



Glasgow City Council Draft Air Quality Action Plan 2008



Executive Summary

The Environment Act 1995 requires that local authorities review the air quality within their boundaries. Where the review concludes that air quality objectives will not be met within the statutory timeframe then the local authority is required to designate an Air Quality Management Area (AQMA). The local authority is then required to produce an Air Quality Action Plan (AQAP) to demonstrate how the Authority intends to work towards meeting the air quality objectives within its AQMA.

Glasgow's first AQMA was declared in 2002 for the City Centre area and subsequently the City Centre AQAP was produced in 2004. Since that time further assessment concluded that the boundary of the original AQMA required to be increased and that new AQMAs were required for both Parkhead Cross and for the Byres Road/Dumbarton Road area.

This document sets out Glasgow City Council's 2008 Air Quality Action Plan and aims to improve air quality in the three AQMAs designated on the 1st July 2007. The Plan sets out a number of actions, ranging from Low Emission Zones (also required for the 2014 Commonwealth Games) to Tree Planting, that have been identified to reduce levels of the air pollutants Nitrogen Dioxide (NO₂) and Particulate Matter (PM₁₀).

The measures in this draft AQAP are those that are currently considered to be the most cost effective and appropriate for Glasgow. Following consultation with key stakeholders and members of the public, and a review by the Council's Executive Committee, a final version of this AQAP will be published.

An annual report will be produced following the implementation of this action plan and will outline progress together with the inclusion of any additional actions into the plan.

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Copies of this document are available:

In electronic format on the air quality pages of Glasgow City Council's website at:-

<http://www.glasgow.gov.uk>

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- Land and Environmental Services, Glasgow City Council
- Development and Regeneration Services, Glasgow City Council
- Scottish Environment Protection Agency
- Strathclyde Partnership for Transport
- Scottish Government

Contents

	Page
1 Executive Summary	2
2 Introduction	6
3 Requirement for an Air Quality Action Plan	8
4 Air Pollution – Sources and Health Effects	10
4.1 NO₂ and Oxides of Nitrogen	10
4.2 PM₁₀	12
5 Air Quality Management Areas In Glasgow	13
5.1 Parkhead Cross AQMA	13
5.2 Byres Road and Dumbarton Road AQMA	14
5.3 City Centre AQMA	15
6 Background to City of Glasgow	16
6.1 Glasgow - Population and Location	16
6.2 Meteorology	17
6.3 Industry and Economy	17
6.4 Transport	19
6.5 Future Transport Development	21
7 Air Pollution Monitoring	29
8 Current and Future Air Quality	31
8.1 Current Levels of NO₂	31
8.2 Future NO₂ Levels	33
8.3 Current PM₁₀ Levels	33
8.4 Future PM₁₀ Levels	34
9 Actions Taken To Date On Air Quality	35
10 Improving Air Quality - The Way Forward	38
11 Consultations	40
12 Costs and Benefits	41
12.1 Cost-Benefit Analyses/Time Scales	41
12.2 Benefit Analyses	41
12.3 Estimated Costs of Actions	42
12.4 Timescales for Action Implementation	42

13	Actions	44
	A - Low Emission Zones	44
	B – Public Service Vehicles	46
	C – Idling Vehicles	47
	D – Emission Testing	49
	E – Cleaner Taxis	51
	F – Council Workplace Travel Plan	53
	G – Construction Sites	54
	H – Domestic Emissions	55
	I – Promote Greener Vehicles	56
	J – Prohibition of Bonfires	57
	K – Planning Guidance	58
	L – Leading by Example	59
	M – Parking Levies	61
	N – Air Quality Information	62
	O – Car Clubs	63
	P – Tree Planting	64
14	Actions not Proceeded	65
15	Summary of Actions Table	67
	Appendix A – Air Quality Management Areas	
	Appendix B – Local Transport Strategy Actions	
	Appendix C –Action Plan Working Group Invitees	
	Appendix D – Option Testing Assessment	

2.0 Introduction

In 2004 Glasgow City Council produced an Air Quality Action Plan with the aim of reducing levels of nitrogen dioxide (NO₂) in the city centre. The plan was required in terms of the Environment Act 1995 following the city centre being declared an Air Quality Management Area in 2002.

Since that time, further monitoring and modelling of air quality data has established that if no action is taken, additional parts of the city will also fail national objectives. Therefore on 01/07/07 Glasgow City Council declared new Air Quality Management Areas (AQMA) for the following three areas;

1. City Centre
2. Parkhead Cross
3. Byres Road & Dumbarton Road

All three AQMA currently fail the 2005 NO₂ objective while the City Centre is also predicted to fail the particulate matter (PM₁₀) objective required by 2010. It may be that further areas within the city might also fail to meet the 2010 PM₁₀ objective; however additional monitoring data will be required before modelled predictions for these areas can be determined.

This new 2008 Action Plan will address all three AQMA while building upon the measures introduced under the original 2004 Plan. Road traffic, while not the only source of air pollutants, is the main source of such pollution within Glasgow. It has therefore been considered appropriate to prepare a single Action Plan covering all three AQMA rather than three separate Plans with broadly similar measures.

This plan examines a series of options to tackle air pollution and a package of short, medium and long term actions are identified as appropriate to take forward within Glasgow. The primary goal of this plan is to improve air quality within the AQMA however the measures required to bring about this improvement will have air quality benefits for other parts of the city including areas to be used for the Commonwealth Games in 2014.

The actions within this plan are limited to actions where the Council can influence change. The Council cannot, for example, reduce the levels of air pollutants blown in from outside the city or from motorways (motorways are the responsibility of the Scottish Government).

An exact prediction of improvement in air quality that will be brought about through the actions in this Plan is an extremely complex matter, and therefore this report cannot guarantee that the required air quality objectives will be met. It should however, be noted that the combined effect of the actions presented within this Plan are anticipated to bring about a cumulative reduction in air pollution, with the aim of bringing levels to within the statutory requirements.

3.0 Requirement for an Air Quality Action Plan

The National Air Quality Strategy sets out the air quality objectives for seven of the main air pollutants. The objectives set limits to be achieved by certain dates for each pollutant. The air quality objectives represent a balance, between reducing air pollution to levels at which there would be no significant risks to human health, with the wider economic and social costs and technical feasibility of reducing pollution. For example, there are no safe levels of particles, but it would be impossible to eliminate them completely from the environment.

The Environment Act 1995 requires local authorities to undertake regular reviews of current air quality and also assessments of whether future air quality objectives are likely to be met by their set compliance dates. Where breaches of air quality objectives are predicted, local councils must declare an Air Quality Management Area and produce air quality action plans, containing measures aimed at achieving the objectives. There is no legal duty on councils to achieve the objectives, as a significant proportion of the air pollution in a particular area will have its source outside of that area and therefore be beyond the control of the local authority. The duty on councils is to take action to try to meet the objectives by identifying who is responsible for the pollution and seeking their co-operation in minimising it.

At a national level the Scottish Government must ensure the prescribed limits for air quality in the European Union's Air Quality Framework and Daughter Directive are met.

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as:	
Benzene	3.25 $\mu\text{g m}^{-3}$	Running annual mean	31.12.2010
1,3-butadiene	2.25 $\mu\text{g m}^{-3}$	Running annual mean	31.12.2003
Carbon monoxide	10 mg m^{-3}	Running 8 h mean	31.12.2003
Lead	0.5 $\mu\text{g m}^{-3}$	Annual mean	31.12.2004
	0.25 $\mu\text{g m}^{-3}$	Annual mean	31.12.2008
Nitrogen dioxide (NO_2)	200 $\mu\text{g m}^{-3}$ not to be exceeded more than 18 times per year	1 h mean	31.12.2005
	40 $\mu\text{g m}^{-3}$	Annual mean	31.12.2005
Particles (PM_{10})	50 $\mu\text{g m}^{-3}$ not to be exceeded more than 35 times per year	24 h mean	31.12.2004
	40 $\mu\text{g m}^{-3}$	Annual mean	31.12.2004
	50 $\mu\text{g m}^{-3}$ not to be exceeded more than 7 times per year	24 h mean	31.12.2010
	18 $\mu\text{g m}^{-3}$	Annual mean	31.12.2010
Particles ($\text{PM}_{2.5}$)	12 $\mu\text{g m}^{-3}$	Annual mean	2020
	15% Cut (target)	(Urban background exposure reduction)	Between 2010 and 2020
Sulphur dioxide	350 $\mu\text{g m}^{-3}$ not to be exceeded more than 24 times a year	1 h mean	31.12.2004
	125 $\mu\text{g m}^{-3}$ not to be exceeded more than 3 times a year	24 h mean	31.12.2004
	266 $\mu\text{g m}^{-3}$ not to be exceeded more than 35 times a year	15 min mean	31.12.2005

Fig 3.1 The National Air Quality Strategy Objectives for Scotland

4.0 Air Pollution – Sources and Health Effects

Air quality legislation introduced following the smogs of the 1950s has brought about major improvements in air quality in the UK. More recently, restrictions on emissions from industry, road transport and domestic sources have further improved air quality. Despite this trend of general improvement it is currently estimated that air pollution reduces the life expectancy of every person in the UK by an average of 7-8 months with estimated equivalent health costs of up to £20 billion each year*.

There is therefore, still much to be done. The European Environment Agency describes air pollution as “the environmental factor with the greatest impact on health in Europe...responsible for the largest burden of environment-related disease”**.

In Glasgow city centre the pollutants identified to be of concern are NO₂ (a gas formed during the combustion process) and PM₁₀ (very small air borne particulate matter less than 10µm in diameter). At both Parkhead Cross and the Byres Road & Dumbarton Road area, NO₂ is the only pollutant of concern.

4.1 NO₂ and Oxides of Nitrogen

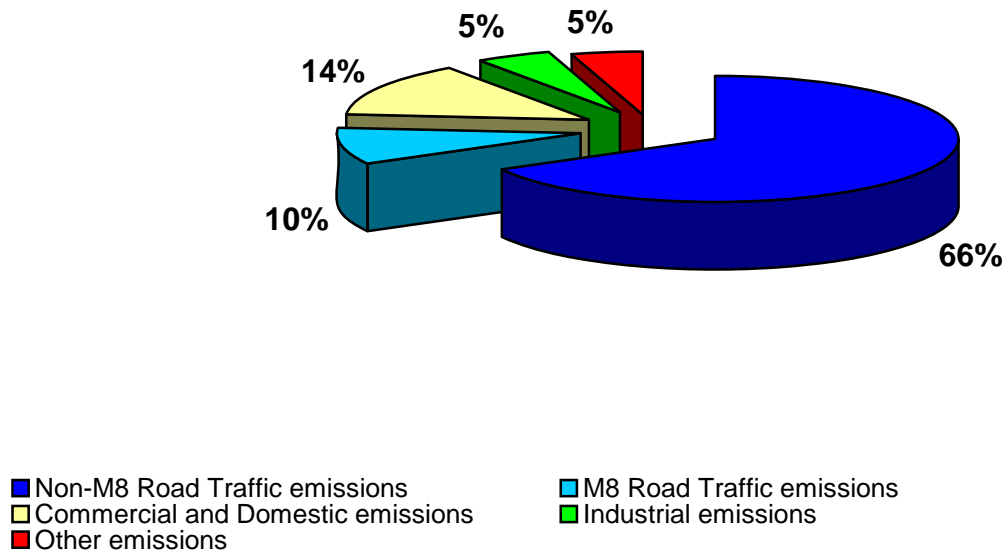
Nitrogen oxides are produced by the burning of fossil fuels and biomass (e.g. forests or agriculture) and from some industrial processes. Oxides of nitrogen (NO_x) is a collective term for the two main nitrogenous gases that cause air pollution problems, nitric oxide (NO), and NO₂. Oxygen or ozone reacts with NO in the air to produce NO₂. Oxides of nitrogen occur both naturally as well as being produced by human activities. The largest source of NO_x in the UK is road traffic, although power generation also produces a significant amount. In Glasgow, like many other urban areas, motor vehicles are the dominant pollutant source, responsible for 76% of NO_x.

* Written Ministerial Statement by Jonathan Shaw on the Air Quality Strategy - 17 July 2007

** EEA Report No 10/2005

Fig 4.1 Estimated contributions from sources to total NO_x emissions in Glasgow

(source : National Atmospheric Emissions Inventory)



Although NO is the primary pollutant the impact on human health is caused by the NO₂ formed when NO is oxidised. High levels of NO₂ can have impacts on sensitive people including children, the elderly and those who suffer from respiratory conditions like asthma and bronchitis.

4.2 PM₁₀

Particulate material comes from a wide range of sources, some of which are naturally occurring (such as sea salt, dust, pollen, forest fires and from as far as the Sahara desert). There are several sources of particulates emitted by human activity, either directly as primary particulates or through secondary particulates formed by reactions involving other pollutants. The main sources are combustion processes including industrial processes, vehicle exhaust and waste incineration, as well as quarrying processes and construction activities. This Action Plan is concerned with particulate matter of diameter of 10 microns or less (PM₁₀), however new objective levels for PM_{2.5} within the 2007 National Air Quality Strategy will require to be addressed in the near future.

While UK emissions of PM₁₀ declined by 48% between 1990 and 2004, urban development and increased traffic congestion has meant that some city locations are experiencing an increase in levels of PM₁₀. In Glasgow 73% of PM₁₀ emissions are attributed to road traffic*, mostly from diesel engines but also from tyre wear and brake dust.

High levels of PM₁₀ pollution are associated with cardiovascular illness and mortality as well as other ill-health effects, and bring about an increase in hospital admissions for those with pre-existing lung or heart disease.

* National Atmospheric Emissions Inventory

5.0 Air Quality Management Areas in Glasgow

Following review and assessment of air pollution levels across the city, Glasgow City Council declared three new Air Quality Management Areas on 01/07/07. The declared areas are as follows;

5.1 Parkhead Cross

Parkhead Cross is formed by the convergence of five roads in Glasgow's east end. The roads are Westmuir Street, Tollcross Road, Springfield Road, Duke Street and Gallowgate. The Area is a mixture of commercial and residential properties within mostly tenement buildings.

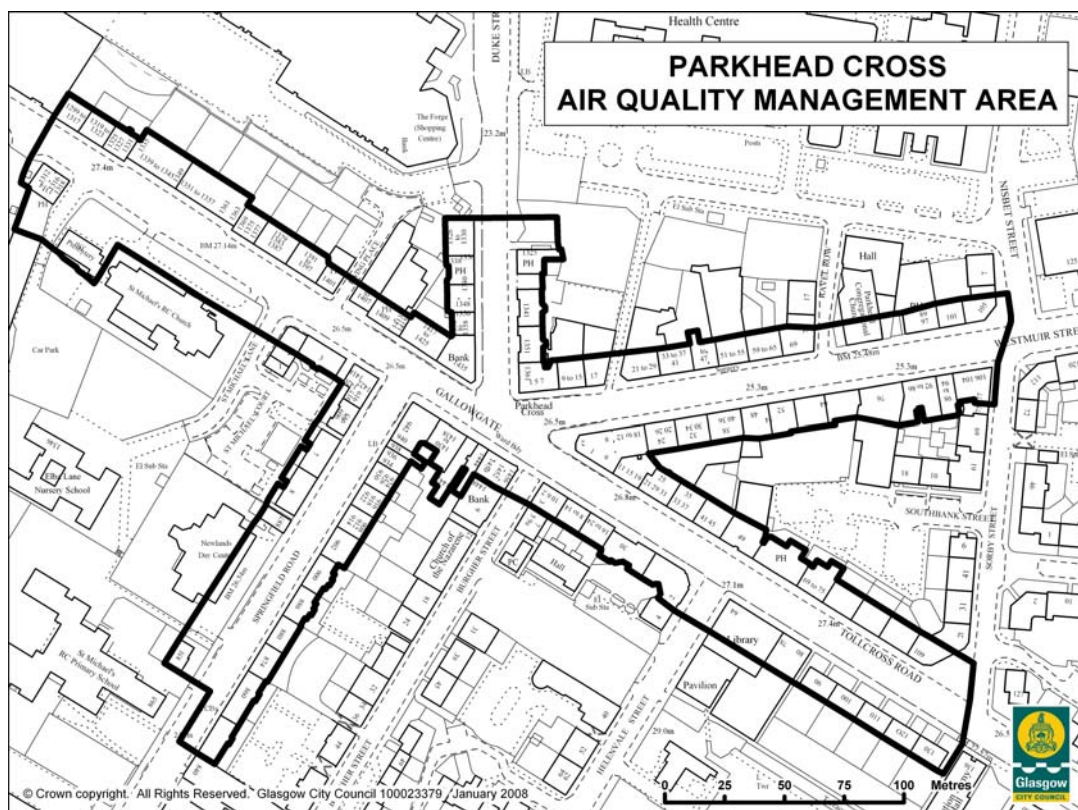


Fig 5.1 Parkhead Cross Air Quality Management Area

The detailed street listing for this AQMA can be found in the 01/07/07 declaration (appendix A)

5.2 Byres Road and Dumbarton Road

Byres Road and Dumbarton Road are at the heart of Glasgow's west end and comprise a mixture of residential and commercial properties within mostly tenement buildings. The Area covers from the junction of Byres Road and Great Western Road south to Dumbarton Road and west along Dumbarton Road as far as Thornwood Drive.

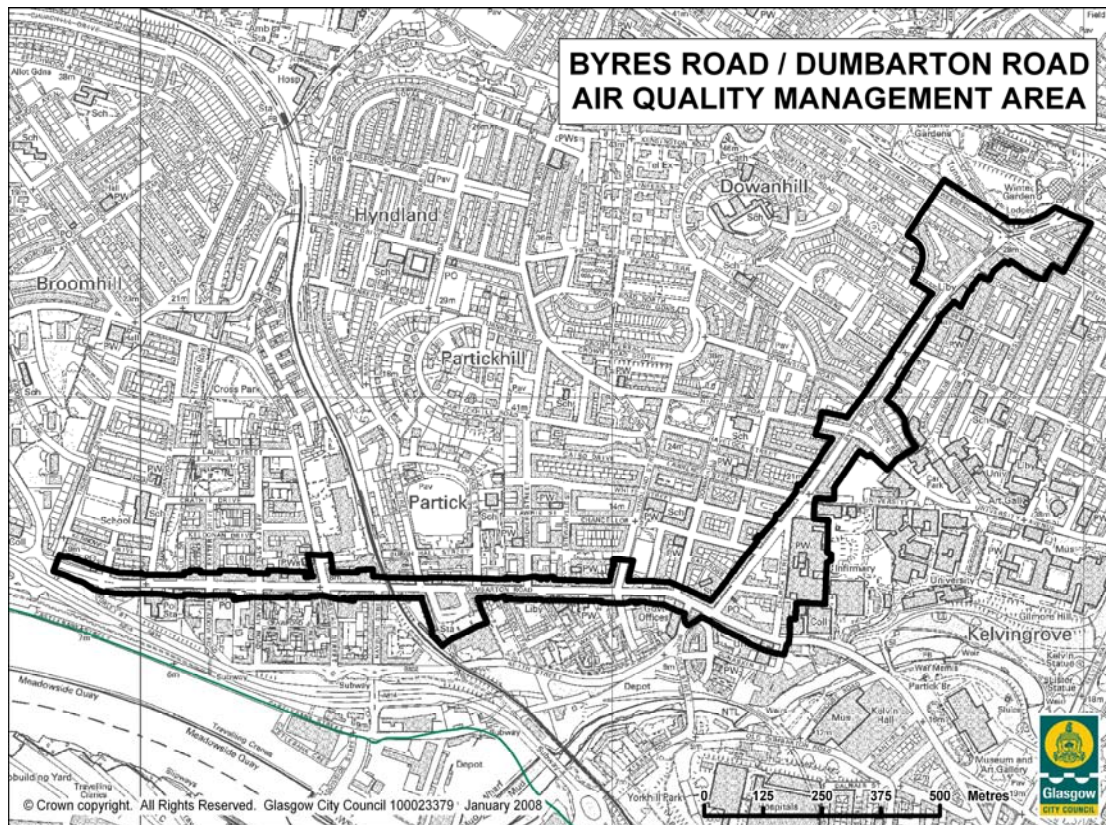


Fig 5.2 Byres Road and Dumbarton Road Air Quality Management Area

The detailed street listing for this AQMA can found in the 01/07/07 declaration (appendix A)

5.3 City Centre Air Quality Management Area

The city centre Area has been extensively developed with a large number of multi-storey properties for both commercial and residential use.

The city centre AQMA is loosely bound by the M8 motorway to the west and north (with minor protrusions at North Street and Robroyston Road), by High Street and Saltmarket to the east and by the river Clyde to the south.

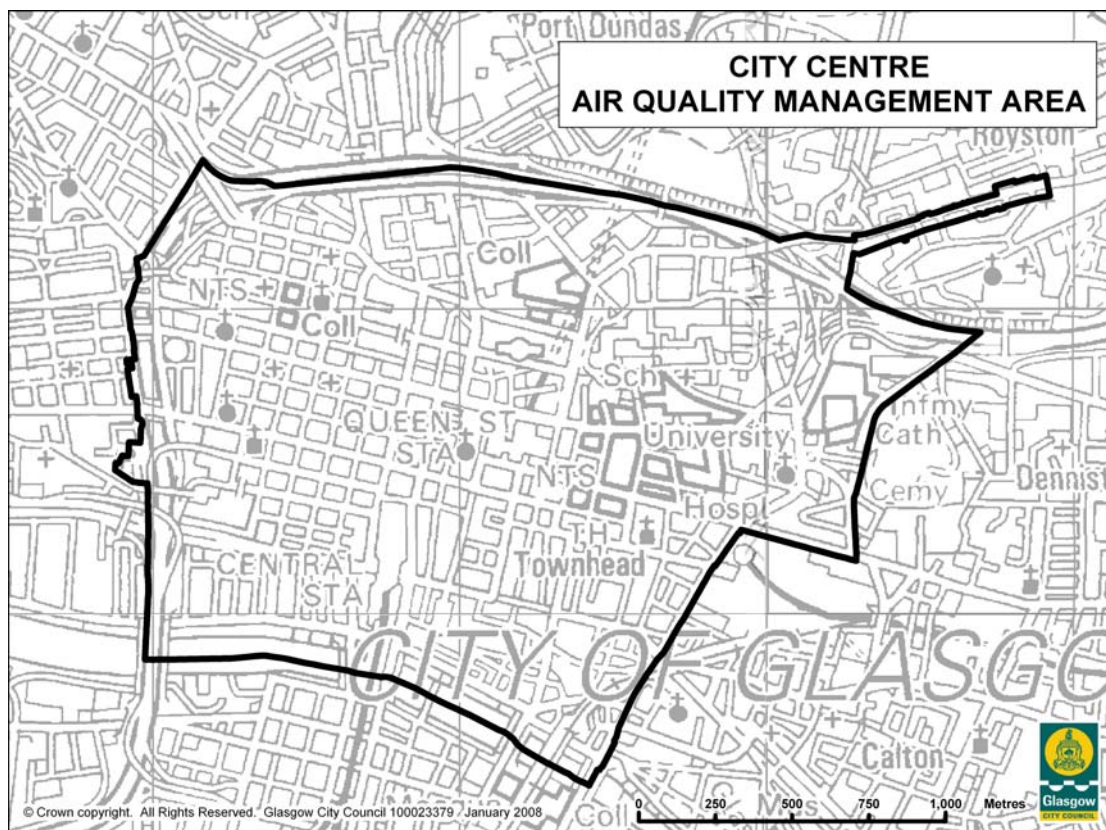


Fig 5.3 City Centre Air Quality Management Area

The detailed street listing for this AQMA can be found in the 01/07/07 declaration (appendix A)

6.0 Background to City of Glasgow

6.1 Glasgow – Population and Location

Glasgow is Scotland's largest city with an estimated resident population of around 600,000, of which approximately 60% are estimated to be in the 'economically active' 20-65 yr age range. The city is located on the banks of the river Clyde on the western end of Scotland's Midland Valley. Following relatively recent boundary changes, the city now covers the area outlined in Fig 6.1, an area comprising some 17,730 hectares or approximately 68 square miles of land, of which about 20 % is classified as countryside or green belt land, whilst some 10 % is vacant land.



Fig 6.1 The City of Glasgow's Current Boundaries including AQMA's

6.2 Meteorology

Due to its relatively sheltered position, Glasgow commonly experiences winter temperatures similar to those experienced at locations in southern Britain, but cooler summers than such locations. The mean annual temperature of the city is approximately 9 °C with a mean maximum of around 12 °C and mean minimum of around 5 °C. The diurnal range of temperature is normally a good deal larger in summer than winter, varying from less than 2 °C in January to an average of about 6 °C in July.

Glasgow experiences a fairly modest 1400 h of sunshine a year but approximately 1200 mm of rainfall, with the first half of the calendar year generally drier than the final six months. Maximum daily levels of precipitation in the Glasgow area are generally around 50 mm. A particular feature of precipitation in the Glasgow area is the combination of heavy rainfall with high winds, which results in 'driving rain', most commonly in a south-westerly direction. Glasgow suffers from this phenomenon more than any other comparably sized settlement in the United Kingdom.

In addition, the Glasgow basin can occasionally experience fogs, which are either carried inland from the Firth of Clyde with light summer winds, carried by advection currents through the Midland Valley from the east coast, or more commonly result from the drainage of cold air into the Clyde Valley from the surrounding hills on calm, cold nights.

6.3 Industry and Economy

In recent decades Glasgow's economy has experienced significant changes. The traditional base of mercantile, engineering, and marine industries still remain but in much smaller numbers. Other production industries have modernised around new technologies and city centre services have increased in importance in recent years. Glasgow is the principal business focus in Scotland and one of the largest office centres in the United Kingdom. Service industries now account for approximately 80 % of the workforce with manufacturing, other production and construction employing the majority of the remaining 20 %.

Despite these changes in industry, Glasgow still produces around 18% of Scotland's gross domestic product and remains the fourth largest manufacturing hub in the United Kingdom, behind London, Birmingham and Leeds. Furthermore, Glasgow represents the largest shopping nucleus in Scotland and the second in the United Kingdom after London. It draws trade from the whole of the west of Scotland and beyond. In addition, the city also attracts large numbers of visitors both national and international to tourist attractions such as museums and galleries, for the use of sports, leisure and business venues, whilst the three Universities located in the city (Glasgow, Strathclyde and Glasgow Caledonian) increase visitor numbers still further.

Glasgow will also host the 2014 Commonwealth Games when over 6000 athletes and officials from around the world and many thousands more spectators will visit the city for the duration of the games.

6.4 Transport

In common with other large cities, Glasgow has a requirement to transport people in and out of the city quickly and effectively, whilst also functioning as a major modal point of the Scottish modal transport system. Consequently, Glasgow has experienced a continuous increase in road traffic. The city has an extensive road network consisting of some 40 km of motorway and 1700 km of other public roads.

The backbone of the road system is the M8 motorway that runs through the city and continues to Edinburgh (A8/M8) (Fig 6.2). At the Baillieston Interchange, on the eastern outskirts of the city, the M8 links, via the M73, with the M74/A74 route to Carlisle and the south, and with the M73/A80 route to Stirling and the north.

The M77 (Ayr road route) was completed in November 1996 and runs through the south west of the city.

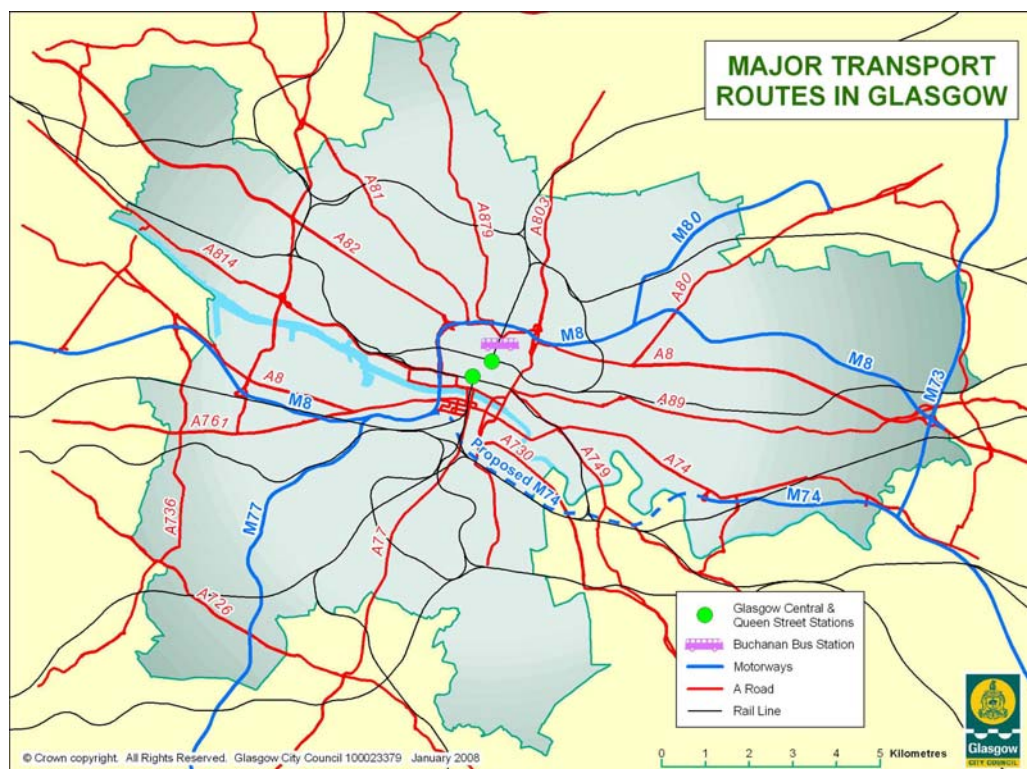


Fig 6.2 Major Transport Routes in Glasgow

Several other major routes radiate from the city centre. These include the Clydeside Expressway, Great Western Road, Springburn Road, Cumbernauld Road, Edinburgh

Road, London Road, Paisley Road West and the M80 Stepps bypass. A large proportion of journeys along these routes are by commuters in private cars travelling into the city. As a result there is frequent congestion on routes leading to the city during peak periods.

As well as the road system, a modernised underground railway system and the largest suburban commuter rail network in the United Kingdom outside London also operate in Glasgow. The rail network is used to make 100,000 daily passenger trips in or out of the six central area stations, with almost 20% of this figure accounted for by morning peak hour movements alone. Two major railway stations (Queen Street and Glasgow Central) are sited within Glasgow city centre and link to a further 60 railway stations throughout the city, five of which have park and ride facilities. The SPT Subway (Glasgow Underground) operates on 10.4 km of double track and handles more than 40,000 passengers a day and is estimated to be used by about 10% of city centre travellers.

In addition, a main bus station (Buchanan Bus Station) is also situated within the city centre (See Fig 6.2). The scale of equivalent bus movements is such that about 16,000 bus trips are made into or across the central area during the morning peak hour period. Buchanan Bus Station is used by an estimated 35,000 passengers per day. It offers a significant terminal resource for both coach and local bus operators. Glasgow International Airport lies some 10 km west of the city centre, outwith the city boundary.

6.5 Future Transport Development

Future transport development within and around Glasgow has the potential to have a major impact on air quality in Glasgow. Air Quality was therefore an important consideration in the Council's Local Transport Strategy (LTS). A list of all the measures proposed within the LTS can be found in Appendix B. The following developments are some of the major developments planned for Glasgow and the surrounding area that are expected to have a positive impact on air quality:

6.5.1 City Centre Transport Plan

Glasgow is currently undertaking a review and update of the City Centre Traffic Management Strategy and opportunities for further enhancing the public realm, including pedestrian priority areas, improved public transport and reducing traffic volumes and thereby pollution in the city centre and its gateways. The strategy is focussing on enhancing the priority and reliability for public transport, walking and cycling within the city centre and discouraging unnecessary private car access. At the same time, the strategy will accommodate city centre residents, blue badge holders and traffic essential to sustain the economic functions. The strategy is also looking at ways of enhancing the physical public realm, particularly the quality and legibility of main pedestrian spaces, development areas and main access routes. The strategy should therefore help to reduce harmful traffic emissions while enhancing road safety and personal security for all city centre users.

6.5.2 The M74 Motorway

The M74 completion (Fig 6.3) will complete the missing link between the M74 at Fullarton Road and the M8 to the west of the Kingston Bridge. This development and its potential impact on air quality have been reported in the M74 Environmental Statement 2003 and are therefore not repeated in detail here. However to summarise, the M74 completion is expected to bring about a slight improvement in air quality within the city centre AQMA by redirecting traffic away from the city centre section of the M8. It is also expected that the relief to traffic congestion on local roads will allow priority to be allocated to public transport, cyclists and pedestrians.

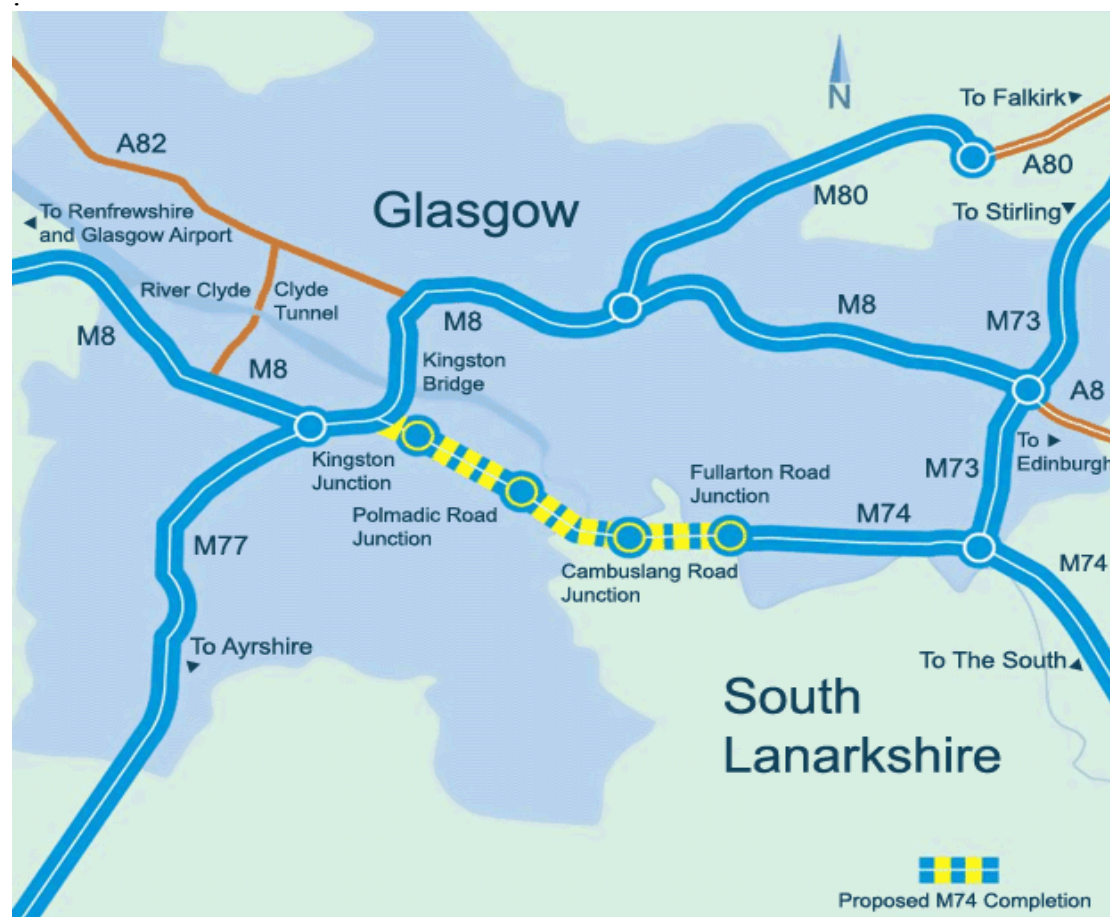


Fig 6.3 M74 Completion Route

(Transport Scotland, © Crown Copyright)

6.5.3 Glasgow Airport Rail Link

Strathclyde Partnership for Transport (SPT) is working on a new direct rail link between Glasgow Central station and Glasgow International Airport. SPT estimate that “in 2003, 8.2 million people used Glasgow Airport with 95% of people travelling to the airport by road”. British Airports Authority also forecast that patronage will almost treble by 2030. The proposed works will enable a direct rail service to Glasgow Airport for the first time and therefore help ease congestion from airport traffic on the M8 into and through Glasgow.

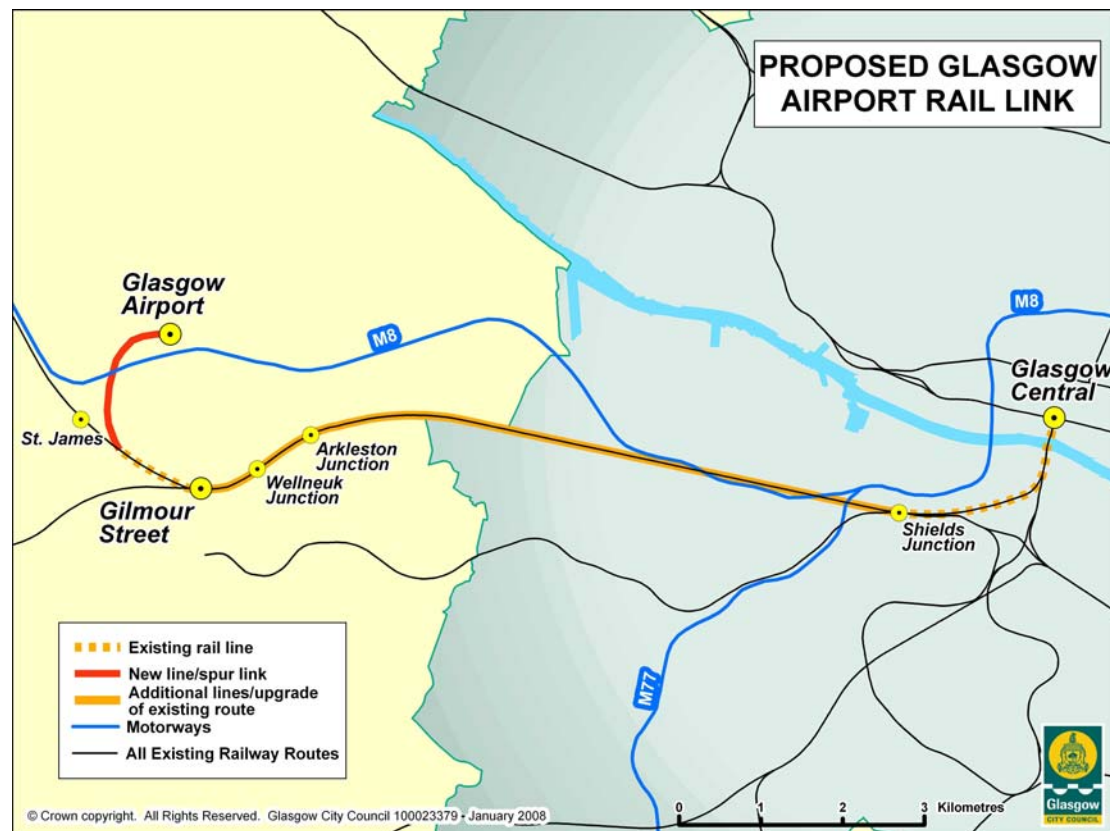


Fig 6.4 Route of Glasgow Airport Rail Link (based on information from SPT)

6.5.4 East End Regeneration Route

Glasgow's East End Regeneration Route (EERR) programme is an ambitious programme that involves the construction of a 3.8km road with the aim of improving accessibility between the East End of Glasgow and the strategic road network. The works which should facilitate regeneration in the Clyde Gateway area are expected to reduce traffic flow through Parkhead Cross and therefore have a positive impact on air quality in that area.

The route of the EERR will extend northwards from Rutherglen Bridge and connect the M8/ M80 with the proposed M74 completion. The development of this road will complement the M74 completion.

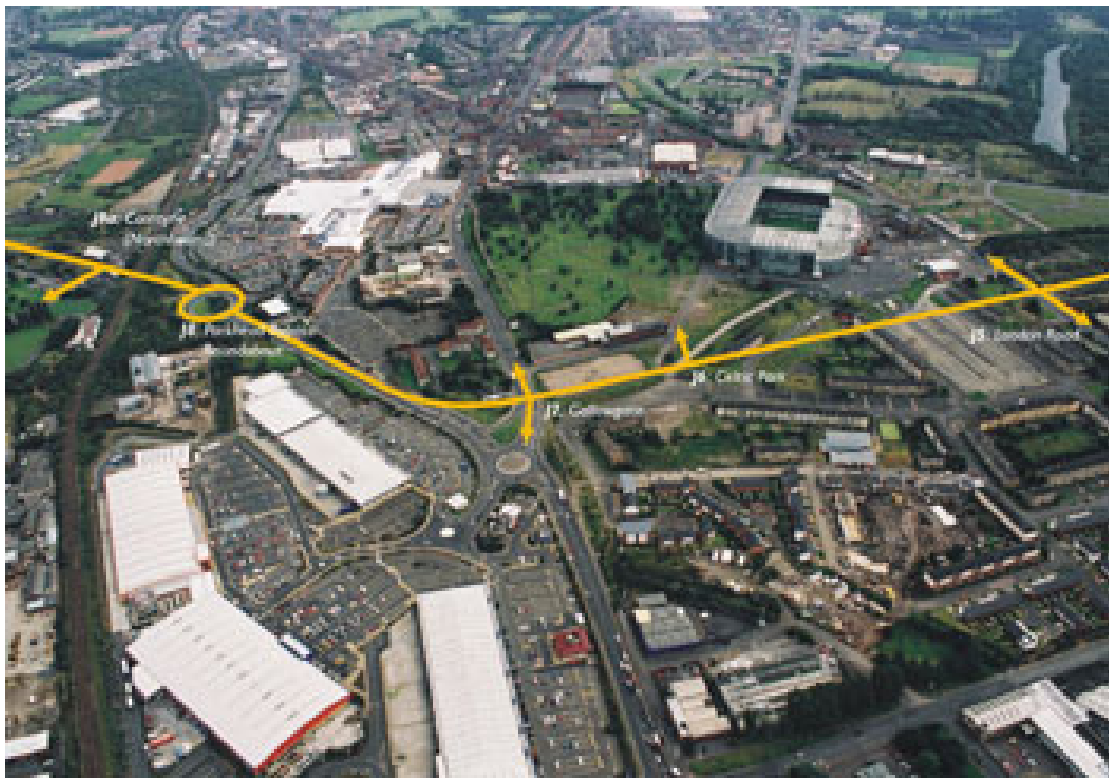


Fig 6.5 East End Regeneration Route

6.5.5 Clyde Fastlink

Glasgow City Council has drawn up proposals for a new public transport system for the Clyde Corridor which will not only provide better access, but will also help tackle increased traffic congestion and associated air pollution in the city centre.

Clyde Fastlink will be a state of the art public transport system running at a six minute interval service.

The route will be from the city centre along the northern bank of the River Clyde, via the International Financial Services District, SECC, and the new Transport Museum, and terminating at the west end of Glasgow Harbour. The public transport vehicle will provide many of the benefits of a tram without the rails embedded in the ground.

From Glasgow Harbour to the eastern end of Broomielaw, the system will be almost fully segregated from the existing road network, running on its own private section. Two-way sections will be provided for this length of the route, with the exception of a short section on Broomielaw at Lancefield flats where it will be on-street due to land constraint. In the city centre section it runs in a clockwise one-way loop passing below Glasgow Central at the “Heilanmans Umbrella” and sharing the network with all other traffic, but running on bus lanes where possible to minimise delay (Fig 6.6).



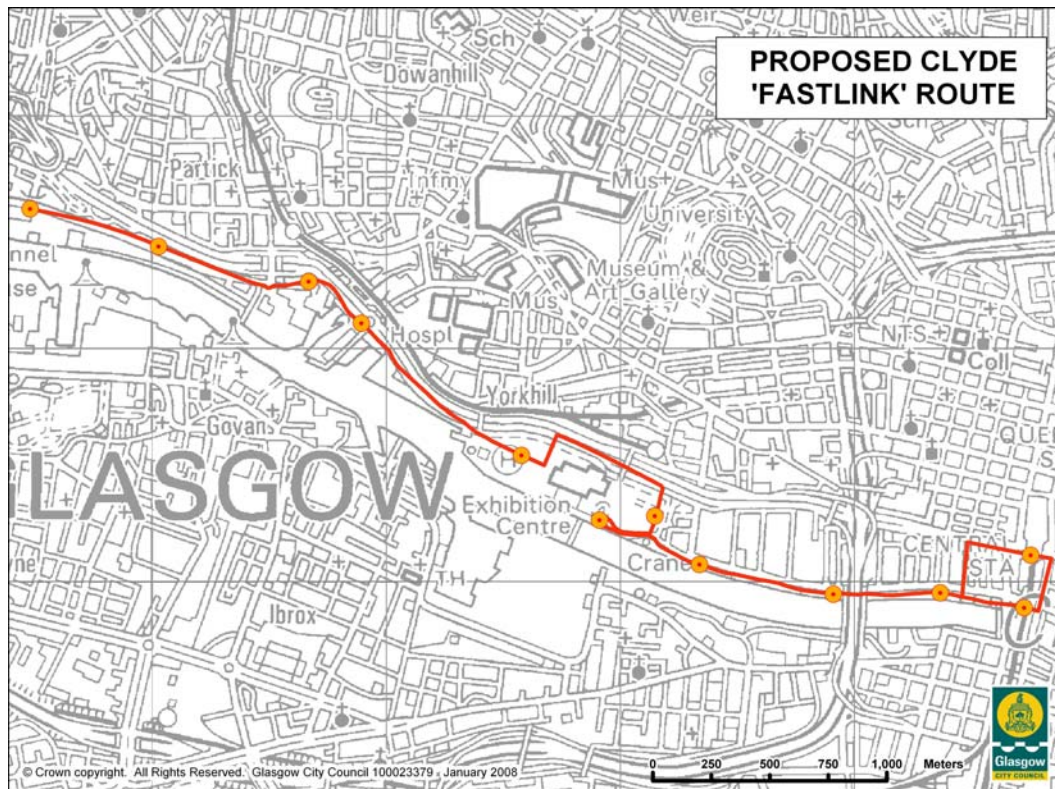


Fig 6.6 Route of Clyde Fastlink

6.5.6 Partick Interchange Redevelopment

Partick interchange consists of a train and underground station and bus stances. It is located within the Byres Road and Dumbarton Road AQMA just off Dumbarton Road. The interchange is one of the busiest in Scotland with 4 million travellers passing through it each year. With extensive regeneration works including new home building in the west end of the city, the station is set to become even busier.

Partick interchange is therefore undergoing a £12 million redevelopment involving rebuilding the station and upgrading the bus stances. The works should improve the facilities for travellers and ensure that future numbers can be adequately accommodated.

6.5.7 Cross Rail

Glasgow Cross Rail is an SPT proposal to improve the rail network in and around Glasgow. While there are no confirmed plans in place for work to commence, likely works would include the following.

- Building three new stations at Glasgow Cross, the Gorbals and West Street
- Moving High Street Station further east from the city centre and completely rebuilding the station
- Investing in signalling and the electrification of rail services to deliver faster journey times and better reliability
- Laying just under 2km of new track to connect the rail lines in the north and south of the city
- Upgrading and restoring 3.5km of track
- Building new sidings at Kelvinhaugh to the west of the city centre

The increase in rail capacity would allow new routes for additional trains to run and therefore attract car users to switch to rail with the associated benefit to air quality.

6.5.8 Scottish High Level Output Specification (HLOS)

The HLOS plan prepared by Transport Scotland aims to increase capacity, reduce journey times and meet rising demand for rail travel. Works proposed will include electrification of the core route between Edinburgh and Glasgow plus 2 diversionary routes. A further programme of infill electrification including Paisley Canal services, Maryhill services, Cumbernauld and other services, diverting where appropriate to low level routes will free up capacity at Glasgow High level stations.

6.5.9 North Clydeside Development Route

In support of development in the River Clyde Corridor, the North Clydeside Development Route (Anderston Junction on the M8 to Clydebank (incorporating SECC works, Glasgow Harbour works and Yoker Relief Road)) is being promoted. The route could provide a solution to the problems of access between Glasgow and

Clydebank along Dumbarton Road and in conjunction with the recently opened Clyde Arc (Bridge), improve access to Pacific Quay from north of the river. The route will have provision for cyclists and public transport and by reducing congestion on Dumbarton Road benefit local air quality in both the City Centre and Byres Road & Dumbarton Road AQMAs.

6.5.10 Streamline and Bus Quality Partnership Schemes

The Streamline project to improve bus services in the city (see Section 9) will be further expanded to include three new corridors covering the North East area of the city, routes to/from Hampden (Caledonia Road, Aitkenhead Road, and Cathcart Road) and Pollok.

The City Council is also committed to investigating the implementation of a bus Quality Partnership Scheme (QPS), involving bus companies operating within the City. Work has already commenced on scoping the likely nature and extent of a QPS and it is the Council's intention to continue work on this with the aim of, subject to successful progression on the required consultation and the availability of funding, implementing a QPS in the lifetime of the new Council Plan. This will build on the existing Streamline quality partnership agreement between the Council and First and pave the way for improving the services of all bus operators.

As part of any partnership agreement the quality of bus services can be set along with a minimum frequency of service. Through Streamline and a QPS, it is anticipated that the quality of buses can be improved, with attendant benefits for accessibility and improvements in air quality, together with a reduction in bus congestion.

7.0 Air Pollution Monitoring

An extensive monitoring network has been established to measure ambient concentrations of air pollutants across Glasgow.

Automated monitoring equipment is located at eleven sites with three of the units (Hope Street, St Enoch Square and the City Chambers) forming part of The Department for Environment Food and Rural Affairs (DEFRA) Automated Urban and Rural Network (AURN).



Fig 7.1 Battlefield Road Automatic Monitoring Station

Equipment located at the sites measure a variety of air pollutants including NO₂, carbon monoxide and PM₁₀. Glasgow City Council also operate a non-automatic monitoring network of diffusion tubes which measure NO₂ levels at over 100 sites around the city.



Fig 7.2 NO₂ and Benzene Diffusion Tubes

All the air quality data gathered is independently ratified by AEA Technology and made available for viewing by the public at the Scottish Government funded air quality website at: <http://www.scottishairquality.co.uk>

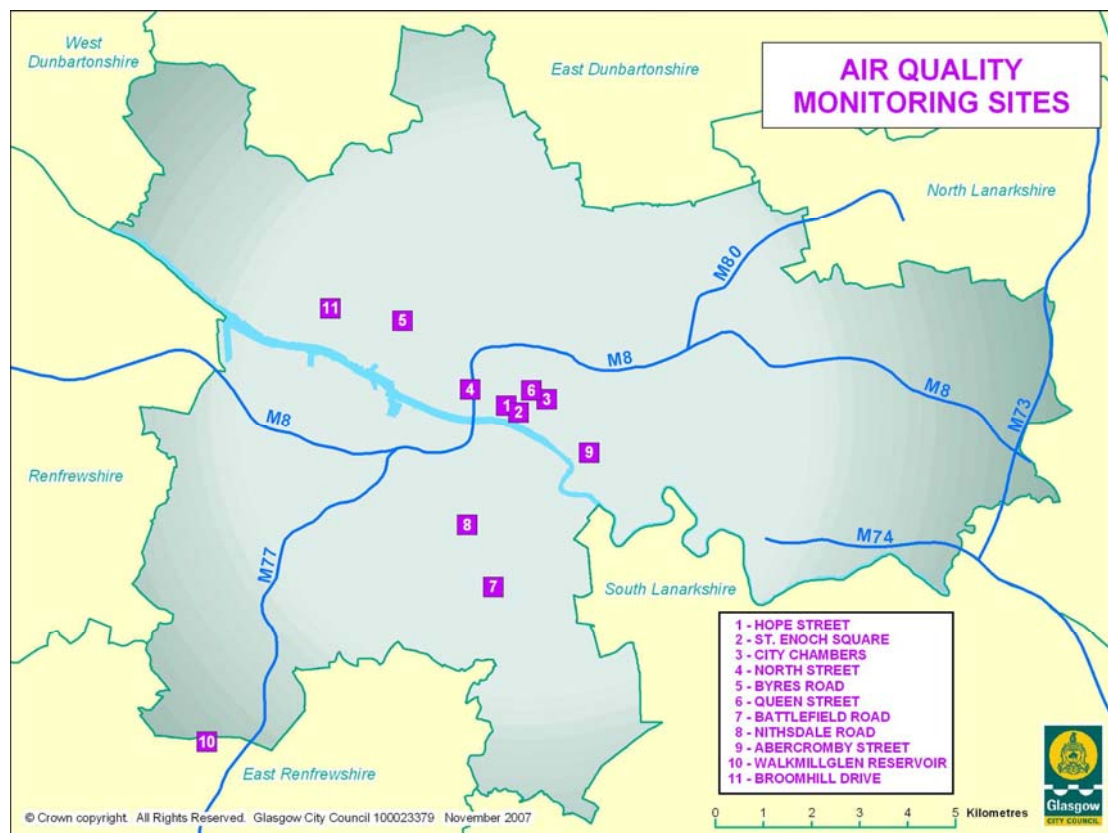


Fig 7.3 – Location of Automatic Air Quality Monitoring Sites for Glasgow

8.0 Current and Future Air Quality

Glasgow City Council has completed both an Update and Screening Assessment (2006) and a further Detailed Assessment (2007) for air quality as required by the Environment Act 1995. The findings of these assessments which involve monitored and modelled data conclude that Glasgow will continue to meet existing statutory air quality objectives for all pollutants except NO₂ and PM₁₀.

8.1 Current Levels of NO₂

NO₂ levels have been found to exceed the required annual mean objective of 40µgm⁻³ within all the three AQMAs: the City Centre, Parkhead Cross and at Byres Road/Dumbarton Road.

Figures 8.1 – 8.3 show annual mean concentrations of NO₂ recorded at set locations within each of the AQMAs.

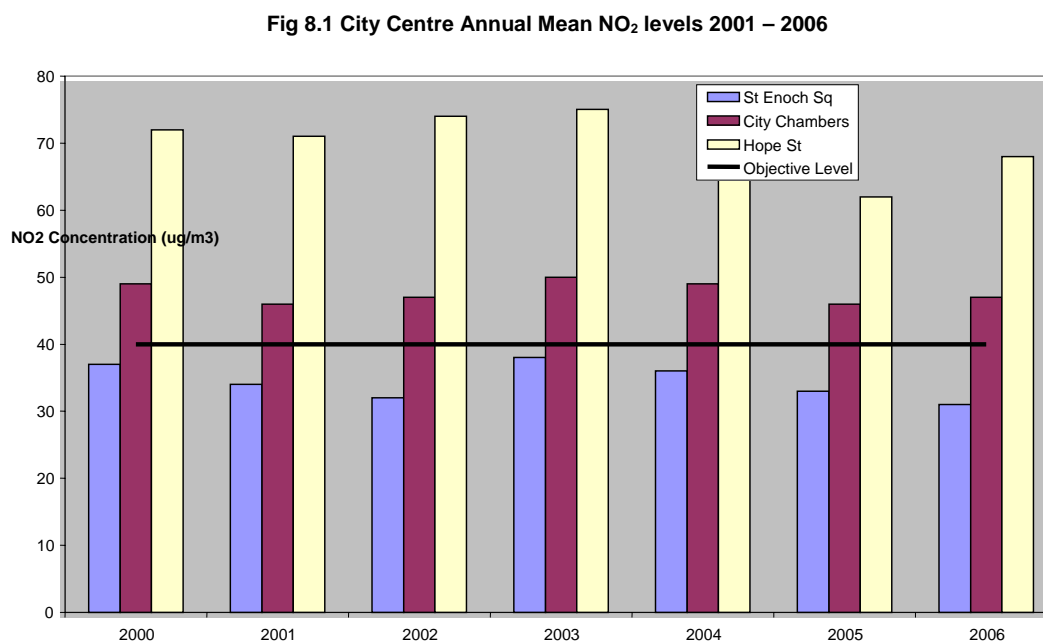


Fig 8.2 Byres Rd & Dumbarton Rd Annual Mean NO₂ levels 2001 – 2006

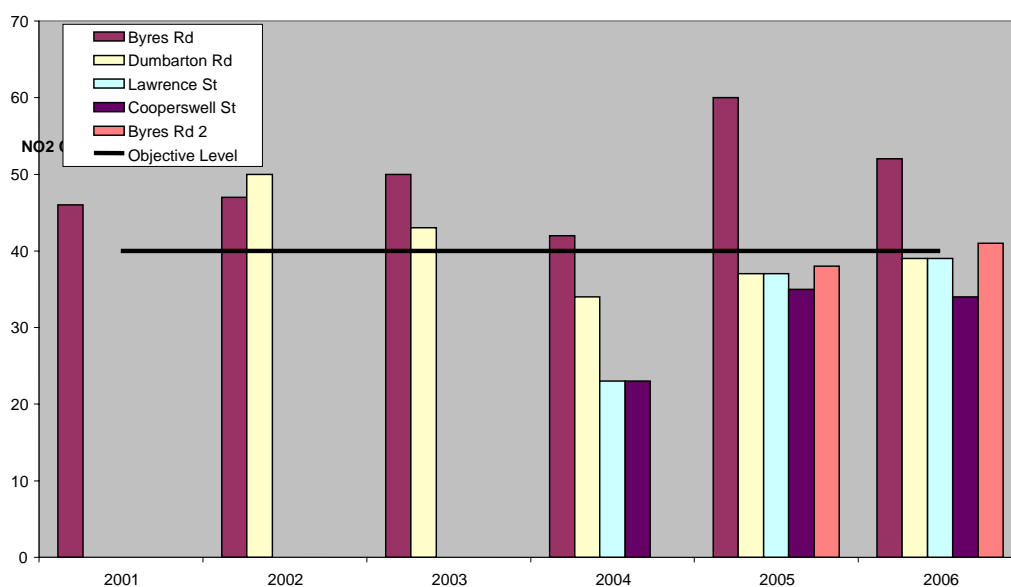
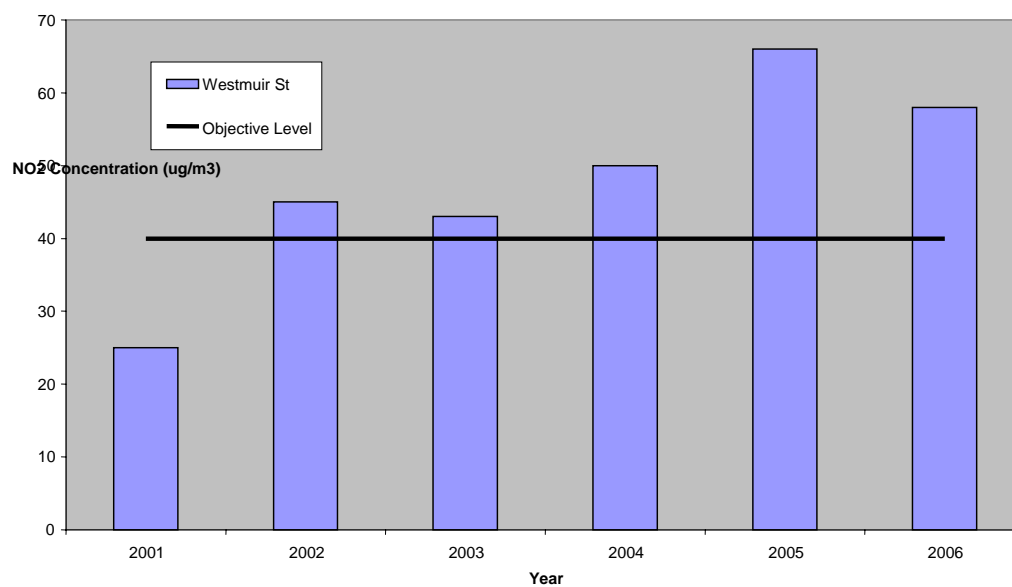


Fig 8.3 Parkhead Cross Annual Mean NO₂ levels 2001 – 2006



8.2 Future NO₂ Levels in the AQMA

Predicted future levels of NO₂ in 2010 based on monitoring results and a “do nothing” scenario (Fig 7.4) have been calculated using method adapted from Local Air Quality Management Technical Guidance LAQM. TG(03) and show a similar trend to those currently observed in Glasgow, with exceedences (in red) of the annual objective within each of the AQMAs.

City Centre AQMA	[NO ₂] µg m ⁻³ (Objective Level 40 µg m ⁻³)	
	2006	2010 Predicted
St Enoch Square	31	27
City Chambers	47	41
Hope Street	68	60

Byres Rd & Dumbarton Rd AQMA	[NO ₂] µg m ⁻³ (Objective Level 40 µg m ⁻³)	
	2006	2010 Predicted
Byres Rd	52	46
Dumbarton Road	39	34
Lawrence Street	39	34
Cooperswell Street	34	30

Parkhead Cross AQMA	[NO ₂] µg m ⁻³ (Objective Level 40 µg m ⁻³)	
	2006	2010 Predicted
Westmuir Street	58	51

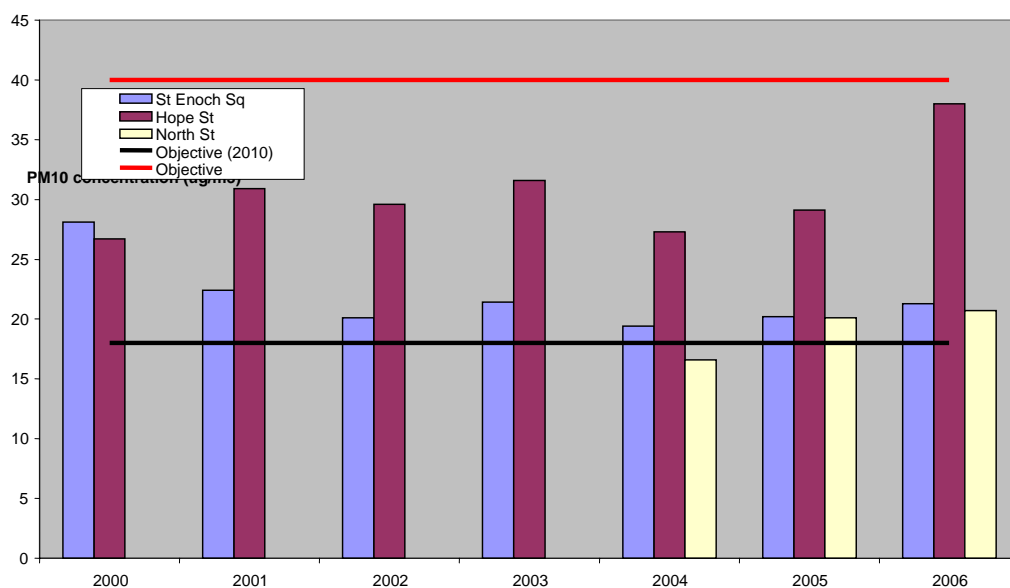
Fig 8.4 Observed and predicted NO₂ concentrations on selected streets within the AQMAs.

More information on predicted NO₂ levels (including dispersion modelling) at a number of locations in Glasgow can be found in Glasgow City Council’s Local Air Quality Management, Detailed Assessment Report 2005.

8.3 Current PM₁₀ Levels

Levels of PM₁₀ recorded within the city centre AQMA are summarised in Fig 8.5. Glasgow meets the current 40µgm⁻³ National Air Quality Strategy objective for PM₁₀ however in 2010 the objective level is lowered to 18µgm⁻³.

Fig 8.5 Annual Mean PM₁₀ levels City Centre



8.4 Future PM₁₀ Levels

As shown above, the current PM₁₀ levels recorded in the city centre are already above the objective level required by 2010. Future PM₁₀ levels expected at these city centre sites (fig 8.6) have been calculated in accordance with LAQM. TG(03) and again show a similar trend to those currently observed with exceedences (in red) of the annual objective at each location.

City Centre AQMA	[PM ₁₀] µg m ⁻³ (Objective Level 18 µg m ⁻³)	
	2006	2010 Predicted
Hope Street	38	35.44
St Enoch Square	21.3	20.02
North Street	20.7	19.47

Fig 8.6 Future PM₁₀ level City Centre

More information on predicted PM₁₀ levels (including dispersion modelling) at a number of locations in Glasgow can be found in Glasgow City Council's Local Air Quality Management, Detailed Assessment Report 2005.

9.0 Action Glasgow Has Taken So Far On Air Quality

In 2004 Glasgow published an Air Quality Action Plan for the city centre. The report listed 20 actions to be taken to improve air quality within the city centre AQMA.

Implementation of the works in the 2004 plan (which will be updated by this 2007 plan) continues and involves liaison with the Scottish Government and other Council Services including Development and Regeneration, Education and Social Work.

Generally speaking, good progress has been made on the 2004 plan; for example, the Council has adopted powers to require drivers of stationary vehicles to switch off 'idling' engines. In the last two years we have received over 40 complaints and issued over 150 fixed penalty notices. Since 2004 the Council have tested nearly 9000 vehicles and issued over 200 fixed penalty notices. This action continues to be implemented.



Fig 9.1 Vehicle Emissions testing in Glasgow

The Council has also implemented the Streamline project (including the Quality Bus Corridors referred to in the 2004 Plan) to improve bus services in the city. This is a partnership agreement between Glasgow City Council and First to develop high quality efficient, reliable and accessible bus services through the use of high quality modern vehicles on a network of Quality Bus Corridors. As well as providing bus lanes and bus gates at key congestion points along the corridors a Bus Information

and Signalling System (BIAS), covering about 40% of the traffic signal controlled network, has also been successfully developed to assist in tackling the city's traffic congestion problems whilst improving bus services. Encouraging commuters out of their cars, easing traffic congestion in key areas and using modern more efficient buses will have obvious benefits for air quality.

The Council is also keen to promote the 'greener' aspects of the original Action plan by for example, encouraging the proportion of trips undertaken by bicycle by improving routes to provide safe and direct access to city destinations including the proposed cycle lanes along the A77 White Cart cycle route.

Many schools now have School Travel Plans established in an effort to try and curb the 'school run' In total 37 schools have completed a School Travel Plan, 8 schools have a draft travel plan and a further 48 schools are in the process of developing a travel plan.

A pilot School Bicycle Loan Scheme which started at St Mungo's Academy has been extended to another four secondary schools. Each school is provided with 30 bicycles and associated equipment to enable the setting up of a cycle club. The scheme aims to engage young people in cycling as a transport choice and for leisure activities.

140 primary schools have so far registered to participate in Walk to School Week. Each school was provided with free resources to help promote and raise awareness of the benefits of walking on the school journey.

Specific engineered projects (safer routes to schools) have also been developed at some school locations; these help provide support for increasing walking and cycling journeys to and from school.

Glasgow City Council continues to aim to raise the profile of air pollution problems within the city and to encourage the public to participate in improving the situation. Publicity campaigns for vehicle emission and idling vehicles enforcement, as well as International Walk to School Week, help to bring air quality issues in Glasgow to a

wider audience. Air quality information also continues to be made available on the Council web site.

10 Improving Air Quality - the Way Forward

Glasgow City Council's first AQMA was declared in 2002 and was concerned with a single pollutant: NO₂ within the city centre area. Subsequent assessment has identified the need to extend the original boundary of the city centre AQMA to include North Street and Royston Road and to now also include the pollutant PM₁₀.

Following assessment a further two new AQMAs have also been declared for NO₂ pollution at both Parkhead Cross and the area at Byres Road & Dumbarton Road.

This new AQAP aims to build on the improvements brought about through the first action plan and to set out the measures we propose to take to improve air quality in all of the three AQMAs: the City Centre, Byres Road & Dumbarton Road and Parkhead Cross. Indeed the air quality benefits from the actions within this Plan may well be noted throughout many other parts of the city.

Measures such as tackling vehicle emissions and vehicle idling enforcement which were introduced following the 2004 plan will be further improved under the new plan. Others such as the introduction of Low Emission Zones and addressing particles from building sites are new directions where the Council feels it is now right to focus its efforts. Measures proposed for the new AQMAs will take account of the particular circumstances at each location.

In preparing this new AQAP the focus has been on delivering measures and dealing with issues that are within the control of the air quality remit. It is not the intention of this action plan to produce a strategy that encompasses all of the many works that local government is involved in that may impact on air quality.

Following regular Air Quality Action Group workshops the total number of actions proposed by this plan has been reduced to 16 in order to concentrate on the key measures we are taking specifically to deliver cleaner air quality.

Strategies already proposed in other areas of the Council such as walking and cycling, and transport improvements may have significant benefits for air quality, however

these strategies would have been brought about regardless of this action plan and are therefore not repeated in detail here. City Plan 2 (2007) and the Local Transport Strategy (LTS) (2007) in particular contain many such strategies. A list of the actions proposed within the LTS is provided in Appendix B and copies of both documents are available at local libraries and on the Council web page at <http://www.glasgow.gov.uk>.

11 Consultations

In order for this Action Plan to be effective it was considered essential to balance the effects of actions with the likely benefits in terms of air quality. For this reason it was decided to form an Air Quality Action Group (the group) with representation from relevant disciplines and organisations.

The group was tasked with overseeing the development of the AQAP. The group contained representatives from a range of Council Services, and also from Strathclyde Partnership for Transport.

The group began by sharing an understanding of the legislative framework and the status of air quality in Glasgow. This included a review of the current and future limit values for the pollutants NO₂ and PM₁₀, together with forecasts for future air quality.

The group then began the process of identifying actions that were likely to result in an improvement in air quality. The broad basis of the group enabled this process to proceed swiftly with a significant number of existing Council actions being identified.

Glasgow's Local Transport Strategy and City Plan 2 were quickly identified as having a considerable number of measures that could result in an improvement to air quality. The measures within these documents are measures the Council is already committed to introduce and are therefore not repeated here. The group instead focused efforts on measures that could be identified and developed specifically within the AQAP.

Finally, the group carried out a cost-benefit analysis of the actions identified and then decided upon an appropriate consultation strategy for the Action Plan.

12 Costs and Benefits

12.1 Cost-Benefit Analyses/Time Scales

According to guidance, the Scottish Government does not expect local authorities to undertake detailed cost-benefit analyses, or to attempt to calculate, for example, the monetary value of lives lost or extended due to actions proposed in air quality action plans. However, local authorities are required to assess the benefits, costs (financial, socio-economical and environmental) and thus feasibility of different actions proposed within the action plan.

12.2 Benefit analyses

In terms of the predicted benefit of the actions listed in the action plan with regard to reducing emissions of NO₂ and PM₁₀ assessments have been conducted where possible, and actions classified as having a (i) low, (ii) medium or (iii) high impact. The predicted effect of each of the three classifications on percentage reduction in emissions within the AQMAs is presented in Table 12.1.

Table 12.1 Classifications of predicted air quality impacts of actions

Impact on air quality Classification	Approximate reduction in PM₁₀/NO₂ emissions
Low	$\leq 0.5 \mu\text{gm}^{-3}$
Medium	$0.5 - 1.0 \mu\text{gm}^{-3}$
High	$> 1.0 \mu\text{gm}^{-3}$

It is stressed that the classifications used are only preliminary due to the nature of the actions. Consequently, where feasible, Glasgow City Council will introduce monitoring programmes to quantify the actual impact of each action on air quality.

12.3 Estimated Costs of Actions

The cost of actions included within the Plan has been provided wherever available. In all other circumstances broad estimates of costs have been provided in the form of low, medium and high. The range of costs associated with each of these categories is presented in Table 12.2.

Table 12.2 Estimated Financial Costs of Action Plan Proposals

Costing Category	Estimated Cost of Action (£ thousands)
Low	< 50
Medium	50 - 500
High	> 500

It must be stressed that there are inherent difficulties associated with estimating costs of actions where the precise nature of the proposals have not been confirmed. Therefore, all estimates given are relative and subject to change.

12.4 Timescales for Action Implementation

Where available, timescales for implementing projects are included in the individual sections however in view of the scale of some of the measures proposed exact timescale cannot be provided. It should also be understood that some of the actions proposed will require to be introduced gradually due to the scale of the projects and the need to secure funding.

While the actions presented in this report represent the most appropriate measures identified by the working group to reduce air pollution within the AQMAs, it must be understood that there is a limit to the effect that these measures will have. In addition significant quantities of the pollutants NO₂ and PM₁₀ originate from outside the AQMAs (e.g. from neighbouring streets, the M8 motorway etc.) and it is therefore by no means certain that the following actions alone will ensure that the air quality objectives are met.

In order to meet objective levels within the AQMAs it may be necessary for further work to be taken at a local level, to reduce air pollution, and the City Council will monitor progress and endeavour to work with others to achieve this goal.

13. Actions

A. Low Emission Zones (LEZs): The Council will undertake a detailed feasibility study with a view to introducing LEZs in Glasgow.

Background

A Low Emission Zone is a declared area where operators of vehicles not meeting an agreed emission standard can be required to pay a daily charge to enter the LEZ or are fined. The aim of the LEZ is that fleet operators either replace or improve some of the heaviest polluting vehicles operating within the LEZ area.

Over 70 cities and towns in eight countries around Europe have, or are preparing, LEZs as a means of controlling vehicle emissions in city centres and urban areas. London has established the UK's first LEZ, effective from February 2008. In Glasgow, where there are similar problems with road traffic emissions, The City Council have already undertaken to declare LEZs at a number of locations within the city for the 2014 Commonwealth Games.

In 2007 Glasgow City Council contracted Hyder Consulting to undertake a study to look at options to reduce air pollution from road traffic in the city (see appendix D). The study compared the introduction of a LEZ with a 10% and 50% reduction in the number of Heavy Goods Vehicles (including buses) on the roads. The result of the exercise indicated that a LEZ would be the more effective option in terms of bringing about a reduction in NO₂.

It is recognised that within certain areas of the city new bus Quality Partnership Schemes (QPS) are under development and may lead to an improvement in bus emissions. While the focus of a new LEZ would most likely be on HGVs and buses, any vehicle meeting the requirement for a QPS should also be LEZ compliant.

The costs for Glasgow City Council to administer a LEZ and for the operators of older "non-compliant" vehicles may be significant; therefore Glasgow City Council will

undertake a detailed study into the feasibility of LEZs. The study will ascertain the potential benefits to air quality and the likely costs for both businesses and for the Council administration of such a scheme.

The Council will undertake a detailed feasibility study with a view to introducing Low Emission Zones in Glasgow.

B. Public Service Vehicles: The Council will investigate the feasibility of using traffic regulation conditions to control bus emissions within AQMAs.

Background

Buses are the most frequently used public transport option for local journeys in the Greater Glasgow area with bus passengers accounting for around 22% of journeys into and around the city. The bus services are operated by a number of different companies using vehicles of varying types and Euro emission categories. The overall contribution to road traffic emission NO₂ and PM₁₀ levels within the AQMAs from buses will be significant.

Recent legislation (The Public Service Vehicles (Traffic Regulation Conditions) Amendment (Scotland) Regulations 2007) has allowed Traffic Commissioners to regulate the emission levels of vehicles used in local bus services. While Glasgow City Council will be developing a bus Quality Partnership Scheme with companies operating in the city, the use of traffic regulation conditions to control bus emissions within AQMAs will also be investigated. Where the investigation concludes that such conditions would be beneficial to air quality the Council will request that the Traffic Commissioners include the condition on operator licenses.

The Council will investigate the feasibility of using traffic regulation conditions to control bus emissions within AQMAs.

C. Idling Vehicles: The Council will expand the programme of vehicle idling enforcement and increase the provision of “No Idling” street signage.

Background

Unnecessary idling of a vehicle engine is the most inefficient use of fuel producing both harmful exhaust emissions and the greenhouse gas CO₂. Unnecessary idling of vehicle engines may also cause noise disturbance to local residents.

In order to tackle vehicle idling Glasgow City Council has been given powers to issue fixed penalty notices to drivers of vehicles found to be idling unnecessarily. Following the publication of the 2004 Action Plan over 200 fixed penalty notices for the offence of unnecessary idling have been issued. Many of the notices have been issued to bus drivers; however recent enforcement action has also targeted areas outside schools. To raise awareness of the enforcement action “No-Idling” signage has also been provided at various locations within the city.

Enforcement and promotion activities by the Council up until now have brought about a better understanding of the requirement not to unnecessarily idle vehicles by some drivers, notably those targeted for enforcement work (e.g. bus and taxi drivers), however unnecessary vehicle idling remains common practice throughout the city.

Presently, vehicle idling enforcement is carried out by a relatively small number of staff from within the City Council Public Health Unit. The participation of additional enforcement staff (such as Glasgow Community and Safety Services) would increase the enforcement presence on the streets. It is expected that an increase in enforcement presence will lead to less unnecessary vehicle idling and therefore less harmful emissions.

In addition to enforcement action, further street signage will be provided within the AQMAs to inform the public of the need to switch off their engines. It is expected that such signage together with an increased enforcement presence on the streets will bring

about an increased awareness among the general public of the need not to idle vehicles unnecessarily.

The Council will expand the programme of vehicle idling enforcement and increase the provision of “No Idling” street signage.

D. Emission Testing: The Council will continue a programme of roadside emission testing with particular focus on taxis, private hires and buses operating within the City.

Background

Local councils have powers to test the emissions from vehicles on public roads. Where a vehicle fails the test the driver is issued with a fixed penalty notice. If within 28 days the vehicle is repaired and proof of a satisfactory re-test submitted to the testing authority the notice is waived.

Over the past 4 years Glasgow have carried out over 10200 tests, mostly on private vehicles, taxis, private hire vehicles and vans. 267 vehicles have been found to fail the test resulting in the issue of a fixed penalty notice to the driver. Analysis of the data available indicates that a higher percentage of taxis and private hire vehicles than privately owned cars are failing the roadside test.

In view of the failure rates for taxis and private hire vehicles and the frequency with which these vehicles operate within the AQMAs, it is considered appropriate to ensure future emission testing is focussed on taxis and private hire vehicles.

At present Glasgow has a team of three daytime staff funded by the Scottish Government to undertake roadside testing of vehicles. Glasgow City Council will purchase additional equipment that will enable Glasgow's taxi enforcement staff to undertake roadside emission testing on taxis and private hire vehicles during the course of their normal operations.

Buses are the main public transport in and around Glasgow. There are approximately 1000 buses operating daily in the Glasgow area under 23 different operators. Due to difficulties associated with stopping and testing buses in-service in Glasgow there has been only limited roadside spot checks by the Council. In view of the high number of buses operating within the AQMAs it is considered necessary that a more proactive approach to testing buses is now developed. Bus emission testing will therefore be

combined, where possible, with other enforcement activities to bring about an increase in the number of bus spot checks carried out.

The Council will continue a programme of roadside emission testing with particular focus on taxis, private hire vehicles and buses operating within the City.

E. Cleaner Taxis: The Council will prepare an emissions strategy to reduce harmful emissions from taxi and private hire vehicles.

Background

In 2008 there are over 1400 taxis and 2700 private hire vehicles registered to operate within Glasgow. Reducing emissions from these vehicles will make an important contribution to improving air quality within the city. A taxi emission strategy could be prepared to tackle emissions from these vehicles by i) raising the emission standard for taxis and ii) increasing the frequency for licensed vehicle emission testing.

i) Raising Emission Standards

At present 98% of private hire vehicles meet or exceed Euro III emission standards, while the remaining 2% will be improved under Glasgow City Council licensing restrictions on the maximum vehicle age (7 years).

There are currently no age restrictions on taxis operating in Glasgow. The most recent records indicate that 32% of the taxi fleet fall below Euro III emission standards, indeed some older vehicles may even be pre-Euro I compliant. If all taxis were brought up to a minimum of Euro III emission standard by 2010 emissions would be reduced.

The cheapest current option for reducing emissions from older taxis is to install selective catalytic reduction systems (approx cost £1500). The cost of upgrading the emission standard of taxis would initially fall on the taxi operator, however costs could be recouped by means of an environmental levy on fares. Such a levy would mean the users of taxis would finance the improvement in the fleet and is similar to the system proposed for the London Taxi Emission Strategy.

ii) Increased Frequency of Inspection

Currently emission testing for taxis and private hire vehicles must be carried out at least once a year as part of the Annual Inspection vehicle test. This test is similar to

the emissions test carried out as part of an MOT on privately owned vehicles. Vehicles may also be given a spot check at the roadside, (see Action D) however such testing only results in a small percentage of the taxi and private hire fleet being tested more than once a year.

In view of the higher failure rate at roadside tests and the amount of time such vehicles operate within the AQMAs, it is proposed to increase the mandatory emission testing for taxis and private hires to every six months.

The Council will prepare an emissions strategy to reduce harmful emissions from taxi and private hire vehicles.

F. Council Workplace Travel Plan: The Council will prepare a Workplace Travel Plan for all employees.

Background

A travel plan is a package of measures produced by employers to encourage staff to use alternatives to single-occupancy car use. Such a plan for example, could include: car sharing schemes, a commitment to improve cycling facilities, a dedicated bus service or restricted car parking allocations. It might also promote flexible-working practices such as home working, flexible hours, remote access and video conferencing.

Travel plans can offer real benefits not only to the organisation and its employees, but also the community that surrounds it. It may help to relieve local parking or congestion problems or improve public transport connections across the area. It may also relieve stress on employees through reducing delays or providing the opportunity to cut their travel commitments by working from home on occasion.

Glasgow City Council as the largest local authority in Scotland employs over 35,000 people located at various premises throughout the city. Employees commute from throughout central Scotland and currently have no Workplace Travel Plan provided for them.

A Workplace Travel Plan may consider, among other options, the possibility of home-working for staff in order that the number of days staff commute can be reduced. The plan should bring about a reduction in the number of private motor vehicles used daily within the city to transport staff to and from work.

Such a travel plan will also allow Glasgow City Council to lead by example and encourage other employers in the city to provide travel plans for their employees.

The Council will prepare a Workplace Travel Plan for all employees.

G. Construction sites: The Council will target dust and smoke emissions from constructions sites.

Background:

Dust and smoke emissions from construction and demolition sites can cause annoyance and possible nuisance. Such emissions also contribute towards poorer air quality.

There are many simple measures that can be taken to reduce dust emissions e.g. damping down, use of wheel washes etc. Land and Environmental Services (Public Health Unit) will produce a Code of Practice that identifies simple measures that can be introduced to reduce dust emissions from construction and demolition activities in Glasgow. Bonfires will be restricted on all construction and demolition sites and consultation will take place with SEPA and the Considerate Constructors Scheme to investigate the prohibition of building site bonfires.

The Council will target dust and smoke emissions from constructions sites. The Council will also produce a code of practice for construction/demolition contractors and investigate the possibility of banning site bonfires.

H. Domestic Emissions: The Council will raise awareness and provide information to assist in energy efficiency in the home.

Background:

Although the majority of NO₂ emissions in Glasgow are attributed to road traffic, emissions from domestic and commercial gas boilers also contribute to the total. This may be particularly so in heavily populated areas of tenement housing.

While the use of domestic gas boilers for heat and hot water is a necessity, significant amounts of energy is wasted because homes are not suitably insulated and/or old inefficient gas boilers are in use. Therefore home energy efficiency measures have an important role to play in helping to reduce levels of air pollution.

Glasgow City Council is responsible for a large number of buildings such as schools, offices etc. These properties are currently being reviewed as part of Glasgow City Council Carbon Management Plan and have a target of improving efficiency in our properties by 20% in 10 years. In addition to this work the Council will provide information on the web site detailing measures that can be taken to improve energy efficiency in the home.

The Council will raise awareness and provide information to assist in energy efficiency in the home

I. Promote Greener Vehicles: The Council will investigate the potential for reduced rate street parking for electric and hybrid vehicles.

Background

Electric, hybrid and other low polluting private vehicles are widely recognised to have an important role to play in reducing harmful road traffic emissions. Indeed when powered by their electric motors such vehicles produce no combustion gasses and therefore no exhaust emissions.

Electric and hybrid vehicles currently make up only a very small percentage (less than 0.4 %*) of the vehicles travelling in the city. Glasgow City Council is keen to encourage the use of such vehicles which also produce less of the greenhouse gas CO₂. The provision of differential parking charges based on emission levels is one way in which the Council could offer incentives for the uptake of such vehicles.

The Council will investigate the potential for reduced rate street parking for electric and hybrid vehicles.

*The UK Automotive Sector Sustainability – Eighth Annual Report, 2007. The Society of Motor Manufacturers and Traders (SMMT)

J. Prohibition of Bonfires: The Council will investigate the case for prohibiting domestic bonfires in the city.

Background

Domestic bonfires have traditionally been used as a way of disposing of garden waste, however they also produce many forms of pollution. Emissions from bonfires can have damaging health effects and although serious harm is unlikely if exposure to bonfire smoke is brief, they can cause problems for people with asthma, bronchitis, and heart conditions.

Bonfire smoke can also cause annoyance by preventing neighbours enjoying their garden or hanging washing out. It is an offence to cause a nuisance from a bonfire and the Council can take enforcement action where this is the case. However, even where the bonfire is not a nuisance, emissions from it may contribute to poorer local air quality.

Glasgow encourages alternative, more environmentally friendly ways of disposing of garden refuse such as composting, recycling, or free uplift for disposal. Glasgow also provide a garden waste uplift service using “brown wheelie bins” to 58000 homes and are pursuing funding for potentially another 50000 homes. Therefore at present there is no need for garden waste to be disposed of by burning on bonfires.

There is no intention to prohibit bonfires for cultural events. Any prohibition on bonfires would also require some degree of public consultation on how the ban would work and when it would apply.

The Council will investigate the case for a ban or partial ban on bonfires throughout Glasgow.

K. Planning Guidance: The Council will produce revised planning guidance to improve air quality in the city

Background

Where new large developments are proposed for locations within the AQMAs, the City Council, as part of the planning process, require the applicant to carry out a suitable air quality assessment. Where the assessment identifies a likely negative impact on air quality the applicant must then identify adequate mitigation measures.

Typically an applicant will employ a consultant to complete the assessment for approval. Glasgow City Council will prepare guidance on what is expected in air quality assessments including suggested mitigation measures. The provision of such planning guidance will also enable the City Council to present a range of measures desirable for improving local air quality.

The Council will produce revised planning guidance to improve air quality in the city.

L. Leading by Example: The Council will demonstrate best practice in the operation of its vehicle fleet.

Background

Glasgow City Council operates a fleet of over 2000 vehicles within the city. It is therefore essential that the Council takes steps to cut harmful emissions from its own fleet where possible.

Present policy within the Council is to ensure that only the most efficient and least polluting (highest Euro category) vehicles are purchased/leased. This policy will shortly see the Council take delivery of a fleet of Bluemotion Volkswagen vehicles capable of 75mpg and with the lowest emission levels in its class. The use of modern low emission vehicles is, however, only part of the solution.

Any vehicle used inefficiently will massively reduce the potential benefits to be gained by using modern Euro IV or V engines. It is therefore important that vehicles used are the most suitable for the job, that they are properly maintained and that they are driven in an efficient manner.

Glasgow City Council will therefore ensure that replacement vehicles are environmentally assessed for purpose in order that smaller more efficient replacements are obtained where possible.

All Council vehicles are regularly serviced and daily checks are carried out and recorded to ensure vehicles are operating safely. These daily checks include measures such as checking correct tyre pressure which also impact on fuel efficiency.

Drivers of Council vehicles have already been instructed not to idle vehicles unnecessarily however further instruction will be issued to drivers to ensure they use their vehicles efficiently. Simple efficient driving styles such as avoiding over accelerating and then braking heavily can make a huge difference to fuel efficiency,

as can reducing speed (e.g. 60mph as opposed to 70 mph). A more efficient driving style means less fuel consumption and therefore less harmful emissions and can be easily supervised by monitoring individual driver fuel use.

Where possible Council Services will also ensure that only vehicles with the highest emission standards are permitted to operate within the AQMAs.

The Council will demonstrate best practice in the operation of its vehicle fleet.

M. Parking Levies: The Council will lobby the Scottish Government to introduce legislation to enable a charge to be levied for all trip-end, off road, non residential parking.

Background

Glasgow City Council has introduced controlled parking across the entire city centre and west to Kelvingrove Park with the aim of reducing traffic volumes by increasing the use of public transport and non-motorised transport. Currently a consultation exercise is being undertaken with a view to extending controlled parking further to the west of the city as far as Crow Road.

If parking control is to be successful in reducing traffic flows, measures will need to be put in place to enable greater local authority control of the availability and cost of car parking than is currently the case. It will be necessary for local authorities to influence the charging regimes of privately operated public car parks (including those currently operated without charges at superstores, retail parks etc.) and to influence the provision and use of non-residential private parking spaces at existing developments.

The Council will lobby the Scottish Government to introduce legislation to enable a charge to be levied for all trip-end, off road, non residential parking.

N. Air Quality Information: The Council will provide data and information regarding current and longer term air quality monitoring within Glasgow on our web site and at Variable Message Signs throughout the city.

Background

The availability of local air quality information can be important for people affected by asthma and other health problems. During times of elevated pollution levels such people can take suitable precautions to try and minimise exposure to the pollutants; however they can only do this if they know what the current pollution levels are.

Glasgow City Council will update the web site to ensure that information about current air quality within Glasgow is readily available.

The Council also operate a network of variable message signals (VMS) throughout the city. These boards can also be used to display real-time pollution levels being recorded in the city. By targeting pollution level messages to drivers awareness will be raised and it may help to bring about a change in behaviour.

The Council will provide data and information regarding current and longer term air quality monitoring within Glasgow on our web site and at traffic signal boards.

O. Car Clubs: The Council will make on-road spaces available for car club vehicles.

Background

A car club provides its members with quick and easy access to a car for short term hire. Members can make use of the car club vehicles as and when they need them.

Research in the UK and overseas has found significant changes in travel behaviour once the link between car use and car ownership is broken. Car club members typically drive less and make more use of public transport, cycling and walking.

With each car club vehicle typically replacing up to 6 privately owned cars, the air quality and environmental benefit is obvious, however other benefits will include less congested roads, fewer accidents and tackling social exclusion and obesity.

While unable to fund and operate a car club scheme of its own the Council will encourage and support employers and other organisations wishing to establish Car Clubs.

The Council will make on road spaces available for car club vehicles where suitable off-road provision cannot be made.

P. Tree Planting: The Council will investigate the potential for a programme of tree planting as a means of City Centre PM₁₀ reduction.

Background

There is some evidence* to support a programme of tree planting as a measure to bring about a reduction in levels of PM₁₀.

Trees can be effective scavengers of both gaseous and particulate matter depending on the percentage tree cover in an area, the species of tree and whether or not they are in-leaf. A study in 2007* suggested that a reduction in PM₁₀ levels in Glasgow may be possible if trees are planted in identified available areas. The actual PM₁₀ reduction possible in the city centre AQMA will be dependent on where and in what numbers trees can be planted and further study will be required.

The Council will investigate the potential for a programme of tree planting to reduce PM₁₀ within the City Centre.

* Bealey, W.J. et al., 2007 Journal of Environmental Management 85, 44-58

14 Actions Not Proceeded With.

14.1 Road User Charging (Congestion Charging)

Road user charging is a concept that allows local authorities to require certain road users to pay to enter certain highly congested roads with the aim of promoting the use of transport options other than private cars. Although the main aim of such schemes is to reduce congestion, the overall effect should be that less vehicles use the roads that are affected by the charge, leading to fewer emissions and improved air quality.

The City Council's view is that control over the availability and cost of car parking is a more appropriate form of road user charging for urban areas. This is discussed in detail in the Local Transport Strategy 2007 (LTS2007). There is no reason to believe that the factors considered before coming to the conclusions within the LTS 2007 have changed to a degree that would justify reconsidering congestion charging as an option.

14.2 Car Sharing Schemes

The term 'car share' refers to the practice of more than one person driving together rather than driving alone. It is also known as "lift sharing", "ride sharing", "drive sharing" and "carpooling". The person getting the lift gives the driver a cash contribution towards the fuel costs, so both of them save money. The amount of money that changes hands is up to the parties concerned, but the driver is not participating on a "for profit" basis.

Where more than one car driver elects to car share rather than use their cars individually there are potential environmental benefits with regard to congestion and air quality.

On considering the matter The Air Quality Action Group agreed that, although a good idea, administering a city wide scheme for the public would be costly and fraught with personal safety and liability concerns. Location specific schemes, such as those related to a workplace or a grouping of workplaces (e.g. a business park) continue to

be encouraged. These location specific schemes may be voluntary (promoted by SPT), or a requirement through the planning process.

Car sharing by Council employees will be considered when the City Council Travel Plan is completed in 2008.

15. Summary of Actions Table

Action	Start Date	End Date	Cost to Council Low < £50K Medium £50 K– £500K High > £500K	Air Quality Benefit Low Medium High For PM ₁₀ & NO ₂ (either combined or individually)	Source of Funding & Comments
A. Low Emission Zones (I) Feasibility study : (II) LEZ implementation	01/04/ 2008 01/04/2010		Low High	N/A High	Council + Scottish Government Council, + Scottish Government (Note cost to bus operators, haulage companies may be high)
B. Public Service Vehicles Emissions	01/04/2008		Low	Low	Council
C. Idling Vehicles	01/04/2008		Low	Low	Council shared with Scottish Government
D. Emission Testing	Ongoing		Medium (including purchase of new equipment)	Low	Council + Scottish Government
E. Cleaner Taxis	01/04/2008		Low	Low	Council (Note initial cost to taxi operators to be recouped from hire levy)
F. Council Workplace Travel Plan:	01/08/2008		Low	Low	Council
G. Construction Sites	01/04/2008		Low	Low	Council
H. Domestic Emissions:	01/04/2008		Low	Low	Council
I. Promote Greener Vehicles:	01/01/2009		Medium (reduced rate) Low (Free parking)	Low	Council (Administration and software/hardware alterations)
J. Prohibition of Bonfires:	01/01/2009		Low	Low	Council
K. Planning Guidance	01/08/2008		Low	Low	Council
L. Leading by Example .	01/08/2008		Medium	Low Medium (if encourages others)	Council
M Parking Levies	01/04/2008		Low	Medium	Council
N. Air Quality Information	01/08/2008		Medium	Low	Council
O. Car Clubs	01/04/2008		Low	Low	Council
P. Tree Planting	01/04/2008 01/01/2009		(feasibility study) Low (tree planting programme) High	N/A Low	Council (possible grants available)

Appendix A

Air Quality Management Areas



Glasgow City Council

Environment Act 1995 Part IV Section 83(1)

The City of Glasgow Parkhead Cross Air Quality Management Area Order 2007

Glasgow City Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order:

1. This Order may be cited as the City of Glasgow Parkhead Cross Air Quality Management Area Order 2007 and shall come into effect on **1st July 2007**;
2. The area outlined on the plan annexed to this Order and sealed with the Common Seal of the Council is declared to be an Air Quality Management Area ("the designated area"). The map can be viewed at the offices of the Council at 231 George Street, Glasgow G1 1RX;
3. This Order may be varied or revoked by a subsequent Order;
4. A written action plan will be prepared in order to pursue the achievement of air quality standards and objectives in the designated area. The written action plan shall include a timetable for the Council's implementation of each of the proposed measures identified;
5. The Council may revise the action plan from time to time.

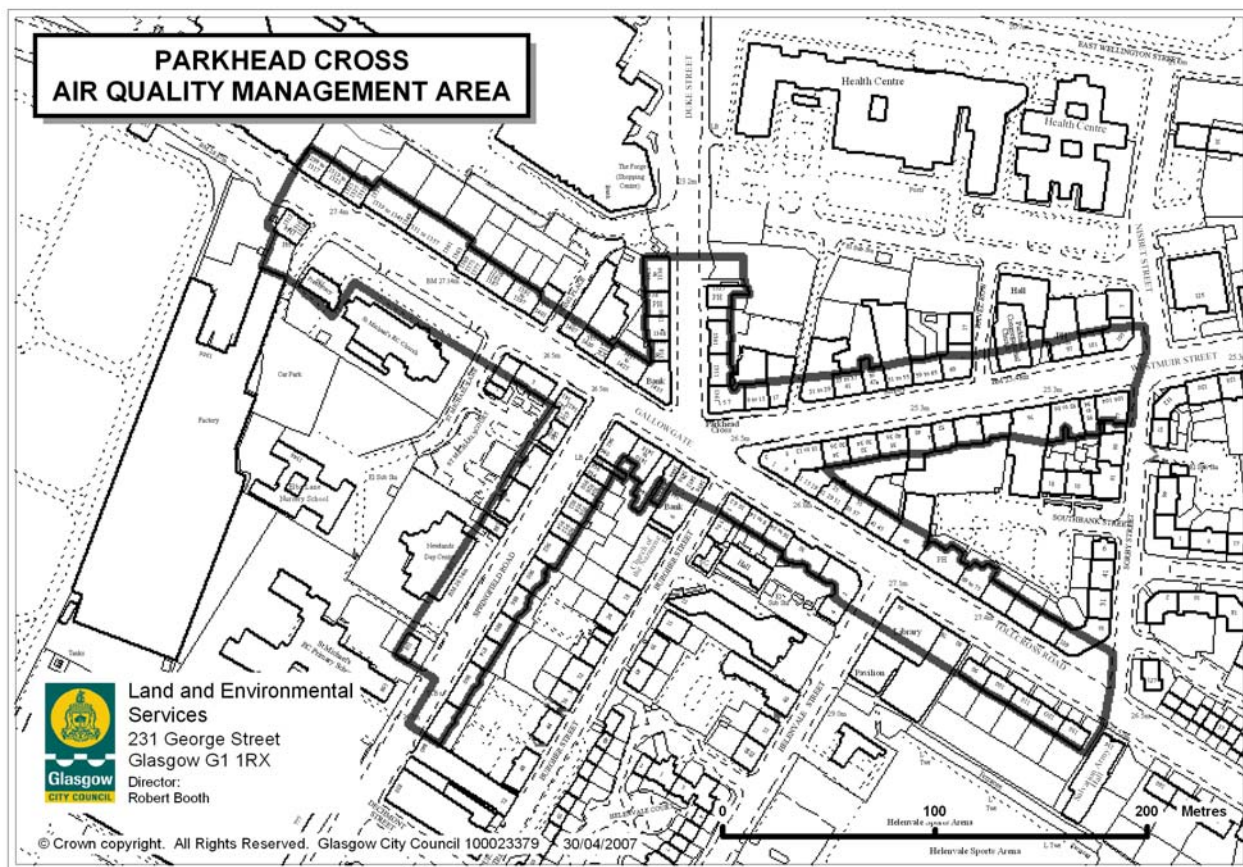
Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of

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**Annex to the City of Glasgow Parkhead Cross Air Quality Management Area
Order 2007**



The area shown on the attached map is to be designated as an Air Quality Management Area. The designated area incorporates Parkhead Cross and including (the full widths of) surrounding streets;

Approximately 200 metres east of Parkhead Cross on the Gallowgate;
Northwards from Parkhead Cross along Duke Street terminating prior to the Forge Shopping Centre;
North-eastwards from Parkhead Cross, following Westmuir Street until the junction with Nisbet Street;
South-eastwards from Parkhead Cross along Tollcross Road until the junction with Sorby Street;
Incorporating Springfield Road approximately 180 metres south of Parkhead Cross.

This Area is designated in relation to a likely breach of the **nitrogen dioxide (annual mean) objective** as specified in the Air Quality (Scotland) Regulations 2000.

This Order shall remain in force until it is varied or revoked by a subsequent order.

Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of



Glasgow City Council

Environment Act 1995 Part IV Section 83(1)

The City of Glasgow Byres Road/Dumbarton Road Air Quality Management Area Order 2007

Glasgow City Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order:

6. This Order may be cited as the City of Glasgow Byres Road/Dumbarton Road Air Quality Management Area Order 2007 and shall come into effect on **1st July 2007**;
7. The area outlined on the plan annexed to this Order and sealed with the Common Seal of the Council is declared to be an Air Quality Management Area ("the designated area"). The map can be viewed at the offices of the Council at 231 George Street, Glasgow G1 1RX;
8. This Order may be varied or revoked by a subsequent Order;
9. A written action plan will be prepared in order to pursue the achievement of air quality standards and objectives in the designated area. The written action plan shall include a timetable for the Council's implementation of each of the proposed measures identified;
10. The Council may revise the action plan from time to time.

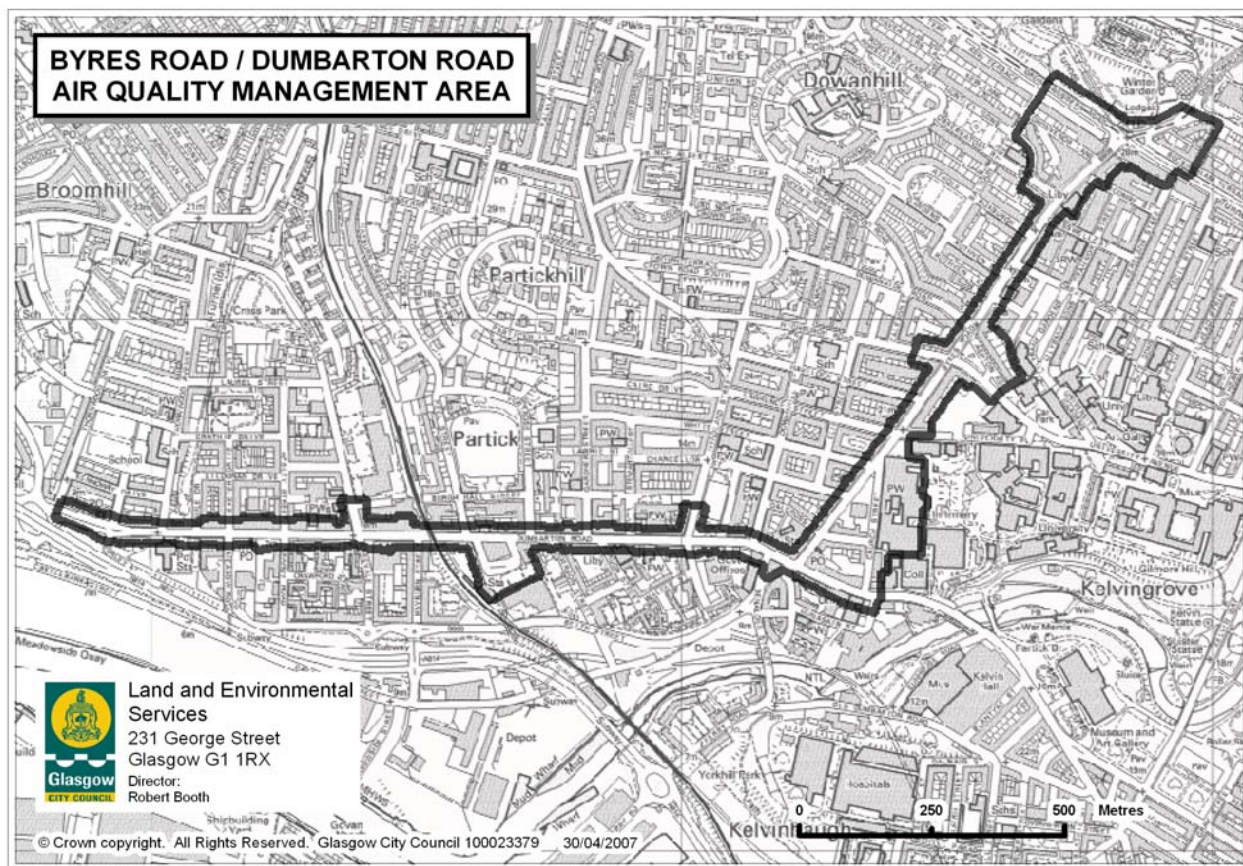
Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of

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**Annex to the City of Glasgow Byres Road/Dumbarton Road Air Quality
Management Area Order 2007**



The area shown on the attached map is to be designated as an Air Quality Management Area. The designated area incorporates the following area (including the full widths of the streets);

South of Thornwood Drive, incorporating the full width (and first line of buildings to the North and South) of Dumbarton Road;
Eastwards along Dumbarton Road incorporating Crow Road to the junction with Norval Street;
Eastwards along Dumbarton Road incorporating Partick Bus Station at Merkland Street and Vine Street;
Continuing eastwards along Dumbarton Road incorporating Hyndland Street to the junction with Fordyce Street;
Continuing eastwards incorporating the triangle junction with Benalder Street;
Continuing eastwards to the junction of Dumbarton Road with Dunaskin Street;
Northwards from Dunaskin Street heading towards Byres Road, incorporating the hospital buildings fronting Church Street;
Continuing north along Byres Road (including line of buildings east and west of the Road) incorporating the junction of Byres Road with Highburgh Road to junction with Caledon Lane;

And incorporating the junction of Byres Road with University Avenue (including Ashton Road), along Ashton Lane and joining back to Byres Road;
Continuing northwards along Byres Road and incorporating the following area;
Along Observatory Road to Grosvenor Crescent;
Along Grosvenor Crescent to Saltoun Street;
Saltoun Street from Grosvenor Crescent north-eastward to Great Western Road;
Incorporating Great Western Road south-eastwards to the junction with Queen Margaret Drive;
Queen Margaret Drive from the junction with Great Western Road north-eastward to the roundabout adjacent to Hamilton Drive;
Eastwards along Hamilton Drive to the junction with Buckingham Street
South- westward along Buckingham Street to Great Western Road;
Continuing westwards to Kersland Street, then southwards to the junction of Kersland Street with Sandringham Lane;
Westwards along the projected line of Sandringham Lane joining back to Byres Road.

This Area is designated in relation to a likely breach of the **nitrogen dioxide (annual mean) objective** as specified in the Air Quality (Scotland) Regulations 2000.

This Order shall remain in force until it is varied or revoked by a subsequent order.

Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of

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Glasgow City Council

Environment Act 1995 Part IV Section 83(1)

The City of Glasgow City Centre Air Quality Management Area Amendment Order 2007

Glasgow City Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order:

11. This Order may be cited as the City of Glasgow City Centre Air Quality Management Area Amendment Order 2007 and shall come into effect on **1st July 2007**;
12. This Order amends the City of Glasgow Air Quality Management Area Order 2001, which originally designated Glasgow City Centre as an Air Quality Management Area;
13. The area outlined on the plan annexed to this Order and sealed with the Common Seal of the Council is declared to be an Air Quality Management Area ("the designated area"). The map can be viewed at the offices of the Council at 231 George Street, Glasgow G1 1RX;
14. This Order may be varied or revoked by a subsequent Order;
15. A written action plan will be prepared in order to pursue the achievement of air quality standards and objectives in the designated area. The written action plan shall include a timetable for the Council's implementation of each of the proposed measures identified;
16. The Council may revise the action plan from time to time.

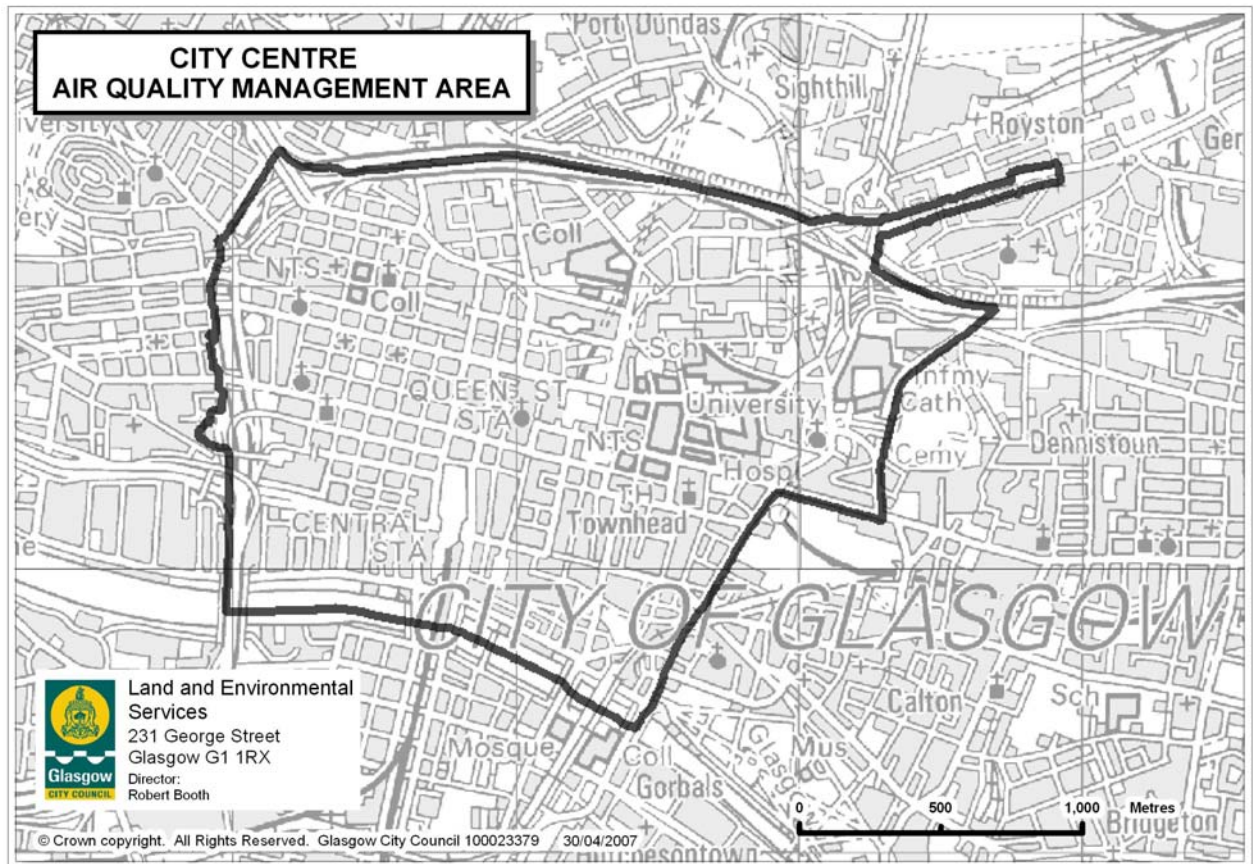
Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of

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**Annex to The City of Glasgow City Centre Air Quality Management Area
Amendment Order 2007**



The area shown on the attached map is to be designated as an Air Quality Management Area. The designated area incorporates;

Kingston Bridge/M8 Motorway, from the centreline of the River Clyde to the junction of Piccadilly Street and North Street;

The full width of North Street (incorporating the line of buildings on the western side of the street including St. Patrick's Primary School) from the junction with Piccadilly Street to Woodlands Road;

Saint George's Road from Woodlands to Phoenix road;

Phoenix Road, from Saint George's Road to the M8 Motorway;

M8 Motorway from Phoenix Road to Baird Street;

Baird Street, from M8 Motorway eastwards incorporating full width of Royston Road (including buildings north and south of Royston Road) to the junction with Garnock Street;

Royston Road westwards from the junction with Garnock Street to the junction with Castle Street;

Castle Street from Baird Street to M8 on-ramp;

M8 Motorway (including on-ramp), from Castle Street to the projected line of the southeast side of Wishart Street;

Southeast side of Wishart Street, from the M8 Motorway to Alexandra Parade;

Wishart Street, from Alexandra parade to Lady well Street;

John Knox Street, from Ladywell Street to Duke Street;

Duke Street, from John Knox Street to High Street;
High Street from Duke Street to Trongate;
Saltmarket, from Trongate to Clyde Street;
Albert Bridge, from Clyde Street to the Centreline of the River Clyde;
The centreline of the River Clyde from Albert Bridge to the Kingston Bridge/M8
Motorway.

This Area is designated in relation to a likely breach of the **nitrogen dioxide (annual mean) objective** and the **particles PM₁₀ (annual mean) objective** as specified in the Air Quality (Scotland) Regulations 2000.

This Order shall remain in force until it is varied or revoked by a subsequent order.

Sealed with the Common Seal of the Council and signed by

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on behalf of the Council this day of

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Appendix B

Local Transport Strategy Actions

Glasgow's Local Transport Strategy (LTS) Actions

LTS Reference Number	Action
SIA1	Develop a methodology for assessing the social inclusion impact of major transportation projects by the end of 2008.
SIA2	Encourage, through the Regional Transport Partnership the provision of appropriate subsidised bus services between residential areas and areas of employment, health care and training.
SIA3	Encourage, through the Regional Transport Partnership, public transport timetabling to reflect multi modal trips and shift working.
SIA4	Provide transport services to take school children to parks and leisure facilities through the 'Class Connections' project and children and adults with special needs to education and work scheme initiatives.
SIA5	Develop accessibility planning as a tool by 2008, including the development and use of the latest accessibility modelling software.
MDA1	Upgrade pedestrian dropped kerb facilities to incorporate designs sympathetic to the needs of people with disabilities and older people, including those that are blind and partially sighted.
MDA2	Provide textured paving at all controlled pedestrian crossing points at new and major upgraded schemes.
MDA3	Seek funding to expand the introduction of real time audio timetable information at bus stops.
MDA4	Continue to provide the M.I.D.A.S. drivers and P.A.T.S escorts training schemes.
MDA5	Ensure that parking schemes accommodate the needs of disabled people.
MDA6	In roads where parking is not statutorily controlled, provide advisory disabled parking bays subject to approved criteria.
MDA7	Encourage bus operators to introduce low floor accessible buses on Streamline and other routes via Quality Partnerships.

MDA8	Ensure that new transport infrastructure incorporates facilities for blind and partially sighted people
MDA9	Support the SPT in the promotion of 'Dial-a-Bus'.
MDA10	Include groups representing people with disabilities in consultations undertaken by the Council
W1A	Ensure consideration is given to the needs of women in the promotion of transport services and infrastructure.
EMA1	Support, through the Regional Transport Partnership, schemes to provide appropriate timetable translations.
EMA2	Support the Council's Race Equality Scheme 2005-08 by including, where appropriate, translations of Council transportation documents in different community languages.
EMA3	Engage with ethnic minority press for consultation.
OAA1	Encourage bus companies in the training of bus drivers in order to improve customer care in relation to young people.
OAA2	Develop the Young Scot card scheme so that it can be utilised in the proposed young person concessionary fare scheme.
CTA1	Investigate how the use of existing resources, with regard to special needs transport, could be better utilised to enhance community transport throughout the City.
CTA2	Continue to monitor the funding and operation of Community Transport Glasgow.
CTA3	Seek additional funding to expand the Community Transport operation within Glasgow.
PTA1	Lobby the Scottish Executive, directly and through the Regional Transport Partnership, for greater regulation of bus services.
PTA2	Lobby through the Regional Transport Partnership for the extension of operating hours of the Subway system.
PTA3	Assess suitable routes or areas for establishing Statutory Quality Partnership Schemes or Quality Contracts by March 2008.
PTA4	Review camera enforcement for bus lane violation and seek regulation to enable enforcement to take place (decision by 2008).
PTA5	Seek funding for the extension of the Bus Priority and Real Time Information system.

PTA6	Review existing Streamline routes by 2008 and seek funding for additional Streamline Routes.
PTA7	Investigate opportunities to assist commuter and express bus services including those that use the motorway network.
PTA8	Work with agencies to facilitate the introduction of LRT, BRT, Crossrail and the Glasgow Airport Rail Link.
PTA9	Introduce bus stop clearways to prevent waiting and loading by other vehicles at bus stops as appropriate on Streamline corridors and review requirements elsewhere.
PTA10	Review the need for further upgrading of bus stops to provide improved access and timetable displays and the installation of quality bus shelters.
PTA11	Promote the introduction of a Bus Rapid Transit System (Clyde Fastlink) to serve the development areas of the North Clyde Corridor between the City Centre and Glasgow Harbour by 2009 and undertake further development work on Phases 2 and 3 to Clydebank and Renfrew riverside.
PTA12	Undertake further investigation into the possibility of providing a transport link from Kelvingrove Art Gallery to the new Riverside Transport Museum.
PTA13	Work with the Regional Transport Partnership towards the delivery of railway stations at Parkhead Forge, Millerston and Jordanhill West and an upgrade of Dalmarnock Station.
PTA14	Lobby to secure additional stations at Blochairn/Garnard, Bogleshole, Drumchapel (west), Germiston, Ibrox, Robroyston, Glasgow Cross and the Crossrail stations of the Gorbals, High Street (relocation) and West Street.
PTA15	Work with SPT to ensure that proposals resulting from SPT Study into public transport and the future of the subway meet the needs of the City.
PTA16	Support proposals for high speed rail links to Edinburgh and English cities.
PTA17	Prepare a request to the Traffic Commissioner to include a traffic regulation condition in bus operator licences which will include for bus layover restrictions and ensuring only allocated bus stops are used in the City Centre.
PTA18	Seek changes in legislation to allow the Council to enforce yellow box

	road markings.
PTA19	Support SPT in the on-going conurbation study.
PRA1	Work with the Regional Transport Partnership to identify appropriate locations for the expansion of existing Park and Ride sites and the provision of new Park and Ride sites.
WPA1	Liaise with the Regional Transport Partnership and Scottish Executive, to integrate walking with public transport and as an important means of transport in its own right.
WPA2	Seek funding to extend and improve infrastructure facilities for pedestrians.
WPA3	Provide where appropriate 'green aspect' pedestrian crossing facilities where appropriate and minimise wait time for pedestrians.
WPA5	Publish, promote and distribute promotional material, such as the 'Fit for Life' leaflet
WPA6	Review and update the pedestrian signage within the City Centre and in the West End to include the display of estimated journey time on foot as well as distance to destination.
WPA7	Provide directional signage with times and distances to destinations, city wide for paths by 2010.
WPA8	Develop a Core Path Plan for Glasgow and review the Glasgow Outdoor Access and Walking Strategy by 2008.
WPA9	Continue to promote the Scottish Outdoor Access Code by leaflets via the park ranger service.
WPA10	Continue to facilitate/host the Glasgow Outdoor Access Forum.
WPA11	Ensure that vegetation is sympathetically maintained such that it does not obstruct paths or reduce passive surveillance from surrounding buildings and roads.
WPA12	Complete 11 path network feasibility studies by 2011.
WPA13	Seek to implement 4 projects per annum arising from feasibility studies following the completion of the Core Path Plan.
WPA14	Develop a Paths to Health Action Plan and 12 local projects City (Health Walks Initiatives) by 2007.
WPA15	Prepare and publish streetscape design guides by 2008 for the

	materials and infrastructure used when constructing walking schemes to create a high quality walking environment.
CPA1	Review the cycle strategy by September 2008, including developing an action plan for increasing cycling in Glasgow.
CPA2	Develop a monitoring strategy for cycling by September 2007.
CPA3	Promote , through the Regional Transport Partnership and Scottish Executive, the integration of cycling with public transport.
CPA4	Exempt cyclists from road closures, one-way streets and banned turns where appropriate to minimise the impact of traffic management proposals on accessibility for cyclists.
CPA5	Identify and promote strategic long distance cycle routes in liaison with adjacent Councils and the Regional Transport Partnership.
CPA6	Review progress and bring forward proposals for the City Centre network linking to the National Cycle Routes by 2007.
CPA7	Allow bicycles to use bus lanes as they are implemented.
CPA8	Continue to ensure wherever possible that bus lanes are of adequate width to allow cyclists to use them safely.
CPA9	Review, improve and expand the network of cycle routes in Glasgow.
CPA10	Increase by 100 per annum for the next three years the number of 'Sheffield' cycle parking racks available to schools and on-road.
CPA11	Review the school Bicycle Loan Scheme by the end of 2007.
CPA12	Investigate with appropriate agencies the need for funding for a regional cycling coach based at Bellahouston Cycling Activity Centre.
CPA13	Continue to work with partners to develop and enhance cycle training throughout the city.
CPA14	Provide and continue to promote the Council's employee cycle mileage rate
CPA15	Hold and support events to promote cycling as an active and environmentally friendly form of transport.
CPA16	Undertake a scoping study of cycling issues in Glasgow and market research to identify the barriers to cycling and potential triggers to increase cycling by March 2008.

CPA17	Investigate the potential for additional pedestrian/cycle bridges across the River Clyde between George V Bridge and the Clyde Tunnel.
CPA18	Develop, in partnership with other bodies, the provision and distribution of cycle route maps.
CPA19	Make available via the Council's website details of cycle routes, events etc.
CPA20	Seek funding for an award scheme to recognise organisations which establish best practice in effective cycling initiatives by 2008.
CPA21	Develop proposals for a mountain bike circuit at Cathkin Braes by September 2007 and seek funding for implementation.
PA22	Develop a lighting strategy for cycle paths by July 2008.
TXA1	When designing taxi ranks ensure where possible that provision is made for access by disabled people.
TXA2	Assess on an annual basis the unmet demand for taxis and utilise the results in setting a ceiling on the number of taxi licences issued.
TXA3	Liaise with appropriate bodies to ensure adequate security at taxi ranks.
TXA4	Review the taxi fare tariff every 18 months.
TXA5	Support the taxi driver training scheme by approving the content of the course.
TXA6	Provide a Taxi and Private Car Enforcement Unit to enforce taxi legislation.
TXA7	Provide taxi marshals as part of the 'nitezone' initiative.
PTWA1	Monitor the evidence from the various UK trials with regard to allowing motorcyclists access to bus lanes.
PTWA2	Provide an appropriate level of secure motorcycle parking.
CRA1	Seek funding to provide further access points including pontoons and additional slipways along the River Clyde.
CRA2	Work with others to provide information to users of canals and rivers to enable them to enjoy a safe experience without causing damage to wildlife and habitats.

CRA3	Undertake the development of a transport strategy to cater for a local development strategy for the Forth and Clyde Canal corridor.
CRA4	Manage and maintain the quay walls and river banks to manage the risk of flooding to the adjacent road, cycle and walkway network.
CRA5	Seek funding for a study into the interface of waterborne transport with land transport, including ferries, river taxis and barges and for a study into waterborne transport on the River Clyde.
PA1	Review parking charges annually.
PA2	Undertake 5 yearly surveys of parking supply and demand (next survey 2009).
PA3	Research and bring forward proposals for using new technology in parking control.
PA4	Consult on a second phase of restricted parking to the west of the city centre by October 2007.
PA5	Investigate on road parking control around stadia.
PA6	Review existing parking restrictions city wide by March 2010.
PA7	Promote the management of off road car parks as a separate company.
PA8	Bring forward proposals to prohibit footway parking except where specifically authorised.
TCA1	Provide monitoring of traffic conditions through the City's traffic control systems (CITRAC/BIAS).
TCA2	Develop CITRAC/BIAS as a Traffic Management Centre incorporating control over the network's traffic signals, enforcement of parking controls and roadworks control to improve traffic flows across the city.
TCA3	Continue to deploy demand responsive traffic signal control (e.g. Split Cycle Optimisation Offset Technique - SCOOT).
TCA4	Undertake linkage of traffic signal timings on main roads into and through the City Centre to optimise their operation.
TCA5	Develop and implement facilities for improved dissemination of road, traffic and event information to road users through the implementation of roadside VMS on key routes and improved web and mobile phone (SMS) based information services.
TCA6	Continue, via membership of European and UK ITS networks and

	through collaboration with other major European cities, to influence the development of best practice in the use of transport technologies.
TCA7	Develop and implement facilities to monitor the operational performance of bus corridors and main traffic routes.
TCA8	Expand car park monitoring and variable information signing to other areas of the city to reduce unnecessary traffic movements within the City Centre. Expand to all major public owned car parks in the east and west of the City by the end of 2007.
TCA9	Continue to introduce, where appropriate, traffic control facilities that meets the needs of pedestrians and cyclists. For example demand responsive pedestrian crossings (PUFFINS).
TCA10	Collaborate with Transport Scotland to ensure effective integrated management of the local and strategic road networks in Glasgow.
TCA11	Provide systems to support bus management, passenger information and bus traffic signal priority systems.
TCA12	Provide real time passenger information at strategic bus stops on Streamline routes and at off-route locations of high public demand such as hospitals, shopping centres and travel interchanges.
TCA13	Install traffic monitoring cameras at an additional 20 sites by the end of 2008.
TCA14	Commence preparation of transport Telematics Strategy by August 2007.
RPA1	Encourage the Scottish Executive to introduce legislation to enable a charge to be levied for all trip-end off road non residential parking.
RPA2	Bring forward proposals to influence the charging regimes at privately operated public car parks in Glasgow.
DMA1	Ensure that all developments include appropriate provision for public transport access, cycling, walking and freight.
DMA2	Ensure that where a Transport Assessment is required it is undertaken in line with SPP17, PAN75 and the Scottish Executive Transport Assessment and Implementation Guide and accommodates City Plan requirements.
DMA3	Require the provision of a least one off road car parking space for each

	dwelling created except for developments within and at least 100m from the boundary of a controlled or restricted parking zone.
DMA4	Identify opportunities for developer contributions to the Council's transport programmes.
DMA5	Review and update the Council's Roads Development Guide by 2010 to reflect new thinking on the design of residential areas.
DMA6	Maintain the operational efficiency of the road network by minimising new accesses on local strategic routes (refer to Figure 6.2) and other routes where it would be inappropriate.
DMA7	Impose maximum parking standards for trip-end developments as set out in Table 6.1 and the City Plan.
DMA8	Within controlled parking zones make on road spaces available for car club vehicles.
DMA9	Require all new housing developments to be designed to facilitate the introduction of 20 mph zones on appropriate residential roads and design new residential roads to encourage speeds of less than 10 mph.
DMA10	Progressively encourage employers, including health agencies, universities and colleges, to reduce their travel impacts by adopting Travel Plans.
DMA11	Seek funding for specific officers to monitor the enforcement of travel plans by 2010.
DMA12	Encourage the Scottish Executive to introduce legislation to make travel plans obligatory for all work places.
DMA13	Encourage and support employers and other organisations wishing to establish Car Clubs for new developments.
EPA1	Continuously maintain and review procedures for liaison with Emergency Services, RALF, adjacent authorities, the City's Emergencies Planning Officer, and the Strathclyde Emergencies Coordination Group (SECG).
EPA2	Continue representation on the SECG at the strategic, tactical and local levels.
EPA3	Review the Clyde Tunnel Contingency Plan as appropriate.
EPA4	Prepare a diversionary route strategy plan detailing potential diversion routes for use as and when necessary.

EPA5	Utilise the city's traffic information displays and those available on the local trunk road network through Transport Scotland.
EPA6	Provide on a 24 hour a day basis the ability to respond to any emergency in the City within a 2 hour period.
EPA7	Work with the City's Emergencies Planning Officer to develop a Business Continuity Plan to demonstrate the Council's ability to respond to emergencies under the Civil Contingencies Act 2004 (Contingency Planning) (Scotland) Regulations 2005.
TAA1	Work with schools to develop School Travel Plans and Safer Routes to School schemes in accordance with Scottish Executive guidance, identifying issues that are a barrier to healthy, sustainable and active travel.
TAA2	Develop a City Council Travel Plan by 2008.
TAA3	Work with the SPT to support the development of workplace, further education and leisure and retail travel plans.
TAA4	Promote the Scottish Cycle Training Scheme in all schools to encourage cycling from an early age.
TAA5	Seek funding to implement any changes to the road layout, where the need for such changes are identified in School Travel Plans as being integral to a Safer Routes to School scheme.
TAA6	Work with the SPT in the development of an effective Car Sharing Scheme.
TAA7	Develop a 'Smarter Choices' strategy to take forward travel awareness and behavioural change.
RSA1	Maintain a specialised Road Safety Unit to provide road safety education and training and publicity programmes.
RSA2	Maintain and utilise a safety audit procedure for the design and implementation of new schemes.
RSA3	Continually review the number of sites automatically monitored by speed and red light cameras.
RSA4	Implement traffic calming or other measures (including 20 mph zones) in selected residential areas focusing on areas of high pedestrian activity with known problems of injury.
RSA5	With community involvement identify and implement advisory 'Twenty's Plenty' 20mph Zones in appropriate residential areas.

RSA6	Complete implementation and provide central control of signs associated with the Twenty Limits around Schools (TWELAS) project (complete implementation by 2007/08).
RSA7	Maintain a list of sites with the worst injury accident record and review the list every 2 years. Undertake remedial measures at 15% of problem sites identified in the above list.
RSA8	Produce an annual summary report including annual tables of casualty types and trends.
RSA9	Seek funding to undertake a mass action campaign on one type of accident per year.
RSA10	Contact each school every year with regard to road safety training.
RSA11	Ensure every Primary School within the Glasgow City boundary is invited to put forward Primary 6 pupils they wish to participate in the Scottish Cycle Training Scheme.
RSA12	Promote a city wide order for no stopping/waiting at schools by 2009.
RSA13	Continue to promote driver training schemes: <ul style="list-style-type: none"> - Council Accident Reduction Scheme - Learn to Teach - Company Driver
RSA14	Continue to provide and expand Kerbcraft and road safety training.
RSA15	Investigate the feasibility of mandatory 20mph limits in appropriate residential areas, supported by an appropriate enforcement regime, as an alternative to traffic calming.
RIA1	Deliver the East End Regeneration Route by 2010 subject to funding availability.
RIA2	Progress construction of the M74 completion in partnership with Transport Scotland, South Lanarkshire and Renfrewshire Councils.
RIA3	Promote the development of the North Clydeside Development Route (Stage 1) allowing for future phases of Fastlink with the planning application lodged by the end of 2007.
RIA4	Upgrade Gartloch Road and support the delivery of the Easterhouse Regeneration Route in conjunction with new housing development.

RIA5	Review in conjunction with Transport Scotland, improvements to the gateway approaches to the City Centre.
RIA6	Encourage Transport Scotland and Strathclyde Partnership for Transport to fully consider the potential of a north circumferential route from M73 to the north side of the Erskine Bridge in any investigation to address capacity issues on the M8 through Glasgow.
RIA7	Use the development control process to encourage developers as part of new developments to provide transport infrastructure that improves circumferential movements through the City (e.g. from Daldowie to Baillieston).
RIA8	Investigate the feasibility of providing improved circumferential routes through the north of the city between Anniesland and Provan.
RIA9	Develop a transport plan to support the city's bid for the 2014 Commonwealth Games. The bid is to be submitted by May 2007.
FTA1	Support Strathclyde Partnership for Transport in the development of a Freight Quality Partnership.
FTA2	Review as appropriate time restrictions giving delivery vehicles access to pedestrian areas.
FTA3	Ensure adequate loading facilities when reviewing parking restrictions.
FTA4	Assist in the expansion of inter-modal freight development.
FTA5	Support proposals by airport and sea port operators to improve the connectivity of Glasgow, especially internationally.
MNA1	Continually review mechanisms for the maintenance of the road and cycle network and ensure an appropriate maintenance regime is in place.
MNA2	Effectively use an integrated Roads Management System to help target expenditure and utilise it to prioritise reconstruction and resurfacing works.
MNA3	Monitor and review the service levels provided by the Access Centre.
MNA4	Develop a cycle network maintenance regime by March 2008.
MNA5	Review the City Centre Public Realm Management and Maintenance Procedures Manual and make it more widely available (e.g. on the Council's web site) and seek to procure appropriate funding for maintenance.

MNA6	Develop a Roads Asset Management Plan (RAMP) by 2011.
MNA7	Continue participation in the joint Scottish Road Maintenance Survey 2007-2011.
MNA8	Endeavour to maximise the use of recycled materials in road maintenance schemes.
MNA9	Undertake safety inspection in accordance with current maintenance code of practice.
MNA10	Ensure, where appropriate, the needs of disabled people are taken into account during maintenance schemes (e.g. dropped kerbs, access through works).
MSA1	Complete the programme of strength assessment of all bridges by December 2008.
MSA2	Complete, subject to available funding, strengthening of a further 4 bridges.
MSA3	Manage sub-standard bridges by applying appropriate interim restrictions.
MSA4	Carry out General Inspections of all Council owned bridges on a rolling 2 yearly cycle (50% of total per year) using the national Bridge Condition Indicator (BCI).
MSA5	Carry out Principal Inspections of all Council owned bridges on a rolling 6 yearly cycle (16.7% of total per year) using the national Bridge Condition Indicator.
MSA6	Ensure an appropriate maintenance regime is in place for the Clyde Tunnel and other structures.
MSA7	Implement the national Code of Practice for the Management of Highway Structures by 2011.
MSA8	Introduce and develop improved Bridge Management System by summer 2007.
MSA9	Seek funding for the use of data capture devices to improve asset inventory information e.g. for retaining walls etc.
MSA10	Liaise with other bridge owners in the city on inspection, maintenance and operational issues.
MSA11	Complete replacement of Clyde Tunnel fire resistant secondary lining during 2007.

MRA1	Continue the local coring contract via the materials testing consultancy programme to ensure adequacy of reinstatements.
MRA2	Continue to invite applications for the Lay Assessors scheme.
MRA3	Support roadwork co-ordination via Traffic Scotland.
MRA4	Continue to implement the considerate contractors scheme-voluntary code of practice.
MRA5	Subscribe to the new Street Works register for Scotland.
MRA6	Develop the availability of online permits, skips and scaffolds via the Council's website.
MRA7	Provide information on road works on the Council's website.
MWA1	Produce, prior to the onset of winter, a Winter Emergency Plan outlining responsibilities within Land Services, setting priorities for treatment routes, specifications for treatments, resources to be used and liaison with other agencies and adjoining authorities.
MWA2	Continue to modify treatment routes using optimisation techniques for carriageways and footways to reflect changes in the network.
MWA3	Utilise new technology and materials for more efficient route treatment.
MWA4	In normal overnight frost conditions ensure that the public road and footway network selected for treatment is completed within the prescribed timescale.
MWA5	Improve public access to information by putting gritting routes on the Council website.
MWA6	Continue to utilise partnership and liaison with adjacent authorities to employ weather forecasting services(joint contract) and cross boundary gritting.
MWA7	Investigate new procedures and materials to minimise the environmental impact of winter maintenance.
MLA1	Maintain lighting to appropriate standards by operating a Roads Operation Service Delivery agreement.
MLA2	Carry out, a 6 yearly electrical inspection and testing programme, with records kept of certificates and remedial works to restore to safe operational condition.

MLA3	Review delivery mechanisms for maintaining street and sign lighting to appropriate standards.
MLA4	Undertake a 2 yearly structural inspection of all lighting plant.
MLA5	<p>Prioritise schemes in the lighting capital programme for:</p> <ul style="list-style-type: none"> - Compliance with Electricity at Work Regulations - Replacement of Scottish Power (5th core) Connections to street lighting by 2010 - Corroded steel and concrete lighting column replacement.
MLA6	Improve performance through the use of Data Capture Devices (DCD), software and asset management.
MLA7	Continue to seek funding to ensure the delivery city wide of the City's lighting strategy via the lighting network renewal (LNR) programme.
MSLA1	When implementing traffic signs use reflectorised sign faces in place of direct illumination wherever possible.
MSLA2	Introduced planned maintenance regime for road markings and signs by 2012.
MSLA3	Utilise GIS database for maintenance of signs and yellow road markings by 2012.
MSLA4	Develop and implement an asset assessment regime by 2009 to ensure that refurbishment of traffic signals is prioritised on the basis of complying with safety regulations and maintaining operational efficiency.
MSLA5	Review the classification of all roads and all strategic directional signing within the City by 2012.
DA1	Ensure design service encompasses the disciplines of roads, structures, geotechnical, lighting, environment and traffic.
DA2	Ensure the Design Service is registered to EN ISO 9001: 2000.
DA3	Ensure Contract Documentation where appropriate contains a Recycled Material Certificate.
DA4	Adopt a proactive approach at the design stage in material selection including consideration of availability, durability and maintainability.
DA5	When required by the Client undertake a whole life costing exercise for project evaluation.

DA6	Ensure low noise road surfacing is considered for all appropriate projects.
DA7	In sensitive areas (e.g. Conservation Areas) ensure all signing, street furniture etc. is designed to a quality appropriate to the location.
DA8	Ensure that clutter due to signage and street furniture is minimised in all new designs.
DA9	Utilise surface sustainable urban drainage techniques wherever appropriate.
AQA1	Undertake a programme of assessment and monitoring of air pollution. £40,000 per annum
AQA2	Undertake a study into the use of alternative fuels and energy conservation measures for the Council's fleet of vehicles.
AQA3	Undertake vehicle emission testing and enforcement in partnership with adjacent Local Authorities.
AQA4	Produce an Action Plan for any designated Air Quality Management Areas in accordance with Scottish Executive Guidelines.
AQA5	Continue to enforce the regulations regarding drivers leaving engines running whilst stationary.
AQA6	Carry out an environmental assessment of all major new transport infrastructure in accordance with EIA Guidelines.
AQA7	Investigate the benefits of introducing Low Emission Zones in the City and the practicalities of enforcement.
AQA8	Investigate using Traffic Regulation Condition powers to improve the emission levels from buses when required legislation to allow this becomes available.
NPA1	Provide input to the Scottish Executive as required to produce a noise map for Glasgow by June 2007.
NPA2	Provide input to the Scottish Executive as required to produce a noise action plan by June 2008.
NPA3	Continue to implement the Noise Insulation (Scotland) Regulations 1975 by assessing new road schemes following implementation and at 5 yearly intervals to assess whether noise thresholds are breached and implementing mitigation measures as appropriate.
VA1	Complete phase 2 of Merchant City Streetscape by 2008. £1.5 m GCC

	SEG
VA2	Deliver International Financial Services District Streetscape Phase 2
VA3	Minimise visually intrusive signing, including the use of yellow lines, to delineate waiting restrictions.
BA1	Ensure that all new infrastructure projects and maintenance works have due regard to the network of designated wildlife sites (SSSIs, LNRs, SINC's and wildlife corridors); species of conservation concern (as listed in the Glasgow Biodiversity Audit); and the appropriate habitat and species plans of Glasgow's Local Biodiversity Action Plan.
BA2	Ensure that specific landscape and environmental features are incorporated within designs to maintain existing habitats and/or create new habitats, with the objective of compensating for, or enhancing affected landscapes and wildlife habitats.
BA3	Ensure no net loss of trees as a result of transportation infrastructure projects or maintenance.
BA4	Undertake maintenance works in a manner aimed at protecting and/or enhancing biodiversity, in support of Glasgow's Local Biodiversity Action Plan.
CCA1	Undertake a review and update of the City Centre traffic management strategy. Develop an integrated transport and public realm plan and seek funding for implementation.
CCA2	Expand car park VMS signing to all permanent car parks in the city centre by 2008.
CCA3	Develop and consider proposals for introducing a mandatory 20mph zone throughout the city centre.
CCA4	Review and evaluate the provision of late night transport from Glasgow city centre.
CCA5	Implement an integrated transport and public realm plan for Glasgow city centre.

Appendix C

List of Invitees

List of invitees to be completed following consultation workshops scheduled to take place following publication of the Draft Action Plan.

Appendix D

Option Testing Assessment

Glasgow City Council

Option Testing Assessment



19 July 2007

Report no: 002-NH51080-NHR-01



Glasgow City Council

Option Testing Assessment

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Report no: 002-NH51080-NHR-01

Date: 19 July 2007

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Contents

1	Executive Summary	1
2	Introduction	3
3	Methodology	5
3.1	Air Quality Model	5
3.2	Traffic Data	5
3.3	Meteorological Data	5
3.4	Model Background NO _x and NO ₂ Concentrations	6
3.5	Modelled Scenarios	7
3.6	Modelled Receptors	7
4	Model Verification	9
4.1	Verification	9
5	Results & Discussion	11
5.1	Modelled Receptor Concentrations 2005	11
5.2	Modelled Receptor Concentrations 2010	13
6	Conclusion.....	16
7	References.....	18

Tables

Table 3-1	Background NO _x and NO ₂ Concentrations for 2005 and 2010	6
Table 4-1	Annual Average Modelled versus Monitored Concentrations 2005	9
Table 5-1	Modelled Annual Average NO ₂ Concentrations 2005	11
Table 5-2	Reductions in Annual Average NO ₂ Concentration from Scenario 1	12
Table 5-3	Modelled Annual Average NO ₂ Concentrations 2010	13
Table 5-4	Reductions in Annual Average NO ₂ Concentration from Scenario 1	14

Appendix A

Figures

Appendix B

Model Setup

Appendix C

Traffic Data

1 Executive Summary

A number of option testing scenarios were considered to determine their impact on annual average nitrogen dioxide concentrations in areas of poor air quality. The areas considered were;

1. Dumbarton Road & Byres Road
2. Royston Road
3. Parkhead Cross
4. North Street

Air quality dispersion modelling was undertaken to determine the impact of the following options in these four areas;

1. Low Emission Zone
2. A 10% reduction in Heavy Goods Vehicles
3. A 50% reduction in Heavy Goods Vehicles

These scenarios were compared against a do nothing scenario where the traffic composition was based on the standard vehicle splits and fleet composition.

The air quality modelling indicated that the most effective scenario was a low emission zone. A reduction in 10% heavy goods vehicles had little impact on modelled annual average nitrogen dioxide concentrations at sensitive receptors. A larger reduction in heavy goods vehicles of 50% resulted in a greater reduction in annual average nitrogen dioxide concentrations.

The assessment illustrates the impact of a small number of scenarios and their relative effect on annual average nitrogen dioxide concentrations. These scenarios illustrate what air quality benefits can be achieved by changes in vehicle composition. However more detailed investigation would need to be undertaken in conjunction with traffic engineers to determine what traffic measures could feasibly be introduced in these areas. Once these assessments have been carried out more detailed option testing could then be carried out specific to each area.



2 Introduction

Glasgow City Council (GCC) appointed Hyder Consulting (UK) Ltd to undertake basic air quality option testing. The purpose of the air quality option testing was to determine the impact of a number of traffic related scenarios on areas that have been designated as Air Quality Management Areas (AQMA).

The option testing have been carried out in the following areas (Figure 1);

1. Dumbarton Road & Byres Road (Area 1)
2. Royston Road (Area 2)
3. Parkhead Cross (Area 3)
4. North Street (Area 4)



3 Methodology

3.1 Air Quality Model

ADMS Roads (version 2.2) was used to model annual average NO₂ concentrations for the option testing scenarios in 2005 and 2010 for the modelled areas (Figure 1). The modelling parameters and settings used in this assessment to model concentrations of NO₂ are presented in Appendix B.

3.2 Traffic Data

The traffic data for 2005 and 2010 used in the assessment is presented in Appendix C. The traffic link diagram is presented in Figure 2. The traffic data was supplied by GCC, and originated from their Saturn model.

3.3 Meteorological Data

Meteorological data from Bishopton for 2005, the nearest suitable meteorological station located approximately 10km west of Glasgow City centre, was used in the model runs. This year corresponds to the availability of actual monitoring data and allows for verification of modelled outputs with the meteorological data for 2005.

The wind rose for 2005 is shown in Figure 3. As depicted on the wind rose, the highest frequency of wind is from the westerly quadrant, with the higher occurrences from the north west and south west. The higher wind speed corresponds with the westerly direction. Secondary wind movements are notable from the east although in comparison they are less frequent, and tend to have lower wind speeds.

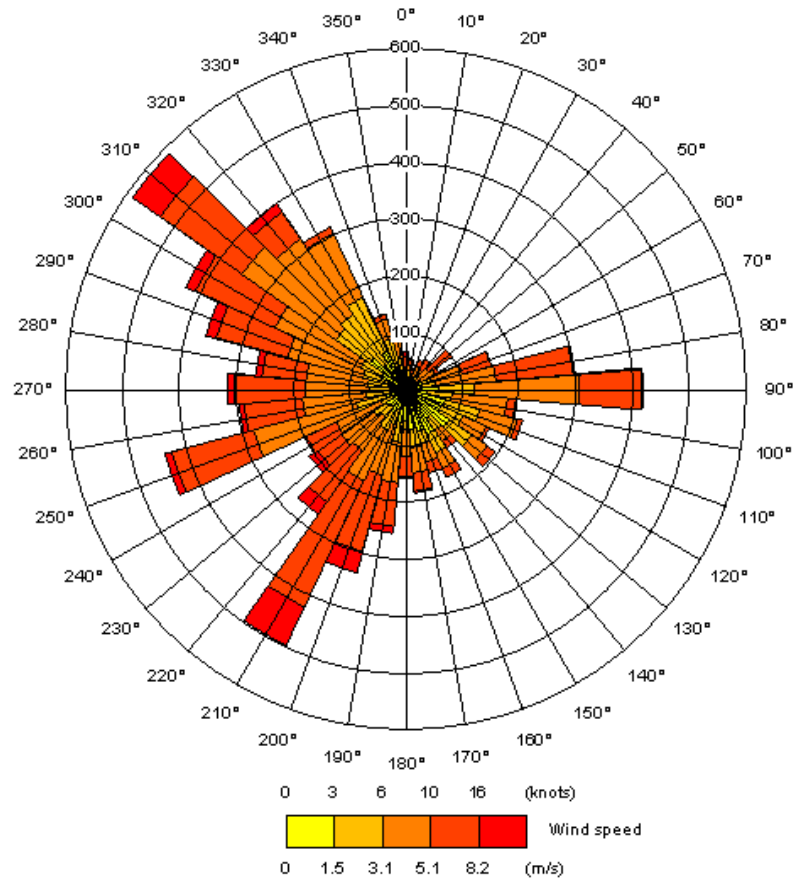


Figure 3 Bishopton Wind Rose 2005

3.4 Model Background NO_x and NO₂ Concentrations

Background NO_x and NO₂ concentrations were obtained from the background pollutant maps (www.airquality.co.uk). To be consistent with the Detailed Assessment (2007) the same background concentrations for NO_x and NO₂ were used in this Scenario Testing Assessment (Table 3-1). The 2005 concentrations were converted to 2010 using the method outlined in LAQM.TG(03).

Year	NO _x Concentration (µg/m ³)	NO ₂ Concentration (µg/m ³)
2005	40.7	25.6
2010	32.8	19.2

Table 3-1 Background NO_x and NO₂ Concentrations for 2005 and 2010

3.5 Modelled Scenarios

A number of scenarios were tested to determine their impact on air quality concentrations within the various modelled areas. The scenarios chosen were as follows;

1. Standard Emission Profile (Do Nothing)*
2. Low Emission Zone (LEZ) where vehicles are all EURO IV Standard
3. A reduction in 10% Heavy Goods Vehicles (HGVs)
4. A reduction in 50% HGVs

**Based on the standard vehicle splits and fleet composition provided on the national atmospheric emissions inventory (www.naei.org.uk)*

The modelled outputs were compared to Scenario 1 to determine their effectiveness of each scenario in reducing NO₂ concentrations in 2005 and 2010.

3.6 Modelled Receptors

To compare the modelled concentrations sensitive receptors e.g. residential properties were chosen in each of the modelled study areas, as illustrated in Figure 4.



4 Model Verification

4.1 Verification

The modelled outputs from the standard 2005 emission profile (Scenario 1) were compared against the monitored concentrations within each of the four modelled areas (Figure 4). This was undertaken to verify the model outputs. The verification factors were applied to the scenarios 2, 3 and 4. Table 4-1 illustrates the initial model versus monitored concentrations in each of the modelled areas.

Diffusion Tube ID (Figure 4)	Modelled NO ₂ (µg/m ³)	Monitored NO ₂ (µg/m ³)	Verification Factor
Dumbarton Road & Byres Road			
DT9	31.4	27	0.9
DT22	31.8	45	1.4*
DT30	28.3	26	0.9
Royston Road			
DT32	33.5	42	1.3
DT4	32.7	47	1.4*
North Street			
DT8	42.9	47	1.1
Parkhead Cross			
DT24	33.0	49	1.5*

**Verification Factor Used in Each of the Modelled Areas*

Table 4-1 Annual Average Modelled versus Monitored Concentrations 2005

The model tends to under predict at the monitoring locations apart from within Dumbarton and Byres Road modelled area where DT9 and DT30 the model over predicts against modelled concentrations. As a precautionary approach, the highest verification factor in each of the modelled areas was used to adjust the modelled concentrations at the receptors, within each area.



5 Results & Discussion

5.1 Modelled Receptor Concentrations 2005

The verified modelled concentrations for each receptor (Figure 4) for the various scenarios are presented in Table 5-1.

	Annual Average NO ₂ (µg/m ³)			
Receptor (Figure 4)	Scenario 1	Scenario 2	Scenario 3	Scenario 4
North Street				
R1	40.8	33.3	40.3	38.2
R2	42.9	34.3	42.2	39.7
Dumbarton Road & Byres Road				
R3	44.8	39.7	44.7	43.0
R4	41.1	38.0	40.9	39.9
R5	46.3	40.4	46.2	44.6
R6	45.3	39.9	45.3	44.2
Royston Road				
R7	46.3	40.7	45.6	42.5
R8	42.8	38.9	42.4	40.2
Parkhead Cross				
R9	46.9	42.2	46.5	44.1
R10	45.9	41.8	45.4	43.2

Table 5-1 Modelled Annual Average NO₂ Concentrations 2005

Table 5-2 illustrates the total reduction in annual average NO₂ concentrations in 2005 against Scenario 1, which represents the Do Nothing Scenario against the implementation of the various traffic options.

	Reduction in Annual Average NO ₂ (µg/m ³) from Scenario 1		
Receptor (Figure 4)	Scenario 2	Scenario 3	Scenario 4
North Street			
R1	7.6	0.5	2.6
R2	8.6	0.8	3.3
Dumbarton Road & Byres Road			
R3	5.1	0.1	1.8
R4	3.1	0.2	1.2
R5	5.9	0.1	1.7
R6	5.4	0.0	1.1
Royston Road			
R7	5.6	0.6	3.8
R8	3.9	0.4	2.6
Parkhead Cross			
R9	4.7	0.5	2.9
R10	4.1	0.5	2.7

Table 5-2 Reductions in Annual Average NO₂ Concentration from Scenario 1

The modelled scenarios illustrate that by far the most effective measure would be to implement a Low Emission Zone, which leads to a reduction in annual average NO₂ concentrations of between 3.1µg/m³ (R4) and 8.6µg/m³ (R2). The greater the flow in traffic the more effective the measure is in reducing emissions and thereby the annual average NO₂ concentrations. This is illustrated by the reduction in annual average NO₂ concentrations at receptors in the North Street modelled area, which is located close to the M8, and as such the area is subjected to a high traffic flow and emissions.

Reducing the number of HGVs by 10% as illustrated in Scenario 2 has little impact on annual average concentrations. The reduction in annual average NO₂ concentration is less than 1µg/m³ at all receptors.

Reducing the number of HGVs by 50% reduces the concentration between 1.1µg/m³ (R6) and 3.8µg/m³ (R7), thereby is a more effective measure reduction in NO₂ concentrations than a 10% HGV reduction.

5.2 Modelled Receptor Concentrations 2010

The verified modelled receptor concentrations for each of the modelled receptors (Figure 4) for each of the scenarios are presented in Table 5-3.

Receptor (Figure 4)	Annual Average NO ₂ (µg/m ³)			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
North Street				
R1	33.5	29.9	33.1	31.7
R2	35.1	31.0	34.8	33.0
Dumbarton Road & Byres Road				
R3	36.5	34.6	36.2	35.6
R4	35.6	33.9	35.3	34.8
R5	38.0	35.5	37.6	36.8
R6	38.3	35.7	38.3	37.3
Royston Road				
R7	39.1	36.5	38.6	36.4
R8	36.7	34.8	36.4	34.9
Parkhead Cross				
R9	38.8	36.9	38.5	37.5
R10	37.8	36.3	37.5	36.7

Table 5-3 Modelled Annual Average NO₂ Concentrations 2010

Table 5-4 illustrates the total reduction in annual average NO₂ concentrations in 2010 compared to Scenario 1 (the Do Nothing Scenario).

All concentrations in each of the scenarios are predicted to be below the annual average NO₂ EU Limit Value.

	Reduction in Annual Average NO ₂ (µg/m ³) from Scenario 1		
Receptor (Figure 4)	Scenario 2	Scenario 3	Scenario 4
North Street			
R1	3.6	0.4	1.8
R2	4.1	0.4	2.2
Dumbarton Road & Byres Road			
R3	1.9	0.3	1.0
R4	1.6	0.3	0.8
R5	2.5	0.4	1.3
R6	2.6	0.0	1.0
Royston Road			
R7	2.6	0.5	2.7
R8	1.9	0.3	1.8
Parkhead Cross			
R9	1.9	0.3	1.3
R10	1.5	0.4	1.2

Table 5-4 Reductions in Annual Average NO₂ Concentration from Scenario 1

The modelled scenarios illustrate that by far the most effective measure would be to implement a Low Emission Zone, which leads to a reduction in annual average NO₂ concentrations of between 1.5µg/m³ (R10) and 4.1µg/m³ (R2). The greater the flow in traffic the more effective the measure is in reducing emissions and therefore the annual average NO₂ concentrations. The reduction in annual average NO₂ concentrations in 2010 as a result of implementing a Low Emission Zone are smaller in 2005 than in 2010. This is as a result of cleaner vehicles being introduced into the vehicle fleet from 2005 to 2010. The further into the future the less effective the Low Emission Zone scenario will be as older EURO specification vehicles are replaced by cleaner higher EURO specification vehicles, as part of the fleet composition.

This is based on the current traffic vehicle emission factors, which assume that vehicles will continually improve emissions as more stringent legislation is adopted into the future.

As with 2005 the reduction in 10% HGV has little impact on the annual average NO₂ concentrations at receptors. A greater reduction in the number of HGVs of 50% does however lead to greater reduction in annual average NO₂.



6 Conclusion

The scenario testing has illustrated the impacts of various traffic measures on annual average NO₂ concentrations on receptors within the modelled areas. The greatest impact has been predicted by establishing a Low Emission Zone. Air quality benefits can also be gained through the reduction in the numbers of HGVs. However for large benefits there needs to be a large reduction in the number of HGVs, i.e. 50% as shown by the difference in reducing the number by 10% and 50%.

The effectiveness of any measure however is dependent on the breakdown of the traffic. For example reducing the number of HGVs in areas where there are little HGV movements would not be effective. This assessment has illustrated a small number of scenarios and their relative impact on annual average NO₂ concentrations. However, to fully assess the impact of measures a more detailed assessment would be required in conjunction with traffic engineers to determine what could actually be done in areas of poor air quality. For example it may not be possible to reduce the number of HGVs in all areas due to the nature of the area (e.g. leading to commercial and industrial areas) therefore greater consideration would be need to determine what measures could be implemented. Once this consideration has taken place more effective option testing could be undertaken.



7 References

CERC. 2003. ADMS-Roads Air Quality Management system User Guide.

Defra 2003. LAQM TG(03): Technical Guidance: Local air quality management.

Defra. 2003. The UK National Air Quality Information Archive Website, <http://www.airquality.co.uk/archive/laqm/laqm.php>

Defra 2003 National Atmospheric Emission Inventory Website, <http://www.naei.org.uk>

Hyder Consulting (UK) Ltd 2007: Glasgow City Council Detailed Assessment Nitrogen Dioxide.



Appendix A

Figures



Appendix B

Model Setup



Option	Detail
Pollutant Details	
Pollutant	Nitrogen Dioxide (NO ₂)
Units	µg/m ³
Averaging Time	Annual Average
Percentiles	None
Input Details	
Point Emissions	None
Area Emissions	None, represented by monitored background concentrations
Volume Emissions	None
Line Emissions	Local Road Sources
Meteorological Data	2005 hourly sequential meteorological data from Bishopton Meteorological Station
Calculation Parameters	
Surface Roughness	Influence of ground terrain on mechanical turbulence. Parkland / Open Suburbia = 0.5m
Monin-Obukhov Length	Influence of thermal and mechanical turbulence on dispersion. Cities and Large Towns = 30m
Source Depth	1.5m representing average respirable height
Gridded Output	No Specified Points
Intelligent Gridding	No
Buildings	No
Street Canyons	No
Terrain	No
Wet and Dry Deposition	No



Appendix C

Traffic Data



Original Traffic Data Set					Reduction of 10% HGV					Reduction of 50% HGV			
Link Id	AADT	%HGV	Speed (Kph)		Link Id	AADT	%HGV	Speed (Kph)		Link Id	AADT	%HGV	Speed (Kph)
Link1	10168	4.5	40		Link1	10122	4	40		Link1	9938	2.3	40
Link2	9617	5.1	29		Link2	9568	5	29		Link2	9374	2.5	29
Link3	15345	5.4	28		Link3	15262	5	28		Link3	14931	2.7	28
Link4	15345	5.4	40		Link4	15262	5	40		Link4	14931	2.7	40
Link5	4130	5.4	40		Link5	4108	5	40		Link5	4019	2.7	40
Link6	12006	5.8	40		Link6	11936	5	40		Link6	11657	2.9	40
Link7	14093	4.4	22		Link7	14032	4	22		Link7	13786	2.2	22
Link8	6923	5.0	25		Link8	6888	5	25		Link8	6749	2.5	25
Link9	12597	3.3	23		Link9	12555	3	23		Link9	12387	1.7	23
Link10	13345	3.2	21		Link10	13302	3	21		Link10	13129	1.6	22
Link11	13412	13.3	31		Link11	13233	12	31		Link11	12517	6.7	31
Link12	11262	14.0	25		Link12	11104	13	25		Link12	10471	7.0	25
Link13	11262	14.0	40		Link13	11104	13	40		Link13	10471	7.0	40
Link14	11262	14.0	40		Link14	11104	13	40		Link14	10471	7.0	40
Link15	3502	8.8	24		Link15	3471	8	24		Link15	3347	4.4	24
Link16	3483	5.2	25		Link16	3465	5	25		Link16	3393	2.6	25
Link17	7957	13.0	22		Link17	7853	12	22		Link17	7440	6.5	22
Link18	11266	7.7	24		Link18	11179	7	24		Link18	10834	3.8	24
Link19	12918	6.4	40		Link19	12836	6	40		Link19	12508	3.2	40
Link20	12918	6.4	80		Link20	12836	6	80		Link20	12508	3.2	80
Link21	66353	6.1	80		Link21	65945	6	80		Link21	64314	3.1	80
Link22	43223	7.3	80		Link22	42909	7	80		Link22	41652	3.6	80
Link23	14183	1.9	40		Link23	14157	2	40		Link23	14051	0.9	40
Link24	13373	2.7	9		Link24	13337	2	9		Link24	13192	1.4	9
Link25	9382	2.0	80		Link25	9363	2	80		Link25	9289	1.0	80
Link26	3790	8.1	40		Link26	3759	7	40		Link26	3637	4.0	40
Link27	12747	4.8	80		Link27	12686	4	80		Link27	12441	2.4	80
Link28	14052	1.7	80		Link28	14028	1	80		Link28	13935	0.8	80
Link29	20868	6.7	39		Link29	20729	6	39		Link29	20173	3.3	39
Link30	12747	4.8	5		Link30	12686	4	4		Link30	12441	2.4	5

Original Traffic Data Set					Reduction of 10% HGV					Reduction of 50% HGV			
Link Id	AADT	%HGV	Speed (Kph)		Link Id	AADT	%HGV	Speed (Kph)		Link Id	AADT	%HGV	Speed (Kph)
Link31	22307	2.3	24		Link31	22257	2	24		Link31	22055	1.1	24
Link32	32194	4.4	26		Link32	32054	4	26		Link32	31494	2.2	27
Link33	23432	2.9	50		Link33	23364	3	50		Link33	23092	1.4	50
Link34	8874	3.5	50		Link34	8842	3	50		Link34	8718	1.8	50
Link35	8874	3.5	50		Link35	8842	3	50		Link35	8718	1.8	50
Link36	13858	2.4	40		Link36	13824	2	40		Link36	13691	1.2	40
Link37	1931	1.4	22		Link37	1929	1	22		Link37	1918	0.7	22
Link38	7148	21.8	13		Link38	6992	20	13		Link38	6369	10.9	13
Link39	25677	0.4	8		Link39	25668	0	8		Link39	25631	0.2	8
Link40	25677	0.4	64		Link40	25668	0	64		Link40	25631	0.2	64
Link41	56800	6.8	26		Link41	56414	6	26		Link41	54871	3.4	26
Link42	43223	7.3	80		Link42	42909	7	80		Link42	41652	3.6	80
Link43	53427	6.1	80		Link43	53101	5	80		Link43	51795	3.1	80
Link44	66353	6.1	80		Link44	65945	6	80		Link44	64314	3.1	80
Link45	64772	3.2	61		Link45	64566	3	61		Link45	63744	1.6	61
Link46	43790	4.6	80		Link46	43590	4	80		Link46	42788	2.3	80
Link47	60923	5.0	16		Link47	60620	4	16		Link47	59409	2.5	16
Link48	15648	1.0	9		Link48	15634	1	9		Link48	15574	0.5	9
Link49	9662	3.0	27		Link49	9633	3	27		Link49	9517	1.5	27
Link50	15901	0.6	26		Link50	15891	1	26		Link50	15850	0.3	26
Link51	11531	0.9	9		Link51	11521	1	9		Link51	11478	0.5	9
Link52	10680	0.9	28		Link52	10670	1	28		Link52	10632	0.4	28
Link53	8823	1.1	11		Link53	8813	1	11		Link53	8774	0.6	11
Link54	32194	4.4	26		Link54	32054	4	26		Link54	31494	2.2	27
Link55	14756	3.2	25		Link55	14708	3	25		Link55	14520	1.6	25
Link56	5818	1.0	32		Link56	5812	1	32		Link56	5789	0.5	32
Link57	18361	2.7	36		Link57	18311	2	36		Link57	18112	1.4	36
Link58	8888	3.5	21		Link58	8857	3	21		Link58	8734	1.8	21
Link59	4791	2.9	40		Link59	4777	3	40		Link59	4722	1.4	40
Link60	5670	2.4	40		Link60	5657	2	40		Link60	5603	1.2	40
Link61	14486	4.1	32		Link61	14427	4	32		Link61	14192	2.1	33

Original Traffic Data Set				Reduction of 10% HGV				Reduction of 50% HGV			
Link Id	AADT	%HGV	Speed (Kph)	Link Id	AADT	%HGV	Speed (Kph)	Link Id	AADT	%HGV	Speed (Kph)
Link62	1873	3.9	40	Link62	1866	4	40	Link62	1836	2.0	40
Link63	7812	14.1	27	Link63	7701	13	27	Link63	7259	7.6	27
Link64	5394	10.3	22	Link64	5338	9	22	Link64	5115	5.4	22
Link65	23093	1.5	17	Link65	23058	1	17	Link65	22921	0.8	17
Link66	18918	1.9	22	Link66	18883	2	22	Link66	18740	0.9	22

Table C1 2005 Traffic Data for Modelled Scenarios

Original Traffic Data				10% Reduction in HGVs				50% Reduction in HGVs			
	AADT	%HGV	Speed (Kph)		AADT	%HGV	Speed (Kph)		AADT	%HGV	Speed (Kph)
Link1	9562	3.1	40	Link1	9531	2.8	40	Link1	9411	1.6	40
Link2	8180	3.8	25	Link2	8149	3.4	25	Link2	8025	1.9	25
Link3	11985	3.8	30	Link3	11940	3.4	30	Link3	11757	1.9	30
Link4	11985	3.8	40	Link4	11940	3.4	40	Link4	11757	1.9	40
Link5	11984	3.8	40	Link5	11938	3.4	40	Link5	11755	1.9	40
Link6	7945	3.3	22	Link6	7918	3.0	22	Link6	7813	1.7	22
Link7	14505	1.9	21	Link7	14477	1.7	21	Link7	14365	1.0	21
Link8	6891	2.3	25	Link8	6875	2.0	25	Link8	6813	1.1	25
Link9	13470	2.1	23	Link9	13442	1.9	23	Link9	13331	1.0	23
Link10	14762	1.9	21	Link10	14734	1.7	21	Link10	14623	0.9	21
Link11	12386	13.6	31	Link11	12218	12.2	31	Link11	11545	6.8	31
Link12	12774	13.5	25	Link12	12603	12.1	25	Link12	11915	6.7	25
Link13	12774	13.5	40	Link13	12603	12.1	40	Link13	11915	6.7	40
Link14	12775	13.5	40	Link14	12603	12.1	40	Link14	11915	6.7	40
Link15	4009	3.1	24	Link15	3996	2.7	24	Link15	3947	1.5	24
Link16	4626	4.3	25	Link16	4606	3.9	25	Link16	4526	2.2	25
Link17	8501	6.1	22	Link17	8449	5.5	22	Link17	8243	3.0	22
Link18	13263	4.8	24	Link18	13199	4.3	24	Link18	12945	2.4	24
Link19	12038	4.6	40	Link19	11982	4.1	40	Link19	11761	2.3	40
Link20	12038	4.6	80	Link20	11982	4.1	80	Link20	11761	2.3	80

Original Traffic Data					10% Reduction in HGVs					50% Reduction in HGVs			
	AADT	%HGV	Speed (Kph)			AADT	%HGV	Speed (Kph)			AADT	%HGV	Speed (Kph)
Link21	69665	5.7	80		Link21	69265	5.2	80		Link21	67666	2.9	80
Link22	43248	7.2	80		Link22	42935	6.5	80		Link22	41681	3.6	80
Link23	18964	1.5	40		Link23	18936	1.3	40		Link23	18823	0.7	40
Link24	12337	2.9	9		Link24	12302	2.6	9		Link24	12159	1.4	9
Link25	9846	2.7	80		Link25	9819	2.4	80		Link25	9715	1.3	80
Link26	2491	3.8	40		Link26	2481	3.5	40		Link26	2443	1.9	40
Link27	11037	3.2	80		Link27	11002	2.9	80		Link27	10862	1.6	80
Link28	12250	2.1	80		Link28	12224	1.9	80		Link28	12119	1.1	80
Link29	16159	7.5	39		Link29	16037	6.8	39		Link29	15551	3.8	39
Link30	11037	3.2	4		Link30	11002	2.9	4		Link30	10862	1.6	4
Link31	22353	1.9	23		Link31	22311	1.7	23		Link31	22143	0.9	23
Link32	30349	4.3	26		Link32	30217	3.9	26		Link32	29692	2.2	26
Link33	23997	3.9	50		Link33	23904	3.5	50		Link33	23530	1.9	50
Link34	11438	4.3	50		Link34	11389	3.9	50		Link34	11190	2.2	50
Link35	11439	4.3	50		Link35	11389	3.9	50		Link35	11190	2.2	50
Link36	10077	2.8	40		Link36	10049	2.5	40		Link36	9937	1.4	40
Link37	2237	1.9	22		Link37	2233	1.8	22		Link37	2215	1.0	22
Link38	2968	16.3	11		Link38	2919	14.7	11		Link38	2725	8.2	11
Link39	24807	0.5	7		Link39	24795	0.4	7		Link39	24747	0.2	7
Link40	24807	0.5	64		Link40	24795	0.4	64		Link40	24747	0.2	64
Link41	56475	6.5	17		Link41	56111	5.8	17		Link41	54653	3.2	17
Link42	49331	6.0	80		Link42	49036	5.4	80		Link42	47857	3.0	80
Link43	64310	5.0	80		Link43	63986	4.5	80		Link43	62693	2.5	80
Link44	69665	5.7	80		Link44	69265	5.2	80		Link44	67666	2.9	80
Link45	67867	3.4	44		Link45	67638	3.0	44		Link45	66722	1.7	44
Link46	44526	4.8	80		Link46	44314	4.3	80		Link46	43464	2.4	80
Link47	58262	5.5	16		Link47	57943	4.9	16		Link47	56667	2.7	16
Link48	21496	0.9	9		Link48	21477	0.8	9		Link48	21401	0.4	9
Link49	7778	3.3	26		Link49	7752	2.9	26		Link49	7651	1.6	26
Link50	18635	0.9	26		Link50	18618	0.8	26		Link50	18551	0.5	26
Link51	13161	0.9	7		Link51	13150	0.8	7		Link51	13105	0.4	7

Original Traffic Data				10% Reduction in HGVs				50% Reduction in HGVs			
	AADT	%HGV	Speed (Kph)		AADT	%HGV	Speed (Kph)		AADT	%HGV	Speed (Kph)
Link52	9702	0.9	29	Link52	9693	0.8	29	Link52	9659	0.4	29
Link53	18983	1.3	12	Link53	18958	1.2	12	Link53	18857	0.7	12
Link54	30349	4.3	26	Link54	30217	3.9	26	Link54	29692	2.2	26
Link55	13574	2.7	25	Link55	13537	2.4	25	Link55	13390	1.4	25
Link56	6694	1.8	33	Link56	6682	1.6	33	Link56	6633	0.9	33
Link57	19814	2.5	36	Link57	19765	2.2	36	Link57	19571	1.2	36
Link58	9280	3.5	21	Link58	9248	3.1	21	Link58	9119	1.8	21
Link59	7697	1.7	40	Link59	7684	1.5	40	Link59	7632	0.9	40
Link60	5174	3.7	40	Link60	5154	3.4	40	Link60	5077	1.9	40
Link61	12136	3.0	24	Link61	12100	2.7	24	Link61	11956	1.5	24
Link62	2584	2.1	40	Link62	2578	1.9	40	Link62	2557	1.0	40
Link63	5520	14.6	27	Link63	5440	13.3	27	Link63	5117	7.9	27
Link64	4834	9.4	22	Link64	4788	8.5	22	Link64	4607	4.9	22
Link65	22767	1.7	17	Link65	22728	1.5	17	Link65	22575	0.8	17
Link66	19407	2.1	22	Link66	19367	1.9	22	Link66	19206	1.0	22

Table C2 2010 Traffic Data for Modelled Scenarios