Air Quality in the City Regions

A Transport Toolkit

Produced for:

pteg

Developed By:

ttr® Transport & Travel Research Ltd.

TRL

A note on definitions

Throughout this document the term 'city region authorities' is used to encompass the varying and evolving governance arrangements in place across the city regions. The term covers:

- **Combined Authorities** (now in place across five of the six Metropolitan areas) or **other leader bodies**. These bodies are led by District Council Leaders for the purposes of collaborating more closely on strategic issues like transport.
- **Passenger Transport Executives (or successor bodies)** who are responsible to the Combined Authority or leader body and are the delivery bodies for public transport functions.

What causes poor air quality in the City Regions?

Green sticky notes have been used throughout the toolkit to guide the reader on the type of information contained within that section.

[5]Public health Outcomes Framework Data Tool

[6]Data from review of NAQS

Web links to key references and other sources of information are provided throughout the document to aid usability. If you are reading as a PDF most of these links are live and will guide you to the relevant online source.

The toolkit has been produced for ***pteg*** by Transport & Travel Research Ltd (TTR) and Transport Research Laboratory (TRL).

About this document

This document has been produced in response to the health and economic impacts of poor air quality in the UK's city regions. It has been written for the public authority professionals who do not work day-to-day in a local air quality management or environmental health function, but do have a role to play in improving matters. This could be through transport, planning, energy efficiency, fleet management or procurement functions.

It contains a comprehensive set of guidance, references, signposts and case study examples relevant to managing local air pollution in the UK city regions.

Purpose

The document provides a **toolkit of resources** in an easily accessible form to aid understanding, co-operation, decision making and action.

The aim of the toolkit is to provide information to guide local authorities and city region authorities in selecting actions to manage sources of local air pollutants, while supporting their other corporate and community goals.

How it works

The main sections of the toolkit provide an overview of:

- Why air pollution is important, summarising transport's contribution to air pollution and impact on health.
- The current policy framework, and the roles and responsibilities of various organisations.
- How can action be taken, primarily on transport sources of pollution via planning, through procurement, development control and educational initiatives.
- The relevant strategies and projects in the city regional authorities and highlight examples of good practice.

The toolkit also includes two annexes. The first provides a comprehensive menu of actions arranged into themes with information on their effectiveness and cost. Examples are provided and links to sources used throughout. Secondly, a worked-example illustrates a method of assessing transport options, and provides an indication of likely impacts.

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Introduction

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Poor air quality is a pressing problem for the UK. The impacts of air pollution are estimated to cost the UK economy £9-19 billion every year, a figure comparable to the economic cost of obesity[1]. The effect of poor air quality on health is estimated to result in 29,000 premature deaths in the UK each year[2]. For those affected, it reduces life expectancy by an average of over eleven years[2].

Road traffic is recognised as the biggest single contributor to two of the most harmful and widespread sources of air pollution – nitrogen oxides (NOx) and particular matter (PM). High levels of these pollutants in local areas meant that by late 2013 there were 610 Air Quality Management Areas (AQMA's) declared by 255 local authorities.

The UK now faces a need to take action after the European Commission launched legal proceedings against it for failing to reduce excessive levels of nitrogen dioxide, much of which stems from traffic pollution. A letter of formal notice was sent by the Commission in February 2014 to start proceedings. The Localism Act of 2011 gives Government powers to require public authorities to pay some or all of European fines.

In a statement, the Commission said: 'Nitrogen dioxide is the main precursor for ground-level ozone causing major respiratory problems and leading to premature death. City-dwellers are particularly exposed, as most nitrogen dioxide originates in traffic fumes.'[3]

Local authorities in the city regions therefore have a vital role to play in tackling poor air quality through the decisions they make on transport. Doing so has the potential to boost economic growth, improve the health of communities and avoid costly fines.

This toolkit is designed to assist transport authorities in this task, with a particular focus on the city region authorities in the six metropolitan areas (Greater Manchester, Merseyside, South Yorkshire, Tyne and Wear, the West Midlands and West Yorkshire). It provides an accessible overview of air quality issues and of the range of options available for tackling those that are associated with transport in the city regions.

It has been developed based on the experience of providing advice on transport and its impact on air quality, the current local air quality management processes and through consultation with local authority practitioners in transport, planning and air quality functions in the city regions and other urban areas.

[1] Defra (2010) Air Pollution: Action in a Changing Climate

[2] Healthy Air Website - The problem

[3] European Commission Press Release: EC launches legal action against the UK

2 Transport's contribution to air pollution and impact on health

2.1 Types of urban air pollutants

What is air pollution & why is it a problem?

Air pollution in cities comes from man-made sources such as transport, generating electricity (power stations), industry, farming and waste and from natural sources including sea salt, wind-blown dust and volcanic eruptions.

2.1.1 Main sources of air pollutants in England

Nitrogen oxides (NO_x)

Nitrogen oxides are a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2) and are released from combustion sources such as vehicle exhausts, power stations and heating. They are also formed in the air in the presence of sunlight. It is NO_2 that has an impact on health and concentrations of this pollutant are well above set national and European limits in many UK urban areas. The impacts include shortness of breath and inflammation of airways in otherwise healthy people and a worsening of lung diseases such as asthma in more sensitive people.

Sulphur dioxide (SO_2)

Sulphur dioxide is produced from combustion processes, in coal or oil power stations or through domestic coal use. Levels of SO_2 are not of great concern in modern cities. A large proportion of SO_2 in the air comes from natural sources.

Carbon monoxide (CO)

Carbon monoxide is produced from natural sources (e.g. volcanoes and fires) and from combustion sources. CO concentrations in urban areas are no longer at a high level to cause concerns for health.

Particulate matter (PM)

Particulate matter are tiny particles that are not visible to the naked eye. They are referred to as PM_{10} and $PM_{2.5}$ based on their size. These are produced from emissions from transport and power stations and naturally by volcanoes, wind-blown sand and soil over large distances. These particles are so small that they can be breathed deep into the lungs and bloodstream. Particulates are amongst the most harmful of air pollutants to human health. This is especially the case for people with pre-existing lung and heart problems for whom exposure may trigger asthma attacks or cause hospitalisation in severe cases. For the most vulnerable in the UK, exposure to particulate pollution may be causing thousands of premature deaths in the UK each year[4].

Ground level ozone (O3)

Ground level ozone is not directly emitted but is a secondary pollutant that is formed in the air from reactions with NO_2, CO and other organic pollutants away from the road source which means concentrations can be higher in more rural areas. High levels of O3 can cause health effects such shortness of breath and inflamed airways.

How much air pollution is related to transport?

Table 1 shows that the main man-made source of NO_X, PM and CO in England is transport. Within transport, road transport is responsible for 60 percent of NO_x emissions and other forms of transport (e.g. rail, aircraft and shipping) make up the remaining 40 percent. For PM_{10}, emissions from road transport made up three-quarters of emissions from all transport sources in 2011 (Defra 2013).

Table 1 - Man-made sources of air pollutants in England (in percentage)

Source	Pollutant (source contribution as a percentage of the total)			
	Carbon monoxide	Nitrogen oxides (NO_X)	Particulate matter (PM_{10})	Sulphur dioxide
Power stations	4	26	7	60
Transport	42	46	26	4
Burning of fuels (industries)	25	17	10	20
Burning of fuels (commercial)	7	4	10	2
Burning of fuels (residential)	12	3	13	7
Other industry	8	1	15	7
Farming	0	0	9	0
Waste	0	0	0	0
Other	2	3	10	4
Total	**100**	**100**	**100**	**100**

Where does data on air pollution come from?

In the UK, information on types and sources of air pollution is provided by the National Atmospheric Emissions Inventory database (NAEI). The most recent NAEI report (Defra 2013) is the source of the information contained in Table 1 above.

The Government also provides data at the regional level using their national background emissions model[5]. Using these data, the contribution from different sources to NO_X and PM_{10} emissions for 2013 is illustrated for two major urban areas (Manchester and Birmingham) and one more rural area (Kirklees) in the city regions in Table 2 and Table 3.

[4] Defra— Public Health Impacts and Local Actions

[5] Defra— 2010 Based Background Maps for NOx, NO_2, PM_{10} and $PM_{2.5}$

Table 2 for NOx shows that transport (particularly road vehicles) is the main source of emissions in the urban areas but in the more rural area of Kirklees, the contribution from sources originating from outside the region (including natural sources) is greater than that from transport.

Table 2 - Sources of NOx emissions in selected city region areas

Source	Source contribution in city region (as a percentage of the total)		
	Manchester City (Greater Manchester)	Birmingham City (West Midlands)	Kirklees (West Yorkshire)
Transport which includes;	**52**	**47**	**33**
- Road	45	42	30
- Aircraft	3	0	0
- Rail	4	5	3
Industry (electricity, waste etc)	**10**	**14**	**15**
Heating (domestic / commercial)	**10**	**8**	**6**
Other (ships, farming etc)	**11**	**12**	**12**
Sources from outside the region	**17**	**20**	**34**

Table 3 for PM_{10} shows the greatest contribution is from sources outside of the region including natural sources. Of those sources emitted within the region, road transport emissions are the largest contributor.

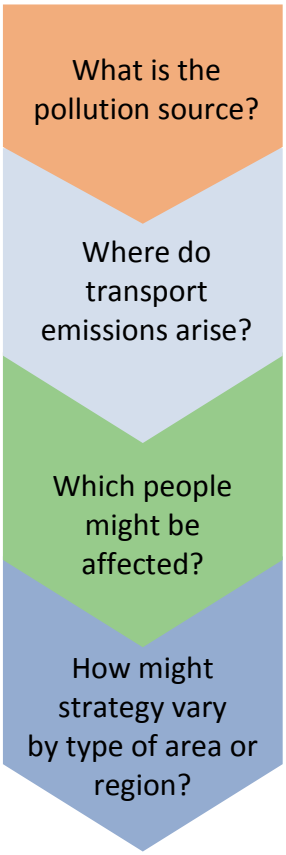
Table 3 - Sources of PM_{10} emissions in selected city region areas

Source	Source contribution in city region (as a percentage of the total)		
	Manchester City (Greater Manchester)	Birmingham City (West Midlands)	Kirklees (West Yorkshire)
Transport which includes;	**12**	**11**	**5**
- Road	*11*	*10*	*4.5*
- Aircraft	*0*	*0*	*0*
- Rail	*1*	*1*	*0.5*
Industry (electricity, waste etc)	**6**	**6**	**7**
Heating (domestic / commercial)	**1**	**1**	**2**
Other (ships, farming etc)	**5**	**5**	**3**
Sources from outside the region	**76**	**77**	**83**

2.2 Role of road transport

This section describes in more detail the role of road transport in contributing to NO_x NO_2 and PM_{10} in the city regions.

2.2.1 NO_x and NO_2 pollutants



Measured concentrations of NO_2 are well above European and national targets in many urban areas (see Section 3), posing a challenge for city region authorities and national Government.

Concentrations of NO_2 fell relatively sharply during the late 1990s as NO_x emissions declined. However, since 2000, concentrations have evened out, or in some cases increased despite on-going reductions in NO_x (GLA, 2013). This can mainly be attributed to the recent increase in diesel vehicles in the UK. Whilst newer models have lower NO_x emission levels, the share of NO_2 in the NO_x emissions from vehicle exhausts is increasing. This is partly due to particle traps which are fitted to reduce another type of air pollution, PM_{10} emissions. In burning off PM, these devices produce NO_x to oxidise the ash and regenerate the filter. This results in an increase in primary NO_2 emissions to the air from the exhaust.

Detailed data on road transport sources is collected by local authorities as part of their local air quality management duties. Table 4 uses this data to provide representative examples (based on real locations) of the contribution of different types of vehicles to NO_x or NO_2 concentrations in different types of area. This is to illustrate that variations do occur, rather than to provide an absolute guide.

Table 4 - Contribution of road transport emissions by vehicle type (in percentage) to NO_X or NO_2 concentrations - based on a selection of city region locations

Source	Contribution by Vehicle Type (as a percentage of the total)				
	Cars	Vans	Buses / Coaches	Lorries	TOTAL
UK-wide	44	18	29	9	100
Motorway	22	9	1	68	100
Major Road	28	11	8	53	100
Large City	29	6	35	30	100
Small City	27	2	26	45	100
Rural	42		19	39	100

Table 4 shows that cars are the greatest source of emissions across the UK as a whole but in cities, emissions from buses/coaches or lorries are similar or higher than emissions from cars. Once local authorities understand the main sources of pollution for their region, they can use this to identify effective solutions to improve air quality. In considering solutions, risk of exposure to air pollution is an important consideration. For example, the focus may be on tackling emissions from buses in a city centre. This may not always lead to a major overall reduction in NO_2 concentrations but it may achieve important reductions in those areas where people are most at risk of exposure and where the threats to health are the greatest.

The key to a sustained reduction in *overall* NO_x emissions is to develop solutions that also reduce background pollution. Once traffic pollution or other emissions enter the air they are subject to wind, air pressure and chemical reactions with other pollutants. Emissions can move considerable distances over regional and even national boundaries. One of the complexities of working to improve air quality, and a challenge for applying measures to reduce pollution is that there is a large 'store' of background pollution in most urban areas. Changes to road traffic at particular locations will therefore only affect a small overall portion of the pollution in the air. To address background pollution, measures with a wider geographical influence are needed (e.g. the London Low Emission Zone).

2.2.2 PM_{10} pollutants

Road transport emissions are also the most significant source of PM_{10} of all the man-made sources within regions. Emissions of PM_{10} have declined over the last few decades and concentrations are now below European and national targets in most urban areas except for some locations near busy roadside sites or industries (such as waste transfer stations). Detailed information on sources is therefore not collected by most local authorities in the same way for NO_x and NO_2. However it is still an important pollution to assess as concerns still remain over the impact of this pollutant on health even at low levels (see Section 2.3).

In summary, road transport has a significant role to play in air pollution. Having access to information on the main sources and background pollution allows an understanding of how to reduce emissions and concentrations but the evidence has to be fully understood to develop the most effective strategy.

2.3 Impact of air quality on health

2.3.1 Introduction

Air pollution is a public health issue. The impacts of air pollution are estimated to cost the UK economy £9-19 billion every year, a figure comparable to the economic cost of obesity[6]. The effect of poor air quality on health is estimated to result in 29,000 premature deaths in the UK each year[7]. Some groups are particularly at risk, including the very young or old and those with existing lung or health conditions. As noted in the introduction for those affected, it reduces life expectancy by an average of over eleven years[7]. Air pollution reduces the average person's life expectancy by six months[8].

The transfer of public health functions to local authorities acts as a key driver to promote the importance of air quality for health.

Table 5 - The impacts of air pollution on health

Particulate matter (PM)	Nitrogen dioxide (NO_2) and Ozone (O3)
Even at "low" levels that are below the European and national targets, PM can have a health risk in the short and long term. People breathe in these tiny particles through their noses and because they are so small they can penetrate deep into the lungs and bloodstream affecting respiratory, health, immune and neural systems. In the long term, this can lead to heart and lung diseases and certain types of cancer. Exposure to PM has also been linked to a low birth-weight of babies and these children are more at risk of developing wheezing problems and asthma later in life. The Public Health Outcomes Framework[9], [10] estimates how many deaths are linked to man-made $PM_{2.5}$ air pollution. The overall fraction for England in 2011 was estimated to be 5.4 percent of all deaths. On a more local level, there are some cities where the percentage of deaths were lower than the national average such as Newcastle (4.3 percent) and York (4.5 percent) whist others had a higher rate including Manchester (5.4 percent) and Birmingham (5.9 percent). The City of London had the highest rate (8.9 percent). There are few air quality management areas declared for PM (compared to NO_2) concentrations, because exceedences of the standard are less frequent, but the significant health impact of this pollutant even at low levels means it is nevertheless important to address.	There is evidence that short-term and long-term exposure to high levels of NO_2 concentrations can cause health impacts. These impacts include shortness of breath and inflammation of airways in otherwise healthy people and a worsening of lung diseases such as asthma in more sensitive people. Nitrogen dioxide reacts with hydrocarbons in sunlight to form ground level ozone. High concentrations of ozone typically occur in the summer months and the impacts on health include throat and lung irritation, coughing and inflammation of airways. Ozone can also worsen diseases such as asthma, bronchitis and emphysema and long term exposure can damage the lining of the lungs and reduce lung function. Government data from the UK indicate that in 2010, the early deaths due to ozone were around 12,000 and the numbers of additional respiratory hospital admissions were around 10,000.[11] *How does air pollution harm human health?*

[6] Defra (2010) Air Pollution: Action in a Changing Climate

[7] Healthy Air Website - The problem

[8] Value to Air Quality Impacts

[9] Public Health Outcomes Framework and Data Tools

[10] The NHS Outcomes Framework 2013-2014

[11] Data from review of NAQS

2.3.2 Exposure to pollution by area

How might air pollution affect communities?

Levels of pollutants will vary in different regions, as those pollutants such as NO_x that are emitted from road traffic will be highest near busy roads but levels of secondary pollutants such as ozone that are formed from reactions in the air away from roads tend to be highest in rural areas. Levels of particulates can be fairly constant across large regions. Pollution also varies in time, for example over the course of a day (due to changes in traffic flows) and over the year (due to changes in weather patterns).

Exposure to air pollution (and therefore risks to health) is known to be related to differences in social and economic characteristics. For example, people that live in poorer households that are close to busy roads are more likely to be exposed to higher pollution concentrations than people living in more suburban or rural areas or those that move around a lot between cities or regions. It is therefore important to consider the impact on population exposure when developing a solution to improve air quality and in the context of urban planning when building new housing developments in areas that already have poor air quality.

2.3.2.1 Research on exposure to air pollution during journeys to work and school

The National Institute for Health Research funded a study conducted by Kings College London to look at personal exposure to particulate matter for seven different members of the public over one day – an ambulance driver, cycle courier, office worker, home worker, pensioner and two school children.

Volunteers carried personal pollution monitors and GPS watches for one day during their daily journeys by car, bus, cycle or walking.

A summary of some of the results is outlined below:

- The ambulance driver was exposed to the highest concentrations, even higher than the cycle courier as pollution gets trapped inside the vehicle.
- The office worker was exposed to the lowest concentrations over the day which suggests that concentrations were lower in the office than in the home, even at night-time.
- The two school children walked to school and travelled home by bus. The journey home by bus had higher concentrations but was quicker than by foot.

Ambulance Picture courtesy of Yorkshire Ambulance Service

The study suggests that exposure to pollution can be higher for someone driving than walking or cycling. The researchers will continue to engage with the public and aim to extend the research by monitoring people's behaviour.

2.3.3 Quantifying benefits of tackling air pollution

How do we put a value on reducing air pollution?

This report has already highlighted that the impacts of air pollution are costly at the national, and therefore city region level[12]. The damage cost approach is most relevant for analysing the costs and benefits of action to tackle air pollution at local authority level. The Damage Cost Calculator is a simplified method to assess small changes in air quality impacts for actions that cost less than £50 million. This approach estimates the change in emissions of a pollutant due to the particular action. A published cost in £ per tonne of emissions is applied to the change in pollutant to get a total cost or benefit of the action. This approach assumes that the impact of the action is the same for the entire population (i.e. the impacts are not specific to a certain area). An MS Excel based tool is available to estimate the monetary values of varying reductions in different pollutants, and can be used to screen different actions and their estimated impacts on pollution[13].

[12] Defra (2010) Air Pollution: Action in a Changing Climate

[13] IGCB Damage Cost Calculator

3 Policy framework, roles and responsibilities

3.1 The legal basis for improving air quality

3.1.1 Worldwide Level

The Word Health Organisation (WHO) provides guidance on recommended limits for pollutants[14].

These guidelines are based on the impact of pollution on health. Some of these guidelines are stricter than European limit values but they are not legally binding.

3.1.2 European Level

The European Union (EU) sets legally binding limit values for outdoor air pollutants. Countries that are part of the EU must meet these limit values by a given date[15].

These limits are based on WHO guidelines. The EU provides strategies and directives to help meet these limits. They also require member countries to monitor pollutants, produce action plans and share information on air pollution with the public.

The Ambient Air Quality Directive (2008/50/EC) set legally binding limits for concentrations in outdoor air of major pollutants that impact health including particulate matter (both $PM_{2.5}$ and PM_{10}) and nitrogen dioxide (NO_2).

The EU developed a clean air policy package in December 2013 [16],[17] which sets out a new programme for Europe and new air quality objectives up to 2030. The package also includes supporting measures to help reduce pollution including revising national emission limits and new proposals to reduce emissions from medium sized industrial processes. The EU commission estimate that by 2030, the package will save 58,000 premature deaths due to air pollution across Europe each year.

3.1.3 National Level

The UK Government[18] has a legal responsibility to meet the EU limit values.

In England, the European directives have been combined into national law through the Air Quality Strategy Regulations (2010) which come under Part 4 of the Environment Act 1995. Under this Act, the Government produced a national air quality strategy in 2007 which gave objectives for pollutants and set out a process of Local Air Quality Management (referred to as LAQM). This process required local authorities to continually review and assess air quality in their area. The English and Scottish Government department responsible recently consulted separately on changes to LAQM and the results of this were published in early 2014. Defra is now looking to make regulatory changes to the process which will be further consulted on during 2014. A summary of the results of this consultation is provided in Section 3.3.

The Government provides reports to Europe each year from its monitoring and modelling programme that states how they will meet the limit values. The UK government has recognised that the EU limit

values for NO_2 were not met in 40 of the 43 nationally recognised areas by the deadline of January 2010. (These are not the same areas as AQMAs, instead they have defined boundaries and divide up the whole country). The Government applied for an extension for 24 of these areas to be met by January 2015 but recognised that 16 of these were unlikely to comply by this time (including the West Midlands, Greater Manchester and West Yorkshire). The Supreme Court ruled that the Government was in breach of its European obligation to meet this limit value which means that the UK now faces fines of up to £300 million. Subsequently, the European Commission has launched legal proceedings against the UK for its failure to cut excessive levels of nitrogen dioxide. The Commission is of the opinion that the UK is in breach of its obligations under the Directive, and a letter of formal notice was sent in February 2014.

3.1.4 Local Level

There are 406 local authorities in the UK. They are responsible for LAQM and have a duty to work towards meeting objectives.

Local authorities do not currently have a responsibility to meet the EU limit values, but must work towards them. However, the Localism Act of 2011 gives powers to require public authorities to pay some or all of the European fines faced by the UK.

Local authorities work with other organisations on a regional and local level to deliver solutions to improve air quality. This is particularly important where the other authority has control over a source of emissions. Details of the roles and responsibilities of these agencies in LAQM are given in Section 3.2 and summarised in Figure 1.

[14] WHO Air Quality Guidelines

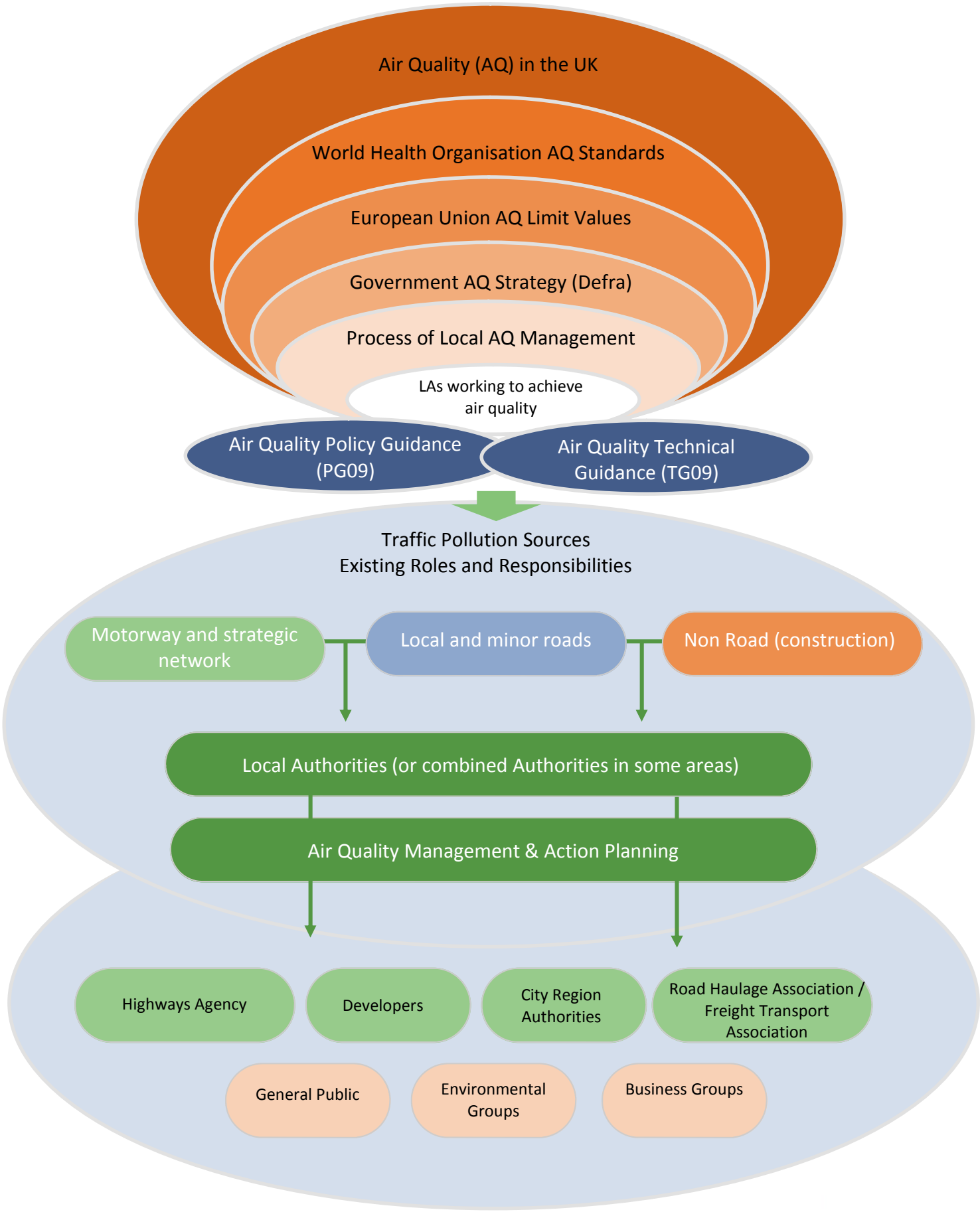
[15] EU air quality policy and directives

[16] The Air Quality Standards Regulations 2010

[17] Clean air policy package

[18] The UK Government refers to the Secretary of State for the Department for Environment, Food and Rural Affairs (Defra) and devolved administrations for Scotland, Wales and Northern Ireland

Figure 1: Roles and responsibilities for air pollution from traffic sources



3.2 Roles and responsibilities for Local Air Quality Management

Figure 1 describes the hierarchy of roles and responsibilities to deliver LAQM. The top part of the figure shows the policy and legal framework driving LAQM and the two key documents that guide the delivery of LAQM (explained further in Section 3.3). The bottom section of the figure shows how the different agencies combine in support of LAQM processes. Whilst local authorities are at the centre of LAQM, cooperation between various agencies is an essential component. One of the main tensions in the process is that sometimes the major road network (which tends to have higher emissions) is not under the control of the same local authorities responsible for co-ordinating LAQM. Therefore local authorities must engage with the relevant managers of that road and other relevant stakeholders.

All of these agencies and organisations need to work together and keep up-to-date with any changes in policy and decision making in order to maintain an efficient transport system that does not hinder the environment or economy.

3.3 Air quality guidance and processes

3.3.1 Existing guidance

The Government has produced technical[19] and policy guidance[20] documents on air quality. These documents are mainly aimed at local authorities but they also provide information for other agencies on their role in the LAQM process.

What guides Air Quality Action Plans, ideas & solutions?

Local authorities need to understand the technical guidance to know how to carry out their LAQM duties. The guidance gives approved methods on how to assess air quality in their area through pollution monitoring and modelling techniques and what to do if there is an issue (i.e. when the air quality objectives are not met). The policy guidance sets out the process of declaring Air Quality Management Areas (AQMAs) in situations when an objective is not met and how to develop an action plan. The action plan informs other agencies on their role in LAQM and how they can work with local authorities to deliver solutions to improve air quality. Both the technical and policy guidance documents provide help with common problems and suggest solutions.

3.3.2 Existing air quality monitoring programme

The Government has been monitoring air pollution since the 1960s and now runs a long term programme of real-time monitoring at more than 100 sites. The monitoring methods have to meet European requirements and their locations are based around the European system of designated zones (Government office regions) and agglomerations (areas with a population greater than 250,000).

[19] Local Air Quality Management Technical Guidance - LAQM.TG(09)

[20] Local Air Quality Management Policy Guidance - PG09

Many LAs have set up their own air quality monitoring

The Government provides yearly reports to the EU using data from these monitoring sites, supplemented by information from national models to fill in any gaps.

To carry out their duties under LAQM, many local authorities have set up their own local air quality monitoring sites - both real-time, permanent monitoring sites and lower cost monitoring techniques such as nitrogen dioxide diffusion tubes. Local authority sites do not need to meet the same strict quality requirements as the national air quality monitoring sites. Data from these local monitoring sites are used with information from detailed models to help local authorities determine the boundary of an AQMA and to measure the impact of schemes in their action plans.

The existing national and local monitoring and assessment methods not only use different techniques but also serve a different purpose. National methods are on a much cruder scale than the more detailed local techniques used by local authorities. This can mean that when the Government reports on air pollution to Europe, they have not always been able to identify local hotspots where air quality objectives are not met. This discrepancy between methods has raised doubts over the role and value of the work conducted by local authorities as part of their LAQM duties and how this feeds into the national assessment method.

3.3.3 Funding arrangements

Who pays for pollution monitoring?

The Government pays for the national monitoring network and in the past has provided funding for local authorities to run their own sites. This is no longer the case, so a local authority must fund its own sites. However, local Government cuts have meant that many local authorities are closing down their real-time sites as they are too costly to run. Although there are agencies that have more money than local authorities such as the Highways Agency, they do not have a responsibility for air quality along their roads so do not conduct their own monitoring.

3.3.4 Current Local Air Quality Management system

Despite the on-going work by local authorities, there are still many areas of the country where the air quality objectives are not met for two pollutants - nitrogen dioxide (NO_2) and PM_{10}. There are 470 AQMAs in England declared due to emissions from traffic, with around 40 due to emissions from roads managed by the Highways Agency only. Of the total AQMAs, 15 percent (72) are in the six metropolitan areas. To date, less than 100 of transport related AQMAs have been cancelled which happens in situations when pollution levels decrease so that the objectives are met.

3.3.5 Future changes

Defra recently consulted on proposed changes to the LAQM process which may affect the way local authorities assess air quality through monitoring and modelling. One of the options consulted on was to combine LAQM with the European regulations so that the limit values and national objectives are the same. This option would remove the requirement for local authorities to review and assess air quality which means they would not need to monitor pollution, carry out detailed modelling assessments or

How might local air quality management change?

declare AQMAs. Instead there would be a greater focus on action planning and reporting on schemes which would feed directly into the government's annual reports to Europe. The implications of this option could mean that there is no longer a way to assess the impact of schemes at a local level.

There were 232 substantive responses to the consultation process including 133 from local authorities as well as many thousands of campaign emails. A summary of the responses and Defra's reply was published in December 2013. Overall there was overwhelming support to retain LAQM, albeit with less reporting requirements and a focus towards action planning and delivery. There was some support to review the air quality objectives and clarify the relationship with the requirement to comply with the EU limit values. There were concerns that different tiers of authorities do not work effectively on air quality. The Defra response will look to improve the guidance to clarify these duties to ensure agencies cooperate more successfully.

Defra will now explore the alternatives to change the strategy and regulations and look to conduct a second consultation on regulatory changes and guidance later in 2014. Any changes to the LAQM system will not happen until 2015 at the earliest.

3.3.6 Role of non-transport stakeholders

Other priorities linked to improving air quality

A range of stakeholders are relevant to successful action on air pollution. As was noted in section 2.1 (Tables 2 and 3) various types of human activities contribute to emissions of air pollution, and therefore other sectors (as well as road transport) must play their part in reducing their contributions:

- Energy production
- Agriculture
- Industry
- Shipping, Rail and Air transport
- Construction
- Housing and office buildings (from heating and cooling)

Local authorities have a number of responsibilities that can influence air quality and where there is great potential for beneficial cross-working:

- **Planning and development control**[21],[22] is a local authority function vital both for long-term planning of sustainable development and individual decisions on how development should proceed where it may adversely affect air quality[23]. Air quality is a material consideration when a development is planned. The Local Planning Authority will often require an air quality assessment to determine whether air quality impacts from the development may be detrimental to the environment or public's health. This can also form the basis for deciding and agreeing mitigation actions, to lessen or remove the impact of the development on air pollution. Once development is approved it is then important to reduce as far as possible the emissions (e.g. dust) from the construction phase of a development[24].
- **Public health** - responsibility for public health passed to local authorities in April 2013. The additional responsibility, resources and close proximity of public health responsibility to air quality functions is seen as a positive change and an opportunity to influence public health outcomes more directly as they relate to poor air quality [25],[26]. The importance of the effect of air pollution on public health is reflected by the inclusion of an indicator of mortality associated with air pollution in the Public Health Outcomes Framework. This will enable directors of public health to appropriately prioritise action on air quality in their local area[27].
- **Carbon reduction** - The Carbon Reduction Commitment Energy Efficiency Scheme (often referred to as simply 'the CRC') is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organisations (including local authorities). There are significant overlaps between carbon reduction actions and opportunities to reduce pollutant emissions to air.
- **Local economy** - Local Enterprise Partnerships (LEPS) , involving business and local authority representatives, have responsibility for strategic planning for sustainable economic growth. The economy is critically dependent on the environment, but this relationship is often not given sufficient recognition in economic plans. However, there are significant economic benefits to be gained by considering and embedding the environment in strategic plans[28].

[21] Planning Practice Guidance - Why should planning be concerned about air quality?

[22] Heart of East Greenwich (Planning Condition / Agreement)

[23] LES Planning Guidance

[24] Guidance on the assessment of dust from demolition and construction

[25] Greater London Authority - Cleaner Air 4 Schools

[26] ASTARS - Active Sustainable Travel and Road Safety

[27] Public Heath Outcomes - Air Pollution

[28] Local Environment and Economic Development (LEED) Toolkit

Taking action on pollution from transport

4

4.1 Introduction

This section of the guide presents examples and ideas of actions that can be taken to reduce on road transport sources of pollution. The funding framework is outlined followed by recent examples of good practice from the city regions and finally advice on selecting transport measures to fit a range of requirements (backed up with an Annex of examples).

The key funding framework, policy setting documents and local authority plans for transport measures are associated with the Local Transport Plan 3 process (2011/12 to 2014/15). Typically these set out spending plans in detail for the period - the services and schemes that are going to be invested in - and outline longer-term goals for the following years.

Transport authorities can access funding streams for specific types of transport investment, for example:

- **Local Sustainable Transport Fund (LSTF) programme**
- **Better Bus Area Fund**
- **The Local Pinch Points fund**

Activities are also carried out in relation to the trunk road network, managed by the Highways Agency on behalf of DfT. In addition, most years there is an opportunity for local authorities with AQMAs (declared for NO_2) to apply for (100%) grant funding to undertake air quality related projects from the Defra air quality grant programme.

The scoping, planning and delivery of transport infrastructure, travel education and behaviour change projects via these routes all have potential to be applied in ways that either avoid making air quality worse or actively improve it. This is relevant to the 72 AQMAs that have been declared in the six metropolitan areas. The air quality action plans produced to focus on these AQMAs make reference to and draw upon existing Local Transport Plan actions. In many cases working or steering groups will have been formed to guide the process of delivery commitments in the action plan, drawing on expertise from environment, transport and planning departments.

4.2 Action from the city regions

Various examples from the current plans, policies and transport actions from the city regions are presented over the next few pages. This is not an exhaustive summary of all activities, but rather aims to provide some highlights that show the range of work being done, acknowledge various innovative projects and achievements along with sign-posting to further information.

4.2.1 Greater Manchester

The current Greater Manchester Local Transport Plan (LTP3) Air Quality Strategy and Action Plan was developed to try and reduce health impacts from poor air quality. The LTP itself contains a range of actions on public transport, congestion reduction and encouraging walking/cycling for which there are ambitious targets and observable progress.

The Greater Manchester authorities work together in execution of their LAQM duties, under the banner, "Greater Manchester Working Officer's Group[29]". The group provides specialist air quality advice and services to colleagues, including air quality modelling and data collection for the local emissions inventory (EMIGMA[30]). This enables a better understanding of sources of air pollution and the potential impact of proposed actions. In conjunction with transport models, it provides the basis for forecasting air quality and determining the effects of changes in land use, planning and transportation policies.

LAQM is a shared responsibility between the ten Greater Manchester districts and the Combined Authority plus the Public Protection Partnership (made up of chief environmental health officers, Trading Standards and other regulatory bodies) together with Transport for Greater Manchester (TfGM). The formation of the Combined Authority with the same powers for air quality as districts enables joint reporting, declaration of AQMAs and action planning.

A range of Greater Manchester-wide measures are being progressed by the group of authorities. A small selection are highlighted here (based on the 2014 air quality progress report):

- **Taxi licensing review** – aiming to harmonise age related standards on new vehicle registrations.
- **Vehicle clean-up programme** – including roadside testing of exhaust emissions, anti-idling measures and smarter driving tips for drivers.
- **Developing supplementary planning guidance on air quality and mitigation measures** – providing a framework for developers and planners to consider and plan to reduce air quality issues arising from development.
- **Promoting and developing freight emission guidance** – on emission reduction practices, fuels and technologies including choice of vehicles, night time deliveries and signage.
- **Working with bus operators to reduce bus emissions** – improving standards to date linked to Green Bus Fund[31] and Code of Conduct, linkages to the A6 Quality Partnership Scheme and setting Bus Quality Agreements (BQAs) that include challenging air quality standards.
- **Metrolink expansion** – providing low emission alternatives for mode shift and supporting economic growth.

[29] GreatAir Manchester

[30] GreatAir Manchester—EMIGMA

[31] More Yellow School Buses go Green

4.2.2 Greater Manchester Case Studies

Making School buses green

Greater Manchester's fleet of 81 Yellow School Buses run to schools across the county, and include 39 green hybrid-electric vehicles. A further ten hybrid buses will be introduced onto school services in the next 12 months.

More of Greater Manchester's Yellow School Buses are set to go green after a successful bid for Government funding. TfGM was awarded £682,890 from the 2013 DfT Clean Bus Technology Fund in order to upgrade 30 of the region's earliest Yellow School Buses. The 'Iveco Scolabus' Yellow School Buses to be upgraded are aged between five and ten years old, with an expected life-span of 20 years. These older diesel vehicles will be retrofitted with pollution control equipment to cut down on harmful emissions. They currently meet Euro III engine standards and will have NOx abatement equipment fitted to reduce the level of nitrogen oxide and particulate matter emissions.

In total, Greater Manchester will soon have 280 hybrid-electric buses on its roads and TfGM is also purchasing three fully electric buses.

Action on the Motorway - Noise & pollution barriers in Manchester

The Highways Agency is to trial barriers on a section of the M62 to see if they can reduce localised air pollution from vehicles on the motorway. A £415,000 contract was awarded for the trial near junction 18 in Greater Manchester[32]. As well as reducing traffic noise, the barriers also reduce concentrations of nitrogen oxides and airborne particulates along motorways. Large scale trials in the Netherlands found that such barriers reduced NO_2 by an average of 15% and PM_{10} by 34% at a distance of 10 metres away[33].

4.2.3 South Yorkshire

The local authorities of Sheffield, Doncaster, Rotherham and Barnsley provide a technical lead on air quality, working in partnership with the PTE to shape transport projects relevant to emission reduction of both air quality pollutants and green-house gases.

For example, the South Yorkshire authorities jointly developed the Care4Air initiative[34,] which has been in place for a number of years[35] with various conferences, communication campaigns and information services developed.

[32] TransportXtra - HA to trial air quality barrier on M62

[33] Dutch Air Quality Innovation Programme (January 2010)

Yellow Bus Picture courtesy of Optare

Individually each of the South Yorkshire authorities have developed Air Quality Action Plans (AQAPs) and are implementing measures based on these.

For example, in Sheffield an ambitious new AQAP was approved at Cabinet in July 2012[36] that aims to reduce pollution in Sheffield in order to achieve health-based national air quality objectives and EU limit values by 2015. In tandem, one of the key aims of the Sheffield City Region Transport Strategy 2011 to 2025 was to reduce transport emissions. Emphasising the importance placed on this, the overall Air Quality Champion is the Director of Public Health and in addition each action in the plan has a lead officer to represent and report on progress.

4.2.4 South Yorkshire Case Studies

South Yorkshire ECO Stars

As part of Care4Air, the authorities developed the ongoing ECO Stars (Efficient and Cleaner Operations) fleet recognition scheme in 2009[37]. ECO Stars is a free, voluntary scheme designed to provide recognition, guidance and advice to operators of goods vehicles, buses and coaches across South Yorkshire.

The aim is to support members to adopt fleet management measures which could help to improve performance and save money, potentially leading to higher operational star ratings over time, and reduce air pollutant emissions (as well as carbon). It has now expanded to many more areas of the country, Scotland and into Europe under the ECO Stars steering group of authorities.

Sheffield Low Emission Zone (LEZ) feasibility study

Significant work has been done by Sheffield City Council with their partners to assess the feasibility of a LEZ[38]. The aim of the most recent LEZ study was to work out the potential costs, benefits, air quality impacts, emissions reductions and timescales for bringing about a LEZ in Sheffield.

One of the main outcomes of the Sheffield LEZ study has been to highlight the poor performance of modern diesel vehicles (Euro V for heavy and Euro 5 for light) across all modes (car, taxi, buses and goods vehicles).

The study concludes that to ensure compliance with NO_2 limits, there ideally needs to be a shift away from diesel fuel to alternative low emission fuels (electric, gas/biogas, hybrid, hydrogen). In the short term however, diesel vehicles, particularly buses, taxis and goods vehicles, would benefit from being

[34] Care4Air Website

[35] Care4Air Archive

[36] Sheffield City Council – Air Quality Action Plan

[37] Care4Air ECOStars

[38] Sheffield City Council - Low Emission Zone - Feasibility Study

retrofitted or be a minimum Euro VI/6 standard, which might be via a LEZ. Further work is now required to analyse the costs and benefits of the study recommendations, and following this, the Air Quality Action Plan will be reviewed and updated.

4.2.5 Tyne & Wear

As part of LTP3 the Tyne and Wear Air Quality Delivery Plan has recently been completed by the Local Transport Plan Core Team as a response to air quality concerns across the county[39], with seven AQMAs declared in Newcastle (4), Gateshead (1) and South Tyneside (2). The delivery plan is based on the conclusion that two different 'sets' of actions are needed; one aimed at area-specific interventions, and one dealing with measures which will improve Tyne and Wear air quality levels as a whole.

A range of measures are being progressed by each of the authorities with AQMAs.

The **South Tyneside** action plan (drafted in 2010) sets out around 70 actions to manage down pollutant emissions in two traffic related AQMAs.

The **Gateshead** air quality progress report (2013) indicated a range of measures that take into account wider considerations (primarily the local economy), but make use of the opportunity from a town centre redevelopment to improve sustainable accessibility.

For **Newcastle,** the action plan was developed after declaration of the city centre and Gosforth AQMAs[40]. Reporting progress in 2013, Newcastle City Council updated on a range of measures with the following considered to have had the highest impact on pollution:

- Residents parking permits - Issuing 18,000 residents/visitor parking permits, capped to reduce congestion but with low emission vehicle discounts.
- Bus Corridors including bus lanes and other priority measures - The Urban Core Area Action Plan (submitted February 2014 to the Secretary of State) aims to increase public transport, pedestrian and cyclists priority by reallocating road-space in the city centre and limiting through traffic.
- Urban Traffic Management and Control (UTMC) - improving bus priority and the management of special events.
- Encouraging low emission/ zero emission vehicles – hybrid buses operate on Quaylink and city centre routes and older buses are being upgraded to Euro IV standard.
- Delivery times outside peak hours – opening a freight consolidation centre in Newburn in 2011 to coordinate deliveries around quieter times, in lower emission vehicles[41].
- Travel Plans for businesses/ schools – every school in Newcastle now has a travel plan. Workplace travel plans continue to be developed, with 80 currently in place.

[39] Tyne & Wear Air Quality Delivery Plan

[40] Managing and improving air quality in Newcastle

It is noted that a LEZ was investigated by Newcastle and Gateshead Councils and reported as unlikely to progress further. From the study report it appears that the benefits anticipated from a natural fleet turnover rate by 2021 (the proposed introduction date) would be significant and meant the additional vehicle 'clean up' brought in by an LEZ was minimal[42].

4.2.6 Tyne & Wear Case Study

Newcastle Air Quality Engagement

Started in October 2013 and finishing in 2015, the project is run by Newcastle City Council and Groundwork North East and Cumbria across the city. The engagement work aims to communicate air quality and health issues through a social media and marketing campaign to actively engage the public to change their travel behaviour and improve their lifestyle. It seeks to establish and train community mentors to deliver the message to the general public with the ultimate aim of gaining pledges to use sustainable transport once a week.

A dedicated Facebook page is regularly updated and provides relevant information on walking, cycling routes and public transport along with a series of community events and local workshops. These are run with a consistent message of "creating a cleaner, greener and healthier city" to show the public how they can save money and energy and improve their own lifestyle and health. The engagement project also involves conducting air quality monitoring to understand the level of pollution exposed at a person's home. As part of the final report an assessment will be made on whether the campaign has had a positive impact upon the health and wellbeing of communities.

Newcastle partners have now launched a dedicated air quality website that covers a range of relevant topics for reducing transport emissions.

4.2.7 Merseyside

The Merseyside Local Transport Plan sets out the implementation plans in the short term to 2015 and looks to the longer term strategy to 2024 on how to improve transport in Merseyside. It includes each of the district's air quality action plans in its annexes. The following summarises a small selection of the actions being pursued by some of the authorities.

Liverpool City Council is focusing on:

- Bus Statutory Quality Partnership Scheme – including minimum Euro III emission standards for buses on five corridors across Merseyside.
- Bus priority infrastructure – introducing bus priority through relevant junctions via enhanced phasing, selective vehicle detection and, in some instances new signals.

[41] Eco-friendly storage centre to support retailers

[42] Newcastle/Gateshead Low-Emission Zone Feasibility Study: Vehicle Emissions and Air Quality Modelling

St Helens District Council is undertaking a range of measures, including direct traffic management:

- Acoustic/Air Quality Barrier on M6 flyover - installing an acoustic barrier on the M6 passing over Southworth Road AQMA to increase turbulence and disperse NOx.
- Traffic Regulation Order on A49 High Street - restricting lorries and light goods vehicles travelling along the High Street to reduce emissions.
- Vehicle idling - stopping stationary vehicles leaving their engines running on the A49 High Street.
- Optimise flow on key routes - Four key routes with better phased traffic lights and use variable message signs to alternative routes.

The council is also implementing a range of other actions, including those focussed on improving vehicle performance and efficiency:

- Freight Quality Partnership - working with freight companies in the Merseyside area to reduce emissions through better logistics and efficiency.
- Green Taxi Fleet - using the council powers of licensing to encourage changes in taxi fleets to improve fuel efficiency.

Sefton Metropolitan Borough Council has organised their latest (2013) action plan under a number of headings, a selection of which are summarised below:

Site specific measures:

- South Road AQMA - A package of measures from the A565 Route Management Strategy and Action Plan.
- Hawthorne Road AQMA – Introducing an ECO Stars Fleet Recognition Scheme, the focus of which are goods vehicles which regularly use the Port of Liverpool area [43].
- Millers Bridge AQMA – road sweeping and 'green advance' on traffic signals when HGVs are waiting (see case study on Millers Bridge).

Sustainable travel and awareness:

- Encouraging businesses to implement workplace travel plans through the planning system, and implement travel plans in schools in and around areas likely to impact on AQMAs.
- Introducing the display of air quality information, advice and alerts into variable message signs.

4.2.8 Merseyside Case Studies

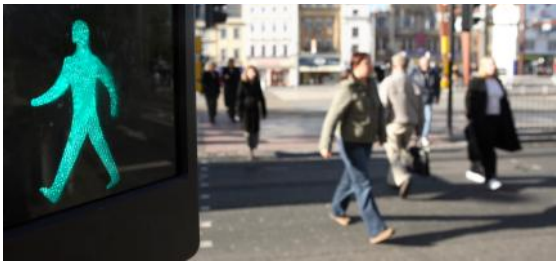
Traffic signal optimisation to reduce emissions in Liverpool

Liverpool City Council is trialling a pollution detection system (called MOTES) that can link to its traffic signal optimisation. This will enable them to develop and test various strategies to smooth or time

[43] ECO Stars Sefton

traffic flows, such as 'green advances' for HGVs to keep them moving through junctions where there is poor air quality rather than stopping/starting which produces more pollution. Feedback from the detection system will enable an assessment of the benefits.

Millers Bridge AQMA in Sefton



At the Millers Bridge AQMA, declared for PM_{10} and NO_2 exceedences, a number of site specific measures were implemented. This included effective regulatory control of industrial sites within the Port of Liverpool (by the Environment Agency) and a programme of regular road sweeping and pavement washing to reduce dust re-suspension (by the local authority). In addition, a 'green advance' system on the traffic signals has assisted with the movement of HGV through the junction to reduce emissions [44]. These, in addition to the relocation of a haulage company out of the area, have all contributed to a reduction in PM_{10} and NO_2 levels at Millers Bridge so that the AQMA can be revoked.

4.2.9 West Yorkshire

The West Yorkshire Integrated Transport Authority (WYITA) and the then West Yorkshire Passenger Transport Executive (WYPTE) (now West Yorkshire Combined Authority) produced MyJourney, a 15-year Local Transport Plan, setting out West Yorkshire's transport needs and ambitions until 2026. LSTF and Pinch Point funds have been successfully obtained for the region.

As well as a range of individual transport-focussed measures that contribute towards more sustainable transport (and reduced emissions), the West Yorkshire authorities have been undertaking significant partnership working.

Leeds and Bradford Councils are undertaking low emission strategy development, with a range of studies and investigations. Leeds collated traffic data for both authorities, while Bradford worked with the Health Protection Agency to produce a draft joint health impact assessment of a LEZ. Low emission scenarios have been developed both for individual authorities and in combination, these will now be assessed for their potential impact on air quality. A combined economic assessment is also planned.

In addition, West Yorkshire Transport Emissions Group has secured funding to develop a county-wide Low Emission Strategy (which comprises Calderdale, Bradford, Kirklees, Leeds and Wakefield).

On vehicle fleets, Bradford has undertaken a gas vehicle trial and Leeds' commitment to low emission vehicles continues with trials of various vehicles and the proposed purchase of further gas (natural and biomethane) powered refuse collection vehicles. Both authorities are encouraging other organisations to trial and consider similar low emission vehicles and refuelling infrastructure.

[44] Sefton Air Quality Action Plan

4.2.10 West Yorkshire Case Studies

Health impacts of a Low Emission Strategy (LES)

The joint Bradford and Leeds LES has put a strong focus on the health impacts (i.e. benefits) of taking action, through measures such as Low Emission Zones (LEZ), freight partnerships as well as mode shift onto active travel modes[45].

Among a range of activities, a health impact assessment of potential LEZ scenarios has been completed. This collected baseline data on health statistics (e.g. mortality, health admissions due to respiratory conditions), made the links to air quality and developed methods to assess impacts of LEZ scenarios. This enabled the low emission strategy study and any future proposal to make a strong links to the relevant public health outcome indicators[46].

Gas Vehicles in Leeds

Leeds City Council began trialling a gas powered refuse collection vehicle in June 2009. A green fleet review identified that while these vehicles accounted for just 7% of the council fleet, they consumed 25% of its fuel – making a disproportionate contribution to pollution and costs. Gas vehicles were identified as one solution to this problem. A subsequent vehicle trial was successful in demonstrating that the vehicle could perform the duties required reliably, while saving money on fuel. Following the trial, the council invested in a permanent gas station, with the help of the Infrastructure Grants Programme. The vehicle purchase programme includes six VW Caddy vans running on gas which have been in service since September 2012, and four MB Econic refuse collection vehicles which entered service in early 2013 [47].

4.2.11 West Midlands

In the West Midlands, as well as the individual air quality action plans produced for each local authority, there are a range of cross-region activities taking place, under the banner of the Low Emissions Towns and Cities Programme (LETCP).

LETCP is a partnership comprising the seven West Midlands local authorities, (Birmingham City Council, Coventry City Council, Dudley MBC, Sandwell MBC, Solihull MBC, Walsall Council and Wolverhampton City Council) working together to improve air quality and reduce emissions from road transport. The partnership is promoting uptake of low emission fuels and technologies, sharing best practice, establishing regional policies and developing various tools and resources.

[45] HIA of Low Emission Zone: Bradford

[46] Bradford MDC Low Emission Strategy

[47] Gas Vehicle Hub Case Study, Leeds City Council

4.2.12 West Midlands Case Study

Examples of good practice guidance and mitigation measures secured through planning obligations and Section 106 agreements

Since the launch of the LETCP in 2011, the partnership has worked with stakeholders to develop a low emissions strategy and good practice guidance on planning and procurement for the West Midlands[48].

Planning obligations are agreements made between local authorities and developers to make developments acceptable which would otherwise be unacceptable in planning terms. Section 106 agreements are an appropriate mechanism for mitigating or compensating against the impact of large scale major developments. The two provide a mechanism to offset additional transport emissions and support a range of infrastructure to encourage more sustainable travel.

The good practice guide includes:

- Background to the policy context supporting the consideration of key pollutants relevant to air quality review and assessment within the planning system.
- An outline of the policies and measures within the National Planning Policy Framework and National Planning Guidance relating to air quality considerations.
- A model for local authorities to use when updating their Air Quality Action Plans, outlining a clear and consistent approach to assessment of planning applications, mitigation and compensation, thus defining what is meant by “sustainable” in air quality terms.
- Provision of a simplified approach, reducing the requirements for air quality assessments while promoting the integration of mitigation into scheme design.

Examples of existing West Midlands development schemes incorporating low emission initiatives, of which can be seen in Table 6, overleaf.

[48] West Midland Low Emissions Towns and Cities Programme – Good Practice Air Quality Planning Guidance

Table 6 - Examples of existing West Midlands development schemes incorporating low emission initiatives

Development	Authority	Date and Method	Operational Phase Measures
Tesco Burnt Tree Supermarket redevelopment	Dudley	2009 as a Section 106 Agreement	Fleet Emission Standards and use and sale of alternative fuels. A financial contribution of £67,000 towards air quality monitoring. A Green Travel Plan.
Tesco Stourbridge Supermarket redevelopment	Dudley	2001 as a planning condition	The position of 8 electric vehicle charging points for the use of customers.
Coseley Eco Park Employment, residential, retail, community hall football pitch, car showroom, trade wholesale, with associated access, roads and car parking	Dudley	2012 planning conditions	Approved with conditions to include submission of Low Emission Strategy, provision of cycle paths and storage facilities, electric vehicle charging points for all dwellings and 5% commercial parking spaces. Additional road network improvements will improve a number of junctions which would otherwise create queuing traffic and hinder traffic flow.
Factory warehouse	Dudley	2012 planning conditions	The installation of cycle storage facilities and one external electric vehicle charging point.
Waterfront South	Walsall	2007 Amended 2009	Charging points and car sharing pool for development.
Gigaport	Walsall	2008 and updated in 2011	Design principles are being applied to the whole area with the aim of minimising use of car travel including promotion of other modes in order to reduce emissions to air.

Source: LETCP Good Practice Air Quality Planning Guidance, 2014

4.3 Guidance on transport actions

This section aims to introduce a range of potential transport actions and a method of selecting these to best fit the problem being faced. It is supported by an Annex of many options, with examples where possible.

4.3.1 Range of options and categorisation

A range of options are available to local authorities, city region authorities and other organisations and agencies to take action on air pollution through transport measures.

Typical to transport projects, many actions can produce co-benefits under other policy commitments. This can include improvements to the economy, congestion, noise, safety, urban realm, streetscape and individuals' physical activity.

A range of potential actions are presented with more detail in Annex A. The method used to categorise potential transport is based on the desired impact. Selecting transport measures by mode, or area of application, is an equally valid approach, and can be combined with the following categorisations:

REDUCE

Reduce the amount of journeys that need to be made, ideally by planning cities/towns so that people do not need to drive or making alternatives to travel attractive. Also, measures to reduce total vehicle mileage within areas of poor air quality.

SHIFT

Shift as many of the journeys which do have to be made onto either non-motorised modes or less polluting road modes per passenger km (e.g. light rail or bus).

IMPROVE

Improve the emissions of journeys that do need to be made by road through:

- *Operational improvements*, based on how an existing vehicle is used on the road (e.g. through priority lanes or based on driver training);
- *Technical improvements*, such modifying an existing vehicle or substituting a standard vehicle with a lower emission vehicle, plus actions that promote these outcomes.

There is also interest in **diverting** any air pollutant emissions which cannot be reduced using barriers, such as the trial of barriers planned at J18 of M62.

Annex A provides further details on potential actions for reducing, shifting or improving journeys with the aim of tackling poor air quality including:

- Focus/description
- Time-scale to implement
- Air quality impact (low, medium, high)
- Cost to implement /operate
- Organisations responsible
- Co-benefits and supporting factors
- Examples of implementation, including:
  - Reference to existing schemes and or locations where this measure has been implemented or is under investigation
  - Reference to the anticipated impacts (for a sample of measures), from previous studies

A selected number of illustrative transport measures can be found in Annex B with a discussion on the impact these might have (in theory) on a major UK city. A series of values from various assessment studies are given to provide an indicative scale of impact of the various transport measures, as applied to the traffic in the city under test. The steps presented also provide an example of how similar scoping work might be carried out to determine what selection or combination of measures may be appropriate in other urban areas.

4.3.2 Selecting transport measures

A key consideration in how well transport measures affect change is from their **scale** or **intensity of application**. A very intensive application of active travel (walking and cycling) at levels seen in some mainland European cities has a much greater effect than travel plans written to satisfy development conditions only. Most transport measures can be applied at varying levels of scale and intensity (and each time may be different) and on which the level of impact depends. Therefore comparability and absolutes (about impact) are hard to define. Similarly, the cost of measures will tend to vary in relation to their scale and intensity.

Generally, the experience has been that small scale, low intensity interventions have only a little impact on traffic emissions and so while cumulatively there may be movement in the right direction this is actually hard to measure. This means little impact in the short-medium term on air quality. Therefore, a strong caveat is given over selecting solely low-cost, easy-to-implement actions as this tends to mean ineffective transport measures. Due to the normally significant background levels of air pollution in urban areas, relatively large changes are required to affect a measurable change.

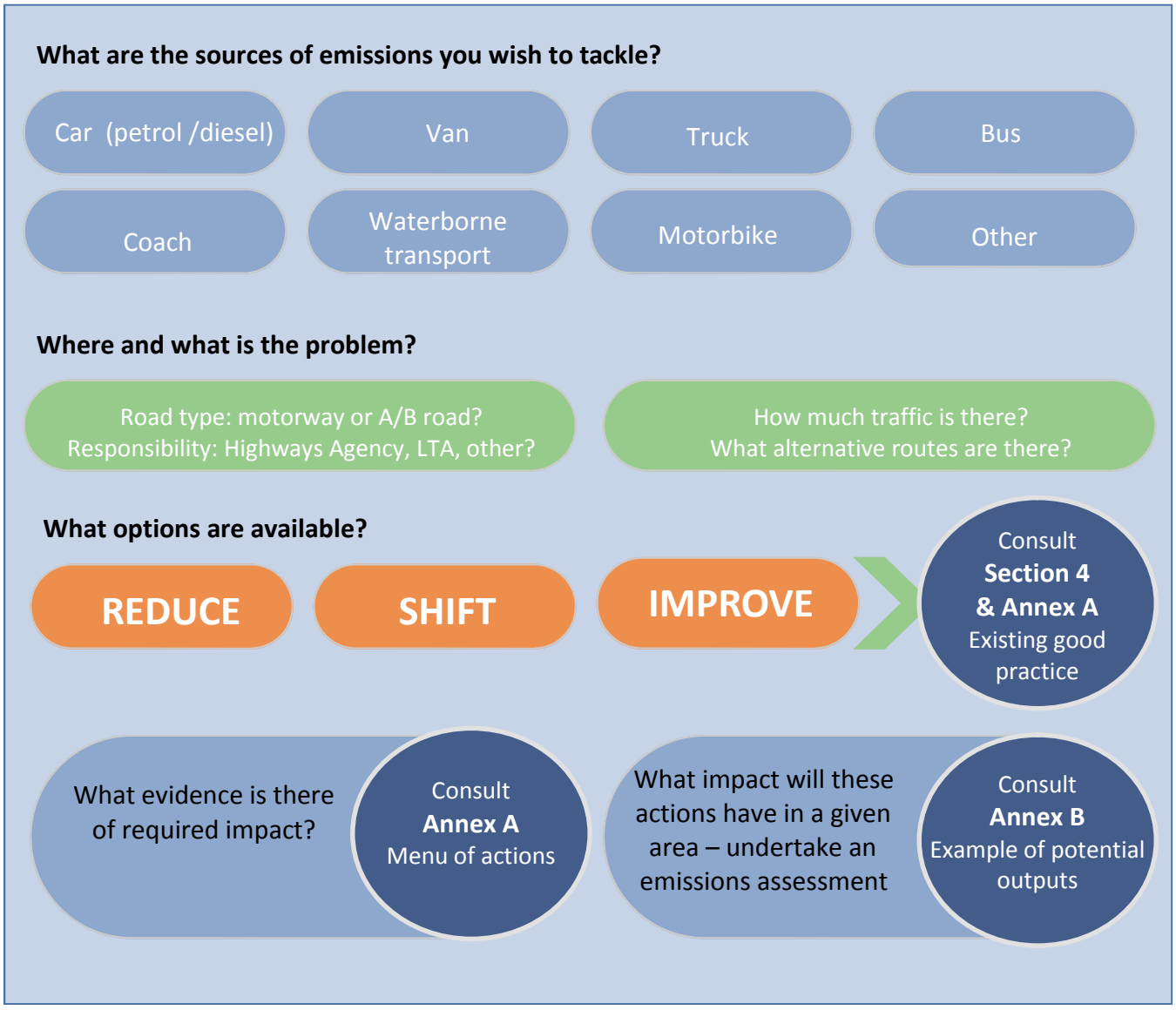
While the transport measures suggested should firstly be considered at their upper scale or intensity if they are to contribute markedly to emission reduction and therefore air quality improvement, there are also opportunities to select measures and apply them at a lower scale or intensity, perhaps as **supporting measures**. This may be useful to ensure a complementary package approach.

The **authority or agency responsible for the road network** in question is key to making changes. Sometimes this responsibility is within the same authority as the air quality action planning function (in

unitary authorities). Even if this is the case, the functions of highways and transport planning/strategy will be led by a separate team to air quality. In most cases selecting the correct measure requires discussion and sharing of information plus analysis from both transport and air quality teams to gain an informed all-round perspective.

Transport policy and planning has inherent uncertainties over impact because of many of the desired outcomes depend to a large degree on the behaviour of individuals in response to a (change in) transport provision or infrastructure. Modelling and forecasting can help understand the impact in advance of scheme implementation, to a degree, but at the scoping and feasibility stages accuracy is hard to produce. More **certainty can be placed on impact of measures** which are mandatory in nature, compared to those that require behaviour change through education or incentives.

A simple method for the selection of measures would be as follows:



4.3.3 Monitoring and reporting outcomes

It is important to track implementation and estimate or measure the impacts where this is possible and proportionate. Local authorities with an AQMA in their area regularly report on activities related to air quality management to Defra (or the relevant devolved administration contact in Scotland, Wales and Department of Environment in Northern Ireland). Defra reviews all progress reports and uses them to base their understanding of the UK's progress towards the EC limit values and national air quality standards.

Monitoring actual changes in air quality may not be the best way to monitor progress, given a significant time period of data is required and intervening weather and other climatic conditions can disrupt the true picture. Other options include setting intermediate indicators or estimating the change in direct emissions as a proxy for improving air quality.

A Annex

Menu of Transport Options

A range of options are available to local authorities, city region authorities and other organisations & agencies to take action on air pollution through transport measures.

This annex presents a range of potential actions, based on the desired impact on road traffic (Reduce, Shift or Improve). Please also refer to the guidance on selecting actions in section 4.3 of the main document.

REDUCE

Reduce the amount of journeys that need to be made, ideally by planning cities/ towns so that people do not need to drive or making alternatives to travel attractive. Also, measures to reduce total vehicle mileage within areas of poor air quality.

SHIFT

Shift as many of the journeys which do have to be made onto either non-motorised modes or less polluting road modes per passenger km (e.g. light rail or bus).

IMPROVE

Improve the emissions of journeys that do need to be made by road through:
- *Operational improvements*, based on how an existing vehicle is used on the road (e.g. through priority lanes or based on driver training).
- *Technical improvements*, such modifying an existing vehicle or substituting a standard vehicle with a lower emission vehicle, plus actions that promote these outcomes.

The following tables span over two pages.

Table A1 – REDUCE the amount of journeys that need to be made
Table A2 - SHIFT journeys which are made to less polluting modes
Table A3 - IMPROVE vehicle emissions through operational changes
Table A4 - IMPROVE vehicle emissions through technical changes

Each table provides examples of transport actions with a range of information on each, including:

- Action name
- Description and focus
- Time-scale to implement
- Air quality impact (on a low, medium, high scale)
- Cost to implement and operate
- Co-benefits, for other policy areas
- Supporting factors, such as whether the action is mandatory or relies on a voluntary action

- Organisations responsible, including where multiple organisations are responsible and joint working is key
- Examples of one or more locations where these actions have been implemented, together with links to further information.

How to view

Each table spans across two pages, for this reason please ensure you view all tables as 'facing pages' or on a two page spread. In this way you are able to obtain all the information you need from the data provided.

Key

A further explanation of the range of values assigned to the descriptions of timescale, air quality impact and cost are given in the key below. It should be noted this is provided as an indication only, based on professional experience and judgement, informed by previous studies and the review of air quality action plans.

Key to Tables A1, A2, A3 and A4					
Timescale		**Air Quality Impacts**		**Costs**	
ST Short Timescale	Up to 6 months	AQ	No significant or measurable impact as will reduce emissions only by a minimal amount on own	£	Under £100k setup and Year 1 operation
MT Medium Timescale	6 months - 2 years	AQ	Will reduce emissions by a more significant amount, likely to have a measurable effect in combination with other measures or at the local level/specific times. Unlikely (on own) to impact on annual average concentrations	££	£100K to £500,000 set up and Year 1 operation
LT Long Timescale	2 years onwards	AQ	Significant and measurable impact	£££	£500,000 set-up and Year 1 operation

TABLE A1 - *REDUCE* the amount of journeys that need to be made

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
1	**Traffic management**	Changes to road layouts and traffic management to reduce general traffic levels and encourage walking/ cycling. Experience shows that removing road-space does not just displace traffic, it tends to also reduce it.	MT - LT	AQ > AQ	££ - £££	- Local / City Region Authorities - Highways Agency	Joint Measure
2	**Strategic highway improvements**	Widen / build highways to reduce congestion or divert traffic from area of poor air quality. Include widening sections of trunk roads/ motorways or bypassing.	MT - LT	AQ > AQ	£££	- Local / City Region Authorities - Highways Agency	Joint Measure
3	**Road User Charging (RUC) / congestion charging**	Apply to an area, key routes and/or times of day to dissuade non-essential and through-traffic.	LT	AQ	££ - £££	- Local / City Region Authorities	
4	**Workplace Parking Levy (WPL)**	Annual charge on private, non-residential parking (off-street)	LT	AQ	££	- Local / City Region Authorities	
5	**Access Management**	Specific streets or whole city centre, with time, weight or purpose restrictions, freeing space for pedestrians, public transport or managed freight/deliveries.	MT	AQ > AQ	££	- Local / City Region Authorities	

[A1] 30 years of car restraint, Oxford UK

[A2] Junctions 28 to 35a Maximum Mandatory Speed Limit - Consultation document

[A3] Case Study London Congestion Charging

[A4] Central London Congestion Charging Scheme

Co - benefits / Supporting factors	Examples
Co-benefits: often include: safety (from speed or conflict reduction) and public realm improvements. **Supporting factors:** road layout changes are mandatory for users so quite reliable.	**Oxford** was probably one of the first UK cities to adopt a traffic restraint policy and abandon road building as a solution to its transport problems, and thanks to its sustained efforts, is one of the least car-dependant cities in the UK [A1].
Co-benefits: often include: safety (from conflict reduction). **Supporting factors:** road layout changes are mandatory for users so quite reliable.	**M1** managed motorway, including provision for four lane running, with 60mph speed limit [A2] in daytime hours.
Co-benefits: congestion reduction aids journey time/reliability. **Supporting factors:** RUC regulations ensure higher levels of compliance and therefore AQ benefits more likely to be achieved.	**London** Congestion Charging Scheme produced significant reductions in traffic inside the zone. Although not its stated purpose the reduction in traffic inside the zone reduced local emissions.
Co-benefits: congestion reduction aids journey time/reliability. **Supporting factors:** regulations will tend to ensure higher levels of compliance.	Employers in **Nottingham** that provide workplace parking places are required to get a licence and, where applicable, pay a charge, as part of the Workplace Parking Levy [A5].
Co-benefits: congestion reduction (or priority for certain vehicles) aids journey time/reliability. **Supporting factors:** regulations will tend to ensure higher levels of compliance.	**Durham** Road User Charging was used to achieve access control [A6], **Cambridge** Core Traffic Management Scheme [A7] prioritised public transport, walking and cycling. **Paris** put in a registration plate ban, alternating between odd and even number plates, during times of very poor air quality and gave free use of bus and the metro system.

[A5] Workplace Parking Levy in Nottingham encourages employers to improve staff travel planning (UK)

[A6] Case Study Durham Road User Charging

[A7] ELTIS - Cambridge (UK) Core Traffic Scheme

TABLE A1 - *REDUCE* the amount of journeys that need to be made

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
6	**Re-prioritising road space away from cars**	Restricting car use and encouraging walking, cycling and public transport.	ST - LT	AQ > AQ	£££	- Local / City Region Authorities	
7	**Parking management**	Can be designed according to the policy it is intended to support, including encouraging: commuter travel by foot, use of low emissions vehicles and use of Park & Ride.	ST	AQ > AQ	£	- Local / City Region Authorities for on-street and council owned sites. - Commercial organisations for (majority of) off street car parks	Joint Measure
8	**Car & lift sharing schemes**	Focused on reducing single occupancy car journeys. Often workplace focussed, on specific employers or business parks.	ST	AQ	£	- Employers, potentially supported by Local / City Region Authorities	Joint Measure
9	**Car clubs**	Can reduce the number of cars in use and raise emission standards (as new vehicles), including low-emission vehicles where specified.	ST	AQ	£	- Local / City Region Authorities - Employers	Joint Measure

[A8] TfL BCS Pilot Evaluation Report

[A9] DfT Local Transport Notes

[A10] London Cycling Design Standards

Co -benefits / Supporting factors	Examples
Co-benefits: congestion reduction (or priority for certain vehicles) aids journey time/reliability, public realm and safety. **Supporting factors:** regulations will tend to ensure higher levels of compliance.	**London** Cycle Superhighways (CS) have seen a rise in the number of journeys on them (83% on CS3 and 46% on CS7) [A8]. A key factor in their success is the use of continual, high quality infrastructure rather than piecemeal interventions. Design guidance can be found on the TfL and DfT websites [A9], [A10]. In **New York** changed road layouts provide more room for pedestrians and cyclists on a city wide scale. They have done this in an effective manner by using simple bollards and road markings. Those that are successful are made permanent when funds become available and those that are not have their old layout reinstated [A11], [A12].
Co-benefits: congestion reduction (or priority for certain vehicles) aids journey time/reliability. **Supporting factors:** demand management will tend to ensure higher levels of compliance.	In **Winchester** public car parking charges were adjusted to provide discounts for drivers of low emission vehicles. Winchester's parking charge structure was adjusted to discount rates for lower emission vehicles [A13].
Co-benefits: congestion reduction (or priority for certain vehicles). **Supporting factors:** Voluntary nature will tend to mean lower levels of take up.	Councils in **Belfast** and **Gloucester** have encouraged informal park and share sites for two or more commuters to park and share one car for the last leg of the journey into the centre. Liftshare, an organisation specialising in car sharing systems, can develop bespoke web pages / portals for employers.
Co-benefits: fuel savings, carbon reduction, maintenance and safety benefits. **Supporting factors:** may require ongoing support from local authorities to maintain scheme, with minimum being allocated parking spaces.	There are a number of car club providers working in cities across the UK, with Carplus providing a useful overview of schemes, evidence and accredited suppliers[A14] .

[A11] Comparing Public Space in Paris and New York

[A12] Sustainable Streets: 2013 and Beyond (NYC)

[A13] ELTIS - Integrated pricing strategies in Winchester/United Kingdom

[A14] Carplus

TABLE A1 - *REDUCE* the amount of journeys that need to be made

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
10	**Workplace Travel Planning**	Encouraging alternative modes for travel to work.	ST	AQ	£	- Employers, potentially supported by Local / City Region Authorities	Scheme Support
11	**Encourage/ facilitate home-working**	Home-working or localised working (e.g. use of shared office space) to reduce car travel.	ST	AQ	£	- Employers, potentially supported by Local / City Region Authorities	Scheme Support
12	**Delivery and Servicing Plans (DSP)**	Based on a review of deliveries and servicing a DSP sets out how to reduce unnecessary (and often duplicated) travel to a site and how to better organise deliveries to suit the receiving organisation.	ST	AQ	£	- Employers, potentially supported by Local / City Region Authorities	Scheme Support

Co - benefits / Supporting factors	Examples
Co-benefits: congestion reduction (or priority for certain road users). Health benefits for employees from using more active travel modes, reduced carbon footprint for business. **Supporting factors:** Voluntary nature will tend to mean lower levels of take up.	Travelwise initiatives, such as the one in **Merseyside** [A15] work directly with schools, businesses and public sector organisations to promote mode shift. Liftshare for business [A16] is an example of a commercial service to support employment site travel planning. Some major employers, such as B&Q [A17], run their own travel plan programmes.
Co-benefits: congestion reduction (or priority for certain road users). **Supporting factors:** voluntary nature will tend to mean lower levels of take-up.	In **London** home working was encouraged by many employers both during the London Olympics 2012 and during tube strikes, and supported by local authorities e.g. Smarter Travel Sutton[A18].
Co-benefits: congestion reduction (or priority for certain road users). **Supporting factors:** exerting influence down the supply chain can be time-consuming, but viewed as relatively reliable way to achieve impacts.	TfL has implemented a DSP for their **London** (**Southwark**) Palestra building [A19].

[A15] Lets Travelwise

[A16] Liftshare My PTP

[A17] A12 B&Q Travel Plans commitment

[A18] Smarter Travel Sutton

[A19] Transport for London freight delivery and servicing plans

TABLE A2 - *SHIFT* journeys which are made to less polluting modes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
13	**Intensive active travel campaign & infrastructure**	Encourage walking, cycling and use of public transport instead of private car.	MT	AQ	£	- Local / City Region Authorities - Employers and potentially NHS	Joint Measure
14	**Personalised Travel Planning**	Advice given directly to households to assist those willing to shift mode for commute, education and personal travel.	ST	AQ > AQ	£ - ££	- Local / City Region Authorities - Employers and potentially NHS	Joint Measure
15	**School Travel Plans**	Encouraging alternative modes for travel to school by children and carers.	ST	AQ	£	- Local / City Region Authorities - Education authorities - Schools	Joint Measure
16	**Promotion of walking**	Develop a quality urban realm which provides pedestrians with a safe, secure and direct network linking city centre with retail, commercial, leisure and transport locations.	MT	AQ	£ - ££	- Local / City Region Authorities - Employers - Schools	Joint Measure

[A20] ELTIS - Darlington (UK) Sustainable Travel Demonstration Town

[A21] DfT Resource library for local authorities

[A22] Travel Blending Australia

[A23] TAPESTRY Project report - Viernheim Household Transport

Co - benefits / Supporting factors	Examples
Co-benefits: congestion reduction, health benefits. **Supporting factors:** requires voluntary changes in behaviours.	**Darlington** [A20], **Worcester** and **Peterborough** participated in the DfT's Sustainable Travel Demonstration Towns over a 5 year period, during which time car use had fallen by up to 9 per cent across the three towns [A21].
Co-benefits: congestion reduction. **Supporting factors:** requires voluntary changes in behaviours, unless twinned with parking reduction at destination.	Various examples are available to refer to that use a range of related techniques to support mode shift and active travel, including: TravelBlending® [A22], Indimark® in **Germany** [A23], TravelSmart® in **Bristol** [A24], UK, TravelSmart® in **Gloucester** [A25], UK
Co-benefits: health, urban realm utilisation. **Supporting factors:** requires significant and continued commitment to ensure growth.	A considerable number of local authorities and schools participate in school travel planning activities, including for example Safer Routes to school, as part of the London STARS initiative [A26]. STARS (Sustainable Travel: Active, Responsible, Safe) is the Transport for London (TfL) school travel plan accreditation scheme. It rewards schools for their engagement with the school community and for carrying out initiatives which result in more pupils and staff travelling sustainably to school. The STARS travel plan site helps schools to create and implement a successful travel plan and apply for one of three awards, Gold, Silver and Bronze.
Co-benefits: health, urban realm utilisation, footfall for businesses. **Supporting factors:** requires significant and continued commitment to ensure growth.	Legible City way finding system in **London** and other cities (**Bristol**, **York**, **Exeter**) allows people to move in and around the city more easily – and feel confident in doing so with way finding maps at key decision points. Studies on the pilot area in London shows that most users strongly agreed that they would walk more because of this infrastructure [A27]. The Pedestrian Environment Review System (PERS) includes a method for conducting audits and general guidance on walkability[A28] which has been produced by TfL explaining the benefits of methods to upgrade the streetscape and urban realm.

[A24] Bristol NHS Travel Smart

[A25] TravelSmart - Changing the way we travel

[A26] STARS is Transport for London's (TfL) school travel plan

[A27] Transport for London - Legible London pilot evaluation results

[A28] Transport for London – Walking good practice

TABLE A2 - *SHIFT* journeys which are made to less polluting modes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
17	**Public cycle hire scheme**	Public cycle hire scheme in city centre to encourage short commutes and link with public transport and work places.	ST	AQ	££	- Local / City Region Authorities - Commercial partners	Joint Measure
18	**Cycle network**	Improve and extend cycle network in the city centre with a network of parallel routes including contra-flow cycle lanes, shared use bus and cycle lanes.	LT	AQ > AQ	££	- Local / City Region Authorities - Commercial partners	Joint Measure
19	**Bus route improvements**	Route based improvements to infrastructure for priority (punctuality and reliability).	MT	AQ	£££	- Local / City Region Authorities	
20	**Bus based Park & Ride**	Encourage Park & Ride use instead of parking in city centres for commuters and longer stay shoppers and visitors.	LT	AQ	£££	- Local / City Region Authorities	
21	**Rail based Park & Ride**	Encourage rail based Park & Ride use instead of long distance driving.	LT	AQ	£££	- Local / City Region Authorities - Network Rail - Train Operating Companies (TOC)	Joint Measure
22	**High Occupancy Vehicle (HOV) lanes**	For car and van users, to encourage car/ride sharing.	LT	AQ > AQ	££	- Local / City Region Authorities	

[A29] The effects of Smarter Choice programmes in the Sustainable Travel Towns

[A30] ELTIS Cycling England Cycling City and Towns end of programme reports

[A31] Bus Priorities – Edinburgh Greenways

[A32] ELTIS – Park & Ride – a success. Edinburgh UK

Co - benefits / Supporting factors	Examples
Co-benefits: congestion reduction, health benefits. **Supporting factors:** requires voluntary changes in behaviours.	Examples include schemes in **London, Bath, Belfast** serving city centre locations, and a number of railway station based schemes including York and via 'Brompton Docks' in Bristol and other station locations.
Co-benefits: congestion reduction, health benefits. **Supporting factors:** requires voluntary changes in behaviours.	**Darlington, Worcester** and **Peterborough** took part in the sustainable travel towns initiative and the evaluation provides evidence of the positive impacts (with around a 9% reduction in car journeys) [A29]. Bristol and other towns and cities participated in the Cycling City demonstrations and implemented a range of infrastructure and promotional measures [A30].
Co-benefits: congestion reduction, health benefits. **Supporting factors:** requires voluntary changes in behaviours.	Extensive use in UK and elsewhere, with evaluation of early schemes (such as in **Edinburgh**) showing positive impacts on bus journey times [A31].
Co-benefits: congestion reduction. **Supporting factors:** requires voluntary changes in behaviours, unless twinned with parking management (restraint) in town centres.	Extensive use of Park & Ride in UK towns, cities and elsewhere (e.g. Reading, **Manchester, York, Leeds, Bradford**). Evidence points to re-routing of car trips (rather than overall reduction) but with the result they are kept out of central areas [A32], [A33].
Co-benefits: congestion reduction. **Supporting factors:** requires voluntary changes in behaviours, unless twinned with parking management (restraint) in town centres.	Many Park & Ride facilities at railway stations in place across the UK network. Can be used to target urban mode shift where there is a good cross-city train services, such as in **Birmingham**.
Co-benefits: congestion reduction and journey time improvements for prioritised vehicles. **Supporting factors:** mandatory nature of road layout will increase compliance if enforced.	A high occupancy 2+ lane has successfully operated on the A647 Stanningley Road in **Leeds** [A34], [A35] since 1998. In the last few years other 2+ lanes have opened; for example on the M606 (from Bradford towards Leeds) and on the A63 to/from M1 junction 45. West Yorkshire's fourth 2+ lane opened just recently on Roundhay Road[A36].

[A33] Park & Ride at West Midlands Stations

[A34] Evidence in Europe. Leeds UK

[A35] ELTIS - High Occupancy Vehicle Lane Demonstration: Leeds, UK

[A36] HOV in Leeds

TABLE A2 - *SHIFT* journeys which are made to less polluting modes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
23	**Development Control**	Limit car parking and ensure good public transport connections and investment in low emission technologies for new developments. Design out the need for vehicular commuting within new builds with mixed use developments. Gain planning contributions to invest in mitigation.	MT - LT	AQ	£ - ££	- Planning Authority	
24	**Promote use of rail and inland waterways**	Various measures, including dock and rail network developments to increase transfer by rail and water (often combined with less road transport).	LT	AQ > AQ	£ - £££	- Local / City Region Authorities - Network Rail - Canals & Rivers Trust - Commercial port owner	Joint Measure
25	**Public transport improvements – interchanges, stations and services**	Aimed at providing efficient public transport interchange points in the city centre.	LT	AQ > AQ	£££	- Local / City Region Authorities - Bus operators - Train operating companies	Joint Measure
26	**Freight consolidation centre**	Goods for delivery are consolidated into full loads at an edge of town warehouse before being moved into city centre, potentially using low emission vehicles.	ST	AQ > AQ	£ - ££	- Local / City Region Authorities - Retailers, third party logistics providers - Major public sector freight attractors	Joint Measure

[A37] Low Emission Zone - Restrictions on vehicle emissions

[A38] SYPTE Plans and Strategies

[A39] Wikipedia - Daventry International Rail Freight Terminal

[A40] Stobart use of DIRFT

Co - benefits / Supporting factors	Examples
Co-benefits: congestion reduction, shorter travel times. **Supporting factors**: requires consistent and long-term decision making on planning and permissions to develop.	**Greenwich** Peninsula LEZ, was put in place through planning conditions and applies to the construction and use phases of the new development [A37]. **Mid-Devon** supplementary planning document paved way for a funding formula linked to emissions generated from a new supermarket development. In **South Yorkshire**, close partnership working between the PTE (SYPTE) and the South Yorkshire districts through the South Yorkshire Land Use Integration (LUTI) project has helped to ensure that new developments are prioritised around existing public transport corridors and that any poorly connected sites are outlined as requiring developer contributions towards public transport services. The work has been welcomed on a city region basis, with partners outside of South Yorkshire now requesting LUTI modelling [A38].
Co-benefits: congestion reduction on roads. **Supporting factors:** requires capacity on rail lines and competition with road freight.	**Daventry** International Rail Freight Terminal [A39] has enabled goods to be shipped across the UK by rail rather than road transport [A40].
Co-benefits: congestion reduction from reduced car traffic. **Supporting factors:** required investment from train, bus and Local Transport Authority.	Various PTE and other Transport Authorities provide examples and experience of public transport interchange design and operation [A41].
Co-benefits: congestion reduction on roads. **Supporting factors:** may require some initial support from local authority or other funding source.	Examples include Freight Consolidation Centres in **Bristol** (serving Bristol Broadmead and **Bath** [A42]), Crown Estate Freight Consolidation centre on Regents Street [A43] and Your Homes **Newcastle's** new freight consolidation centre [A44].

[A41] TfL microsite on interchange design and operation

[A42] Bristol and Bath Freight Consolidation

[A43] Transport for London - Regent Street Consolidation and collaboration

[A44] Your Homes Newcastle - Eco-friendly storage centre to support retailers

Table A3 - *IMPROVE* vehicle emissions through operational changes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
27	**Route management plans**	Apply highway and pavement designs that improve efficiency for all road users on key routes (including car, HGV, public transport, cyclists, pedestrians).	LT	AQ	££	- Local / City Region Authorities - Freight Quality Partnership	Joint Measure
28	**Strategic routing strategy for HGVs**	Work with partners to define routes, and implement physical traffic management measures to assist. May be combined with restrictions into sensitive areas. To ensure freight and servicing can continue to serve economically important areas the design needs careful consideration.	MT	AQ > AQ	££	- Local / City Region Authorities - Freight Quality Partnership - Highways Agency	Joint Measure
29	**Co-ordinate traffic signals and apply other traffic management systems**	Smooth traffic flows, react to events and re-route traffic..	MT	AQ	££	- Local / City Region Authorities	
30	**Anti-idling enforcement**	Reduction in idling vehicles can be done by focussing on enforcement and regulation (by Local Authority) or by working directly to support fleet operators.	ST	AQ > AQ	£	Local / City Region Authorities - Fleet owners (bus, HGV) - Sensitive destination sites (e.g. schools & hospitals)	Joint Measure

[A45] Sefton Council - A565 route management strategy

[A46] Lorry routes and bans – Windsor area, UK

[A47] Tyne and Wear Freight Map

Co - benefits / Supporting factors	Examples
Co-benefits: capacity or reliability improvements. **Supporting factors:** mandatory nature of road changes tends to ensure results.	**Sefton** Council has developed a strategy and draft action plan to improve conditions along the very busy A565 route between Thornton and Seaforth. This managed traffic congestion, improved safety and accessibility (especially for pedestrians) and managing air pollution [A45].
Co-benefits: capacity or reliability improvements. **Supporting factors:** mandatory nature of road changes tends to ensure results.	There are various examples of lorry controls, including in **Windsor** and **London** [A46]. **Tyne and Wear** Freight Partnership, among others, has provided freight route mapping for operators [A47].
Co-benefits: capacity or reliability improvements. **Supporting factors:** mandatory nature of signalisation changes tends to ensure results.	Most UK cities have some level of co-ordinated signals, with examples of time saving in a range of circumstances [A48]. **Liverpool** Council is currently trialling a link between pollution monitoring equipment on the road-side with signalisation techniques [A49].
Co-benefits: fuel savings for operators/owners. **Supporting factors:** mandatory tends to ensure results.	A range of areas have focussed on reducing emissions from idling vehicles, including **Sheffield** and **Sefton** where bus emissions were perceived to be an issue, and **Croydon** and **Manchester** where general information and awareness campaigns took place along with some enforcement [A50].

[A48] Urban traffic control systems – SCOOT, UK

[A49] New technology trial to improve air quality in Liverpool

[A50] Greater Manchester idling vehicle hotline

Table A3 - *IMPROVE* vehicle emissions through operational changes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
31	**Quiet & out of hours delivery**	Deliveries made before and after peak traffic hours. Reduces time and variability spent making deliveries, evidence of small fuel savings.	ST	AQ	£	- Local / City Region Authorities - Freight Quality Partnership - Retailers	Joint Measure
32	**Selective vehicle priority**	Bus lanes or bus / HGV / taxi priority routes.	ST - MT	AQ	£ - ££	- Local / City Region Authorities - Bus operators	Joint Measure
33	**Parking enforcement on highway**	Focus on where stationary vehicles are causing problems to flow traffic (congestion / delays)	ST	AQ	£	- Local / City Region Authorities	
34	**Driver training and ECO driving aids**	For improved fuel efficiency and emissions from car, taxi, van and bus/ coach drivers through better driving habits. Sometimes supported by in-cab technology or monitoring.	ST	AQ	£	- Local / City Region Authorities - Freight Quality Partnership - Employers	Joint Measure
35	**Emissions based parking charges**	Aims to encourage residents to consider vehicles that have lower (carbon) emissions that are also often smaller in size.	ST	AQ	£	- Local / City Region Authorities for on-street parking. - Commercial owners of private off-street parking	Joint Measure

[A51] Transport for London - Retiming & out-of-hours deliveries

[A52] Quiet Deliveries Demonstration Scheme Final Report

[A53] Quiet Deliveries Demonstration Scheme Case Studies

[A54] Bus lanes reintroduced to tackle Colchester air quality

[A55] Highways Agency – M4 bus lane air quality study

[A56] Suspending M4 bus lane breached air pollution law

[A57] Gravesham Borough Council - Pollution control - air quality

Co benefits / Supporting factors	Examples
Co-benefits: fuel and time savings for operators/owners. **Supporting factors:** needs buy-in from local communities and businesses.	Pilot demonstrations during the 2012 London Olympics[A51] and for DfT [A52] / [A53].
Co-benefits: fuel and time savings for operators/owners. **Supporting factors:** mandatory nature tends to mean success, if enforced. After a number of years of introduction they have proved recently contentious.	Bus lanes are widely used in PTE and other areas. In **Colchester** [A54] bus lanes have been reintroduced for air quality purposes. A study of the M4 bus lane showed its removal worsened air quality [A55/ A56].
Co-benefits: congestion reduction. **Supporting factors:** mandatory nature tends to mean success, if properly enforced.	A number of schemes reference anticipated benefits to air pollution including **Gravesham** [A57] and **Hull** [A58]. Air quality benefits were indicated in a study of parking enforcement in **Towchester** by the Highways Agency [A59].
Co-benefits: fuel and vehicle safety benefits for operators/owners. **Supporting factors:** voluntary nature tends to mean ongoing monitoring is required to re-train drivers who slip back.	Various public and private sector organisations run courses and partnerships, including those aimed specifically at emissions saving [A60/ A61/ A62] Various organisations have fitted or supported fitment of in-cab equipment, either through policies (TfL for **London** Bus services) or via grant applications (**West Yorkshire** Combined Authority [A63]).
Co-benefits: may be carbon benefits (if stimulates low emission vehicles). **Supporting factors:** availability of lower emission vehicles is important.	Various **London** boroughs [A64] have set graduated charges for residents parking schemes based on carbon emissions of cars (via car tax bands). **Winchester** provided discounts at public car parks for certain lower emission vehicles [A65].

[A58] Hull City Council – Parking enforcement

[A59] Highways Agency - A5 Towcester Parking (Northamptonshire)

[A60] Fuel Good Training Sessions

[A61] Reduce your Travelfootprint – What is Eco-driving?

[A62] Welsh Government – Freight Best Practice

[A63] Metro – Yellow buses going green

[A64] Eltis - Financial Incentives for using ECO Vehicles in Westminster and London

[A65] Winchester MIRACLES (parking)

Table A4 - *IMPROVE* vehicle emissions through technical changes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
36	**Low Emission Zone (LEZ)**	Set emission standards for specific vehicles entering a prescribed road or region. Can be focussed by vehicle type: HGV, bus, van, car.	LT	AQ > AQ	£££	- Local / City Region Authorities working with: - Highways Agency - Freight industry - Bus operators - Motorist organisations	Joint Measure
37	**Bus fleet improvements**	Rapidly increase average bus emission standards (new vehicles, low carbon bus or exhaust retrofit).	MT	AQ > AQ	£££	- Local / City Region Authorities - Bus operators	Joint Measure
38	**Rapid take up of low emission private cars**	Encourage adoption of electric, hybrid and plug-in vehicles.	LT	AQ > AQ	£££	- Government, - Local / City Region Authorities - Employers - Fleet operators	Joint Measure

[A66] Transport for London – Low Emission Zone

[A67] Oxford Low Emission Zone

[A68] Low Emission Zone - Norwich

Co benefits / Supporting factors	Examples
Co-benefits: may be carbon reduction benefits if stimulates energy efficiency (from low emission vehicles). **Supporting factors:** more complex enforcement systems are required for LEZ covering multiple vehicle types, to ensure compliance. Simple LEZ, focussed on a local fleet (e.g. bus) can use simpler monitoring and checks.	The **London** LEZ initially set emission standards for heavy duty vehicles (bus, coach, truck) and in later years included heavier vans and minibus[A66]. A ultra LEZ is being considered for 2020 in the inner congestion charge zone. **Oxford**'s LEZ focuses on bus fleets[A67], as does **Norfolk**[A68].
Co-benefits: may be carbon reduction benefits if stimulates energy efficiency (from low emission vehicles); improved vehicles benefit to customer experience. **Supporting factors:** generally needs to fits with plans to renew fleet given cost and life-span of buses.	**Nottingham** city electric bus fleet[A69] uses buses which will be recharged by electricity from a municipal waste incinerator. Various local authorities have applied for DfT's Clean Bus Technology Fund[A70], and the majority have received funding to retrofit NOx abatement technology to older buses, and in some cases convert buses to electric or gas power (e.g. **York** and **Sheffield**).
Co-benefits: carbon reduction benefits if stimulates energy efficiency (from low emission vehicles). **Supporting factors:** generally needs to fits with plans to renew cars and requires subsidies, given cost and life-span of cars.	The plugged in places scheme has co-funded large roll-outs of electric vehicle charge point infrastructure across UK cities, for example in the **West Midlands** [A71]. The E-car project for **Northern Ireland** [A72] has focused on charge points on the strategic road network to enable longer distance journeys.

[A69] Transport Minister launches eco-friendly buses

[A70] £5 million boost to cut pollution from local buses

[A71] Plugging in Midlands – Supporting electric vehicles in the Midlands

[A72] ECar charged for success

Table A4 - *IMPROVE* vehicle emissions through technical changes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
39	**Compressed natural gas (CNG)/ biomethane refuelling for HGV / Bus**	Support take-up of gas truck or bus operations through refuelling facilities and demonstrations of vehicles.	MT	AQ *(if high take up)*	££	- Government, - Local / City Region Authorities - Employers - Fleet operators	Joint Measure
40	**Electric Vehicle charging points and priority parking**	Prioritise public parking for electric and low carbon vehicles.	MT	AQ > AQ	££	- Local / City Region Authorities - Employers	Joint Measure
41	**Fleet efficiency and recognition schemes**	Voluntary fleet recognition and advice schemes that encourages HGV, bus, coach and van operators to move towards a cleaner fleet and improve fuel efficiency.	ST	AQ	£	- Local / City Region Authorities - Freight Quality Partnership - Other fleet Operators	Joint Measure

[A73] GVH – Gas Vehicle Hub

[A74] ELTIS - Bio-methane powered vehicles and filling station in Sheffield, UK

[A75] ELTIS - Installation of On-Street Recharging Points for Electric Vehicles

Co - benefits / Supporting factors	Examples
Co-benefits: strong carbon reduction benefits if biomethane is used. **Supporting factors:** generally needs to fits with investment plans to renew fleets, given cost and life-span of vehicles and need to plan for long-term use of a gas filling station.	The DfT Low Carbon Truck Demonstrations[A73] are funding a series of gas refuelling stations and gas HGV fleets. Sheffield has been developing the case for and experience of CNG refuelling stations [A74].
Co-benefits: carbon reduction benefits and reduction in running costs. **Supporting factors:** generally needs to fits with plans to renew cars and requires subsidies, given cost and life-span of cars.	There has been a major roll out of charge point infrastructure in a number of major urban areas[A75]). Source London oversees over 1,300 publicly available charging points in **London**[A76]. The City of **York** [A77] are helping install charge points at leisure destinations.
Co-benefits: fuel savings, carbon reduction, maintenance and safety benefits. **Supporting factors:** requires ongoing monitoring and measurement to maintain benefits and ensure continual progress, including central resource/champion.	ECO Stars fleet recognition scheme implemented in many towns and cities in the UK and Europe [A78]. Fleet Operators Recognition Scheme (FORS) [A79]. Freight Best Practice Programme [A80].

[A76] Source London

[A77] Zero Carbon World - York Case Study: A new way of driving

[A78] ECO STARS fleet recognition scheme

[A79] Fleet operator recognition scheme

[A80] Welsh Government – Freight Best Practice

Table A4 - *IMPROVE* vehicle emissions through technical changes

ID	Action	Description and Focus	Timescale to implement ST - Short MT - Medium LT - Long	Air Quality Impact AQ - Low AQ - Med AQ - High	Costs £ - Low ££ - Med £££ - High	Organisations responsible	
42	**Taxi licensing conditions**	Set age or Euro limits for licensing.	MT	AQ	£	Licensing Authority (i.e. Council)	
43	**Taxi emission incentives**	Give incentives/priority to cleaner vehicles at key ranks e.g. Taxi ECO Stars.	ST	AQ	£	- Local / City Region Authorities - Taxi owners and operators	Joint Measure
44	**Procurement priority for companies with lower emission vehicles**	Across all Council procured services, e.g. – waste collection/recycling – parcel delivery – school transport	MT	AQ > AQ	£	- Local / City Region Authorities - Other public sector fleet operators	Joint Measure

Co - benefits / Supporting factors	Examples
Co-benefits: fuel savings, carbon reduction, maintenance and safety benefits. **Supporting factors:** requires ongoing monitoring to maintain benefits.	TfL sets age limit for licensed taxis (black cabs) and private hire vehicles in **London** [A81]. Many other local authorities set age limits for new taxi registrations with aim of encouraging a newer, less polluting fleet.
Co-benefits: fuel savings, carbon reduction, maintenance and safety benefits. Supporting factors: requires ongoing funding to maintain benefits.	The **Mid-Devon** ECO Stars scheme[A82] includes a parallel fleet recognition scheme for taxis and private hire operators [A83]. The City of **York** has been offering grants to taxi operators to buy hybrid vehicles[A84].
Co-benefits: potentially lower carbon where there are overlaps. Supporting factors: required strong support and involvement from procurement.	**Hampshire** County Council low carbon procurement strategy recognises use of low carbon alternative fuels [A85]. **Sefton** Council and the LES Partnership have developed a process guide for Sefton Council procurement. The guide emphasises the need to influence the procurement activity at all stages and particularly at the outset, when there is most scope to affect subsequent emissions [A86].

[A81] Mayor's Air Quality Strategy

[A82] Mid Devon ECO Stars Fleet Recognition Scheme

[A83] Mid Devon ECO Stars Fleet Recognition Scheme for Taxi and private hire vehicles

[A84] City of York Council - Joyair

[A85] Hampshire County Council Corporate procurement strategy

[A86] Low emission strategies – Liverpool City Region

B Annex

Estimating the impact on emissions and air quality

A joint TTR-TRL study (2013) undertook assessments of a range of transport measures applied (in theory) to a major UK city to scope out options for tackling air pollution in exceedence of limit values across many roads and junctions and surrounding areas. The main steps were:

1. Select a range of transport/traffic actions, some working across the whole city centre and inner city suburbs (including residential streets) and others just on key radial routes
2. Compile traffic data for representative road links, estimate emissions from each vehicle class and total emissions from traffic
3. Estimate the change in transport emissions from altering the road traffic in line with selected actions (that either reduced, shift or improved the emissions of road traffic);
4. Estimate the impact on air pollution through changes in air quality pollutant concentrations:
    - at the immediate road-side
    - at background levels, i.e. away from roadside

The main steps and resulting traffic, emissions and air pollutant concentration values are set out below. These provide an indicative scale of the impacts that might be expected from various transport measures as applied to the traffic in the city under test. They also provide a suggested approach for local authorities to undertake similar scoping work. Finally, they illustrate a range of measures described in Annex A, applied in a real city context.

Step 1 Select a range of measures

This example study deliberately focussed on the measures (and their variations) with the greatest impact. While acknowledging these may be challenging to consider for implementation it was necessary understand the scale of change to air quality from theoretical changes to traffic given the size of the problem with poor air quality and difficulty making progress in previous years. It is possible to scale back on implementation if a measure is over effective.

Illustration of transport measures can be seen overleaf - Table B1.

Step 2 Compile traffic data, estimate emissions

Road links were selected for a small range of representative road types, locations, traffic flow, classification by vehicle type and speed data matched to locations (Table B2).

Using this information, and pollutant information available from tools such as the Emissions Factor Toolkit[B1] the contribution of different vehicle types to overall levels of pollution (and what these overall levels are) can be calculated. The share of road transport pollution on each type of road from each vehicle type is shown in Table B3 on page A27 in what is referred to as the 2013 baseline emission source apportionment. (Table B3).

[B1] Emission Factor Toolkit

Table B1 - Illustrative selection of transport measures

Location	A-Road (wide single)	Urban Motorway
Test	**Type**	**Description**
Test 1	Low Emission Zone	Same standards as for the London LEZ: Euro IV minimum for PM levels on bus, coach and HGV plus Euro 3 (for PM) on large vans and minibus.
Test 2	Low Emission Zone "Plus"	Euro V for all vehicles (including cars, but not motorcycles).
Test 3	Freight consolidation centre	Able to service majority of shops in central retail district (excluding 3-4 major flagship retailers who already practice consolidation techniques).
Test 4	Bus fleet A	All buses are assumed to be very latest Euro VI.
Test 5	Bus fleet B	All bus are Euro V, with older vehicles retrofitted via NOx/PM equipment on exhaust (as done by many applying for Clean Bus Technology Fund).
Test 6	Bus fleet C	Any Euro IV buses in the fleet are upgraded to Euro V, via engine re-programming.
Test 7	Traffic cells	Selective road closures (permeable to pedestrians, cyclists and some public transport) are anticipated to reduce city centre and suburban short trips by car/van (up to 5km in length) by up to 50%. This leads to overall car/van traffic falling (with correlating reductions of 4%, 12% and 22%) in this part of the traffic flow.
Test 8	Major active travel schemes	Increases cycling to 20% (desired target) and then 30% (best in Europe levels) of mode share (which produces a resulting reduction in general car/van traffic flows of 12% and then 22%).
Test 9	Road user charging (RUC)	Reduces car trips (only) in AM peak by 15% and PM peak by 5%.
Test 10	A reduction in all traffic flow	Of 25% and also 50% to provide a benchmark (all vehicles, including buses).

Table B2 - Summarised traffic information

Location	Total Flow	Cars	LGV	HGV	Buses / Coaches	Motor Cycles	Average Speed
Measure	AADT*	%	%	%	%	%	Km / h
City Centre road	7991	79	11	2	6	2	21
Single carriage A-road (District Centre)	6739	77	14	2	5	3	23
Wide single carriage A-road (some 2 lane sections)	10786	77	15	3	3	2	37
Urban motorway (4 lane)	29690	84	11	3	1	1	73

* Annual Average Daily Traffic

Table B3 - 2013 Baseline emission source apportionment

Location	Petrol Cars	Diesel Cars	LGV	HGV	Buses / Coaches	Motor Cycles
CO_2(%)						
City Centre road	35	25	10	6	24	1
Single carriage A-road (District Centre)	35	25	14	6	19	1
Wide single carriage A-road (some 2 lane sections)	35	26	15	11	12	1
Urban motorway (4 lane)	42	29	13	12	3	1
PM_{10} (%)						
City Centre road	23	32	14	6	25	1
Single carriage A-road (District Centre)	23	32	19	5	19	1
Wide single carriage A-road (some 2 lane sections)	25	33	19	10	12	1
Urban motorway (4 lane)	31	40	15	10	3	1
$PM_{2.5}$ (%)						
City Centre road	19	34	14	6	26	1
Single carriage A-road (District Centre)	21	35	20	8	15	1
Wide single carriage A-road (some 2 lane sections)	21	35	19	10	13	1
Urban motorway (4 lane)	27	43	16	10	3	1
NOx (%)						
City Centre road	6	24	10	10	50	0
Single carriage A-road (District Centre)	7	27	14	9	42	0
Wide single carriage A-road (some 2 lane sections)	8	29	17	19	28	0
Urban motorway (4 lane)	12	43	18	20	7	1

The information displayed in Table B3 is useful as it can be used to confirm or investigate what vehicles are causing most or least pollution on different types of roads.

The baseline source apportionment showed that light duty vehicles (car and LGV [van]) contributed between circa 70 and 85% of CO_2 and PM_{10}/ $PM_{2.5}$ emissions, with higher figures at the Urban Motorway location compared to the other three sites. The remaining 15 to 30% of pollutant emissions were attributable to Heavy Duty Vehicles (Heavy Good Vehicle [HGV], Bus, Coach). This is broadly in line with the percentages of total traffic flow made up by these vehicle types.

However, for NOx emissions, then the split for three non-Motorway test sites between light duty and heavy duty vehicles was around to 50:50. This is largely due to a disproportionate amount of emissions from buses, given their relatively small numbers compared to other traffic.

Step 3 Estimate the change in transport emissions

The traffic flows, mix and age profile are changed in line with the selection of measures (chosen in Step 1) and a new set of emission estimates are made. This can normally be done using the same pollutant information available from tools such as the Emissions Factor Toolkit. This again provides the contribution of different vehicle types to overall levels of pollution (and what these overall levels are). It gives a view on differences from the baseline. Table B4 shows the differences in percentage, which represents one way of measuring impact of the selected transport measures.

Table B4: Illustrative impact of transport measures on traffic emissions - average change in road traffic emissions for each test scenario by location

Test	Description	City Centre		Single carriage A-road (District Centre)		Wide single carriage A-road (some 2 lane sections)		Urban Motorway (4 lane)	
		Road NOx	Road PM	Road NOx	Road PM	Road NOx	Road PM	Road NOx	Road PM
1	LEZ (as London)	-11%	-9%	-9%	-7%	-8%	-6%	-4%	-3%
2	LEZ Plus (all to Euro V)	-17%	-30%	-20%	-30%	-27%	-26%	-42%	-25%
3	Freight Consolidation Centre	-1%	-1%	-2%	-1%	-1%	-1%	0%	0%
4	Bus A (all fleet Euro VI)	-29%	-8%	-25%	-6%	-17%	-3%	-5%	-1%
5	Bus B (all fleet Euro V)	-3%	-4%	-3%	-3%	-5%	-2%	-2%	0%
6	Bus C (all Euro IV to V)	2%	0%	1%	0%	-1%	0%	-1%	0%
7a/ 8a	Traffic cell/Active travel (4% reduction in car traffic)	-1%	-2%	-1%	-2%	-2%	-2%	-2%	-3%
7b/ 8b	Traffic cell/Active travel (12% reduction in car traffic)	-4%	-7%	-4%	-7%	-4%	-7%	-7%	-9%
7c/ 8c	Traffic cell/Active travel (22% reduction in car traffic)	-7%	-12%	-8%	-12%	-8%	-13%	-12%	-16%
9	Road User Charging (peak)	-1%	-2%	-1%	-2%	-1%	-2%	-2%	-2%
10a	All traffic reduced (25%)	-25%	-25%	-25%	-25%	-25%	-25%	-25%	-25%
10b	All traffic reduced (50%)	-50%	-50%	-50%	-50%	-50%	-50%	-50%	-50%
10c	All traffic increased (25%)	25%	25%	25%	25%	25%	25%	25%	25%

This information can provide a number of insights, for example:

- Firstly, it is prudent to note the two theoretical, comparator tests (Test 2 LEZ Plus and Test 10b, All traffic reduced by 50%) in order to appreciate the lower impact from the remaining transport measures that are more likely to be implemented.

- For standard LEZ (London equivalent), bus fleet renewal (to latest standard) and active travel (largest mode shift) were the measures with the largest impact on emissions across the various sites and pollutants (of NO_x and PM).

- There are variations in impact depending on test location, which is due to existing traffic composition and the manner in which a given measure then changes that traffic and vehicle mix.

- The scope for reducing traffic emissions by focussing on buses is demonstrated by the potential impact of Euro VI buses, which the latest emission standard designed to bring emission benefits in real-world operations. Other bus fleet options, not tested, but anticipated to give similar emission reductions would be via natural gas / biomethane fuelled vehicles or battery electric buses.

- Active travel and traffic cells were interchangeable in terms of the mode shift away from car/ van and onto bike (or walking), therefore all modelled under Test 7/8 (a, b and c) for different intensities of application. The most ambitious (50% of current short trips by car/van shifted to walk/cycle) results in a 22% reduction in general car traffic and reduces emissions by up to 15% (on Urban Motorway where LDV dominate emissions) and up to 12% at other test sites.

Step 4 Estimate the change in air pollution

The task is to estimate the impact on air pollution, through air quality modelling (known as dispersion modelling). In this study air pollution at two different types of location were studied (for each of the four types of road).

Normally this step would be done by someone with air quality modelling expertise, so it is expected that transport and air quality teams work together. There are various tools available, but again getting advice from air quality officers or other professionals experienced in this area is recommended.

A) Changes in air quality pollutant concentrations (on pollution at the immediate roadside);

For roadside pollution Table B5 provides a summary of the main results for road NO_2 showing the average and percentage change concentrations across all receptors compared to the baseline concentration of annual mean road NO_2 levels. The focus was on just NO_2 and also a smaller number of the transport actions (generally the more ambitious in impact).

The values are estimated changes in absolute NO_2 concentration levels (Table B5), based on the road pollution element. Overall air pollution will be higher as there are other sources.

The reduction is however representative as in these tests it is the road traffic (and therefore pollution) that is changed. The annual average limit for NO_2 is 40 µg/m3.

In some cases (with % figures in brackets) this shows the % change in pollution against the baseline. This is not done for every cell, just a few to give an impression of typical changes in pollution from road traffic due to these measures.

The study also estimated the impact of traffic increases, with a flow increase of 25% (under test 10c).

Table B5 - Average change in annual mean road component NO_2 concentration

Test	Description	Baseline - Annual mean road NO_2 concentration (µg/m^3)	Average change in concentration (µg/m^3) Where modelled also shows maximum (% change) baseline v.s. road NO_2			
			A-road (District)	City Centre	A-road – wide single	Urban motorway
1	LEZ (London)	6.6	-0.2 to -0.4	-0.7 (11%) to -0.3	-0.3 to -0.6	-0.2 (5%) to -0.5
2	LEZ (London) Plus	6.6	-0.6 to -1.6	-1.1 (17%) to -2.8	-0.9 to -2.3	-1.8 (43%) to -0.7
3	Freight consolidation centre	3.8	-0.1 (2.4%)	-0.2	-0.1	-0.1
4	Bus Fleet A (All Euro VI)	6.6	-1.1	-1.8 (28%)	-1.5	-1.1
7c & 8c	Traffic cells / Active travel (22% reduction in car trips)	5.3	-0.3	-0.6	-0.44 (8%)	-0.3
9	Road user charging	4.1	-0.1	-0.1	-0.1	-0.07 (2%)
10a	Traffic change (25% reduction)	3.8	-1.0 (26%)	-1.7	-1.4	-1.0
10b	Traffic change (50% reduction)	3.8	0.9 (23%)	-1.5	-1.2	-0.9
10c	Traffic change (25% **increase**)	3.8	+1.9 (50%)	+3.3	+2.6	+2.0

B) Changes in air quality pollutant concentrations (background levels, i.e. away from roadside)

An additional task was completed to start to understand the impact of selected measures on background concentrations. Background 'sites' are locations in the urban area that are not directly next to a main road, but instead represent pollution levels in the general urban area. This is where the majority of the population live (Table B6). In this study a relatively simple method was used to avoid time consuming modelling. The results were derived for just two example measures, the LEZ (London) Plus and the major active travel measure.

The results indicate the scale of impact a given road NO_2 change might have on background concentrations if the measures are widely applied. The most relevant area wide measures are: LEZ and active travel (supported by traffic cells). In both cases the change in µg/m^3 value for the background pollution is greater than the modelled road NO_2 value, and in the case of an LEZ considerably higher at almost twice the reduction value (+194%).

Table B6 - Estimated change in NO_2 concentration at two urban location (away from at roadside)

Location	A-Road (wide single)	Urban Motorway
Measure	Active Travel (-22% car / van)	LEZ Plus (all Euro V)
Road NO_2 change	- 0.44 (µg/m^3)	- 1.8 (µg/m^3)
Background NO_2 change	- 0.6 (µg/m^3)	- 5.3 (µg/m^3)
% additional impact (road NO_2 value to background value)	+50%	+194%

Conclusions

The analysis indicates that measures that target sub-sets of the traffic, or certain types of journeys, may on their own make only a small contribution to removing the problem of air pollution exceeding limit values. This suggests that a reasonably large number of travel behaviour and traffic activity changes may be needed to make a significant impact.

The analysis of the relationship between roadside and background pollution also provides an indication that applying measures that affect the vast majority of roads in a widespread area is key to achieving more significant air quality improvements, and because these roads feed into background air quality, such measures could bring down background pollution levels by a larger proportion than seen at roadside.

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ANNEX A

TABLE A1 - *REDUCE* the amount of journeys that need to be made

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ANNEX B

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Glossary of Terms

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
BCS	Barclays Cycle Superhighway
CRC	Carbon Reduction Commitment
Defra	Department for Environment Food and Rural Affairs
DSP	Delivery Servicing Plan
EC	European Commission
EU	European Union
FCC	Freight Consolidation Centre
HA	Highways Agency
HIA	Health Impact Assessment
ICGB	Interdepartmental Group on Costs and Benefits
ITA	Integrated Transport Authority
LAQM	Local Air Quality Management
LEPS	Local Enterprise Partnerships
LETCP	Low Emissions Towns and Cities Programme
LEZ	Low Emission Zone
LTA	Local Transport Authority
LTP	Local Transport Plan
NAEI	National Atmospheric Emissions Inventory
NAQS	National Air Quality Standards
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxide
PM	Particulate Matter
PTA	Public Transport Authority
PTE	Passenger Transport Executive
RUC	Road User Charging
UTMC	Urban Traffic Management Control
WHO	World Health Organisation
WPL	Workplace Parking Levy