction of schemes that would involve paying more to improve traffic congestion and pollution.

2.1 CfIT (Commission for Integrated Transport) MORI survey on public attitudes to transport in England, 2001

National survey of 2202 adults sampled (with an additional 500 in London) from focus groups and defined sampling points in England:

- 37% thought that transport was a local problem
- Vehicle pollution was one of the top six transport issues, with 30% of respondents concerned with health and 32% with global warming.
- Frequency and punctuality and lower fares were thought of as a key to increasing public transport use
- 80% felt that greater investment was needed in public transport before measures to reduce car usage were introduced, but 38% would agree to pay higher taxes to improve public transport and there was support for measures such as motorway tolls, abolishing VED for alternative fuel vehicles (66%), traffic calming (68%) and congestion charging proposals (37%)
- 68% felt that traffic congestion would get worse in the future but that public transport would improve

2.2 GLA Annual London MORI Survey on the capital and public services 2001

Survey carried out by MORI between October-December 2001 of a sample of 1458 people in London.

- 63% thought that air quality was an environmental problem (compared to 70% for litter) and an overall 23% thought that the environment was one of the top 3 things that should be a priority to improve London as a place to live.
- 59% felt that reducing traffic congestion was the most important area of transport that needed to be improved (with 36% in favour of improving traffic pollution)
- 50% wanted more reliable buses and tubes and 38% wanted cheaper fares

2.3 London Borough of Camden MORI survey on transport, 2001

Survey of 500 residents in Camden (via a Citizen panel)

- 90% agreed with proposals that both restricted commercial vehicles based on their emissions and that reduced levels of traffic in the most polluted areas of Camden.
- An average of 75% supported actions to reduce the level of traffic in the whole of Camden, although public support for traffic reduction was greatest in the more central and heavily congested areas. For example, 80% of people living in the south (Bloomsbury, Brunswick, Holborn and Kings Cross) support traffic reduction across Camden, compared to support by 65% of those who live in the North of the borough (Adelaide, Belsize, Hampstead Town, Fitzjohns, Frognal, and South End).

2.4 Questionnaire in Covent Garden Market magazine on clean fuel vehicles, 2002

A questionnaire was published during December 2001 as part of the Camden, Westminster and Corporation of London joint Clear Zone project. Over 100 people responded (including 4 businesses and 50 commuters into the area).

- 88% were unaware of the benefits of alternative fuels
- Over 50% were in favour of buying or leasing an electric or gas fuelled vehicle

- 73% of residents said they were willing to join a City Car Club to hire out cars instead of owning one

3. Camden Citizen's Jury

11 randomly selected citizens in Camden attended eight 3-hour sessions with a mediator to discuss local air quality management. The major recommendations of these sessions were:

- extra provision for additional green spaces and tree planting
- re-organisation of the school run including school bus provision and school-parent collaboration
- restricting delivery times of HGVs and refuse vehicles
- co-ordinating roadworks and fining companies for late completion
- safer walking routes
- introduction of HomeZones – areas of slow moving traffic
- greater integration of public transport modes

Camden Council is already working to put most of these conclusions into action. For example, Camden's street management and traffic departments work together to improve streets to benefit pedestrians, cyclists and vehicle movement and aim to co-ordinate roadworks as much as possible including fining companies for overrunning street works. Camden recognises that almost 1/3 of children travel to school by car and through events such as Safer Routes to School and Walk to School week, the council is working to encourage parents to use other methods of transport.

4. Summary of consultation responses

Camden's Air Quality Task Group (members from council departments such as transport and environmental health) and a specific focus group with external organisations (local universities, Groundwork Camden and Islington, LA21 groups and the Health Authority (now NHS Primary Care Trust) had regular meetings to write and develop this action plan.

London Borough of Camden consulted on the draft action plan during January-April 2002 using measures based on the NSCA (1999) and DETR guidance (LAQM.G2 (00)). The plan was publicised on the Internet, summarised in leaflets in local libraries, adverts and articles in local newspapers and through mailings to local groups and to all 15,000 businesses in Camden (through the business tax mailing list). Presentations and meetings were held with variety of groups including a selected Citizen's Jury, Channel Tunnel Rail Link contractors, the cycling and pedestrian liaison group and businesses. A copy of the plan was mailed out to all other Central London boroughs and Government bodies including Environment Agency, TfL, GLA, ALG, DEFRA, DTLR and NSCA as well as to council officers, businesses and individuals in the borough asking for their comment.

Camden received a range of responses from its consultation, most of them as a result of receiving the report in the post, although some were received in response to the business leaflet and browsing the Internet. As shown in the MORI surveys, people that responded were concerned about air pollution, health and local traffic problems and supported the majority of Camden's proposals. Suggestions and positive comments that were given included working more to encourage the use of cycle deliveries, concentrating more on improving air pollution in the more disadvantaged areas of Camden and promoting the use of other fuels such as biodiesel. There were concerns from the Road Haulage Association (RHA) and the Freight Transport

Association (FTA) about a Low Emission Zone, particularly its timing, what Euro standard would be adopted and how it would be enforced. The RHA also felt that a LEZ should apply to private cars and light goods vehicles as well as heavy goods vehicles (HGVs). Similar concerns were given by smaller businesses due to the costs that may be incurred of changing their vehicle fleet to meet the standards. The LEZ feasibility study will be looking into such concerns and at all possibilities of the scheme (see section A2). Several businesses also felt that alternative fuelled vehicles were not reliable or cost-effective enough (even with grants) to be an acceptable option to them.

Greater London Authority (GLA) and Casella Stanger on behalf of Department of Environment, Food and Rural Affairs (DEFRA) both felt that the action plan set out many practical suggestions to improve air quality and it covered a wide range of measures. They suggested that Camden set out in more detail a more quantitative approach to what levels of improvements are required to achieve the objective and to assess the cost-effectiveness of the measures. These have both been taken into account in this final action plan.

APPENDIX 2. SOURCES AND HEALTH EFFECTS OF AIR POLLUTION

1. Pollutants

Smoke and sulphur dioxide pollution from industry and power stations has declined considerably in the past few decades, due to the introduction of legislation that controlled emissions from chimneys. The introduction of Smoke Control Areas in the 1960s has also largely put an end to coal and wood being burnt in domestic fireplaces. Although this has meant that we no longer have the pea-souper smogs of the 1950s, growing traffic levels have meant that pollutants from vehicle exhausts have been rising steadily.

Today, motor vehicles are the single largest source of emissions in London, accounting for around 70% of total NOx and PM_{10} emissions (GLA, 2002) with large commercial diesel vehicles contributing more than petrol cars and light goods vehicles. Although pollutants emitted in the exhaust gases are the main source of emissions, evaporation from petrol tanks, brake and tyre wear also contribute to overall emissions. The main motor vehicle related pollutants are nitrogen dioxide, fine particles (also known as PM_{10}), carbon monoxide and hydrocarbons, such as benzene. Other less significant sources of pollution are industry, power stations and domestic and commercial heating. For example, in London gas heating contributes approximately 15% of NOx emissions.

Camden is situated in the heart of London, and therefore has to cope with a high volume of traffic passing through the borough each day, with traffic flows of over 60,000 vehicles per day on the major routes such as Euston Road. There are also increasing levels of congestion and slow speeds during peak hours, which can lead to higher emissions from motor vehicles. These conditions mean that Camden has some of the worst pollution levels in London, and often these are at a high enough concentration to cause ill health effects.

In recognition of growing pollution levels and the potential health effects that these may have on local populations, new legislation has emerged from Europe setting new air quality standards that aim to protect people's health. The UK government has adopted this legislation through the National Air Quality Strategy, which places the principal duty on Local Authorities to meet the new standards. Although there are national policies already in place, which should result in a steady reduction in emissions over the next few years, measures will still need to be taken on a local level, particularly in urban areas, if the air quality targets are to be met on time.

A) Nitrogen dioxide (NO_2)

Nitrogen dioxide is a gas produced by the reaction of nitrogen and oxygen in combustion processes. Exhaust gases consist primarily of nitric oxide, and it is only through reactions with ozone that nitrogen dioxide is then later formed in the environment. The main source of nitrogen dioxide in urban areas is from motor transport and fossil fuel combustion. Individual diesel vehicles produce more nitrogen dioxide than petrol vehicles, but because there are larger numbers of petrol vehicles on the road compared to diesel, the overall emissions from petrol vehicles are slightly higher. This relationship is however changing with the progressive introduction of catalytic converters on petrol vehicles.

B) Fine Particles (PM_{10})

Particles in the air may arise from a wide variety of sources, either natural or man-made. Man-made airborne particles result mostly from combustion processes, working soil and rock, other industrial processes and from the wearing down of road surfaces by motor vehicles. The air quality standard for particles refers to all particles, which are less than 10 microns in aerodynamic diameter (one micron is a thousandths of millimetre), since these particles are small enough to be breathed into the airways and the lungs. Particles in this size range are referred to as PM_{10}.

Particles can be divided into three types: primary, secondary and coarse. Primary particles are generated from combustion processes such as power stations and car exhausts, and are emitted directly into the atmosphere. Primary particles are extremely small carbonaceous particles, of around 0.3 microns in diameter. Secondary particles are formed through chemical reactions in the atmosphere, and ammonium nitrate and ammonium sulphate are two common components of PM_{10} in urban areas. These particles again are very small, occurring generally in the 0.5-1.0 micron size range. Coarse particles on the other hand are generated through activities such as stone crushing, wind blown dust and soil, or from pollen. These particles are much larger in size, generally occurring in the 2.5 to 10 micron size range.

2. Health effects

Recent medical research undertaken by Department of Health (DOH) has shown that exposure to air pollution in the UK has both acute (short-term) and chronic (longer-term) effects on health.

A) Short term impacts

In 1995, a Government's advisory group carried out reviews of a large number of published studies on the association of particle air pollution with excess mortality. Original London studies from 1950s to 1970s showed a relationship between increases in black smoke/sulphur dioxide and excess numbers of deaths from heart and lung disease and although the absolute concentrations of pollutants are much less today, pollutants (including particles and nitrogen dioxide) are still found to increase the risk of developing lung cancer as well as having an effect on mortality from heart and lung diseases of vulnerable people, such as those who already suffer from an existing heart or lung disease, such as asthma or bronchitis, as well as young children, pregnant women and elderly people. Healthy people however are unlikely to show symptoms even at high pollution levels, such as during a pollution episode.

In 1998, the Committee on the Medical Effects of Air Pollution (COMEAP) was set up to carry out research on behalf of DOH on the short term impacts of air pollution on health. This report concluded that with available evidence, high pollution levels may be responsible for bringing forward 14,000 to 24,000 hospital admissions each year and between 12,000 to 24,000 vulnerable individuals may be dying prematurely each year from air pollution in the UK. The COMEAP concentrated on quantifying the health impacts of the four pollutants; PM_{10}, SO_2, O_3 and NO_2 to determine their dose-response co-efficients (Table 12) and rates (Table 13) for deaths and hospital admissions.

Table 12. Dose Response Coefficients

Pollutant	Health Outcome	Dose-response coefficient
PM_{10}	Deaths brought forward (all causes) Respiratory hospital admissions	+ 0.75% per 10 µg/m^3 (24 hour mean) + 0.80% per 10 µg/m^3 (24 hour mean)
Sulphur dioxide	Deaths brought forward (all causes) Respiratory hospital admissions	+ 0.6% per 10 µg/m^3 (24 hour mean) + 0.5% per 10 µg/m^3 (24 hour mean)
Ozone	Deaths brought forward (all causes) Respiratory hospital admissions	+ 0.6% per 10 µg/m^3 (8 hour mean) +0.7 % per 10 µg/m^3 (8 hour mean)
NO_2	See note below	See note below

Notes:
For NO_2 a coefficient of 0.5% per 10 µg/m^3 was used to estimate the effect on respiratory hospital admissions in a sensitivity analysis.

Table 13. Baseline death rates and respiratory hospital admissions rates per 100,000 people, EAHEAP, 1999 (COMEAP data in brackets)

Pollutants	Deaths	Respiratory hospital admissions
Particles, SO_2 (and NO_2)	1,074 (1,106.4)	830 (1,342.3)
Ozone	491.8 (506.8)	360 (345)

The report concluded that of all these pollutants assessed, ozone and fine particles were the two pollutants which had the greatest health impacts. Evidence showed that fine particles (PM_{10}) were associated with 8,100 premature deaths and 10,500 hospital admissions nationally each year of which approximately 1,927 deaths are brought forward each year in London. The COMEAP studies have also made some estimate of the specific effect transport in London has on health which in terms of PM_{10} are 198 deaths brought forward each year and 188 respiratory hospital admissions each year.

B) Long term impacts

In 1998, there was much less available data on the long-term impact on health in the UK, but based on data from the US, COMEAP suggested that health effects would be significantly increased after long term exposure, although they could not be quantified. In 2001, COMEAP published a report on long-term effects in the UK and concluded that although there were still many uncertainties, there was more than a causal association between long-term exposure to particles and mortality. For the UK population alive in 2000, pollution control measures were most likely to cause a gain of 0.2-0.5 Million life years for every µg/m^3 reduction in $PM_{2.5}$ (which can be related to 1.5 to 3.5 days per person). However, it is unlikely that everyone is as susceptible to long-term effects, so if, for example 1 million rather than 52 million were affected, this gain would increase to between 3-6.5 months per person. This gain in life years is estimated to be at least 10 times greater than a gain in life years from a reduction of short-term pollution changes. Although long-term effects have been found to be more closely related to $PM_{2.5}$, short-term effects are most associated with PM_{10}, so COMEAP recommend that air quality standards should still be based on PM_{10} concentrations. The report also concluded that further research is needed on the emerging evidence that PM_1 (ultra fine particles) are responsible for the most adverse effects.

The effect of long term exposure to air pollution was found to be less than that from active smoking (a reduction of life expectancy across the population by one year compared to reduction of 8 years due to smoking), but the risk of mortality from heart disease is similar to passive smoking. Recent research in the US has shown an association between long-term exposure to fine particulates and lung cancer and heart disease after studying approximately 1.2 Million adults from 1982-1998 (Pope et al, 2002). The study found that each increase of 10 $\mu g/m^3$ ambient $PM_{2.5}$ concentration was associated with a 4, 6 and 8% increase in disease.

C) New research

Air pollution and lung disease/asthma

Lung disease has recently been shown to be a greater killer than coronary heart disease in the UK. For example the number of women dying from lung conditions have increased in the last two decades, rising to 28% and over 5.1 million people in the UK are diagnosed with asthma, of which approximately 1,500 die from asthma each year. Lung disease is also the most common long term illness in children and research carried out at the University of Leicester has shown that PM_{10} in diesel fumes can penetrate deep into children's lungs causing inflammation, coughing and respiratory symptoms. Air pollution is well known to increase symptoms such as wheezing and can make people more sensitive to pollens and allergens. There is also clear evidence of a link between indoor sources of pollution, particularly tobacco smoke, and wheezing illness but until recently, there was no compelling evidence to suggest air pollution actually causes asthma. However, a recent study in California has now shown evidence for a link between ozone and cancer. The study followed 3,500 children over 5 years and concluded that children that undertook outdoor exercise in areas with high ozone levels from road vehicles had over 3 times greater risk of developing asthma than children that did not play sport (McConnell et al, 2002).

Air pollution and birth defects

Recent research from Havard University in US has shown that there is a link between increased air pollution and low birth weight or stillborn births. For example, between 1995-1997, air pollution was thought to be responsible for 9% of infant mortality in US. Research into this association is now beginning in the UK. These findings have also been confirmed by researchers at UCLA, who have carried out studies with the California Birth Defects Monitoring Program (CBCMP). This team also found that pregnant women exposed to high levels of ozone and carbon monoxide may be up to three times as likely to give birth to a baby with heart defects. The role of carbon monoxide has not been confirmed because it may be just acting as a marker of vehicle pollution.

APPENDIX 3. LEGISLATIVE AND POLICY FRAMEWORK

A. EUROPEAN LEGISLATION AND INTERNATIONAL AGREEMENTS

1. Air Quality Framework Directive

European limit values for a number of pollutants, including nitrogen dioxide and fine particles, have already been introduced through the Air Quality Framework Directive 96/62/EC, and will eventually cover 12 pollutants in total. The limit values were made legally binding on Member States in 1999 through the first Air Quality Daughter Directive, and have since been incorporated into UK legislation through the revised National Air Quality Strategy.

2. Auto oil programme

Agreements in the European Union have resulted in progressive reductions in emissions from motor vehicles though engine technology and improved fuel quality, and will continue to do so over the next decade. Emission standards for three different vehicles types (cars, light goods vehicles and heavy goods vehicles), are specified through the Auto Oil programme, and began with Euro I which was introduced in 1992/3 and required all petrol-fuelled cars to have catalytic converters fitted as standard. Euro II vehicles were introduced in 1996, and Euro III vehicles began to come off the production line from 1 January 2001. Euro IV standards are the highest standard set so far, and these will become legally binding from January 2006 (see Table 14).

Table 14. Emissions from Euro Standards

EU Emission Standards for Heavy Duty Diesel Engines, g/kWh (smoke in m^{-1})						
Standard	**Date/category**	**CO**	**HC**	**NOx**	**PM**	**Smoke**
Euro 1	1992, <85 kW	4.5	1.1	8.0	0.612	
	1992, >85 kW	4.5	1.1	8.0	0.36	
Euro II	1996	4.0	1.1	7.0	0.25	
	1998	4.0	1.1	7.0	0.15	
Euro III	1999 (EEVs)	1.5	0.25	2.0	0.02	0.15
	2001	2.1	0.66	5.0	0.1	0.8
Euro IV	2005/6	1.5	0.46	3.5	0.02	0.5
Euro V	2008	1.5	0.46	2.0	0.02	

The Auto Oil programme has helped reduce emissions from vehicles considerably. The introduction of Euro I standards alone helped reduce total oxide of nitrogen emissions from vehicles by 25% between 1990 and 1996. The continued introduction of tighter standards, particularly with respect to heavy goods vehicles, and reductions in the permitted level of sulphur in petrol and diesel will also help to reduce both oxides of nitrogen and PM_{10} emissions. The government estimates that together these measures will achieve a further reduction of oxides of nitrogen emissions of 56% by 2005, and a reduction in urban PM_{10} emissions of about 50%.

3. Sulphur content of certain liquid fuels Directive

In April 1999 an EC directive setting maximum levels for sulphur in liquid fuels was adopted, specifying a maximum level of sulphur in heavy fuel oil of 1% from 2003 and for gas oil of

0.1% from 2008. In Camden, the directive will primarily result in reductions in emissions from commercial and domestic boilers, mostly with respect to sulphur dioxide emissions, although particle emissions should also be reduced as a result.

B. UK POLICY FRAMEWORK

1. The National Air Quality Strategy

The Environment Act 1995 introduced a new system of local air quality management, placing new legal duties on local authorities, and a requirement that the Government publish a National Air Quality Strategy containing air quality targets which would protect people's health.

The National Air Quality Strategy was published in March 1997 and adopts an integrated approach to air quality issues. The Strategy promotes the principles of sustainable development, and includes international measures – particularly European agreements – to reduce emissions from vehicles and industry, as well as national policies and local air quality management. It seeks to balance the costs of meeting targets between different sectors on a proportional basis. While primarily health-driven, it also includes targets to protect vegetation and ecosystems in rural areas.

The Strategy contains air quality standards for eight air pollutants; nitrogen dioxide, sulphur dioxide, carbon monoxide, fine particles (PM_{10}), ozone, lead, 1,3-butadiene and benzene. All, with the exception of ozone, are the direct responsibility of the local authority. Air quality objectives have been set, to be met by target deadlines ranging from 2003 to 2008. Table 15 shows the latest standards and objectives published in the revised National Air Quality Strategy in January 2000 and made legally binding in the Air Quality Regulations 2000.

In order to keep abreast of developments in air quality research and changes to European legislation, the Government has committed itself to a periodic review of the National Air Quality Strategy. The first review commenced in 1998, and the revised Strategy was published in January 2000. Changes were proposed to reflect the anticipated improvements in air quality in the UK, and to ensure compliance with EU legislation.

Whilst some objectives were made tighter by bringing forward the target dates for compliance, the objective for PM_{10} was relaxed considerably. The previous objective allowed for the standard to be breached on four days, but the new objective allows for the standard to be breached on 35 days. This new objective is based on the EU target, but the government stated that this was a staging post, and it would assess whether the objective should be tightened up in the next review of the strategy.

Table 15. Air Quality standards and objectives

Pollutant	Objective	Date to be achieved by
Benzene	16.25µg/m^3 as a running annual average	31 December 2003
1,3-butadiene	5 µg/m^3 as a running annual average	31 December 2003
Carbon monoxide	11.6mg/m^3 as a running 8 hour average	31 December 2003
Lead	0.5 µg/m^3 as an annual average 0.25 µg/m^3 as an annual average	31 December 2003 31 December 2008

Nitrogen dioxide	200µg/m^3 as a 1 hour average 40µg/m^3 as an annual average	31 December 2005 31 December 2005
Pollutant	**Objective**	**Date to be achieved by**
Fine Particles (PM_{10})	50 µg/m^3 as a 24 hour average, not to be exceeded more than 35 times a year 40 µg/m^3 as an annual average	31 December 2004 31 December 2005
Sulphur dioxide	350µg/m^3 as a 1 hour average, not to be exceeded more than 24 times a year 125 µg/m^3 as a 24 hour average, not be exceeded more than 3 times a year 266 µg/m^3 as a 15 minute average, not to be exceeded more than 35 times a year	31 December 2004 31 December 2004 31 December 2005
ppb – parts per billion; ppm = parts per million, µg/m^3 = micrograms per cubic metre		

The strategy requires all local authorities in the UK to try and meet these targets by specific deadlines, with the exception of ozone, as this cannot be controlled at a local level. This pollutant will instead be the responsibility of central Government. The strategy also sets out the various steps that each local authority should undertake in order to improve air quality. The first step is to carry out a comprehensive three-stage review of air pollution levels in the borough, each of increasing complexity. Then, from this information, local authorities conduct an assessment to see whether the air quality targets set by the government will be met on time and where it appears that these will not be met, an Air Quality Management Area (AQMA) must be declared. Local authorities that have declared an AQMA will need to carry out a more detailed assessment and draw up an Action Plan setting out how they intend to reduce emissions sufficiently to meet the targets.

New standards for PM10, benzene, CO, PAH

In September 2001 the government published proposals for new air quality standards and objectives and after consultation, new objectives were agreed in August 2002.

Particulates

The government's new objectives for PM_{10} are different for London compared to the rest of England due to the difficulty of local authorities to meet the tighter standard (Table 16). These new objectives will not be in the guidance for the next round of review and assessment under the Environment Act 1995 but may be included after 2003 or 2004.

Table 16. New proposed PM_{10} objective for 2010

Area	**Annual mean standards for 2010 µg/m^3**	**Number of exceedences of 24 hour mean of 50 µg/m^3**
England	20	7
London	23 (working towards 20 by 2015)	10

Benzene

The current standard is 5 parts per billion (ppb) to be achieved by local authorities 2003, and this is already achieved at all monitored sites in Camden, including busy roadsides and near petrol stations. The EU objective is 3.5µg/m^3 by 2010 and a new objective of 5 µg/m^3 to be achieved by 2010 has been set for the UK. It is estimated that this will be met on a business-as-usual scenario in all or most sites in Camden.

Carbon monoxide

The present standard of 10 ppm to be achieved by local authorities by the end of 2002 is to be replaced by the new objective of 8.6ppm (10$\mu g/m^3$) by 2003. It is expected that this will be achieved everywhere on a business-as-usual scenario.

Polycyclic Aromatic Hydrocarbons (PAH)

PAH is a family of compounds many of which have carcinogenic properties. The main sources are the burning of coal and wood, fires in buildings, and agricultural burning. Vehicles are no longer thought to be a major source. The EU is likely to set an objective 1.0 nanogram per cubic metre (1ng/m^3) by 2010 and as emissions are falling, the UK government has set a national objective of 0.25ng/m^3 by 2010 which is expected to be achieved everywhere without additional measures.

2. National Transport Policies

The Transport White Paper (*"A New Deal for Transport: Better for Everyone"*) set out the government's policy framework for transport, through an integrated approach. The aims of the New Deal include cleaner air by tackling traffic fumes, thriving town centres by cutting stranglehold of traffic, and quality places to live where people are the priority

The White Paper proposed to revise planning guidance on Development Plans and Regional Planning Guidance (PPG12) and on Transport (PPG13). PPG12 has been consulted upon and issued in its final version (January 2000). Consultation on PPG13 closed in January 2000 but to date, no revised guidance has been issued. Draft PPG13 sets criteria for traffic management measures to reduce noise and local air pollution and provides guidance on discouraging traffic generation from new developments.

The Road Traffic Reduction Act 1997 (RTRA) requires local authorities such as Camden to prepare a report on existing levels of traffic and a forecast of expected growth on those roads for which it is highway authority. Camden has done this as part of the Council's Interim Transport Plan. Authorities should also set targets for reducing local road traffic in their area or its rate of growth. Local authorities have the option of not setting targets for part or all of their area. However, they have to justify their reasons for not setting such targets.

The Secretary of State issued draft Guidance to Local Authorities on the RTRA in January 1998 stressing that the approach to road traffic reduction targets should be integrated with authorities' obligations under Part IV of the Environment Act 1995 for local air quality management and the requirements of the UK National Air Quality Strategy. London boroughs are obliged to consider guidance from the Mayor's Air Quality Strategy.

3. The Mayor's Air Quality Strategy for London

The Greater London Authority Act 1999 provided the legislative framework for the establishment of a Greater London Authority and an elected Mayor. The Mayor and the Greater London Assembly took office on the 3rd July 2000.

The Mayor is required to produce a number of strategies for London, including planning, transport and air quality. The transport strategy was published in November 2000 and was formally adopted in July 2001. The draft air quality strategy consultation version came out in September 2001 and the final strategy is due out in September 2002.

London local authorities must have regard to the Mayor’s strategies when undertaking air quality review and assessments and when drawing up their own Action Plans and Strategies, to ensure consistency in policy formulation across London. The Mayor is required to send proposals (with timescales) to London boroughs for exercising his powers in pursuit of the achievement of air quality standards and objectives. Camden has been working closely with the GLA in the production of the Mayor’s Air Quality Strategy, and the measures contained in this Action Plan closely reflect the proposals contained in the draft GLA strategy.

The Mayor’s proposals for working in pursuit of achievement of the air quality standards and objectives in Camden’s AQMA will be set out in the final version of the Mayor’s Air Quality Strategy. These aim to:

- Increase the number of cleaner vehicles
- Support a feasibility study on one or more low emission zones for London
- Reduce emissions from vehicles licensed through the functional bodies
- Use traffic management infrastructure to reduce emissions
- Encourage people to switch from using private cars onto public transport by, for example, improving every aspect of bus travel
- Reduce emissions from freight movements
- Encourage proper vehicle maintenances and more efficient driving
- Reduce emissions from buildings and industries
- Reduce emissions from construction sites
- Enable continued research into London’s air quality
- Lobby government to improve national measures to further reduce air pollution

Indicative proposals are set out in the Mayor’s draft Air Quality Strategy as discussed below;

i. Traffic Reduction

The Air Quality Strategy refers to measures in the Transport Strategy and Spatial Development Strategy to encourage more sustainable travel and reduce unnecessary car use, including congestion charging and measures for reducing freight lorry movements.

ii. Cleaner vehicles

The Mayor recognises that both encouragement and enforcement are required to reduce emissions from vehicles using London’s roads. The Mayor will therefore encourage retrofitting of existing vehicles and the take-up of cleaner vehicles, seek to reduce costs of such technology through bulk purchasing, and promote the benefits of cleaner technologies and fuels. Businesses which meet good environmental standards on emissions will be awarded an “Environmental Business Marque”.

The Mayor has also pledge to work with coach operators to encourage the use of cleaner vehicles and to encourage all waste authorities to specify that refuse vehicles used in new contracts should meet Euro III or Euro II with after treatment standards. Additionally the Mayor will work with the boroughs, ALG and DEFRA/DFT on proposals for a LEZ to set minimum emission standards for heavy goods vehicles, buses and coaches.

iii. Cleaner fuels

The Mayor will promote the development of refuelling infrastructure for alternatively fuelled vehicles and through borough UDPs and will encourage the development of cleaner technology such as fuel cells.

Other key proposals to come out of the strategy are briefly highlighted below:

The GLA and functional body fleets

- The Mayor will set targets for cleaner vehicles in the fleets run by the functional bodies. In particular to ensure that all London buses meet Euro II standards with particle trap by 2005, and new buses meet Euro III standards with particle trap from October 2001.
- Transport for London will work with the taxi trades and private hire companies to improve taxi emissions
- The London Fire and Emergency Planning Authority and Metropolitan Police will have targets for cleaner vehicles
- Vehicle emissions will be a criterion for evaluating contractors' tenders.

Taxis

The Mayor will encourage taxi drivers to use cleaner fuels and engines and will consider options for retrofitting existing taxis with oxidation catalysts.

Traffic management

The Mayor will develop plans to reduce emissions through a range of traffic management techniques including possible reduction of speed limits, reducing congestion. The draft also offers support to Clear Zones and other local initiatives.

Public awareness

The Mayor will support public awareness campaigns such as Don't Choke Britain, Car Free Day and Walk to School Week.

Longer term measures

In the longer term the Mayor will encourage the development and use of zero-emission vehicles such as fuel cells or electric vehicles recharged from renewable sources.

Local Authority Action Plans

The Strategy also sets out what measures it expects local authorities to take in reducing emissions within their borough. These include;

a) Leading by example through;

- Ensuring that their vehicle fleets, and those of contractors are as clean as possible.
- Ensuring that vehicles are used sensibly, are well maintained and that specific routes are worked out to be as efficient as possible.
- Co-ordinating deliveries of their own goods and services
- Adopting work place travel plans

b) Working with the Energy Saving Trust's CleanUp and Powershift programmes to assess what assistance can be given in reducing emissions from their own vehicles.

c) Encouragement of roadside emissions testing and enforcement of idling stationary vehicles when new powers are introduced in April 2002.

d) Working with the boroughs, GLA and the ALG on the Low Emission Zone feasibility study.

e) Developing quality partnerships with coach operators, hauliers and delivery companies.

APPENDIX 4. REVIEW AND ASSESSMENT OF AIR QUALITY IN CAMDEN

Local Air Quality Management requires local authorities to periodically review and assess current and future air quality in their area. The Government recommends that the review and assessment is carried out in a phased approach, in three stages. All local authorities are required to complete the first stage, and where this identifies areas that may have potentially high pollution levels, the authority is required to progress to the second stage (or in some cases directly to the third stage).

Stage 2 relies on monitoring data and basic modelling techniques to assess whether concentrations of any pollutants might not meet the air quality objectives. Again, where the second stage identifies pollutants that might not meet the objectives, these must be taken forward to a more detailed and accurate third stage review and assessment, which is based on monitoring data, emission inventories and computer modelling. Following the completion of the third stage review and assessment, the local authority must declare Air Quality Management Areas (AQMAs) in those locations where the objectives are unlikely to be met. The deadline for formally declaring any Air Quality Management Areas was December 2000.

A further assessment is also required following the declaration of AQMAs, which aims to look in more detail at air quality within the proposed areas, and identify what the sources of air pollution are. Authorities are also required to commence drawing up their Action Plan at the same time as carrying out their further assessment of air quality, and this should be completed within one year of declaring any Air Quality Management Areas.

Local authorities are required to complete a second round of review and assessments by December 2003 (although the NAQS recommends 2004 as more appropriate for London), to assess whether initial predictions were correct, and whether any changes need to be made to the Air Quality Management Area. This round is likely to be made up of a brief updating and screening assessment and a more detailed assessment with annual reports on progress.

1. Stage 1 & 2 Review and Assessment results

Stage 1 requires the local authority to identify any potential major sources of pollution which might lead to a breach of the air quality objectives by the target deadline. This therefore requires the collation of information on emissions from large industrial processes and heavily trafficked roads. Stage 2 requires more detailed information, including results from any air pollution monitoring.

Stages 1 and 2 of the review and assessment were reported to Camden Council's Public Health Sub-Committee in June 1998. The work concluded that five pollutants either met the objectives already, or would easily do so by the target deadline; sulphur dioxide, carbon monoxide, benzene, 1,3-butadiene and lead. The report therefore recommended that the remaining two pollutants, nitrogen dioxide and fine particles (PM_{10}), were taken to a more detailed stage 3 review and assessment.

Copies of the Stage 1 and 2 reports are available in libraries, at the Environment Department reception at Camden Town Hall, and can be downloaded from the Green Camden web site at www.camden.gov.uk/green, under the 'air' section, and then 'action on air pollution'.

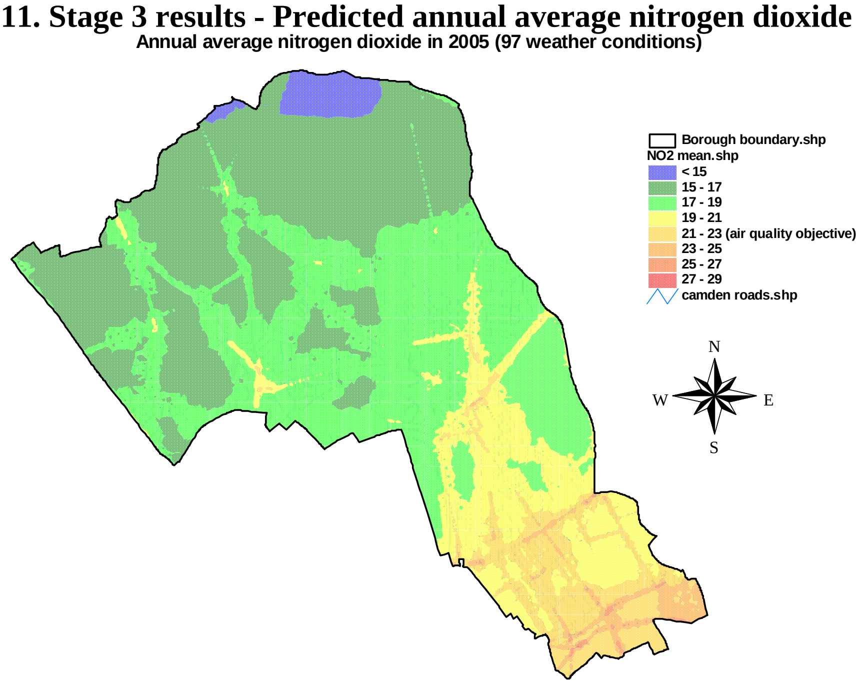
2. Stage 3 Review and Assessment results

Camden invited seven other boroughs in the central London area (known as the central London air quality cluster group) to work together on the Stage 3 review and assessment in May 1998, and jointly commissioned a detailed computer modelling exercise for the whole of central London. This ensured that our results would be consistent across all eight boroughs, and was more cost effective than working individually.

Nitrogen dioxide monitoring data and dispersion modelling results showed that exceedences of the annual mean and hourly nitrogen dioxide objective occur across the whole borough under present day conditions. By 2005, concentrations will have declined due to the introduction of cleaner fuels and improved engine technology, but there are still exceedences of the annual mean objective in large parts of the south of the borough, and isolated areas such as Swiss Cottage and Camden Town (see Figure 11).

PM_{10} monitoring data and dispersion modelling results also show widespread exceedences of the 24 hour mean objective under present day conditions, although the annual mean objective is only exceeded in the south of the borough, and by a small margin. By 2004 emissions have declined such that there are no exceedances of the annual mean objective anywhere in the borough, and there are only a small number of roads which will exceed the 24 hour mean objective.

Figure 11. Stage 3 results - Predicted annual average nitrogen dioxide concentration, 2005

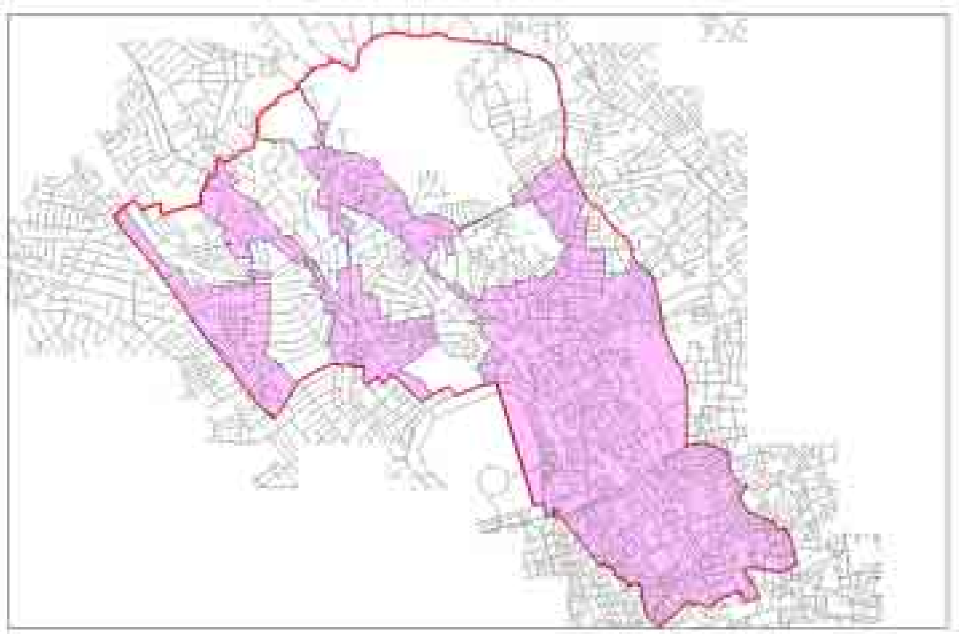


3. Declaration of Air Quality Management Areas

Having determined that air quality objectives for nitrogen dioxide and particles would be exceeded by the required deadlines, the Council was then legally required to declare Air Quality Management Areas. In defining the AQMA boundary, uncertainty was taken into account and a precautionary approach adopted. Whereas a margin of error +/- 10% was taken into account for the annual average nitrogen dioxide predictions, thus taking the area of exceedances from 21 parts per billion (ppb) to 19 ppb, the margin of error could not be calculated for PM_{10} due to an inadequate number of monitoring sites for validation purposes. The potential area of exceedances was instead taken to be the 49 $\mu g/m^3$ boundary of the 90^{th} percentile 24 hour mean concentrations on the basis that this allows for some uncertainty to be taken into account in the modelling results, and that it overlaps well with the predicted exceedances of the annual mean NO_2 objective.

The AQMA boundary took into account the potential for public exposure by considering the location of schools, hospitals and residential premises. Aligning the AQMA boundary with existing physical and administrative boundaries was considered, such as wards and polling districts, but as none appeared appropriate for use the AQMA boundary was drawn primarily around the road network and any other physical boundary such as paths or fence lines (Figure 12). Camden consulted on the proposed Air Quality Management Areas from February to June 1999 and recommendations made on the final Air Quality Management Areas to the Environment Committee in September 2000. The Air Quality Management Areas were formally declared by Order in October 2000.

Figure. 12. Air Quality Management Areas in Camden



Camden was then required to carry out a further assessment of air quality within the AQMA to refine any modelling work undertaken and to review additional monitoring results. This further assessment should be carried out in parallel with the Action Plan, and should be produced within a year of having declared any AQMAs. Dependent on the outcome of the further assessment, some changes to the AQMA boundary may be required, which can be implemented through a revision to the Order. Another key aim of the further assessment is to quantify emissions from all the different sources in the borough to inform the Council as to which sources need to be controlled in order to meet air quality objectives.

4. Stage 4 further Review and Assessment results

Camden's Stage IV further modelling work was delayed whilst waiting for the new London emission inventory and revisions of nitrogen dioxide and PM_{10} emission factors. The work was completed in July 2002 and reported that levels of PM_{10} and NO_2 would still exceed the objectives by 2004 and 2005 respectively in parts of the borough (Stage IV report, 2002). In the case of nitrogen dioxide, it has been predicted that annual average concentrations will exceed the objective in a much more widespread area of the borough compared to the Stage III results, excluding only a few more open areas such as Hampstead Heath (Figure 13). The reason for this difference is due to the changes in vehicle emission factors in the new London Atmospheric Emission Inventory used in this study which show that NOx emissions from vehicles will not decline as rapidly by 2005 as previously expected.

Figure 13. Stage 4 results- Predicted annual average nitrogen dioxide concentrations, 2005

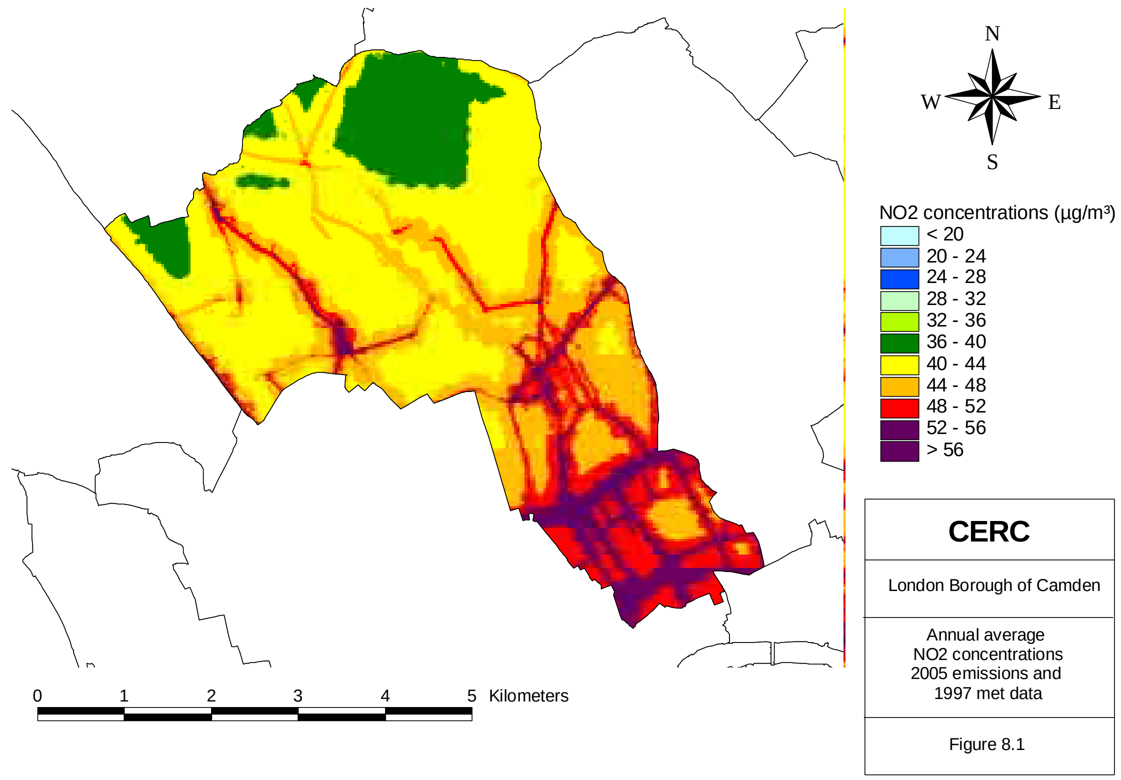
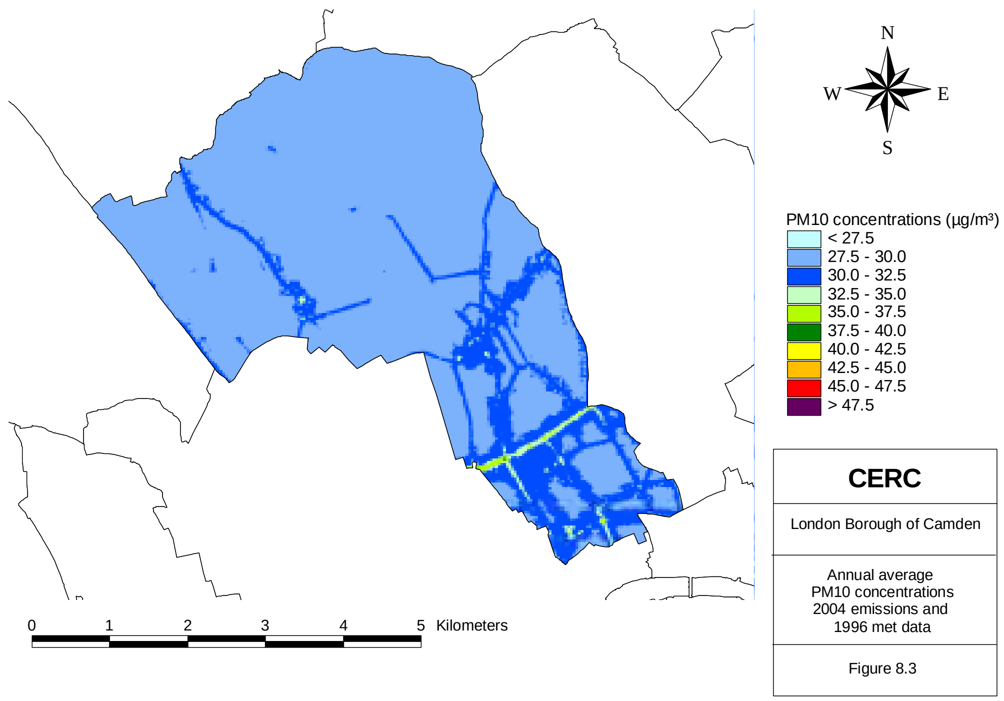


Figure 14. Stage 4 results - Predicted annual average PM_{10} concentrations, 2005



Predicted annual average PM_{10} concentrations were only slightly higher than those predicted in the Stage III study and are below the objective (see Figure 14). The 24-hour PM_{10} objective is likely to be only exceeded on the busiest roads such as Euston Road and the hourly nitrogen dioxide should be exceeded on most of the roads in the south.

As a result of this further modelling work, London Borough of Camden has revoked the original 2000 AQMA order and re-declared the entire borough as an AQMA. This declaration takes into account model uncertainty of approximately 5% so includes areas such as Hampstead Heath, which have NO_2 concentrations a few percent below the objective.

A large proportion of the Stage IV work involved CERC carrying out source apportionment studies to identify the principle sources in the borough that are likely to contribute to breaches of the PM_{10} and NO_2 objectives in 2004/5. The key results from the source apportionment study are highlighted below:

Nitrogen oxides (NOx)

- 60-70% of NOx concentrations in Camden is from roads (major and minor)
- At roadside sites, a high proportion of NOx concentrations results from sources within Camden (66% at Swiss Cottage), with around 30% from the rest of London and very little contribution from sources outside London
- Cars and HGVs both contribute approximately 30% of emissions
- Of the non-road sources, emissions from gas heating make the largest contribution (82%) and railways approximately 14%. Gas heating emissions are of a similar magnitude to road vehicle emissions in Camden.
- Ground level NOx concentrations can be used as an indication of the likely sources of NO_2 concentrations, as these are more difficult to calculate. Some inferences of NO_2 concentrations can be made based on empirical relationships such as Derwent & Middleton (1996)

Fine particulates (PM_{10})

- Secondary and coarse particulates from background sources (outside London) are the greatest contribution to PM_{10} concentrations in Camden, contributing approximately 85-90%
- Of the primary emissions, road vehicles contribute approximately 60% of PM_{10} emissions of which cars contribute 30%, taxis 22% and HGVs 20%
- Of the non-road sources, emissions from industrial sources contribute approximately 57%, rail contribute 37% and buildings the remainder. It should be noted that data for buildings does not include any emissions from large scale construction activities which may contribute significantly to local PM_{10} concentrations

This work is useful to estimate what reductions in emissions are required in order to meet air quality objectives, and what measures need to be implemented in order to achieve these reductions. Camden therefore commissioned CERC to model a range of different scenarios with air quality benefits (including several LEZ options, congestion charging and traffic reduction schemes) to see what impact they had on NOx and PM_{10} emissions and resulting ambient concentrations. The results for this are not available at the time of publication of the action plan.

APPENDIX 5. TRAFFIC IN CAMDEN

1. Overview of the transport network in Camden

Because of Camden's location, the rail and main road networks are oriented towards Central London. The A41 and A400 both act as connections to the regional and national road network north of London. Three major London termini (Euston, King's Cross and St Pancras) are situated in the borough giving links to north London and beyond. The Inner Ring Road (Euston Road, A501) provides an important orbital route around Central London, and has high traffic flows for most of the day with an average of 60,000 vehicles daily. The Inner Ring Road will be the boundary road for the Central London Congestion Charging area but is unlikely to carry much more traffic because it is already running at capacity. Other, less-suitable roads in Camden also provide orbital routes. The traffic flows on these are often very considerable.

2. Journey characteristics of residents

Camden residents make about 430,000 journeys every day. Of these about 30% are made by car, about 30% walk for the whole journey. Underground and bus travel accounts for 16% and 14% respectively. The comprehensive travel surveys carried out in 1981 and 1991 indicated that walking, pedal- and motor-cycling all declined (-32%, -18% and -56% respectively). Use of cars (as drivers and passengers) and public transport by Camden residents increased between 1981 and 1991. The results from the 2001 London Area Transport Study (LATS) will be used to monitor the general trends that have taken place over the last decade, enabling the long-term trends from 1981-1991-2001 to be studied.

Of journeys by residents to Central London, the proportion using public transport rises to 40% (18% by underground) while approximately 30% walk and 20% travel by car. These differences reflect the orientation of public transport services towards the central area.

Two-thirds of the journeys by Camden residents described above are completely within the Borough. Added to these trips, are 330,000 journeys a day made by non-residents to Camden. Of these journeys, 34% were by car, 27% by underground train and 13% by surface train. 14% of non-residents walked to locations within the Borough and 10% travelled by bus.

3. Transport trends in Camden

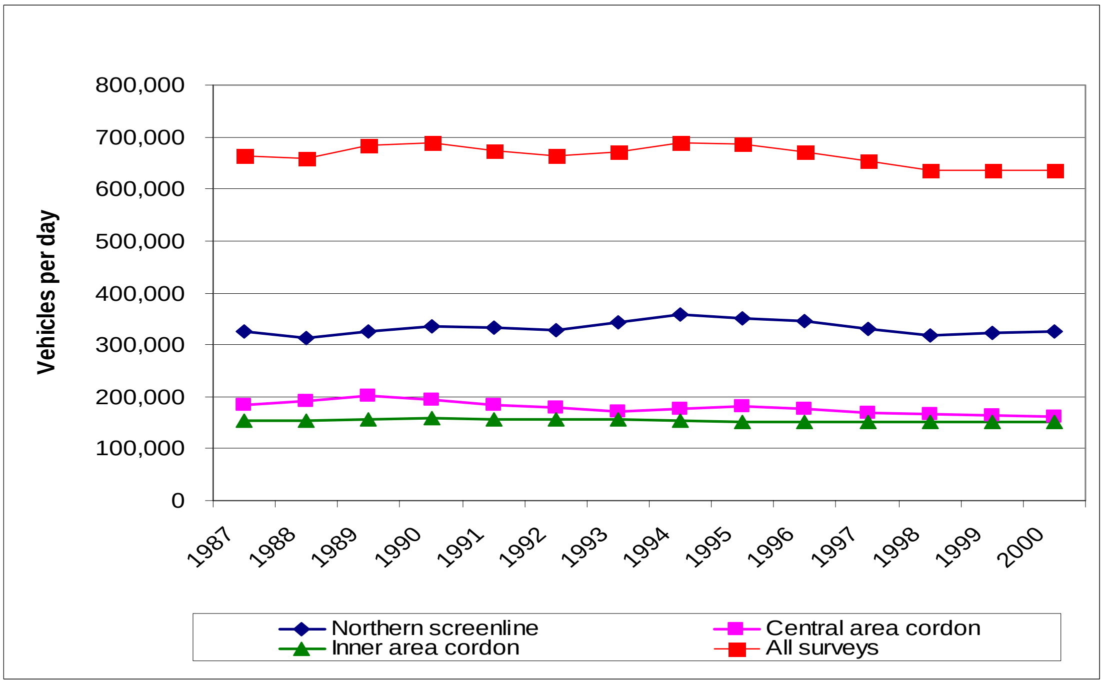
Traffic levels

Overall, traffic has remained fairly static since 1987, fluctuating within a range of +4% and -7% of the average (see Figure 15). From a peak in 1994, motor traffic has been declining and, in 1999, was 90% of its 1994 level. The fact that surveyed flows have only fluctuated by a small amount between 1987 and 1999 suggests that the network has been over-capacity for many years.

Daily east-west movements have fluctuated between 312,000 (1988) and 359,000 (1994) and, in 1998, were 2% lower than in 1988. Over the same period radial traffic across the boundary with Barnet fell by 3% whilst it fell by 15% across the Central London boundary. Figure 15 shows the 24-hour flows across the three lines in Camden.

Private car traffic in Camden has generally been declining since 1987 and in 2000, flows were around 9% lower. However, they remain the dominant class of vehicle on Camden's roads being two thirds of total vehicular flow. A great many car trips are of relatively short distances with 26% of car journeys made by Camden residents being less than one mile with a further 25% between one and two miles. These are the types of car journey that could change to walking or cycling. The National Travel Survey records that individual journey length by car and van has been declining in Inner London. The number of journeys between 1985/6 to 1997/9 increased by 8% whilst total distance travelled fell by 6%, which means that average journey length fell by 13%.

Figure. 15. 24 hour vehicle traffic flows in Camden 1987-2000

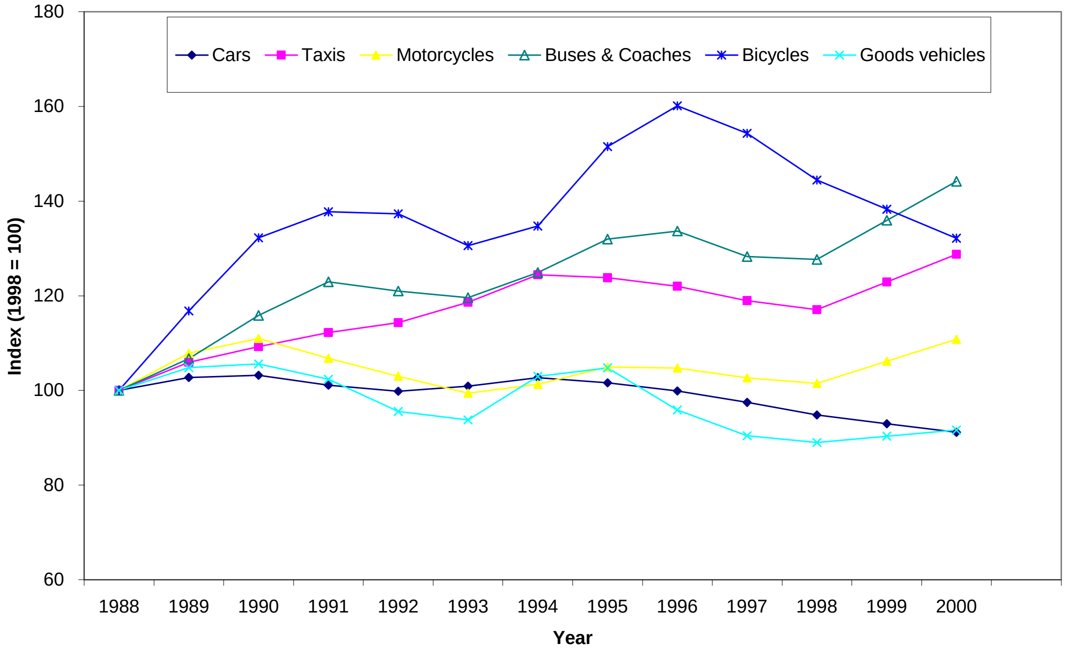


Motorcycle use in 2000 was the around same as in 1987, although commuting to Central London by motorcycle on Camden roads fell by 2% over that time. Taxi journeys increased by 29% between 1988 and 2000. Numbers of heavy goods vehicles have roughly stayed the same in 2000 compared to 1998, but medium goods vehicles have decreased by 36% in this time. Buses and coaches have seen an increase by about 40% and pedal cycle use also increased by 30% with peak use seen in 1996.

Sustainable modes

Where walking is associated with another mode, over 90% of trips (compared to 30% of trips made on foot alone) are to/from public transport, and a mere 2% to/from a car (indicating that most cars are parked within 200 metres of their origin or destination). Inner London residents, however, walked 45% further than the national average in 1997/99. There is a general downward trend in walking throughout Great Britain.

Figure 16 Trends in vehicle classes 1988 - 2000



Cycle use still amounts to only 2% of trips in Camden, compared to Danish, German and Dutch cities where between 15% and 50% is common. On average, Inner London residents cycled 27% less than the national average in 1997/99.

Use of cycles to Central London on Camden's roads increased by 50% between 1987 and 1997 whilst, generally in Camden, cycle flows increased by 59% over the same period. During the morning peak, cycle flows southwards to Central London on Camden's roads increased by 53% over the ten years to 1987. This trend is the opposite for most other parts of London.

Public transport modes

Underground use in Camden (passengers entering stations) was at its highest in 1998 for the last twenty years, up 13% since 1988. Morning peak flows increased by 16% and evening peak by 5%. The largest increase was in the evening (after 7 p.m.) of 34%, albeit on a much smaller base. Inter-peak flows saw an increase very similar to the average (+11%) between 1988 and 1998.

Bus passengers crossing into central London on Camden routes in the morning peak rose between 1987 and 1989. It fell back to a low in 1992 but since then has increased to 96% of the 1987 level. Bus passenger kilometres in London generally have been increasing over the last four years.

Traffic Speeds

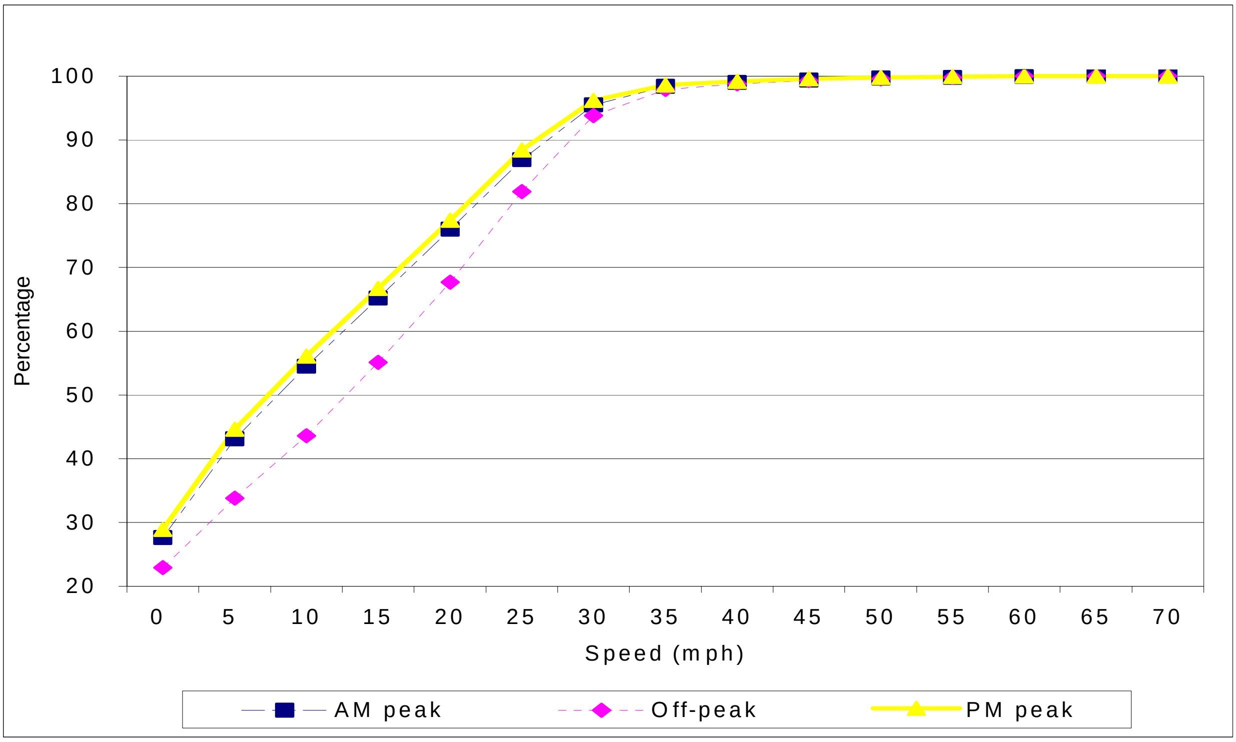
Speeds on Camden's roads are very similar to those in central and inner London generally. Table 17 and Figure 17 show the trend in average speeds since 1968 when consistent surveys began. Since the early 1970s speeds have generally fallen and are now at their lowest point. As might be expected, speeds in central London are lower than in inner London due to the fact there is more congestion on these roads.

Cumulative speed distributions varies from period to period in a way that is broadly consistent with average speeds. If the average speed is relatively low, then the percentage of time spent travelling at low speeds is relatively high.

Table 17. Average traffic speeds in central and inner London

	Miles per hour									
Central Area	**1968**	**1971**	**1974**	**1977**	**1980**	**1983**	**1986**	**1990**	**1994**	**1997**
AM Peak	**12.7**	**12.9**	**14.2**	**12.3**	**12.1**	**11.8**	**11.5**	**10.3**	**10.9**	**10.0**
Inter-peak	**12.1**	**12.6**	**12.9**	**12.6**	**11.6**	**11.9**	**11.0**	**10.6**	**10.9**	**10.0**
PM Peak	**11.8**	**12.7**	**13.2**	**11.9**	**12.2**	**11.5**	**11.0**	**10.3**	**10.8**	**10.2**
Inner area	**1969**	**1972**	**1975**	**1978**	**1981**	**1984**	**1988**	**1991**	**1995**	**1998**
AM Peak	**15.1**	**14.5**	**15.9**	**13.9**	**14.2**	**13.5**	**11.8**	**13.3**	**13.4**	**12.0**
Inter-peak	**18.3**	**18.6**	**18.6**	**17.3**	**17.2**	**16.3**	**14.6**	**15.8**	**15.0**	**14.8**
PM Peak	**15.2**	**14.5**	**15.5**	**13.5**	**14.1**	**13.1**	**11.6**	**13.2**	**12.8**	**11.4**

Figure 17. Proportion of time spent travelling below various speeds



The time spent stationary in a queue of traffic or waiting at traffic lights or road junctions is of particular interest since idling vehicles producing considerably more pollution than when they are moving. In inner London, about 28% of travelling time is spent stationary during the peak periods and about 44% either stationary or travelling at less than 5 mph. Even off-peak in inner London, vehicles are stationary or travelling at less that 5 mph for a third of the time.

APPENDIX 6. PREVIOUS STUDIES ON LOW EMISSION ZONES

Low Emission Zones are policy tools that have been recognised by the DETR for some time, and they are described in the National Air Quality Strategy (2000):

"It is possible that low emission zones will be one of the tools used by local authorities to reduce air pollution in air quality management areas, particularly in the centres of towns and cities. The Department is working with both the National Society for Clean Air (NSCA) and Westminster City Council to consider the impact that LEZs will have on local air quality, what criteria for access might sensibly be applied, and how low emission zones might be operated and enforced in practice…Although low emission zones will be implemented primarily to address air quality problems, other benefits may include reductions in traffic and noise which may in turn help to promote increased cycling and walking."

1. NSCA Cleaner Transport Forum report by Transport and Travel Research (TTR)

One of the first studies on LEZs was conducted by the NSCA, who commissioned work from TTR (Transport and Travel Research) and the University of West of England, Air Quality Group in 1998. This work recommended that the Euro emission standards for new vehicles should be the main basis of criteria for admitting vehicles to LEZs. The report also recommended that a development of a LEZ would need to be closely linked to Local Transport and Development Plans and that Traffic Restriction Orders would be the most suitable regulatory framework.

2. DETR/Westminster City Council report by Transport Research Laboratory (TRL)

In 2000, Westminster City Council commissioned TRL to develop proposals for a practical and working Low Emission Zone in London that would achieve the targets in the National Air Quality Strategy (Cloke et al, 2000). TRL modelled twenty different vehicle emission scenarios and the general conclusions were that:

By 2005, Medium and Heavy Goods Vehicles (MHGVs) and buses are predicted to be the biggest source of PM_{10} emissions in central London (41% and 18% respectively) with taxis contributing about 12%, petrol cars 11%, diesel cars 7% and LGVs 11%. With regard to NOx emissions, by 2005, MHGVs would contribute 29% and buses 27%, taxis about 7%, petrol cars 21% and diesel cars 4%. Outside Central London, cars contribute relatively more to both pollutants, with MHGVs being somewhat polluting and buses and taxis the least.

Emission predictions were made for each emission scenario and it was found that it would not be practicable to exclude cars, but disproportionate gains in air quality could be gained by a London-wide LEZ that excluded MHGVs, buses and taxis which do not meet Euro III or Euro II plus particulate-trap standards in combination with strategies that achieve a 10% traffic reduction. TRL claimed that these measures would achieve the NAQS objectives for NO_2 at all sites apart from busy roadside sites but not the PM_{10} objective for Central London due to the large background contribution of PM_{10} from continental sources. Total costs for enforcement are estimated to be similar to the London night-time lorry ban (£2-5 million set-up and £2-4 million annual costs).

The findings from the TRL report are based on an empirical relationship between emissions and atmospheric concentrations dispersion modelling systems such as the ADMS-Urban model, which has been used by CERC to carry out the Stage 3 and 4 review and assessments for Central

London. Modelling results are crucial in making choices between different policy options, for example what standard to impose on vehicles allowed into the LEZ

The Westminster-TRL study considered likely benefits to air quality for different scenarios and these are shown for the following three scenarios in Table 18 and 19 below.

1. Excluding all pre-Euro 3 vehicles
2. Excluding all pre-Euro 3 vehicles but including Euro 2 cars
3. Excluding all pre-Euro 3 vehicles but including Euro 2 with RPC

Table 18. Estimated improvements in emissions in 2005 compared to 1996 levels

Scenario	PM_{10} (tonnes/year)		NOx (tonnes/year)	
	Central London	All London	Central London	All London
1	-34	-32	-36	-40
2	-33	-31	-34	-39
3	-55	-50	-27	-35

Table 19. Estimated reductions in concentrations of PM_{10} and NO_2 compared to 1996 levels

Scenario	PM_{10} ($\mu g/m^3$)		NO_2 (ppb)	
	Central London	Background	Central London	Background
1996 conc.	28.3	22.0	33	33
1	21.4	19.0	16.5	10.7
2	21.4	19.0	16.5	10.7
3	20.6	19.0	17.3	10.7

It should be noted however that unlike these figures, the current thinking from the feasibility study is not to exclude any private cars. It can be seen from comparing Scenario 1 and 2 that although obviously there would be large differences in costs if cars were to be excluded, the emissions benefits would not be much greater.

The Westminster-TRL study predicted that excluding pre-Euro III vehicles would affect 52% of the total vehicle stock in 2005, however if private cars were not included in the scheme, only 4% of the vehicle stock would be affected. The major economic costs that are likely to be associated with an LEZ would therefore be derived from vehicle upgrades, changes in travel patterns, number of journeys and mode of transport. Vehicle replacement costs would obviously be the major economic impacts to businesses (see Table 20) and the overall cost to businesses throughout London to achieve Euro 3 standards has been estimated by the GLA to be up to £500 million. There are obviously also substantial costs to key organisations, including TfL and London Boroughs to enforce and administer the scheme such as to install cameras (at least £4 Million a year) and for the Government for the CleanUp programme (£30 Million currently available to 2003/4).

Table 20. Estimated range of costs and savings of vehicle replacement

Type of vehicle	**Initial Cost**	**- EST grant (up to 75%)**	**Fuel savings/ year (30,000 miles/y)**	**VED savings/ year**	**Total cost (-) / savings (+) over lifetime**	**Air quality benefit (% reduction of pollutants)**
Retro-fitting a CRT to a 3.5 tonne vehicle	£3000	£750 to £2250		Haulage £190	7 years -£2215 to +£2750	Particle traps give: <95% PM <90% CO, HCs <10% NOx
New Euro 2 vehicle with trap (plus trade-in)	£23000	£20900 to £22250		HGVs <7500kg £5	7 years -£22215 to -£17400	
New Euro 3 vehicle (incl trade-in of old vehicle)	£50000	N/A		HGVs <4500kg £500	10 years -£49950 to -£45000	Euro 3 engine over Euro 2: <75% PM <35% NOx
Conversion of petrol engine to gas (LPG, CNG)	£2500	£625 to £1750	£2000		8 years +£14290 to +£19375	LPG <10% NOx & CO_2 CNG <15% NOx & CO_2
Conversion of diesel engine to gas (LPG, CNG)	£4000-6000	£1000 to £4200	£900		8 years +£3040 to +£10200	LPG <90% PM, <85% NOx +<24% CO_2 CNG <99% PM <90% NOx +<16% CO_2

(PM = particulates, NOx = nitrogen oxides, CO = carbon monoxide, HC = hydrocarbons, CO_2 = carbon dioxide) (source from EST information, Westminster City Council's action plan, DVLA website, AEAT LEZ vehicle cost data).

APPENDIX 7. FISCAL POLICIES TO ENCOURAGE CLEANER VEHICLES

The Cleaner Vehicles Task Force (CVTF) was set up by the Government in 1998 to encourage people to buy and use vehicles that are less polluting, more fuel-efficient, quieter and less resource intensive. The CVTF developed a series of packages of practical solutions to put cars on the road now and in the future. Some of the most significant initiatives are detailed below;

1. Developing the market and consumer information

The task force recommended that the Government provide clear and simple information about incentives to anyone that needs it and to involve industry at an early stage. From 2001, all new cars must have comprehensive labelling providing information on CO_2 emissions and fuel economy.

2. Cleaner fuels

a) Reduced tax on cleaner fuels

The Government has encouraged reductions in emissions from road transport by reducing taxation on cleaner fuels. This has encouraged oil companies to manufacture cleaner fuels and motorists to use them. Tax differentials have been extremely successful at encouraging the switch to cleaner fuels, ever since the introduction of lower duty on unleaded petrol in 1989.

Ultra Low Sulphur Diesel (ULSD) has a reduced sulphur content of less than 50 parts per million (ppm) compared to less than 500 ppm for conventional diesel. It also has a lower heavy hydrocarbon content, and is effective in reducing emissions of oxides of nitrogen, volatile organic compounds, carbon monoxide and particles. From the November 1996 budget onwards the government has increased the price differential to make ULSD cheaper than conventional diesel. By the time it announced the three pence differential in the March 1999 Budget, the Government was confident that this further increase would convert almost the entire diesel market to ULSD by the end of the year. A further reduction of three pence per litre on ULSD was announced in the 2001 budget. ULSD is now the standard diesel fuel.

Following the success of ULSD, the government introduced a tax differential on ultra low sulphur petrol (ULSP). The EU has specified that the maximum sulphur content of petrol should be 50 parts per million, and the introduction of ULSP will help the UK meet the EU standard ahead of schedule. The emission reductions will not be as great as for ULSD, but the government estimated that the introduction of ULSP before 2005 could save 8 kilotonnes of oxides of nitrogen, 120 kilotonnes of carbon monoxide and nearly 6 kilotonnes of volatile organic compounds each year between 2001 and 2004. The duty on ULSP was reduced by one pence per litre compared to ordinary petrol in the 2000 budget, and it is estimated that by the end of 2000/01 40% of all petrol sold in the UK will be ULSP. A further reduction of two pence per litre on Ultra Low Sulphur Petrol was announced in the 2001 budget.

Tax differentials have also been introduced for alternative fuels such as Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CNG). Although the duty on these fuels has been gradually reduced since 1995, the biggest reduction was introduced in the 1999 budget, which cut the duty by 29% compared to conventional fuels.

b) Energy Saving Trust programmes
The Government currently provides funding to the Energy Saving Trust's Transport Action programmes – Powershift and CleanUp, which are aimed at encouraging cleaner vehicles. The government began funding the Powershift programme in 1996 to encourage the use of gas and electric vehicles, by providing up to 75% of the cost of purchasing the vehicle, or converting an existing vehicle to gas. The programme was given approximately £8 million between 1996 and 2000 in which time it has helped to convert over 2,700 vehicles to run on gas, over 1,000 cars, 1,500 vans and just under 200 buses and trucks. Powershift's budget for 2000/2001 was increased substantially to £10 million.

The differential in duty on cleaner fuels and the creation of Powershift has helped to increase the number of cleaner vehicles on the road. There are now over 750 Compressed Natural Gas vehicles and around 20,000 Liquid Petroleum Gas vehicles registered in Britain.

The Energy Saving Trust recently launched a new initiative under the Transport Action Programme, aimed at reducing emissions in pollution hot spots. The CleanUp campaign provides up to 75% funding for the fitting of emission control devices such as particulate traps and catalytic converters. The campaign is targeting urban areas with the highest pollution levels, and covers nine areas, including London. The CleanUp programme received a budget of £6 million in its first year, with a further £30 million allocated over the next three years (2001 - 2004).

a) Green Fuels Challenge
This was launched in 2000 as a means to encourage the involvement of industry by inviting them to come with practical proposals for more environmentally friendly fuels. The Government's response to this challenge was to introduce a package of measures including:

* 20p/litre cut in duty on renewable bio-diesel from April 2002
* 6p/kg cut in duty on road fuel gases to maintain price difference to conventional fuels. These levels of duty are fixed until 2004 at the earliest.
* A commitment to support best pilot projects that encourage new low-carbon vehicles, such as hydrogen, landfill gases and methanol. The Powering Future Vehicles paper sets out strategies to promote take-up of such technologies and in 2000, the Government set up a £9 million fund to encourage new vehicle technologies.

3. Reduced vehicle excise duty

The Government has introduced other fiscal incentives in recent Budgets designed to reduce the tax on less polluting vehicles and fuels. This follows the Chancellor's Statement of Intent on Environmental Taxation in the 1997 Budget, which promised to look at the potential for using taxes together with other measures to achieve environmental improvements:

- In January 1999, the Government introduced a cut Vehicle Excise Duty (VED) by up to £500 for buses and lorries meeting stringent particle emission standards, encouraging bus and lorry operators to run cleaner vehicles. Vehicles can meet these standards by fitting a particulate trap, fitting a new engine to a higher standard or converting to gas. So far, over 40,000 vehicles have qualified for this concession;
- The 1999 Budget announced a reduced VED rate for cars with engines up to 1,100cc, giving a £55 cut to owners of around 1.8 million smaller-engined cars, which tend to be more efficient and therefore less polluting than larger-engined models. Budget 2000 extended the reduced rate threshold to 1,200cc, benefiting the owners of a further 2.2 million cars. The 2001 Budget brought another extension to the reduced rate threshold to 1549cc benefiting a further 5 million car owners.

- The 2001 Budget introduced a graduated VED system that applies to all new cars from March 2001. The new company car tax system will also come into effect from April 2002. Although the new system is primarily linked to carbon dioxide emission rates, discounted rates are given for cars which run on cleaner, alternative fuels. They also include supplements for diesel cars to reflect the fact that, while they generally have lower carbon dioxide emission rates per kilometre than petrol cars, diesel cars produce higher emissions of local air pollutants;
- The 2001 Budget also cut the HGV VED from 1 December 2001, bringing UK rates down to among the lowest in Europe for the cleanest lorries.
- The Chancellor also announced in the 2001 Budget that the Government plans to introduce lower VED rates for lorries meeting latest Euro-IV standards from around 2004.
- Vehicles powered by solely by electricity are now exempt from VED and new gas powered vehicles benefit from a further discount of £5-10

4. Reducing environmental impact of fleets

The Government programmes, Motorvate and Energy Efficiency Best Practice are both focused on green fleet management and the Government is ensuring that its own fleets meet the Motorvate targets.

a) Motorvate

Motorvate is a Government-backed award scheme, designed to help companies cut their fleet travel costs and at the same time help the environment by working towards voluntary targets. The scheme is designed for businesses with several vehicles or thousands and provides benefits not just to the fleet but also to the whole organisation. Once a company signs up to the scheme they are give 3 days of free advice from a fleet management consultant to help them develop simple targets to improve fleet fuel efficiency and reducing fleet mileage. The core target is a reduction of 12% in the fleet's total carbon dioxide emissions over a 3-year period, 3% of this must be achieved through reduced business mileage. Certification is awarded on a five star point system, which are awarded as the company progresses towards the target. Motorvate is strongly promoted within the public and private sectors, and in the media, to gain wide recognition as a significant environmental award. Certification to Motorvate will help show your customers that you are managing your fleet in an environmentally responsible manner.

Motorvate costs businesses between £500-1000 to join, but for this they will receive an initial 3 day free visit from a professional transport management consultant and free telephone advice as well as all the other benefits to staff and to the company that are associated with greening fleets. Information is found at http://www.greenerfleet.org.uk and there are currently 30 members representing 41,000 vehicles.

b) Energy Efficiency Best Practice

The Government sponsors an on-site consultancy and free regional seminars through this programme to offer businesses advice on best practices including how to reduce the fleet mileage and CO_2 emissions

APPENDIX 8. ALTERNATIVE FUEL OPTIONS

1.Electric

Electric vehicles are now widely available and produce no emissions at point of use. They have limited range (50-60 miles per battery charge), which means they are unsuitable for long journeys, but they can be a suitable for short trips within towns and cities. For example, Camden Council's Environmental Health department has 3 pool electric Peugeot 106 cars for short trips, such as to service the air pollution monitoring equipment and visit residents. The batteries of electric vehicles are charged using a normal 3-point plug and left overnight for a full charge. The cost of electricity is therefore minimal, although of course there is a small contribution to carbon dioxide emissions from power stations. However through Camden's policies to increase the use of renewable energy supply, this downside will be removed.

2. Liquefied petroleum gas (LPG)

LPG is mainly comprised of propane and is a by-product of oil refining. It is also found as an associated gas in natural gas fields. LPG is less efficient than conventional fuels, so a car travelling on one litre of LPG would travel 75% of the distance than if it was running on petrol, but it is much cheaper than conventional fuels, by approximately 30-50% following the reduction in duty in the 1999 Budget. It is a much cleaner fuel and produces far less emissions compared to petrol or diesel, with emissions of carbon monoxide reduced by over 20%, oxides of nitrogen by 30%, and hydrocarbons by over 40% in light goods vehicles. For heavy goods vehicles, the reductions are much greater, with carbon monoxide reduced by over 90%, hydrocarbons by over 80% and oxides of nitrogen by over 60%. There are virtually no particle emissions from LPG engines.

3. Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG)

Natural gas is predominantly methane, mainly found in underground (or undersea) fields and often associated with oil. When compared to diesel, heavy goods vehicles running on CNG or LNG produce 50% less carbon monoxide, 85% less oxides of nitrogen, and nearly 70% less particle emissions. CNG emissions have lower concentrations of other pollutants such as hydrocarbons and sulphur dioxide and is most suitable for heavy goods vehicles (HGVs) due to the size of tank required to hold the fuel.

4. Dual fuel

Dual fuel vehicles are now commonly produced from many motor manufacturers to run on both petrol and gas (LPG or natural gas). These have the advantages of low emissions through LPG but petrol can also be used when required.

5. Emission reduction technologies

There are several different types of emission reduction technologies, which can be fitted to engines at low cost, but to provide a substantial reduction in emissions. Vehicles with such technologies may often meet a higher Euro standard and with a reduced pollution certificate (RPC) may qualify for reduced VED and entry into a potential LEZ. Current technologies that are widely used include:

a) Oxidation catalysts
Suitable to fit any vehicles with low operating temperatures (light loads) and are fitted to new vehicles. They act by promoting chemical reactions to transform pollutants into harmless gases by oxidation and in a Light Goods Vehicle (LGV) can reduce carbon monoxide and hydrocarbons by up to 90% and particles by up to 25% (50% for HGVs).

b) Particle traps (e.g. continuously regenerating traps, CRT)
These traps act as a filter to collect material from the engine and burn carbon to form a harmless ash residue. Their main benefit is to reduce particles (by up to 95%) and can be combined with oxidation catalysts to give an improvement for a range of pollutants. To achieve the best performance, engines with particle traps often need to be serviced more regularly to remove ash, but this depends on the frequency of use.

c) Re-engines
In some cases, a newer engine can be fitted to an older car, such as to convert a Euro 2 vehicle to a Euro 3. This has regularly been carried out for buses and improves their fuel consumption, reliability and reduces NOx by 35% and particle emissions by up to 70%.

d) EGR and SCR
Exhaust gas Recirculation (EGR) and Selective Catalytic Reduction (SCR) are both new technologies being trialed by the EST CleanUp programme with the aim of significantly reducing NOx emissions. EGR is currently used on LGV diesels in Europe but has also shown to give 50% NOx reduction on HGVs and can be combined with a particulate trap to have overall emissions benefits for PM_{10} and NOx. SCR uses ammonia as a catalyst to reduce NOx emissions and when fitted to HGVs has shown to reduce NOx emissions by 70%, with the potential of 90%. An SCR can be used with an oxidation catalyst also to reduce CO and hydrocarbons.

6. Hydrogen fuel cell

Hydrogen fuel cell vehicles are the latest development in alternative fuel technology and are likely to be the fuel of the future as they are the cleanest alternative fuel. The hydrogen is used to power fuel cells through catalytic energy release that produces only water. Fuel cell vehicles are still very much at the prototype stage and are extremely expensive to produce but there is a great deal of research currently focused on the technology and how it can be mass produced at a cost which is reasonable to the consumer. Camden is part funding a research project at Imperial College to look at the feasibility of developing fuel cell taxis.

7. Biodiesel

Biodiesel is made from soybean oil, other vegetable oils or animal fats and has been used in engines since 19th Century. As it is not a fossil fuel, it could be a good alternative to a sustainable future of vehicles and recycles carbon in the atmosphere. Biodiesel can be run on any unmodified diesel engine and can be mixed with diesel fuel (most commonly in a 1:4 ratio) to give reductions in emissions including 80% less carbon dioxide, zero sulphur dioxide, 90% less hydrocarbons and significant reductions in particles (when burnt alone). Few vehicles run on biodiesel in the UK primarily because modern diesel engines have been developed specifically for fossil-based diesel, and although they will run for some time on biodiesel, they eventually suffer problems such as coking of the injector tips and degradation of the lubricating oil. To successfully use biodiesel as a viable fuel either vehicle engines need to be modified or the fuel needs to be altered which means there needs to be realistic and competitive solutions to make biodiesel a commercially viable alternative.