DRAFT Gloucester Air Quality Action Plan 2008

Note this is a Draft Plan and subject to change after consultation and refereeing.

A Plan for the Air Quality Management Areas at Priory Road, Painswick Road (North) and Barton Street in the City of Gloucester

Authors:
Peter Watkins, Environmental Health, Gloucester City Council
Paul Hardiman, *formerly* Network & Transport Strategy, Gloucestershire County Council
Orlagh Stoner, Development Co-ordination & Transport Strategy, Gloucestershire County Council

Please address correspondence to Peter Watkins at

Environmental Health
Gloucester City Council
Herbert Warehouse
The Docks
Gloucester GL1 2EQ *peter.watkins@gloucester.gov.uk*

If you have a print version of this paper, note that a colour version is available on the web at www.gloucester.gov.uk/pollution, which may make the graphs, maps and main tables easier to read.

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Summary

This Air Quality Action Plan is produced under Part IV of the Environment Act 1995. It is not directly a part of the County Council's second Local Transport Plan, but will be used to update that plan (Ref 15). The plan covers specifically the two Air Quality Management Areas declared in August 2005, Barton Street and Priory Road, and the AQMA declared in Painswick Road in October 2007. Maps of these areas are at the end of Chapter 1.

Since the first draft of this report was published, proposals for Painswick Road have been added. All of the proposals in Chapter 2 have been reassessed resulting in changes in costs and feasibilities. This report provides the detailed narrative for the outcomes listing required by the Department of Transport, which will be found in the County Report of Progress on the current Local Transport Plan. See www.gloucestershire.gov.uk/ltp2.

It should be stressed that while the air in the three Air Quality Management Areas is suffering nitrogen dioxide levels above the National target concentration, the general concentrations of nitrogen dioxide within the City of Gloucester away from heavy traffic, are not rising. **Air quality in Gloucester away from heavy traffic remains good.**

The first chapter explains the background to the air quality management areas. The second, produced by Gloucestershire County Transport planners, lists all the solutions that were considered with their advantages, disadvantages and cost-effectiveness, and then makes recommendations. It also lists things that are ongoing that will help reduce poor air quality. The recommendations in this chapter are the subject of public consultation. The third chapter discusses other relevant issues. The fourth chapter describes the consultations and hence the chosen actions. Chapter five identifies future traffic and air quality monitoring needs and review of this work.

The recent Rogers review of national enforcement priorities for local authority regulatory services (Ref 14) placed air quality firmly at the top of the local authority agenda. However most of the action plan we propose cannot be enforced – much of it is not directly within our remit. The City Council will have to work closely with the County Council as Highway Authority and with the local community to bring about air quality improvements. This plan has been developed jointly by the City and County and has been subjected to consultation particularly within the areas that are directly affected.

The plan should give a date or dates by which the air quality will be brought back within the target; in these three cases, when the annual average nitrogen dioxide concentration in the area is reduced below 40 ug/m3. On recent investigation, only Priory Road will be above the target by 2010, and we aim for it to be below target by 2014, when improvements to other parts of the road network should reduce traffic through the area. The lifetime of this plan is to match the current Local Transport Plan.

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Chapter 1 Introduction to the Air Quality Action Plan

Introduction to the law.

Part IV of the Environment Act 1995 set up the regime for local authorities to examine and report on the air quality in their area following a National Air Quality Strategy. The National Strategy has been revised three times, most recently in July 2007 (Ref 16). This revision, while extending the pollutants covered, does not affect this plan. Current Air Quality targets are listed in Appendix 1. While the City Council has produced air quality reports for its citizens for many years, this act required for the first time regular reporting to central government. The various reports to government are listed in Appendix 8. Central government guidance has been useful in focusing reporting on important substances and advice on what sort of locations to examine. The advice has changed over time as experience has been gained, and has led to finding the current problem areas. With the advent of easy access by all to the Internet, current guidance is on the DEFRA website and local reports are on the City Council website at *www.gloucester.gov.uk/pollution*

Where it becomes clear that National Air Quality objectives are not being achieved, or are likely not to be achieved by various target dates, then the affected areas shall be designated as "Air Quality Management Areas (AQMAs)". The city currently has three designated areas, which are the subject of this Action Plan. This plan requires the city to include a statement of the time or times by which we intend to implement each of our proposed measures. Section 84(5) requires effectively that City and County must agree on the plan. We have been working together to this end since the first two areas were designated in August 2005. Section 86 requires the County Council to make proposals for the use of any powers that are their responsibility. This is the main subject of Chapter 2, and all potential measures are discussed there. The city is not required to solve the problems by any set time, as they may prove beyond our capability; but we must demonstrate that we are working towards solutions.

What is the problem?

While this report discusses actions in terms of the law, there is a growing body of evidence that poor air quality shortens life. The most recent reference is a report for the Department of Health entitled "Long term exposure to air pollution: effect on mortality" (Ref 17)

The Updating and Screening Assessment for 2002 (ref 3) published in May 2003 showed that five locations in the city merited detailed assessment, as they seemed likely to breach targets for benzene, particulates and/or nitrogen dioxide. The subsequent detailed assessment (ref 4) showed that three of these areas were in fact unlikely to breach National Air Quality Objectives at the target dates, though they are still subject to monitoring as a watching brief. The assessment showed that the other two areas, Priory Road and Barton Street, breached the annual objective for nitrogen dioxide for 2005. At Priory Road two of the sample locations were also likely to exceed the annual nitrogen dioxide objective for 2010. As a consequence both areas were declared as "Air Quality Management Areas" by Order in August 2005.

Subsequently the Updating and Screening Assessment for 2005, published in April 2006, showed that a part of Painswick road required a detailed investigation. Subsequent to this investigation and after consultation with the affected residents, an AQMA was declared in October 2007. Painswick Road is in effect an extension of Barton Street. Both form part of the B4073. It is thus likely that the solutions for one will improve the other.

All three areas are shown on maps at the end of this chapter.

Why do we need to fix it?

Having declared three areas as having poor air quality, we are required to produce this Action Plan, with the expectation that it will be acted upon where practicable, and will improve air quality for those living and working in the declared areas. While this is a requirement, it of course is only natural justice to attempt to improve situations that are affecting people through no fault of their own. We have a responsibility to ensure that public funds are spent wisely and must therefore consider the benefits to be gained in relation to cost. This means that large sums of money may not be available to tackle problems experienced by small numbers of people if other simpler solutions will make small improvements for all our citizens.

The proposed actions do not just include changes inside the affected areas. Some possible actions within the affected areas are not practical, but have been considered for the sake of completeness. For example, it is not possible to remove traffic from St Oswald's Road, as this is a main route round the city, with no obvious alternative at the moment. However it may be possible to influence a large number of people not to drive round here, but take alternative routes use park and ride, or walk or cycle for some of their trips.

Where does the nitrogen dioxide come from?

The answer is quite complex, but simply put it is from combustion. Burning of fuel in an engine or a boiler produces enough heat to convert some of the nitrogen in air to nitric oxide. This then can react with ever-present ozone to give nitrogen dioxide. Usually a mixture of the two (so-called NO_x) exists at any one place, the ratio varying according to many factors. Ref 13 is a recent major study of nitrogen dioxide in the UK. Nitrogen dioxide is of much greater concern for health than nitric oxide, and thus is the substance of concern.

Nitrogen dioxide is produced by domestic and commercial boilers and by the engines of road and rail vehicles. Thus it could come from industrial sources, though there are none of significance locally, and also from railway locomotives, but these are too few in number to be significant here. While all these sources make up the background, the major source is traffic. The background concentration in Gloucester is measured at locations away from traffic and makes up roughly half of the concentrations noted in areas of concern.

Industrial Pollution

There are 49 businesses in Gloucester that are regulated by either the Environment Agency (5 installations), or the City Council (44 installations) under the Pollution Prevention and Control Act 1999. These businesses are regulated as they have potential to cause environmental pollution, the purpose of the regulation is to ensure that such pollution is prevented or minimised. None of these businesses are considered to add to the nitrogen dioxide present in the three AQMAs. Information about all these businesses is available on-line for the Environment Agency processes, and also on a public register held by Gloucester City Council Environmental health. The public register may be examined free of charge during normal office hours.

There are no known industrial polluters of any size within the three AQMAs.

Do we still need to fix the problems?

We are continuing to monitor the air in these three areas (and others). We are also covering locations just outside the declared areas, to make sure the problem areas are not increasing in size. As newer vehicles, which are less polluting than older ones enter the national fleet, it is hoped that the problem will improve to acceptable levels by 2010. Certainly in the first few months after declaration there were signs that air quality was improving. However in practice changes in traffic levels and flows over time have negated this. In the case of Priory Road, the

traffic pattern has completely changed, with the new traffic lights allowing frequent right turns, which were difficult before. The right turns have meant that there are now routine queues not present before.

Due to the demographic nature of the Barton & Tredworth area (a deprived ward with some 6500 dwellings) the local fleet is expected to improve more slowly than national average trends. As the cost of initial purchase of old vehicles is now so low, the numbers of older vehicles may actually increase.

Recent research discussed in Ref 13 shows that nitrogen dioxide is produced directly from heavy diesel engines in greater amounts than thought. This means that expected reductions, as a result of cleaner engines, may happen more slowly than predicted. Other work has shown the perversity of the problem, for reduction of smoke particles from buses in London (where they are now all fitted with particle traps) has resulted in increased nitrogen dioxide emissions!

We are not alone

At the time of writing more than 225 local authorities in the United Kingdom have declared AQMAs, mostly for the same pollutant we experience here in Gloucester. The current list and further information can be found at *http://www.airquality.co.uk/archive/laqm/list.php.* This list does not yet include new AQMAs declared in Cheltenham, Cotswold and the Forest of Dean districts.

Present Traffic patterns

Manual traffic counts were made in Barton Street and Priory Road in November 2006 and are fully described in Ref 9. Tables showing the vehicle mix and calculated relative proportions of nitrogen dioxide of each class are reproduced from that report. The 2006 count did not include Painswick Road. We want to conduct a further automatic traffic count to ensure data is accurate.

Barton Street

	AADT Vehicles	% of vehicles	NO_2 conc $\mu g/m^3$	NO_2 proportion
Car / Taxis	8358	86.8%	2.5	29%
PSV	345	3.58%	2.7	31%
LGV	724	7.52%	0.8	9%
MGV & HGV	203	2.11%	2.7	31%
Total	**9630**	**100.00%**		

Priory Road

	AADT Vehicles	% of vehicles	NO_2 conc $\mu g/m^3$	NO_2 proportion
Car / Taxis	24389	86%	5.4	31%
PSV	454	1.6%	2.5	14.5%
LGV	2540	9%	1.8	10.5%
MGV & HGV	970	3.4%	7.5	44%
Total	**28353**	**100.00%**		

AADT = annual average daily total

For Barton Street a number-plate count in 2006 was made to determine the proportion of through traffic. Number plates of silver coloured cars were noted in Barton Street and Painswick Road. This showed that between 20 and 25% of cars was through traffic. A further traffic count will be undertaken in 2008 to assess the current accurate through traffic.

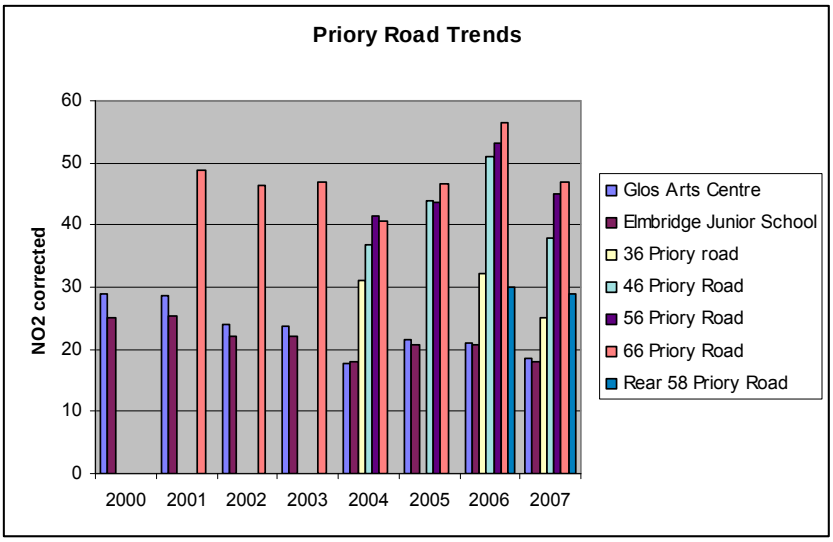
Automatic Traffic Counters

An automatic counter was installed in Painswick road and also counters in and around the other AQMAs. Unfortunately it was then discovered that some queuing vehicles were being recorded as motorcycles. Counts were repeated and manual counts done to verify the results, but this took months to resolve and has held up progress on traffic measures.

Priory Road Nitrogen Dioxide Trends

The long-term trends in nitrogen dioxide concentrations (µg/m^3) are shown in the graph compared with our background locations at Elmbridge School and the pedestrian area at the Guildhall (referred to in graphs as Glos. Arts Centre) in Eastgate Street. The target we are aiming to be below is 40 µg/m^3. As each year is not strictly connected due to different factors being applied, a bar chart is used.

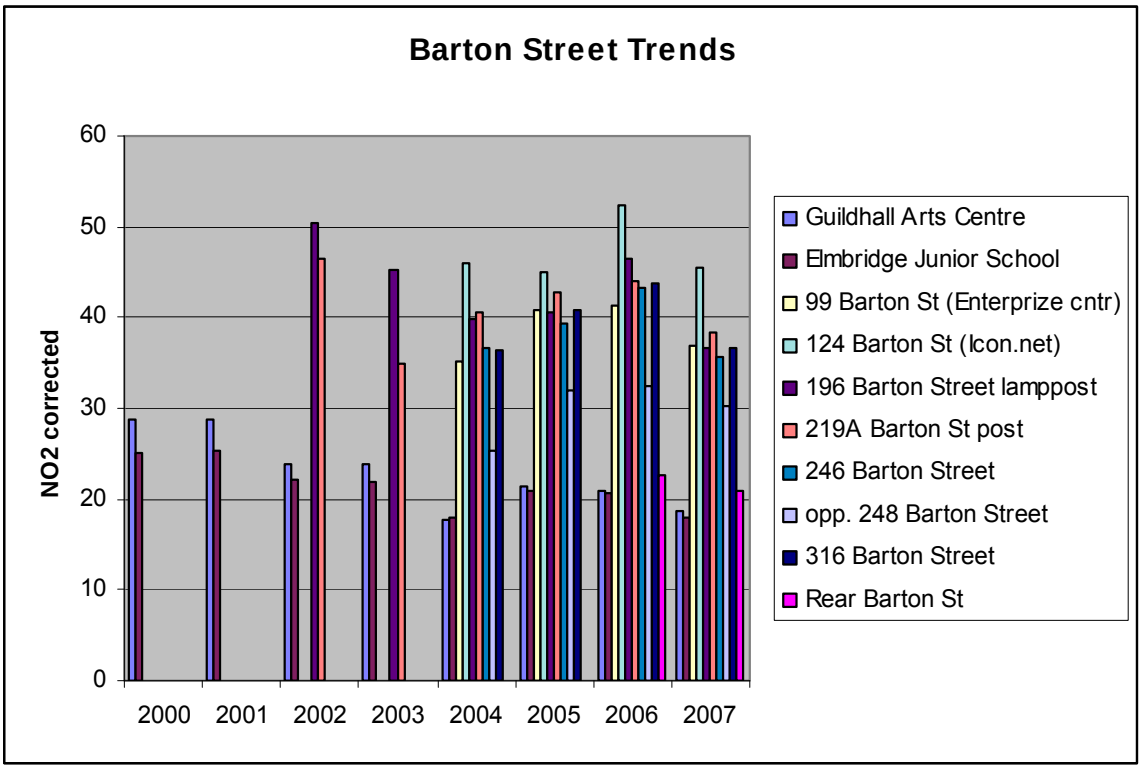
The two background sites are a couple of miles apart and are in good agreement. The dip in 2004 shows the overarching effect of the weather. The Priory Road levels were expected to rise from 2005, as roadworks for most of that year kept traffic away from the nearside lane. When the works finished, the new retail development nearby opened, attracting more traffic.



No. 36 Priory Road is outside the AQMA on the other side of Mount Street and is monitored to ensure that the area is wide enough. No. 36 is consistently below the target. Monitoring was started behind Priory Road houses, as one possibility for improvements to the indoor air is to ventilate from the rear. The only readily accessible location at No. 58, is at a gap in the terrace, and so the nitrogen dioxide is above background level at roughly that found outside the AQMA at no. 36. It may therefore be a good enough source of air. We note that front windows to this terrace have never been observed to be open, and so it is likely that most ventilation is already from the rear.

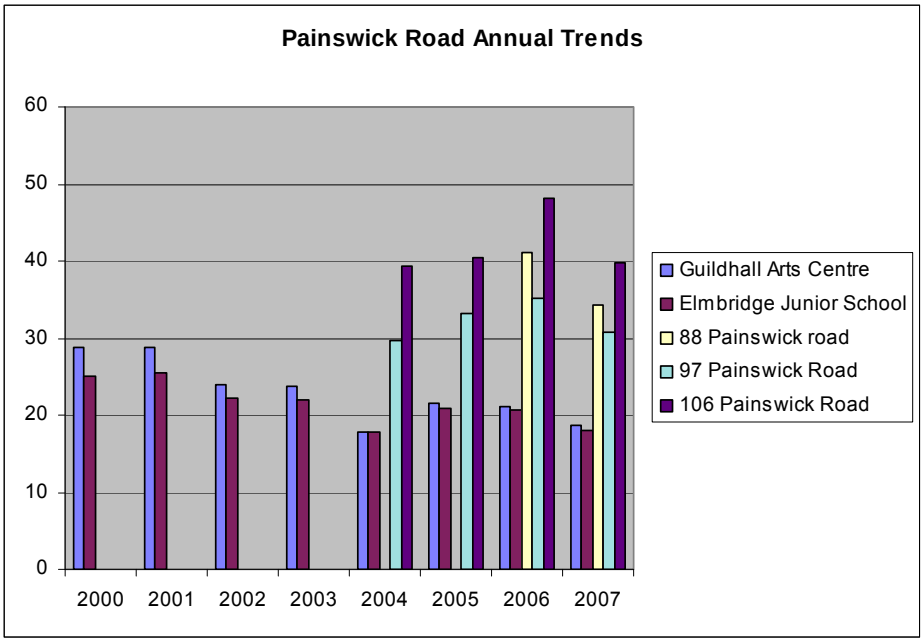
Barton Street Long Term Pollutant Trends

The long-term trends in nitrogen dioxide concentrations (µg/m^3) are shown in the graph compared with our background locations at Elmbridge School and the pedestrian area at the Guildhall. Background data is discussed above.



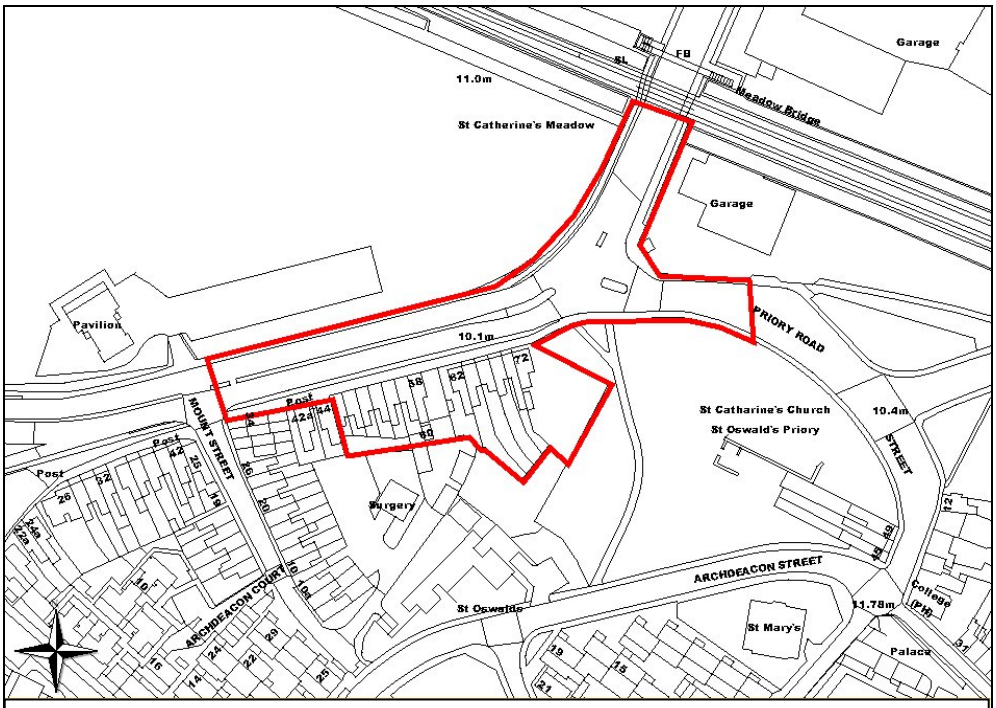
Areas further south along Barton Street were studied in earlier years. The area becomes more open beyond Upton Street and will not become a problem. The eastern side of Barton Street south of India road remains below target. A sampling point established in Vauxhall Terrace (labelled as "Rear Barton St" on the graph) shows that the air behind Barton Street is very near to background levels.

Painswick Road (North) Long Term Pollutant Trends

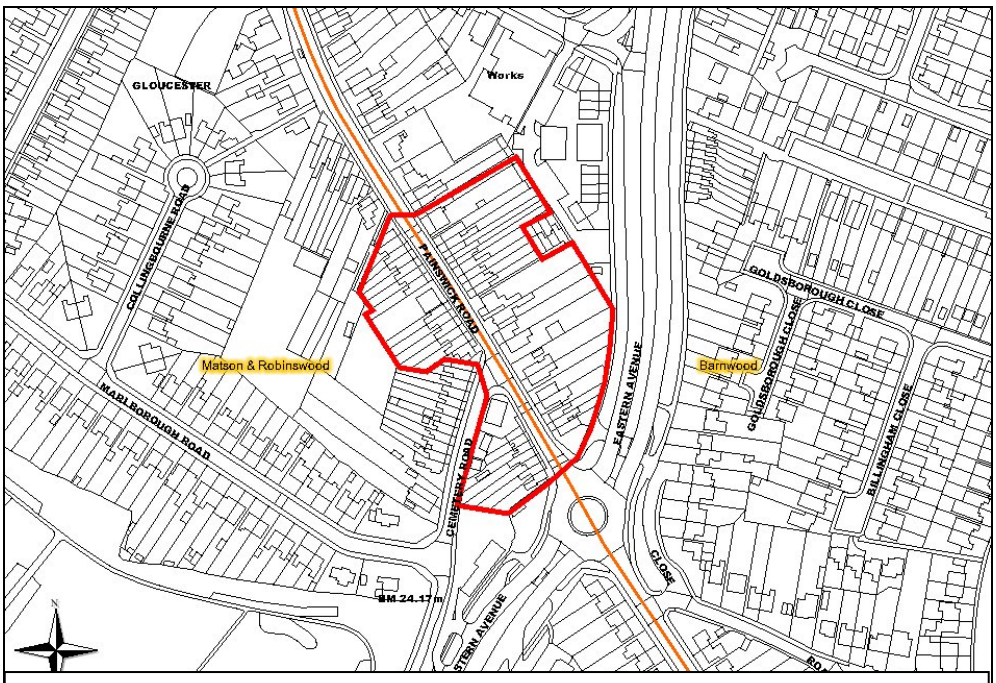


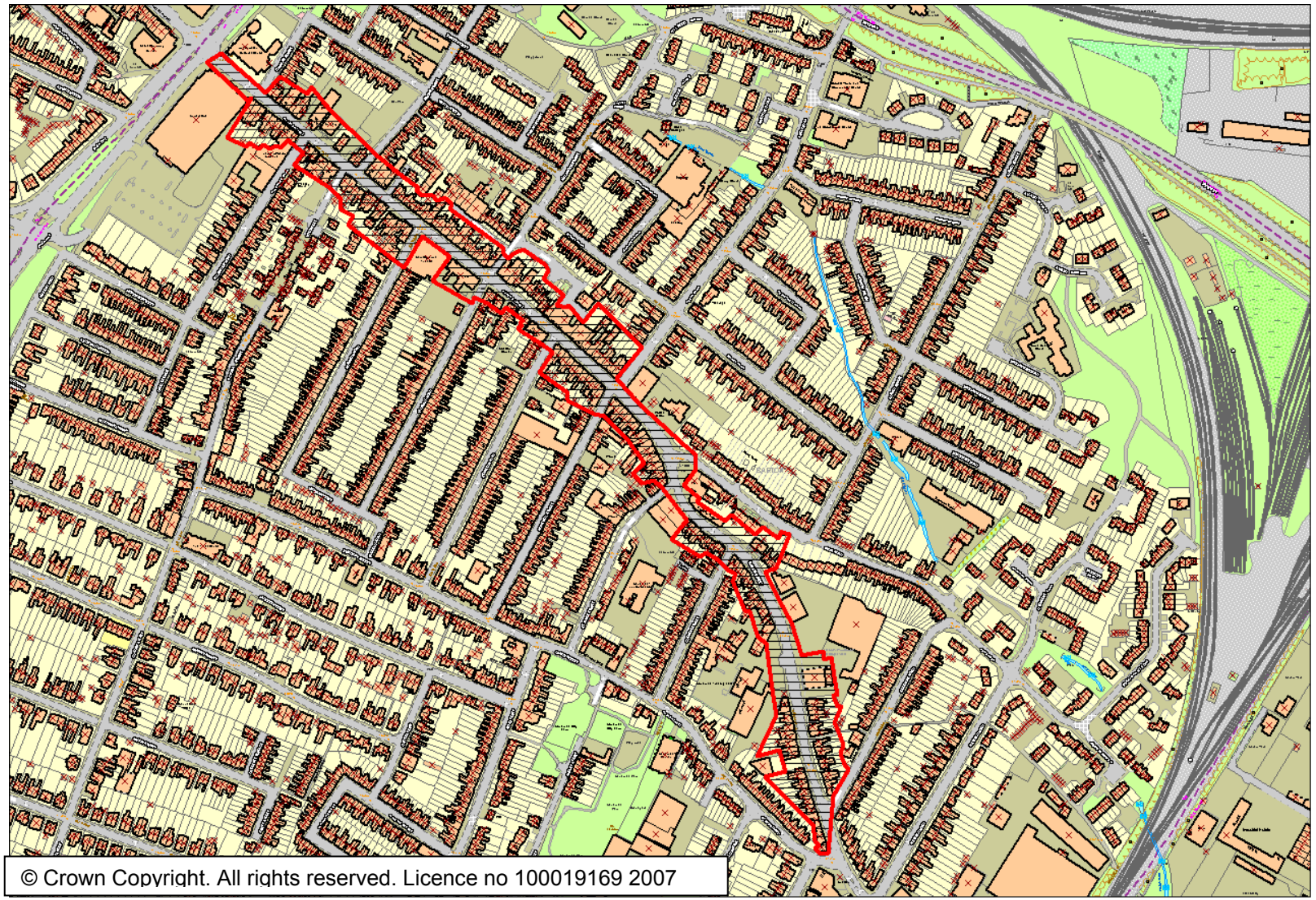
This is a continuation of the B4073 Barton Street. Again the results are compared with the same two background sites as above. The same effect of rising levels on the west side (even numbers) is observed. There is less data as the effects of canyons were not recognised in the early years. Studies were extended in 2007 to sites either side of the road just to the north of the declared area. The results show as expected that the area does not need increasing. The single point results are not shown above.

St Oswald's Road/Priory Road AQMA including affected domestic properties



Painswick Road (North) AQMA including affected domestic properties





Barton Street AQMA including affected domestic properties.
Future domestic properties fronting the Street are also included in the order

Chapter 2 Highways Authority Proposals

This chapter explains the options that have been considered and details the Highway Authority's (Gloucestershire County Council) proposals for the three AQMAs that have been designated in Gloucester. The first draft proposals were established late 2006, when a second AQMA emerged on the same route B4073 we delayed the action plan to look at measures for this route. We have Priority Assessed the appropriate measures, there is still a requirement to model alternative traffic movements for those measures that identify partial or full road closure.

Barton Street

The City Council's "Detailed Assessment of Local Air Quality for 2003/4" [Ref 4] report shows an annual mean nitrogen dioxide concentration of between 41 and 47 micrograms per cubic metre compared with the objective of 40. It also found that "air quality on the even (southern) side of the road is much worse than on the odd side" and it is concluded that this is due to the even side being closer to city inbound queuing traffic. The calculation of 2010 figures, which are based on the average national vehicle mix, shows that pollution concentrations may have dropped below the objective level by 2010. But in spite of the improvements in vehicle technology, providing greater numbers of less polluting vehicles, a reduction in the concentration to below the limit is unlikely to occur without intervention to discourage growth in traffic or exposure to harmful emissions as the projection includes only an assumption that traffic will grow at the National average rate and is not able to take account of local circumstances. Gloucestershire's traffic growth rate has increased by 2% compared to the target of 1.4%, additional growth in the AQMAs is predictable due to permitted future development. The impact of future development will be even more relevant to St. Oswald's Road / Priory Road.

Painswick Road (North)

For this AQMA discussion, the length of Painswick Road north and west of the junction with Eastern Avenue is referred to as Painswick Road North.

Two sites have been monitored monthly since September 2003, with others nearby which were dropped after the detailed assessment of 2004, which showed the area not then to be a problem. Monitoring during 2005 of the remaining two sites showed that one of them on the west of the canyon on Painswick Rd North was marginally over the target of 40 μgm^3, thus requiring a detailed assessment.

For the detailed assessment, monitoring at these two sites continued, with a new site in the next housing block on the Painswick Rd North (west side) added. Unfortunately both the original site and the new site at no. 88 were well above the target in 2006, with Painswick Rd South (the eastern side of the road) remaining below the target. Projection to 2010 shows that no.106 may well still be above the target then.

Consultation with residents after this chose both sides of the road to be included. The Air Quality Management Area includes 42 residents, plus 2 empty properties likely to be converted to residential. This includes the redundant chapel, so that planning improvements taking air quality into account can be required for the expected redevelopment at this site.

St. Oswald's Road / Priory Road

This AQMA has been designated to include two blocks totalling 13 houses just south of the priority junction with St. Oswald's Road and fronting St Oswald's Road. It has been estimated that two sampling sites will be above the air quality objective for nitrogen dioxide in 2005, with levels of nitrogen dioxide of 41 to 58 micrograms per cubic metre compared with the objective of 40, and one is predicted to be above the level in 2010. The City Councils' "Detailed Assessment of Local Air Quality for 2003/4" suggests that "poor air collects in the dip under the railway arch and is pushed towards the houses by vehicles emerging from the dip."

Since the last available monitoring two changes have taken place which may affect air quality. Firstly, the junction of St. Oswald's Road and Priory Road was signalised in August 2005 as part of a major retail development at the nearby Cattle market. This has provided a controlled right turn lane for traffic from Priory Road and from Westgate Gyratory whereas previously these turns were difficult to make. Secondly, the final section of the Gloucester South West bypass, that allows traffic to skirt Gloucester on the western side, opened in May 2007. It is not yet possible to estimate what impact either of these changes will have on nitrogen dioxide concentrations in the AQMA, and a proper assessment will require the collection of at least one year's worth of monitoring data by the City Council. Increased queuing on St Oswald's Road / Priory Road is expected for 6 months during the A40 west of the River Severn improvements and construction of the inbound bus lane as the first step towards the relocation of the St Oswald's park & ride site. Long term the new west of Severn park & ride will reduce through traffic.

Potential Solutions

A number of potential measures are described and assessed according to the following criteria: Impact on air quality in the AQMA; the likely timescale and cost of implementation; feasibility and the non-air quality impacts.

The measures have been categorised according to their objectives:

For Barton Street the objectives are: (i) to reduce through traffic; (ii) reduce emissions from traffic and (iii) to encourage local trips by non-car modes.

For Painswick Road objectives are: (i) to reduce through traffic; (ii) reduce emissions from traffic and (iii) to encourage local trips by non-car modes.

For St. Oswald's Road / Priory Road measures aim: (i) to reduce traffic flows and (ii) to reduce the reception of pollutants.

Key to cost-effectiveness calculation

Low Cost (< £50k) = 3	Low Effectiveness (< 5% reduction in through traffic) = 1
Medium Cost (£50k to £250k) = 2	Moderate Effectiveness (5% to 10% reduction in through traffic) = 2
High Cost (> £250k) = 1	High Effectiveness (>10% reduction in through traffic) = 3

For benefit, low indicates a likely improvement in NO_2 of less than 0.2 microgrammes per cubic metre, medium an improvement of 0.2 to 1 microgramme per cubic metre, and high an improvement of more than 1 microgramme per cubic metre.

Hierarchy

Cost	Effectiveness	Score
3	3	6
2	3	5
1	3	4
3	2	5
2	2	4
1	2	3
3	1	4
2	1	3
1	1	2

Key to timescale

Short =	Within one financial year
Medium =	Within one Local Transport Plan Period (current is 2006 to 2011)
Long =	Over 5 years

Table 1 Barton Street

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
(a) To Reduce Through Traffic									
1.Variable Message Signs (VMS)	A real-time air quality-monitoring unit would be used to activate a message telling drivers about poor air quality and suggesting an alternative route OR VMS signs to alert drivers of significant queuing traffic leading up to Bruton Way signals. Could also advise drivers of incidents on Barton Street such as road works and accidents	2 (Moderate)	2 Real-time air quality-monitoring unit = approx. £30,000 Would be dependent upon the implementation of the County's Intelligent Transport System	4	Long Term	Yes Dependent on developer funding	☺ Less traffic on Barton Street would improve the environment ☹ Increased traffic/congestion alternative routes	☺ Less traffic on Barton Street would improve perception of safety and community ☹ Identification of 'poor' air quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Identification of 'poor' a quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
2.Improvements/Control of the signals at the junction of Barton Street, Bruton Way, Trier Way and Eastgate Street	With measures 1 & 2 the ITS could be used to restrict traffic from turning into Barton Street to travel eastbound. Access for buses could be prioritised without making this measure ineffective as bus movements into Barton Street turn left from Bruton Way and buses on this arm could be prioritised	2 (Moderate)	3 (<£50k) Would be dependent upon the implementation of the County's Intelligent Transport System	5	Short Term	Yes	☺ Less traffic on Barton Street would improve the environment ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would improve perception of safety and community ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
3.Environmental traffic signals	Measures 1 and 2 could be combined with traffic signals just before the junction with Upton Street which would go to red for city bound traffic when	2/3 Moderate to High) When combined with Option	1 (> £250k)	3		No	☹ A major problem is that westbound buses would be caught by the signals at Upton Street. To overcome this would either require the buses to bypass the queue	☹ Increased waiting traffic / congestion on Barton Street before the Upton Street junction city bound, on Derby Road towards Horton Road and on	☹ Extra costs to drivers who divert ☹ Increased traffic/congestion on alternative routes

Table 1 Barton Street

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
	triggered by an air quality problem or significant queuing on Barton Street	1					using a bus lane, which would require sufficient land to be available; or the signals would need to detect the bus and allow it through, however this could encourage traffic to use Barton Street	Barton Street outbound ☹ Increased traffic/congestion on alternative routes	
4. Journeys from the City Centre that are signed to use Barton Street to use Metz Way instead	Currently drivers are signed from Bruton Way down Barton St. for "B4073 Painswick". The "City Centre" is signed along Metz Way rather than along Barton St. from the roundabout on Eastern Avenue	1 (Low) If implemented in isolation, as many drivers on through journeys already know this route and find it quicker than Metz Way	3 (< £50k)	4	Short Term	Yes There is evidence that only 20% (manual silver car count 2006) of cars are through traffic. **Needs updated count**	☺ Less traffic on Barton Street would improve the environment ☹ Increased traffic/congestion on alternative routes including Metz Way and Bruton Way	☺ Less traffic on Barton Street would improve perception of safety and community ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
5. Restrict all City bound (westbound) traffic	From just east of Derby Road. This may be achieved through the use of devices such as rising bollards to allow only buses to pass the affected area of Barton Street. As the main problem occurs at the façade of houses on the south side of the road a restriction in this direction is preferable. An alternative access to the city centre would be signed via Metz	3/2 (High to Moderate) Depending on the size of the scheme	2 £50k to £250k	4	Medium to Long	Unknown Subject to traffic model impact assessment Evidence from Quedgeley and elsewhere shows bollards cause other problems	☺ Less traffic on Barton Street would improve the environment ☺ Would allow retiming of the Derby Rd lights to reduce queuing on Derby Rd ☹ Increased traffic/congestion on alternative routes ☹ Complementary traffic management measures on Upton St may be required to deter detours around the barrier if only a section of	☺ Local traffic could still use Tredworth Rd and Derby Rd but these routes would be unattractive for through trips ☺ Less traffic on Barton Street would improve perception of safety and community ☹ There would be an adverse impact on emergency services that would need to be considered and ameliorated	☺ Local traffic could still use Tredworth Rd and Derby Rd but these routes would be unattractive for through trips ☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert

Table 1 Barton Street

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
	Way for through traffic. Local traffic would still be able to use Barton St in both directions						Barton St. is affected ☹ Reduced direct access by car will mean longer journeys to reach destinations	☹ Increased traffic/congestion on alternative routes	
6. Introduce a restriction on traffic travelling both ways on Barton St at Derby Road junction, except for buses and cycles	This measure would require rising bollards with bus detection at the Derby Rd signals. An alternative access to the city centre would be signed via Metz Way	3 (High)	2 (£50k to £250k)	5	Long Term	Unknown Subject to traffic model impact assessment	☺ Less traffic on Barton Street would improve the environment ☺ Would allow retiming of the Derby Rd lights to reduce queuing on Derby Rd ☹ Local vehicle traffic would have more restricted use of Barton St and the use of streets around it may increase as a result ☹ Through traffic would still be able to use Derby Rd, and may use Hopewell St instead to reach Trier Way or Eastern Avenue	☺ Less traffic on Barton Street would improve perception of safety and community ☹ Local vehicle traffic would have more restricted use of Barton St and the use of streets around it may increase as a result ☹ Increased traffic/congestion on alternative routes ☹ Probable strong local objections ☹ Objection base on crime & disorder	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
7. Make the entire length of Barton St eastbound only with a contra flow bus lane in the westbound (city centre bound) direction	This measure would require rising bollards with bus detection at the start of the bus lane with an alternative access to the city centre signed via Metz Way. As the main air quality problem occurs at the façade of houses on the south side of the road reducing traffic in this direction is preferable. Local and through traffic would still be able to use Barton St eastbound	2 (Medium)	2 (£50k to £250k)	4	Long	Unknown Subject to traffic model impact assessment	☺ Less traffic on Barton Street would improve the environment ☹ Local vehicle traffic would only be able to use Barton St eastbound and the use of streets around it may increase as a result, so complimentary traffic management measures would be required as a result	☺ Less traffic on Barton Street would improve perception of safety and community ☹ Local vehicle traffic would only be able to use Barton St eastbound and the use of streets around it may increase as a result ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert

Table 1 Barton Street

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
8. Enforce existing HGV ban on Barton St and/or Derby Road, except for access	This measure would affect up to 740 HGVs (AADT 2007). There already is a 7.5t weight restriction, except for access, in the city centre boundaries including is area, but it may be flouted.	1 (Low)	2 (£50kto £250K)	3	Medium to Medium to Long Term	Yes Would require ANPR cameras & enforce-ment	☺ Less HGV traffic on Barton Street would improve the environment ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Barton Street would improve perception of safety and community ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Barton Street would make the street more attractive shoppers ☹☺ Increased HGV traffi on alternative routes
(b) To Reduce Emissions from Traffic									
9. Greater restriction and better timing of deliveries on Barton Street	Currently deliveries are banned from 8-9 am and 5-6pm. The aim would be to get deliveries made in the least trafficked period. Gloucestershire's Freight Quality Partnership can provide one avenue for communication if it reaches smaller independent firms.	1 (Low)	2 (£50k to £250k)	3	Medium Term	Yes	☺ Less congestion on Barton Street during peak periods would improve the environment	☺ Less congestion on Barton Street may improve perception of safety and community ☹ Less congestion on Barton Street may increase vehicle speeds and increase number or severity of accidents	☺ Less congestion on Barton Street may encourage shoppers to vi ☹ Delivery problems for shops
10. "Turn off engine when stationary" signs at Horton Road and Derby Road signals	The current sign is too small and needs updating.	1 (Low)	3 (< £50k)	4	Short Term	Yes Current signs are too small	☺☹ Switching off and re-starting an engine for very short periods may be worse in emission terms	☺☹ Less noise and emissions would improve conditions for pedestrians and cyclists and would enhance the sense of community. Engines stopping and re-starting may be more intrusive	☺☹ Less noise and emissions would improve conditions for pedestrians and cyclists and would encourage shoppers. Engines stopping and re-starting may be more intrusive
11. Encourage bus company to buy new vehicles to provide the bus services travelling along Barton St or investigate ways of reducing emissions	Currently services 1, 3, 13 and 7 use Barton St for approx. 28 two way journeys per hour during the working day	1 (Low)	1 (> £250k)	2	Medium to Long Term	Yes Already slowly happening.	☺ Less emissions would improve the environment	☺ Less emissions would improve conditions for pedestrians and cyclists and would enhance the sense of community	☺ Less emissions would improve conditions for pedestrians and cyclists a would encourage shopper ☹ Such intervention may be 'anti competitive'

Table 1 Barton Street

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
from existing buses									
12. Reduce illegal parking on Barton Street Improved enforcement delivered through the decriminalisation of parking enforcement	Cars are sometimes parked illegally or partly on the footway which causes traffic to queue behind them waiting to get past. Measures would include 1st management of the shoppers parking in Sinope Street which is currently used all day by commuters.	1 (Low)	2 (£50k to £250k)	3	Medium	Yes	☺ Less congestion on Barton Street would improve the environment	☺ Less congestion on Barton Street may improve perception of safety and community ☹ Less congestion on Barton Street may increase vehicle speeds and increase number or severity of accidents	☺ Less congestion on Barton Street may encourage shoppers to vi ☹ Shoppers who currentl park illegally may shop elsewhere
(c) To Encourage local trips by non-car modes									
13. Promote alternatives through a 'TravelSmart' intervention	Individualised marketing scheme	2 (Moderate)	2 (£50k to £250k)	4	Short to Medium	Yes	☺ Less traffic on Barton Street would improve the environment	☺ Less traffic on Barton Street would improve perception of safety and community ☺ Encouraging more active modes will Improve health	☺ Less traffic on Barton Street would make the street more attractive to shoppers
14. Promote the use of alternative modes through School Travel Plans	Work with schools on encouraging parents and children to use modes other than the car for the school run	1 (Low)	3 (< £50k)	4	Short to Medium	Yes	☺ Less traffic on Barton Street would improve the environment	☺ Less traffic on Barton Street would improve perception of safety and community ☺ Encouraging more active modes will Improve health	☺ Less traffic on Barton Street would make the street more attractive to shoppers
15. Promote the use of alternative modes and alternative routes through Business / Employer Travel Plans	Influence mode (and route) of travel through travel plans developed voluntarily and those required by the planning process. Use existing for a to disseminate information	1 (Low)	3 (< £50k)	4	Short to Medium	Yes	☺ Less traffic on Barton Street would improve the environment ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would improve perception of safety and community ☺ Encouraging more active modes will Improve health ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Barton Street would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert

Table 2 Painswick Road (North)

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
(a) To Reduce Through Traffic									
1.Variable Message Signs (VMS)	A real-time air quality-monitoring unit would be used to activate a message telling drivers about poor air quality and suggesting an alternative route OR VMS signs to alert drivers of significant queuing traffic leading up to Bruton Way signals. Could also advise drivers of incidents such as road works and accidents	2 (Moderate)	3 (< £50k) Real-time air quality-monitoring unit = approx. £30,000 Would be dependent upon the implementation of the County's Intelligent Transport System	5	Medium to Long term	Yes Dependent on developer funding	☺ Less traffic on Painswick Road North would improve the environment ☹ Increased traffic/congestion alternative routes	☺ Less traffic on Painswick Road North would improve perception of safety and community ☹ Identification of 'poor' air quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Painswi Road North would make t street more attractive to shoppers ☹ Identification of 'poor' a quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
2.Through route journeys from the City Centre to Painswick signed to use Barton Street/Chequers Bridge/Painswick Road North to use Metz Way instead	Currently drivers are signed from Bruton Way down Barton Street/Chequers Bridge/Painswick Road North for "B4073 Painswick". The "City Centre" is signed along Metz Way rather than along Barton St. from the roundabout on Eastern Avenue	1 (low) If implemented in isolation, through route journeys by local drivers may continue as they find it quicker than Metz Way	3 (< £50k)	4	Short	Yes There is evidence that only 20% (manual silver car count 2006) of cars are through traffic. **Needs updated count**	☺ Less traffic on Painswick Road North would improve the environment ☹ Increased traffic/congestion on alternative routes including Metz Way and Bruton Way	☺ Less traffic on Painswick Road North would improve perception of safety and community ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Painswi Road Norh would make th street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
3. Enforce the existing HGV ban on Painswick Road North/Chequers Bridge/Barton St except for buses and access	This measure could affect 676 HGVs. (AADT 2007). There already is a 7.5t weight restriction, except for access, in the city centre boundaries including is area, but it	2 (medium)	2 (£50k to £250k)	4	Medium to long	Yes Would require ANPR cameras	☺ Less HGV traffic on Painswick Rd North would improve the environment ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Painswick Rd North would improve perception of safety and community ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Painswick Rd North would make the street more attractive to shoppers ☹☺ Increased HGV traffi on alternative routes

Table 2 Painswick Road (North)

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
	may be flouted.								
4. Alter signage to allow all traffic from Chequers Lane onto Eastern Avenue	Allow access for all vehicles to turn left through Chequers Lane onto Eastern Avenue (at present it is buses only)	1 (Low)	3 (<£50k)	4		No	☹ Safety Issues ☺ Less HGV traffic on Painswick Rd North would improve the environment ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Painswick Rd North would improve perception of safety and community ☹☺ Increased HGV traffic on alternative routes	☺ Less HGV traffic on Painswick Rd North would make the street more attractive to shoppers ☹☺ Increased HGV traffi on alternative routes
5. Signalise Painswick Rd/Eastern Ave	A real-time air quality-monitoring unit would be used to activate a message telling drivers about poor air quality and suggesting an alternative route. Would only work if linked to measures 1&2 for Painswick Rd and Barton Street	3 (High)	1 (> £250k)	4	Long term	Unknown Subject to Eastern Avenue junction capacity study	☺ Less traffic on Painswick Road North would improve the environment ☹ Increased traffic/congestion alternative routes	☺ Less traffic on Painswick Road North would improve perception of safety and community ☹ Identification of 'poor' air quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Painswi Road North would make t street more attractive to shoppers ☹ Identification of 'poor' a quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
(b) To Reduce Emissions from Traffic									
6. Encourage bus company to replace buses travelling along Painswick Rd North/Barton St with modern low emission vehicles or investigate ways of reducing emissions from existing buses	Currently services 1, 3, 13 and 7 use Painswick Rd North/Chequers Bridge/Barton St for approx. 28 two way journeys per hour during the working day	1 (Low)	3 (< £50k)	4	Medium to Long Term	Yes This is already happening slowly.	☺ Less emissions would improve the environment	☺ Less emissions would improve conditions for pedestrians and cyclists and would enhance the sense of community	☺ Less emissions would improve conditions for pedestrians and cyclists a would encourage shopper ☹ Such intervention may be 'anti competitive'
7. Reduce illegal parking on Painswick Road	Cars are sometimes parked illegally or partly on the footway which causes traffic to queue behind them waiting to	1 (Low)	2 (£50k to £250k)	3	Medium	Yes	☺ Less congestion on Painswick Road would improve the environment	☺ Less congestion on Barton Street may improve perception of safety and community ☹ Less congestion on	☺ Less congestion on Barton Street may encourage shoppers to vi ☹ Shoppers who currentl park illegally may shop

Table 2 Painswick Road (North)

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
	get past. Measu(res would include improved enforcement delivered through decriminalised parking enforcement							Barton Street may increase vehicle speeds and increase number or severity of accidents	elsewhere
(c) To Encourage Local trips by non-car modes									
8. Promote alternatives through a 'TravelSmart' intervention	Individualised marketing scheme	2 (Moderate)	2 (£50k to £250k)	4	Short to Medium	Yes	☺ Less traffic on Painswick Rd North would improve the environment	☺ Less traffic on Painswick Rd North would improve perception of safety and community ☺ Encouraging more active modes will Improve health	☺ Less traffic on Painswi Rd North would make the street more attractive to shoppers
9. Promote the use of alternative modes through School Travel Plans	Work with schools on encouraging parents and children to use modes other than the car for the school run	1 (Low)	3 (< £50k)	4	Short to Medium	Yes	☺ Less traffic on Painswick Rd North would improve the environment	☺ Less traffic on Painswick Rd North would improve perception of safety and community ☺ Encouraging more active modes will Improve health	☺ Less traffic on Painswi Rd North would make the street more attractive to shoppers
10. Promote the use of alternative modes and alternative routes through Business / Employer Travel Plans	Influence mode (and route) of travel through travel plans developed voluntarily and those required by the planning process. Use existing for a to disseminate information	1 (Low)	3 (< £50k)	4	Short to Medium	Yes	☺ Less traffic on Painswick Rd North would improve the environment ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Painswick Rd North would improve perception of safety and community ☺ Encouraging more active modes will Improve health ☹ Increased traffic/congestion on alternative routes	☺ Less traffic on Painswi Rd North would make the street more attractive to shoppers ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert

Table 3 St. Oswald's Road / Priory Road

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
(a) To Reduce Traffic Flows									
1. Re-timing the traffic signals on Priory Rd, St. Oswald's Road and Worcester Street to deter traffic using this route	These signals are controlled by UTC and a signal plan could be set up to be implemented, for example, in the peak traffic periods	1 (Low) Since larger reductions in pollutants would probably require significant traffic diversion which is unlikely to be acceptable	3 (< £50k)	4		No	☹ Given the strategic importance of this route and the lack of suitable alternative routes this measure may divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ Given the strategic importance of this route and the lack of suitable alternative routes this measure may divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ Given the strategic importance of this route and the lack of suitable alternative routes this measure may divert traffic into the city centre and on to residential streets such as Archdeacon Street instead ☹ Extra costs to drivers who divert
2. Traffic management measures in the city centre and Western Waterfront areas to reduce traffic passing through this AQMA	A traffic study carried out for the City and County Councils recommended traffic management changes to Westgate gyratory and other streets that would significantly reduce traffic in this AQMA and on the Commercial Rd/ The Quay route to the west of the city centre	2 (Moderate)	1 (> £250k) Potential Developer Contributions	3	LongTerm	Unknown	☺ Significant reductions in traffic on the edge of city centre and in the western waterfront will improve the environment		☺ Significant reductions in traffic on the edge of city centre and in the western waterfront will make these areas more attractive to shoppers ☹ Increased traffic/congestion on alternative routes
3. Improvements to junctions on the A40 Gloucester Northern bypass could encourage east/west through traffic to use this route rather than St. Oswald's Road (2003 Study).	Traffic modelling has shown that a significant proportion of through east/west traffic uses roads within the urban area including St Oswald's Road, because of congestion on the A40 Northern bypass.	2 (Moderate)	1 (> £250k) Funding through LTP3 and potential for additional improvements through Major Scheme Bid and Developer Contributions	3	Long term	Yes	☺ Reduced traffic, congestion and environmental nuisance on east/west routes through Gloucester ☺ Significant reductions in traffic on the edge of city centre and in the western waterfront will		☺ Significant reductions in traffic on the edge of city centre and in the western waterfront will make these areas more attractive to shoppers

Table 3 St. Oswald's Road / Priory Road

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
							improve the environment		
4. Variable message signs (VMS) to alert drivers to poor air quality in Priory Road Or VMS signs to alert drivers to significant queuing traffic on St. Oswald's Road	A real-time air quality-monitoring unit costing about £10,000 would be used to activate a message telling drivers about poor air quality and suggesting the use of the Gloucester Northern bypass instead	1 (Low)	2 (£50k to £250k) The costs for both measures 4 and 5 assume the implementation of the County Council's Intelligent Transport system	3	Long Term	Yes Dependent on developer funding	☺ Less traffic on Priory Road and St. Oswald's Road would improve the environment	☹ Identification of 'poor' air quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes	☹ Identification of 'poor' air quality in the area may introduce a 'stigma' ☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
5. Prohibit traffic turning right out of Priory Road and from St. Oswald's Road into Priory Road. In addition modifying the junction layout to eliminate the need for signal control of traffic except to allow pedestrians to cross at the junction	Traffic that is prohibited from turning right could use Westgate gyratory or the roundabout near Tesco to turn right instead.	1 (Low)	3 (< £50k)	4		No	☹☺ Traffic delays and hence emissions at this junction should be reduced although some vehicles will pass through the junction twice negating the benefit gained ☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead ☹ Increased traffic delays and congestion may be caused at the Tesco roundabout, at Westgate gyratory and on alternative routes used by diverted trips ☹ Extra costs to drivers who divert
6. Prohibit traffic turning right out of Priory Road onto St. Oswald's Road (only)	Traffic that is prohibited from turning right could use Westgate gyratory instead.	1 (Low)	2 (< £50k)	3	Short – Medium Term	Unknown LINSIG signal model underway Subject to Western Waterfront Traffic Management	☹☺ Traffic delays and hence emissions at this junction should be reduced although some vehicles will pass through the junction twice negating the benefit gained ☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead	☹ May divert traffic into the city centre and on to residential streets such as Archdeacon Street instead ☹ Increased traffic delays and congestion may be caused at Westgate gyratory and on alternative routes used by diverted trips ☹ Extra costs to drivers who divert

Table 3 St. Oswald's Road / Priory Road

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
7. Replacement of St Oswald's P&R with alternative sites.	At present St Oswalds in situated too close to the city centre.	2/3 (Moderate to High)	(> £250k)	5	Medium to Long term	Yes	☺ Less traffic on Priory Road and St. Oswald's Road would improve the environment	☺ Encourage drivers to use alternatives modes including new outer ring of p&r sites ☹ Increased on-street parking in residential areas instead	☹ Increased traffic/congestion on alternative routes ☹ Extra costs to drivers who divert
(b) To Reduce the Reception of Pollutants									
Measure	**Description**	**Air Quality Impact**	**Cost**	**Cost - Effectiveness**	**Timescale**	**Feasibility**	**Environmental Impact**	**Social Impact**	**Economic Impact**
8. Further Monitoring	As a result of changes to the junction, with the installation of traffic lights	N/A		N/A	Short to on-going	Yes	N/A	N/A	N/A
9. A physical barrier between the houses in the AQMA and St. Oswald's Road	The barrier would be directly in front of the houses and would need to be clear to allow light to pass through and be high enough to protect all living spaces within the house	1 Low)	2 (£50k to £250k)	3		No	☹ May be regarded as having a negative aesthetic impact ☹ Research shows no clear evidence that a physical barrier will improve air quality	☹☺ The response of the people in the houses affected would be crucial to the implementation of this measure	☹ The barrier is likely to require significant maintenance, as it is likely to be subject to graffiti and vandalism
10. Planting between the houses in the AQMA and St. Oswald's Road		1 (Low)	3 (< £50k)	4		No	☹ The use of planting has not shown to improve the air quality from NO2 emissions		
11. Demolition of the 13 houses in the AQMA	The land could be used for flats located further from the road and facing away from it. Alternatively the land released could form part of the adjacent public open	3 (High)	1 (> £250k)	4		No Response from residents would be crucial to implement -ing this	☺ This measure would allow the AQMA to be rescinded	☹ It may require compulsory purchase of properties and hardship to individuals and families *however* these properties were flooded	☹ It may require compulsory purchase of properties and hardship to individuals and families

Table 3 St. Oswald's Road / Priory Road

Measure	Description	Air Quality Impact	Cost	Cost - Effectiveness	Timescale	Feasibility	Environmental Impact	Social Impact	Economic Impact
	space					measure		twice by sewer overflow in June & July 2007	
12. Install secondary-glazing and mechanical ventilation using air from the rear of the 13 houses in the AQMA	These measures are sometimes taken when double-glazing is installed under road traffic noise regulations In addition to the glazing and air conditioning it may be necessary to include the installation of some form of renewable power source to provide electricity to off-set running costs	1 (Low) Windows have never been seen open due to traffic proximity	1 (> £250k)	2		No The response from residents in summer 2007 was not positive for rear ventilation.	☺ This measure would slightly reduce the reception of pollutants ☹ This measure would increase households consumption of electricity		☺☹ The installation of this equipment would have an uncertain impact on the property values ☹ Expense of running and on-going maintenance of the system – fall to GCC, GcityC or Residents?
13. Pollutants collecting in the dip under the railway bridge to be pumped into a chimney for dispersal or treated in some way	The feasibility and acceptability of such a measure would require further investigation	1 (Low) Unknown as the contribution of this source of pollution to overall concentrations is unclear	1 (> £250k) This measure would require assessment by environmental consultants; Estimate of study costs £20k	2		Unknown	☺ This measure has the potential to reduce the reception of pollutants ☹ No clear evidence of pollutants collecting in the dip, no suitable tube monitoring site available here.		☹ The costs of such an innovative system, which would be similar to tunnel systems in operation are unknown

Recommendations

All measures need to go through a Priority Assessment process in order to evaluate a cost benefit for any measures. Once a measure has qualified then it can go into the Gloucestershire County Council Capital Programme. This programme is subject to review when financial pressures such as flooding occur.

Barton Street

Completed/Underway

1. Encourage local trips by non-car modes - promote alternatives through a 'TravelSmart' intervention.
2. Encourage local trips by non-car modes - promote the use of alternative modes through School Travel Plans.
3. Reduce through traffic - improvements/control of the signals at the junction of Barton Street, Bruton Way, Trier Way and Eastgate Street. Environmental controlled link to real-time air quality monitoring.
4. Reduced bus emissions - replacement by March 2009 of the fleet (bus service no. 1) with Euro-4 compliant vehicles by the bus operator Stagecoach.

Short-term

1. Do further traffic counts to determine the proportion of traffic, both light and HGV that is through traffic.

Medium-term

1. Reduce emissions from traffic – reduce illegal parking on Barton Street, which causes congestion, through increased enforcement.

On-going

1. Encourage local trips by non-car modes/Reduce through traffic - promote the use of alternative modes and alternative routes through Business/Employer Travel Plans.
2. Continue to work with bus operators to upgrade existing bus fleet to Euro-4 compliant vehicles that are less polluting.

Painswick Road (North)

Completed/Underway

1. Encourage local trips by non-car modes - promote alternatives through a 'TravelSmart' intervention.
2. Encourage local trips by non-car modes - promote the use of alternative modes through School Travel Plans.
3. Reduced bus emissions - replacement by March 2009 of the fleet (bus service no. 1) with Euro-4 compliant vehicles by the bus operator Stagecoach.

Short-term

2. Carry out further traffic counts to determine the proportion of traffic, both light and HGV that is through traffic.

Long-term

1. Reduce through traffic – replace roundabout on Eastern Avenue/Painswick Road junction with signal controls. Subject to Eastern Avenue junction capacity study which is scheduled for the medium term and then available capital funding in the long-term.

Ongoing

1. Continue to work with bus operators to upgrade existing bus fleet to Euro-4 compliant vehicles that are less polluting.

2. Encourage local trips by non-car modes/Reduce through traffic - promote the use of alternative modes and alternative routes through Business/Employer Travel Plans.

St. Oswald's Road/Priory Road

Completed

1. Completion of the Gloucester South West bypass that will allow traffic to skirt Gloucester on the western side.

Short/Medium-term

1. Monitor the reception of pollutants - as the junction of Priory Road and St. Oswald's Road has changed since traffic lights were installed and went live in July 2005 (this has provided a right turn lane for traffic from Priory Road and from Westgate Gyratory whereas previously these turns were difficult to make). It will be necessary to monitor the impact of these changes to establish whether this has improved or exacerbated the situation.

2. Reduce through traffic – investigation of signal changes to stop right hand turns from Priory Road into St Oswald's Road is underway. It will be necessary to monitor the impact of these changes to establish whether this has improved or exacerbated the situation.

Long-term

1. Reduce through traffic - traffic management measures in the city centre and Western Waterfront areas to reduce traffic passing through this AQMA. Note: current "Western Waterfront" proposals will increase traffic through this zone; reconsideration required.

2. Reduce through traffic - improvements to junctions on the A40 Gloucester Northern bypass to encourage east/west through traffic to use this route rather than St. Oswald's Road.

3. Reduce through traffic - removal of Park and Ride from St Oswald's Way. Replacement with the West of Severn Park and Ride. A bus lane which will facilitate cross river Park and Ride is under construction in 2008.

Chapter 3 Other issues

Effects of current parking policies in centre of Gloucester.
Car parking charges in the city centre are deliberately set high to encourage drivers to use alternative transport modes. However the park and ride system has not caught up with this policy, with only two sites in use, and none planned for the Painswick side of the city. Vehicles are thus parked as near the centre as possible where there is not on-street charging. Sinope Street car park (free parking) is thus full all day with city centre workers and not available for people wishing to use the Barton Street shops. All surrounding streets are full of parked vehicles as there is virtually no off street parking available to the inhabitants. This does have the advantage, together with selective "stopping up" measures taken through the "safer city" campaign of 2000, of making "rat-running" through the area unattractive. However the lack of rat runs does keep the traffic on Barton Street.

Planning
Seeking S 106 agreements to either improve air quality or monitor air quality. An agreement to provide and maintain a real-time Air Quality monitor will be sought from any developer of the old "B&Q" site on Barton Street. Similar agreements will be sought from any other "large" development that is sought. Agreement will be sought to set back from the highway where possible any future developments. Any development that cannot achieve this has to provide ventilation from the rear to any living accommodation that fronts the street of an AQMA. A number of developments have had this requirement, which was introduced before the AQMA, in response to pressure to convert retail to domestic use on Barton Street.

Care is being taken that new living accommodation elsewhere in the city does not generate new AQMAs by being too close to heavily trafficked zones. Already one large new development has had its proposal altered to prevent the creation of a new AQMA by moving the housing line back from a heavy traffic zone. In the case of another proposal in a heavy traffic area, it has been redesigned so that there is no living space on the ground floor.

The Gloucester Historic Urban Regeneration Company has been made aware of general air quality issues, though there are no current proposals affecting the AQMAs. Healthy urban planning, physical activity and active living have been put at the heart of the urban regeneration framework.

Encouraging alternative modes of travel
Following on from the TravelSmart pilot is described in Appendix 2. The County Council promotes Traveline for bus and train services. Traveline is a service to provide comprehensive information on public transport services. The County Website links to the useful www.transportdirect.info site where customers may work out their own travel modes. These facilities are advertised wherever and whenever possible in a low-key manner.

Two park and ride sites exist for Gloucester, Waterwells site to the south and St Oswald's site close to the city centre. Replacement of the St Oswald's site to a more suitable location west of the river is in planning. Progress is being made on the site location at present. A further Park and Ride at Elmbridge is the subject of a Major Scheme bid.

The County and districts councils are working towards an accessibility map for all new developments. Accessibility planning will outline the transport requirements for new developments and assist in travel-planning.

Encouraging cycling
The County has helped fund the provision of cycle route maps in Gloucester, Cheltenham and Stroud. Signed Cycle routes enable cycling in the general direction of Barton Street using a combination of quieter roads and joint cycle/footpaths. These are promoted wherever an opportunity exists. The National Cycle Network Route 41 long distance route passes through the city which is also suitable for commuters.

For some years now City planners have required that bicycles and storage be provided with each new dwelling.

Cleaned up emissions from Public Service vehicles
The new contracts for Gloucestershire Highways and for City Streetcare Services "I Care" have ensured that more modern and thus less polluting vehicles are now in use by the public services on city streets. Stagecoach has made recent major investment in new double-decker buses on high frequency services in the city, which are less polluting. For services using Barton Street and Painswick Road, Stagecoach will upgrade Service No. 1 with Euro-4 vehicles to help reduce emissions on this route.

Central Severn Vale Transport Strategy (CSVTS)
Emerging from the Regional Spatial Strategy Gloucester, Cheltenham and Tewkesbury have agreed in principal to develop a Joint Core Strategy which will address the way in which the development will take place and the policies that will govern that development. The Central Severn Vale Transport Strategy will focus specifically on the key transport corridors. The Gloucester Transport Strategy will form the building blocks for the CSVTS.

Chapter 4 Consultations

All reports are published on *www.gloucester.gov.uk/pollution*. Attention of relevant ward Councillors is sought by e-mail whenever a new report is issued, and attention of all Councillors sought by e-mail whenever a new report is approved by DEFRA. Similar notes are passed to Gloucestershire Pollution Group members.

Letters are written annually to properties hosting sampling devices giving a link to the latest report on the web and offering to send paper copies and answer questions. The only response has been two notes of thanks.

The First Consultation on the Orders was made in spring 2005. Leaflets were dropped to all affected properties, both domestic and business. Display boards were placed in the City Council Entrance Hall. A Press Release was issued. The same information was on the City Consultations website.

Responses:

1 written enquiry from ex-city councillor on effect on trade.
Verbal response from specialist trader "Sinope Street carpark cannot be used by my customers as it is blocked all day by workers in town".
Verbal response from furniture trader. "I don't want parking outside my shop stopped".

Consultation on various Barton Street traffic issues was held between City and County Council Highways Dept and local residents on 6 June 2006. The consultation included information on the AQMA and took the form of three drop in sessions. As there is a large community of non-native speakers, the "Community Counts" organisation acted as host. A note of inputs and outputs is in appendix 7.

In July 2007 Consultation on the proposals in this Plan was held by posting all affected properties a questionnaire and prepaid reply envelope, supported by three drop-in sessions at nearby locations and web consultation linked from the City Council's Home page.

Electronic terminals charged with the same questions were sited at the Trust Centre (a drop-in location), a doctors surgery on Barton Street and the GL1 Leisure Centre, a few yards from Barton Street. The terminals had to be left in place for some weeks while City and County staff were diverted to dealing with flooding issues. Unfortunately the data was lost due to poor instructions on matching the terminals with their transport cases, resulting in a mix-up of the data recovery, even though one terminal and case was correctly matched; this was extremely disappointing.

One of the drop-in sessions was abandoned after no-one came to the first two. Priory Road had suffered from sewer flooding in June and was then flooded again in the July incident, the day after the session was abandoned.

Responses:

"New bypass encourages more traffic. Single tracking it may discourage growth. Relocate the houses. Stop the buses going this way. No to ventilation – may be noisy. Used to be hedge barrier, but it caused problems …"

Barton Street Response

400 letters sent out; 21 written replies (5%), one website response.

Priory Road Response

17 letters sent out; 4 replies (24%), no website response.

Painswick Road (North)

A postal consultation on the Order, of all addresses in the proposed area took place in August 2007. It took the form of a questionnaire. Reply paid envelopes were provided. There was a 27% response rate. This resulted in the proposed area being enlarged to both sides of the road. A number of highway suggestions were made for the action plan, which were evaluated by County Highways staff.

A consultation took the same form in May 2008 about the draft proposals for this action plan. Only 4 responses were received, (6%) all recommending different alternatives.

Chapter 5 Monitoring and Review

Nitrogen dioxide diffusion tubes will be used to Monitor the effectiveness of the plan. A protocol for the use of diffusion tubes has been developed by AEA Environment, which we hope will increase the reliability of this method.

We also intend to have available results from a continuous NO_2 monitor, which will be linked to the County Urban Traffic Control system. It is intended that this will influence the traffic light sequence at the Barton Street/Trier Way junction under adverse air quality conditions in Barton Street.

We have also sought funding for a continuous monitor for the Priory Road junction. This application was not successful.

Annual reports in the LTP will continue to report the *corrected* NO_2 concentration in the worst case location in each AQMA, as now.

Automatic traffic counters have been installed by the County in and at the approaches to all the AQMAs so that changes in traffic volumes can be monitored at least annually.

The progress of the plan will be reviewed no less than annually.

Appendix 1

National Air Quality Objectives

Relevant objectives included in the Air Quality Regulations (England) (Wales) 2000 and in Air Quality (England) (Wales) (Amendment) Regulations 2002 for the purpose of Local Air Quality Management			
Pollutant	**Objective**	**Concentration Measured as**	**Date to be achieved by**
Benzene	16.25 μg/m^3 (5 ppb)	Running annual mean	31 Dec 2003
Benzene	5 μg/m^3 (1.54 ppb)	Annual average	31 Dec 2010
1,3-butadiene	2.25 μg/m^3 (1 ppb)	Running annual mean	31 Dec 2003
Carbon Monoxide	10 mg/m3 (8.6 ppm)	Maximum daily running 8-hour mean	31 Dec 2003
Lead	0.5 μg/m^3	Annual mean	31 Dec 2004
Lead	0.25 μg/m^3	Annual mean	31 Dec 2008
Nitrogen Dioxide	200 μg/m^3 (132 ppb) not to be exceeded more than 18 times a year	1- hour mean	31 Dec 2005
Nitrogen Dioxide	40 μg/m^3 (21 ppb)	Annual mean	31 Dec 2005
Sulphur Dioxide	350 μg/m^3 (132 ppb) not to be exceeded more than 24 times a year	1-hour mean	31 Dec 2004
Sulphur dioxide	125 μg/m^3 (47 ppb) not to be exceeded more than 3 times a year	24-hour mean	31 Dec 2004
Sulphur Dioxide	266 μg/m^3 (100 ppb) not to be exceeded more than 35 times a year	15- minute mean	31 Dec 2004
Particles (PM_{10})	50 μg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
Particles (PM_{10})	40 μg/m^3 (21 ppb)	Annual mean	31 Dec 2004

Appendix 2. Travel Smart Results

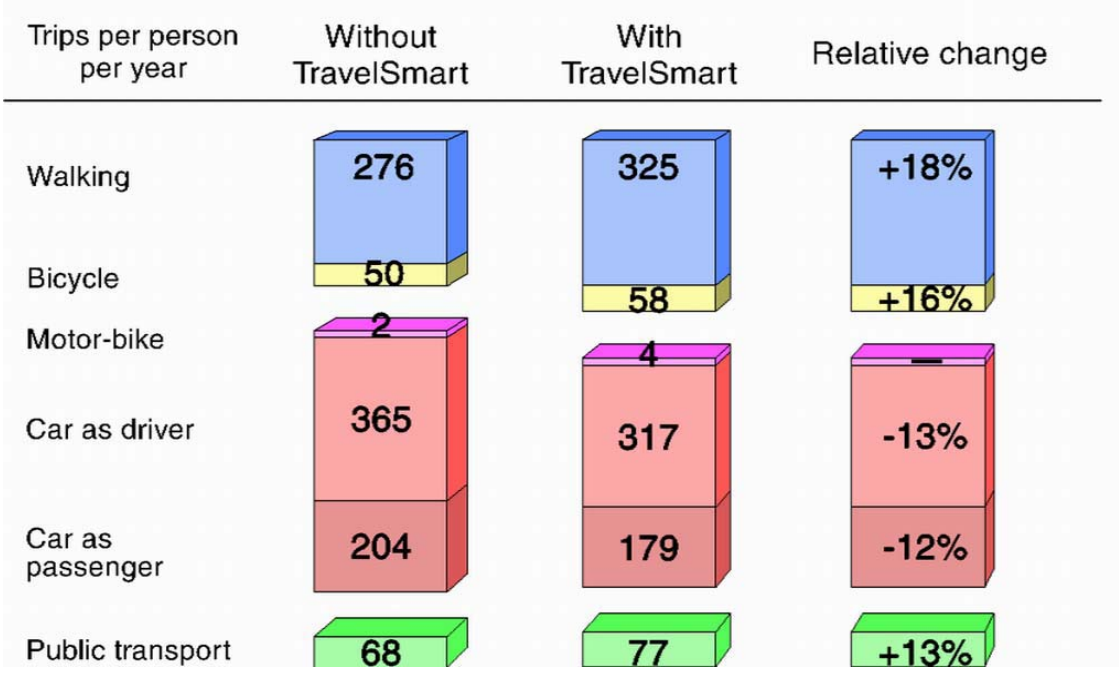
– Extract from Executive Summary of final report

(The campaign took place between April – July 2005, about 18 months before the traffic counting took place)

The Barton, Tredworth and White City TravelSmart programme was managed by a working group consisting of Gloucester City Council, Gloucestershire County Council, Sport England, Health Promotion in Gloucestershire, Stagecoach and Vision 21, alongside Sustrans and Socialdata. The Individualized Transport Marketing campaign and main evaluation activities were designed and implemented by Sustrans and Socialdata, under contract to Gloucester City Council.

The project was funded mainly by the Active England programme (jointly operated by Sport England and the Big Lottery Fund), via a grant to Gloucester City Council, and by Gloucestershire County Council. In-kind contributions were made by Stagecoach, Gloucester City Council and Vision 21. The final cost of the project, including all information materials, incentives and staff time of all project partners, was put at £210,000.

The changes in travel behaviour, measured in trips per person per year, are summarised in the figure below. This suggests that the greatest modal shift occurred from car driver and passenger trips to walking. Overall, all this modal shift was achieved without any constraint on daily mobility among the target population, without introducing any new bus services or providing new walking and cycling routes and with no significant increase in daily travel time. Other survey data suggest that while it occurred throughout the day and for all types of trips, behaviour change was concentrated at off-peak times and on shopping and leisure trips.



Appendix 3 Emission Reduction Required

The emission reduction required to meet the target nitrogen dioxide concentration was calculated using the 2007 version of the NO_x/NO_2 calculator obtained from LAQM tools website.

Barton Street

The worst-case nitrogen dioxide concentration as annual average for 2007 for Barton Street was at 124 Barton Street, 45.6 $\mu g/m^3$. The background concentration for 2007 was 18.3 $\mu g/m^3$. These figures were entered into the NO_x/NO_2 calculator from the LAQM tools website. This gave a roadside increment of NO_x of 97.5 $\mu g/m^3$

Repeating this for the desired 40 $\mu g/m^3$ of NO_2 gave a roadside increment of 73.3 $\mu g/m^3$

Thus the desired reduction in NO_x is (97.5-73.3)/(97.5) = 24% for Barton Street AQMA

Priory Road

The worst-case nitrogen dioxide concentration as annual average for 2007 for Priory Road was at 66 Priory Road, 47.6 $\mu g/m^3$. The same background figure applies. Again using the NO_x/NO_2 calculator gave a roadside increment of NO_x of 106.6 $\mu g/m^3$

Thus the desired reduction in NO_x is (106.6-73.3)/(106.6) = 31% for Priory Road AQMA

Painswick Road

The worst-case nitrogen dioxide concentration as annual average for 2007 for Painswick Road was at 106 Painswick Road, 39.8 $\mu g/m^3$. Thus no further reduction is required, but the area continues to be monitored, as there are many variables which may cause the nitrogen dioxide average to rise again.

Appendix 4

The Gloucester City Air Quality Management (Barton Street) Order 2005

Order designating an Air Quality Management Area

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

This Order may be cited/referred to as The Gloucester City Air Quality Management (Barton Street) Order 2005 and shall come into effect on 8 August 2005.

The area shown on the attached map *[Page 12]* in red together with adjoining domestic dwellings, is to be designated as an air quality management area (the designated area). The designated area incorporates Barton Street from its junction with Trier Way/Bruton Way and Upton Street including the whole of domestic dwellings between 97 and 313 Barton Street inclusive [odd numbers] and 110 to 334 Barton Street inclusive [even numbers]. The designated area shall include any future dwellings adjacent to the area marked in red. The map may be viewed at the Council Offices, 4th Floor Reception, Herbert Warehouse, The Docks, Gloucester.

This Area is designated in relation to a likely breach of the Nitrogen Dioxide (Annual Mean) Objective as specified in the Air Quality Regulations (England) (Wales) 2000.

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

Appendix 5

The Gloucester City Air Quality Management (Priory Road) Order 2005

Order designating an Air Quality Management Area

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

This Order may be cited/referred to as The Gloucester City Air Quality Management (Priory Road) Order 2005 and shall come into effect on 8 August 2005

The area shown on the attached map *[Page 11]* in red together with adjoining domestic dwellings, is to be designated as an air quality management area (the designated area). The designated area incorporates St Oswalds Road from the railway bridge to Mount Street, the houses known as nos. 46-72 Priory Road and Priory Road for a distance of 50m from its junction with St Oswalds Road. The map may be viewed at the Council Offices, 4th Floor Reception, Herbert Warehouse, The Docks, Gloucester.

This Area is designated in relation to a likely breach of the Nitrogen Dioxide (Annual Mean) Objective as specified in the Air Quality Regulations (England) (Wales) 2000.

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

Appendix 6

The Gloucester City Air Quality Management (Painswick Road) Order 2007

The Council of the City of Gloucester, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order.
This Order may be cited/referred to as **The Gloucester City Air Quality Management (Painswick Road) Order 2007** and shall come into effect on 5th October 2007

The area outlined in red on the attached map *[Page 11]* is to be designated as an air quality management area (the designated area). The designated area incorporates the road including both pavements and properties to the west side of Painswick Road between nos 70 and 110 and properties on the east side between 51 – 99 Painswick Road.

The designated area shall include any future dwellings in or adjacent to the area marked. The map may be viewed at the Council Offices, 4th Floor Reception, Herbert Warehouse, The Docks, Gloucester.

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

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

Appendix 7

Barton Street – RESIDENTS WORKSHOPS

Trust Centre 07/07/06

Problems

- Lack of parking, access to pavement
- Barton Street pedestrian crossings and Barton gates traffic signals
- Lack of dialogue with planners

- Parking, poor planning guidance
- Traffic signals at Barton gates
- Road safety / air quality

- Traffic management, traffic lights at Barton gates
- Consult on whole area traffic management eg one way streets
- Parking, lack of dialogue on planning

Ideas

- Convex safety mirrors Thomas Street
- One way Stratton Road
- Relocate scrap yard Bleinham Road to create parking
- Parking charges in City centre forcing parking into residential streets

- Allow footway parking
- Create Homezones
- Barton Street traffic lights, install left turn lane

- Widen Barton Street at Barton gates lights
- Time zone for HGV's
- One way at Conduit St, Brooke St, Ryecroft and Goodyere

Appendix 8

References

a. Reports of Gloucester City Council (from item 3 available at *www.gloucester.gov.uk/pollution*)

1. [1999] Stage 1 Local Air Quality Review and Assessment
2. [Dec 2000] Stage 2 and 3 Local air quality Review and Assessment
3. [May 2003] Updating and Screening Assessment for 2002
4. [Dec 2004] Detailed assessment of air quality for 2003/4
5. [Mar 2005] Progress Report for 2004
6. [Aug 2005] Order declaring Barton Street an AQMA
7. [Aug 2005] Order declaring Priory Road AQMA
8. [Apr 2006] Updating and Screening Assessment for 2005
9. [Dec 2006] Source Apportionment for the Two AQMAs in Gloucester
10. [Mar 2007] Progress Report for 2006 incorporating a detailed assessment for Painswick Road and the annual report on progress with Barton Street and Priory Road AQMAs
11. [Oct 2007] Order declaring Painswick Road AQMA
12. [Mar 2008]Progress Report for 2007 including detailed assessment for Barnwood Road and annual reports for the three AQMAs

b. Other references

13. Nitrogen Dioxide in the United Kingdom [2004] Air Quality Expert Group for DEFRA and others.
14. The Rogers review [March 2007]. *http://www.cabinetoffice.gov.uk/regulation/reviewing_regulation/rogers_review/index.asp*
15. http://www.gloucestershire.gov.uk/ltp2
16. The new National Air Quality Strategy, July 2007
    Volume 1
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    Econonmic Analysis: all at
http://www.defra.gov.uk/environment/airquality/strategy/index.htm

17. Long Term exposure to air pollution: effect on mortality (COMEAP) July 2007 at:
http://www.advisorybodies.doh.gov.uk/comeap/statementsreports/longtermeffectsmort2007.htm
18. Gloucestershire Air Quality Strategy (at www.gloucester.gov.uk/pollution)