Belfast City Air Quality Progress Report, 2008

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Executive Summary

The Environment Order (NI) 2002 places a responsibility on councils to periodically review and assess air quality within its boundaries. As part of this process, Belfast City Council presents the 2008 Air Quality Progress Report.

This report has been prepared following LAQM.PRGNI(04) Progress Report Guidance document issued by the DOE(NI). The aim is to report the progress of implementing local air quality management; and to report progress in achieving, or in many cases maintaining, concentrations below the air quality objectives.

Relevant Air Quality Objectives for carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide are being met throughout the city and no evidence to suggest that they are in jeopardy has been found.

It is encouraging to note the downward trends in urban background concentrations of nitrogen dioxide evident over the past 15 years of monitoring and a 3% reduction in annual means since 2005. Over the same period, the Belfast Roadside site has seen reductions of between 2 and 4% in annual mean nitrogen dioxide. Monitored exceedences of the annual mean objective continue to be recorded within the four Air Quality Management Areas. Exceedences of the hourly mean nitrogen dioxide objective have been monitored in the M1-Westlink AQMA. As stated above roadside concentrations also exhibit a downward trend and when projected forward these trends suggest that by 2010 annual mean nitrogen dioxide concentrations may possibly be below the objective in the Ormeau Road AQMA and Cromac Street and Albertbridge Street AQMA. However, the area around the old Westlink Air Quality Monitoring Station is predicted to be beneath the objective by 2016. The area around the Stockman's Lane area is unlikely to fall beneath the objective before 2020.

Again, it is encouraging to note a downward trend in the urban background particulate matter (PM_{10}) and the objectives are unlikely to be breached. However, monitoring in the M1-Westlink AQMA continues to record breaches of the objectives. No discernable downward trend in particulate matter is yet evident. Both the annual mean and 24-hour objective are unlikely to be met in this area by 2010.

Several new developments have occurred throughout Belfast since the last Updating Screening Assessment. These developments were identified during the planning application process and where necessary an air quality assessment was requested. The impact of these developments was then assessed and any necessary development specific mitigation measures were identified.

Further progress with the Air Quality Action Plan was also identified. Belfast City Council is making good progress with two high ranking Cost Effective Score Actions and completion is on target to occur within the allotted Timescales. Further evidence is presented to support the improved emissions because of the upgrading of the bus fleet and the large increases in the use of bicycles within the city. Traffic disruption within the city is evident from the M1-Westlink upgrade and encouragingly this work is reported to be ahead of schedule. Although air quality benefits will no doubt be gained after the cessation of these works, little evidence can be found that changes in car use and transportation patterns are occurring.

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1.0 Introduction

In 2002, the Environment Order was introduced in Northern Ireland. This places a responsibility upon district councils to periodically review air quality within their areas and compare them against the health based standards.

As part of this review process Belfast City Council conducted a Second and Third Stage Review and Assessment of air quality throughout its area in 2004. This concluded that modelled exceedences of the nitrogen dioxide and particulate matter were occurring in the city and would continue to do so after 2010. Consequently, in August 2004 four Air Quality Management Areas (AQMA) were declared. The M1-Westlink AQMA was declared because annual mean and hourly mean nitrogen dioxide concentrations would exceed the 2005 Objective. Particulate matter (annual and 24-hour means) was also predicted to exceed the relevant objectives for this area. Three other areas were declared on the grounds that they would exceed the annual mean nitrogen dioxide objective. These areas are defined in Figures 1 to 4.

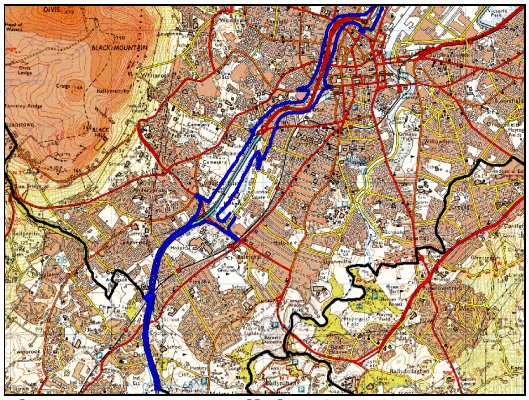

Figure 1: M1-Westlink AQMA

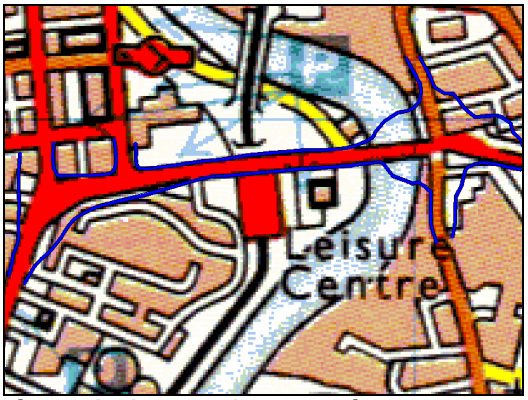

Figure 2: Cromac Street and Albertbridge Street AQMA

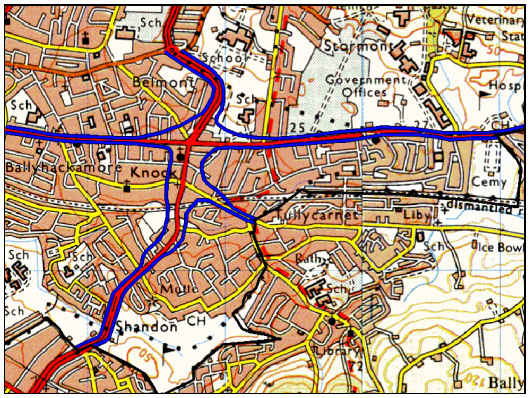

Figure 3: Upper Newtownards Road AQMA

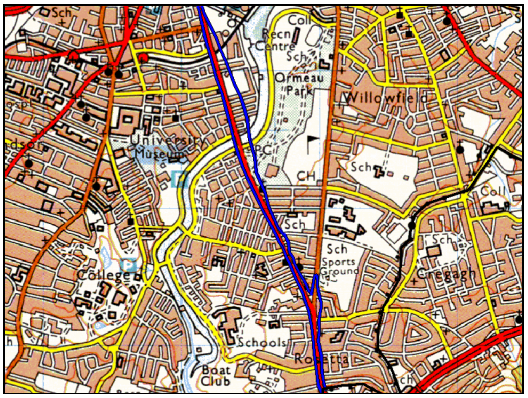

Figure 4: Ormeau Road AQMA

In May 2006, Belfast City Council and 11 other parties published an Air Quality Action Plan setting out how air quality in these areas and across the city as a whole was to be tackled. In April 2006, Belfast City Council published their Updating and Screening Assessment that concluded that five further areas within the city required consideration. These areas underwent a detailed dispersion modelling exercise in 2007. With the exception of the city centre and the four existing AQMAs no other areas were found to be exceeding the relevant objectives. The city centre was highlighted as being particularly sensitive to potential exceedences of the nitrogen dioxide annual mean objective and consequently Belfast City Council have increased their monitoring infrastructure in this area and will be regularly review the situation. In the same year, Belfast City Council published the first progress report relating to the Action Plan. This found that good progress on the majority

of the 164 identified actions was being made with only 4% of the actions having had no progress within the first year.

The current stage in the Review and Assessment process is to conduct an Air Quality Progress Report. This report follows Guidance LAQM.PRGNI(04) issued by the Department of Environment Northern Ireland in November 2004. This report aims to meet the minimum reporting criteria and fulfil the recommended additional elements. Consequently, this report covers air quality monitoring data carried out throughout Belfast, all new developments that could impact on air quality, progress with the implementation of the Action Plan and Transportation Strategies.

2.0 Monitoring Results

2.1 Carbon monoxide

Carbon monoxide concentrations have been monitored at the Belfast Centre site since 1992. The continuous real time carbon monoxide monitoring equipment is affiliated to Defra's Automatic Urban and Rural Network (AURN). Belfast Centre site is classed as an Urban Centre site and representative of typical population exposure in the city centre (Appendix 1).

Table 7 in Appendix 2 summarises the carbon monoxide monitoring results collected since 1992. Where data capture fell below 9 months, annual means were adjusted to provide an estimate of the annual mean using the procedure set out in LAQM.TG(03) (Box A1.3, page A1-16). Data verification and QA/QC procedures are as per the AURN protocol.

No exceedence of the 2003 National Air Quality Strategy Objective (11.6 mgm^{-3} maximum 8 hour mean) or the 2005 EU Limit Value (10 mgm^{-3} maximum 8 hour mean) for carbon monoxide has been monitored in Belfast since 1996. Figure 5 clearly shows a downward trend in concentrations over the past 15 years of monitoring.

Figure 5. Maximum 8 hour mean for carbon monoxide (mgm^{-3}) monitored at Belfast Centre Site since 1992.

2.2 Benzene

Benzene concentrations have been monitored at the Belfast Centre and the Belfast Roadside site since 2002. Monitoring stopped at the Belfast Roadside site in October 2007. The Belfast Centre site monitors benzene exposure for the City Centre whilst the Belfast Roadside site monitors benzene concentrations experienced at a Roadside location. More details of these monitoring locations are given in Appendix 1.

Benzene monitoring is carried out in accordance with the UK non-automatic hydrocarbon network. Table 8 in Appendix 2 summarises the monitoring results collected since 2002.

No exceedence of the 2010 National Air Quality Strategy Objective (3.25 ugm^{-3} annual mean) or the 2010 EU Limit Value (5 ugm^{-3} annual mean) for benzene has ever been monitored in Belfast since 2002. Figure 6 shows that there is a clear downward trend and it is very evident that future concentrations of benzene in Belfast will not exceed the 2010 Objective or Limit Value.

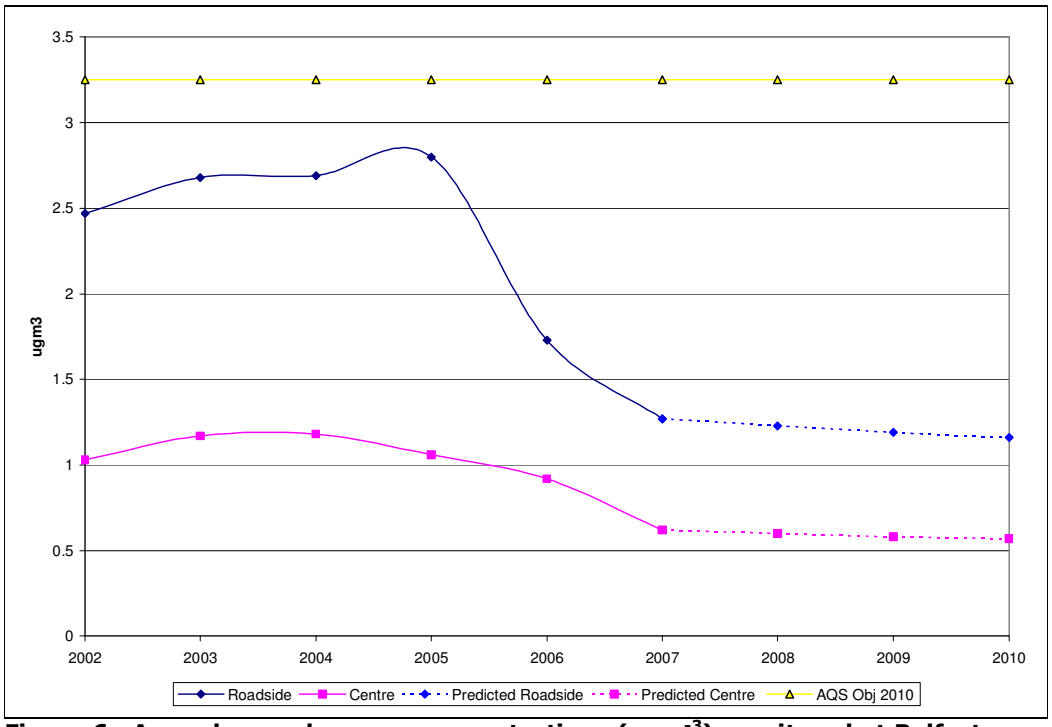

Figure 6. Annual mean benzene concentrations (ugm^{-3}) monitored at Belfast Centre Site and Belfast Roadside site since 2002.

2.3 1,3-butadiene

1,3-butadiene concentrations were monitored at the Belfast Centre and the Belfast Roadside site from May 2003 to October 2007. The Belfast Centre site monitors 1,3-butadiene exposure for the City Centre whilst the Belfast Roadside site monitors benzene concentrations experienced at a roadside location. More details of these monitoring locations are given in Appendix 1.

Monitoring is carried out in accordance with the UK non-automatic hydrocarbon network. Table 9 in Appendix 2 summarises the monitoring results collected since 2003.

No exceedence of the 2003 National Air Quality Strategy Objective (2.25 ugm^{-3} annual mean) for 1,3-butadiene has ever been monitored in Belfast. Figure 7 shows that 1,3-butadiene trends are unlikely to exceed the 2003 Objective.

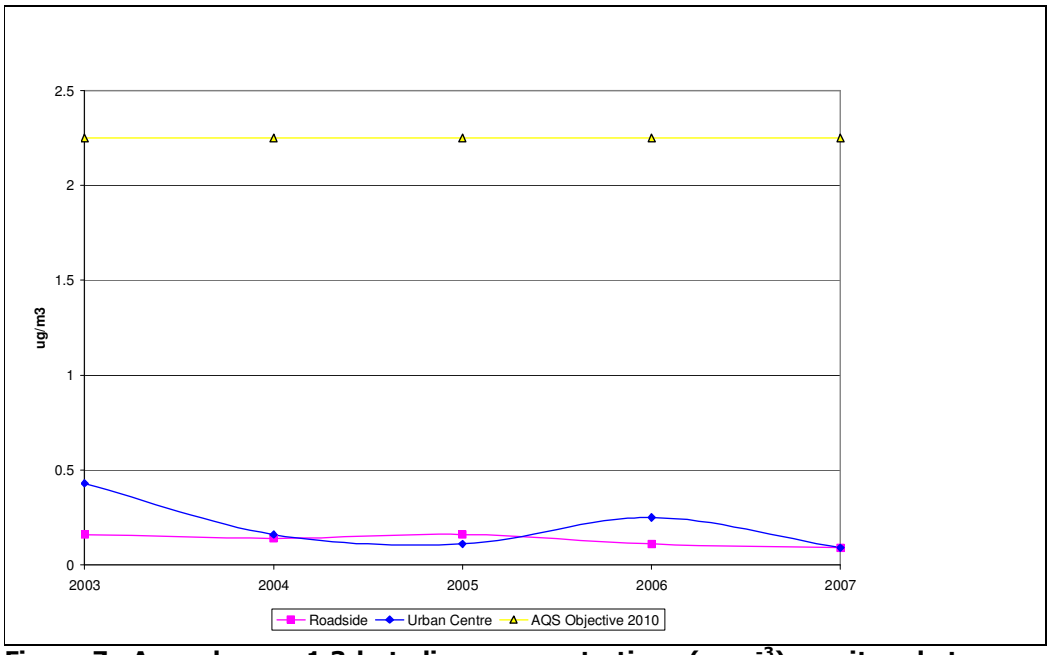

Figure 7. Annual mean 1,3-butadiene concentrations (ugm^{-3}) monitored at Belfast Centre Site and Belfast Roadside site since 2003.

2.4 Lead

Between December 1999 and November 2000 lead was monitored at Victoria Park, 800m from the Belfast Harbour Estate in an area classed as mixed industrial (J3364, 3754). Annual mean concentrations were well within the EU Directive Limit value of 0.5 ugm^{-3} and the lower 2008 National Air Quality Strategy Objective (0.25 ugm^{-3}). Based on this one-year study it was concluded that levels of metallic pollutants across Belfast were low and were not going to jeopardise the objective (Department of Environment (Northern Ireland), 2002).

Heavy metal monitoring recommenced in December 2007 at the Belfast Centre site. Preliminary results suggest that annual mean lead concentrations will be significantly lower than those monitored in 2000 and meeting the 2008 Objective (annual mean of 0.25 ugm^{-3}) will be feasible. This Defra funded monitoring is expected to continue until 2009.

Table 10 in Appendix 2 summarises the monitoring results collected for lead.

2.5 Nitrogen Dioxide

Continuous nitrogen dioxide concentrations have been monitored at the Belfast Centre site since 1992. This continuous real time nitrogen dioxide monitoring equipment is affiliated to Defra's Automatic Urban and Rural Network (AURN). In April 2002, Belfast City Council established a roadside continuous monitoring location on the Upper Newtownards Road (Belfast Roadside site) and on the Westlink (Appendix 1). In 2006, due to the major road rebuilding scheme along the M1-Westlink corridor the Westlink site was closed and relocated to the Stockman's Lane Site. In May 2006, a roadside continuous nitrogen dioxide monitoring station was established on the Ormeau Rd. These council operated sites are calibrated and operated under the same principles as Defra's Automatic Urban and Rural Network, they undergo regular independent audits and the data is independently collated, scaled and verified before disseminating

Table 11 in Appendix 2 summarises all nitrogen dioxide continuous monitoring data collected since 1992. Where data capture fell below 9 months, annual means were adjusted to provide an estimate of the annual mean using the procedure set out in LAQM.TG(03) (Box A1.3, page A1-16).

No exceedence of the 2005 National Air Quality Strategy Objective and the 2010 EU Limit Value annual means (40 ugm^{-3}) or the 1 hour means (200 not to be exceeded more than 18 times per year) have been monitored at the Belfast Centre site since 1994. Figure 8 clearly demonstrates a downward trend for city centre nitrogen dioxide concentrations and that the 2010 EU Limit Values are unlikely to be breached.

Figure 8. Annual mean nitrogen dioxide concentrations (ugm^{-3}) monitored at Belfast Centre Site since 1992.

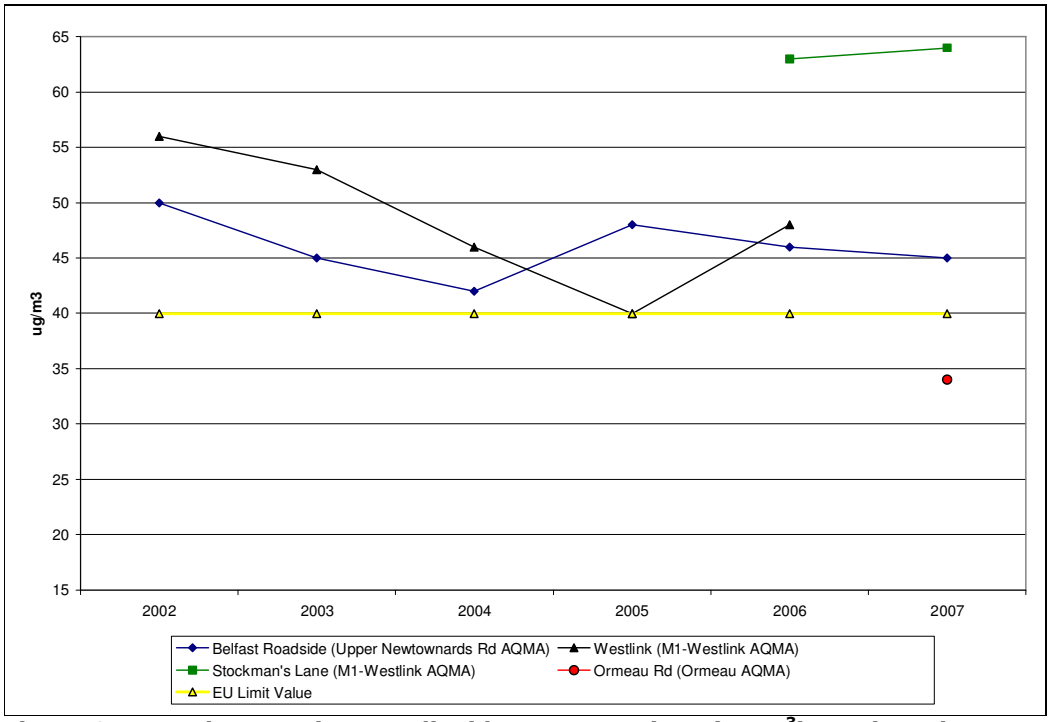

Figure 9. Annual mean nitrogen dioxide concentrations (ugm^{-3}) monitored at continuous AQMA monitoring stations since 2002.

Exceedences of annual mean NO_2 objective have been recorded at all continuous AQMA monitoring stations with the exception of the Ormeau Road Air Quality Monitoring Station. Hourly means in excess of 200 ugm^{-3} have not exceeded the 2005 Objective limit of more than 18 times per year since 2004. In 2007, 15 one-hour means in excess of 200 ugm^{-3} occurred at Stockman's Lane, Table 11, Appendix 2.

Since 2005, the Belfast Centre site has seen a gradual year on year decrease of approximately 3% in urban annual mean nitrogen dioxide concentrations. Over the same period, the Belfast Roadside site has seen year on year decreases of between 2% and 4% annual mean nitrogen dioxide. These downward trends are encouraging. If they are assumed to continue and are projected forward for each AQMA air quality monitoring station it is possible to determine whether these downward trends are sufficient to prevent exceedences of the 2005 objective in the compliance year of 2010. These projections also assume that traffic trends within these AQMAs remain relatively consistent with that experience over the past three years. The Year Adjustment Calculator using the Roadside adjustment function was used for the third predictive reduction rate.

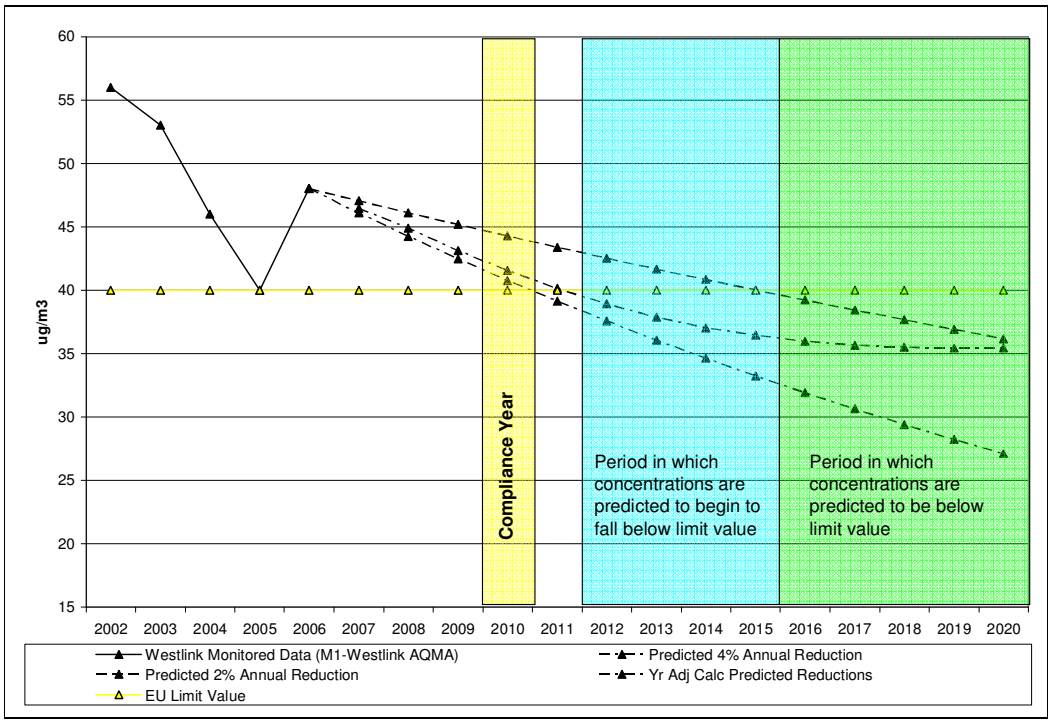

Figure 10. Monitored and predicted annual mean nitrogen dioxide concentrations for the Westlink Air Quality Monitoring Station in the M1-Westlink AQMA.

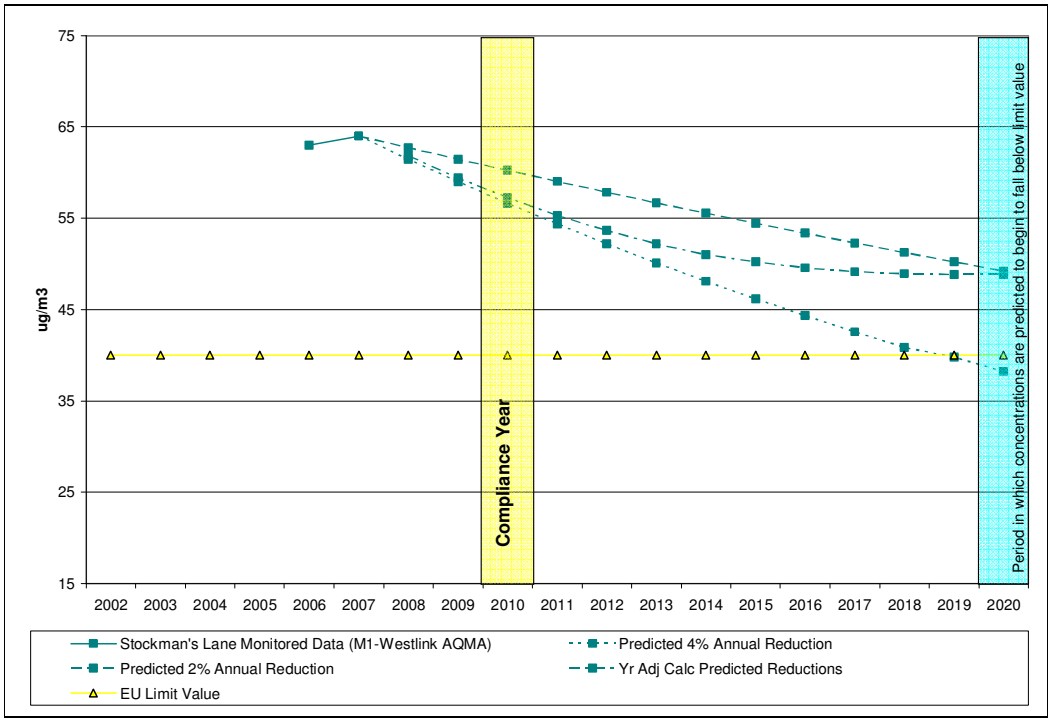

Figure 11. Monitored and predicted annual mean nitrogen dioxide concentrations for the Stockman's Lane Air Quality Monitoring Station in the M1-Westlink AQMA.

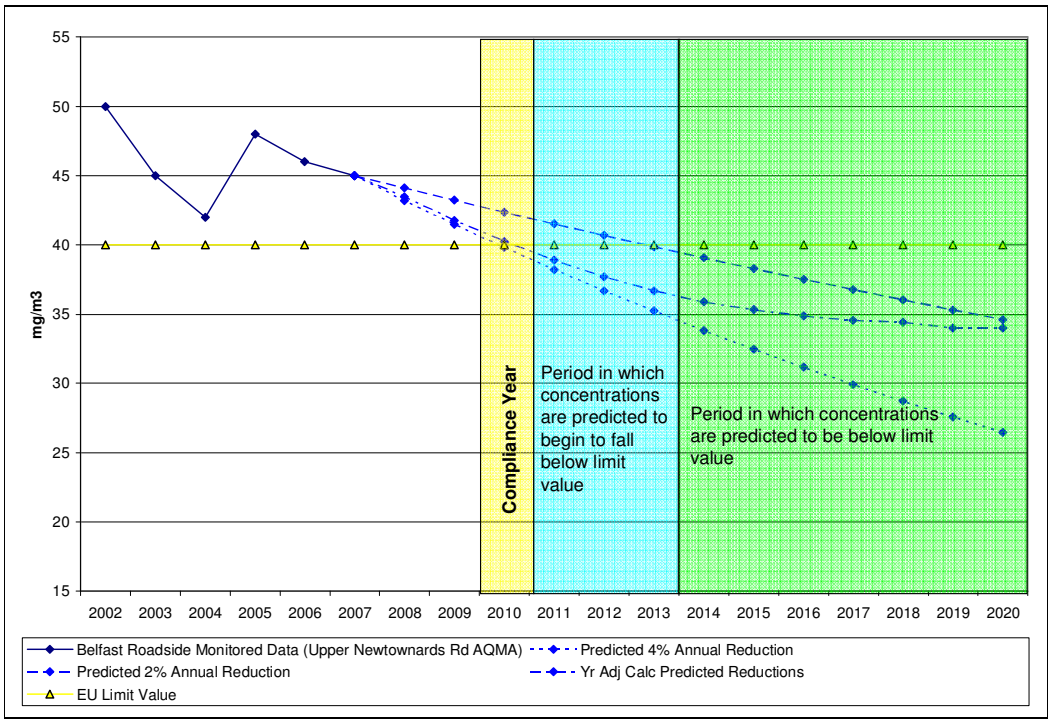

Figure 12. Monitored and predicted annual mean nitrogen dioxide concentrations for the Belfast Roadside Air Quality Monitoring Station in the Upper Newtownards Rd AQMA.

The highlighted blue periods represent the years where, with further monitoring and a thorough detailed atmospheric modelled exercise, enough evidence could potentially be gathered to revoke the AQMA. The highlighted green periods represent the years where, if the downwards trend continues, the annual mean objectives are most likely to be met within the AQMAs.

Continuous and diffusion tube monitoring along the M1-Westlink corridor would suggest that exceedences of the annual mean would continue after 2010. The best estimate for the area around the location of the old Westlink Air Quality Monitoring Station would indicated that annual mean levels of nitrogen dioxide would fall below the objective after 2012. However, based on the current situation and trends the Stockman's Lane area is unlikely to fall beneath the objective before 2020.

Continuous and diffusion tube monitoring along the Upper Newtownards road AQMA would suggest that exceedences of the annual mean would continue after 2010. The best estimate (a 4% year on year reduction) for this area would indicate that annual mean levels of nitrogen dioxide will fall below the objective after 2011. However, the most probable prediction (using the 2% year on year reduction and the year adjustment calculator) for this area is that the limit values will be met in or around the year 2014.

The Ormeau Rd continuous air quality monitoring station would suggest that at this location nitrogen dioxide levels are well below Limit Value. This coupled with the results obtained so far from the diffusion tube monitoring along this AQMA would indicate that annual mean nitrogen dioxide concentrations are at a level that could result in the revoking of the AQMA. A detailed dispersion model in 2010 for the entire length of the AQMA would be able to confirm this.

Evidence from the diffusion tube monitoring and the 2007 Detailed Assessment would suggest that exceedences remain in the Cromac Street AQMA (Belfast City Council, 2007). Using the 2 to 4% annual predicted decreases it is feasible that this area will also meet the annual mean objective by 2010. Further monitoring and a detailed dispersion model in 2010 for this AQMA would be able to confirm this.

In addition to the continuous monitoring stations, Belfast City Council operates numerous nitrogen dioxide diffusion tubes throughout the city. This data is presented in Table 12, Appendix 2. These locations provide indicative annual mean concentrations of nitrogen dioxide throughout the city and are bias adjusted against co-located tubes at the Belfast Centre site in accordance with LAQM.TG(03), Box 6.4. The bias adjustment factor and adjusted tube data for 2007 is reported in Appendix 3. In 2007, Belfast City Council maintained 27 tube locations. After a review of these locations and because of the Detailed Assessment (Belfast City Council, 2007) this number has now risen to 40 locations. These new locations focus on monitoring receptors near busy roads. They will be used to evaluate any potential exceedences outside of the declared AQMAs and to highlight potential areas of concern for future investigation. This is particularly relevant in the City Centre where the potential for exceedences was highlighted in the 2007 Detailed Assessment.

Where relevant exposure exists, no exceedences of the annual mean nitrogen dioxide objective have been monitored by diffusion tubes in locations outside of the AQMAs since 2005.

Exceedences of the annual mean objective for nitrogen dioxide are predicted to occur along the M1-Westlink corridor and the Upper Newtownards Road after 2010. Exceedences of the annual mean objective are unlikely to occur after 2010 at the monitoring locations along the Cromac Street and the Ormeau Road AQMAs. The hourly nitrogen dioxide objective is not predicted to exceed along the M1-Westlink corridor after 2010. No other area of Belfast is predicted to exceed this objective.

2.6 Sulphur Dioxide

Sulphur dioxide concentrations have been monitored at the Belfast Centre and the Belfast East site since 1992. These continuous real time carbon monoxide monitors were affiliated to Defra's Automatic Urban and Rural Network (AURN). The Belfast East site was closed in October 2007. Belfast Centre site is classed as an Urban Centre site and representative of typical population exposure in the city centre and the Belfast East site was classed as an Urban Background representative of citywide background conditions (Appendix 1).

Table 13 in Appendix 2 summarises the sulphur dioxide monitoring results collected since 1992. Where data capture fell below 9 months, annual means were adjusted to provide an estimate of the annual mean using the procedure set out in LAQM.TG(03) (Box A1.3, page A1-16). Data verification and QA/QC procedures are as per the AURN protocol.

No exceedences of the 2004, 2005 National Air Quality Strategy Objectives, and the 2005 EU Limit Values have been monitored at the Belfast Centre site since 1998 when 47 exceedences of the 15 minute mean occurred (limit of 35 per annum). Exceedences of the 15 minute mean and the 24-hour mean occurred at the Belfast East site up to the year 2001. Figure 13 clearly demonstrates that a downward trend in concentrations over the past 15 years has been monitored at both sites. Therefore, sulphur dioxide objectives are and will continue to be met throughout the city.

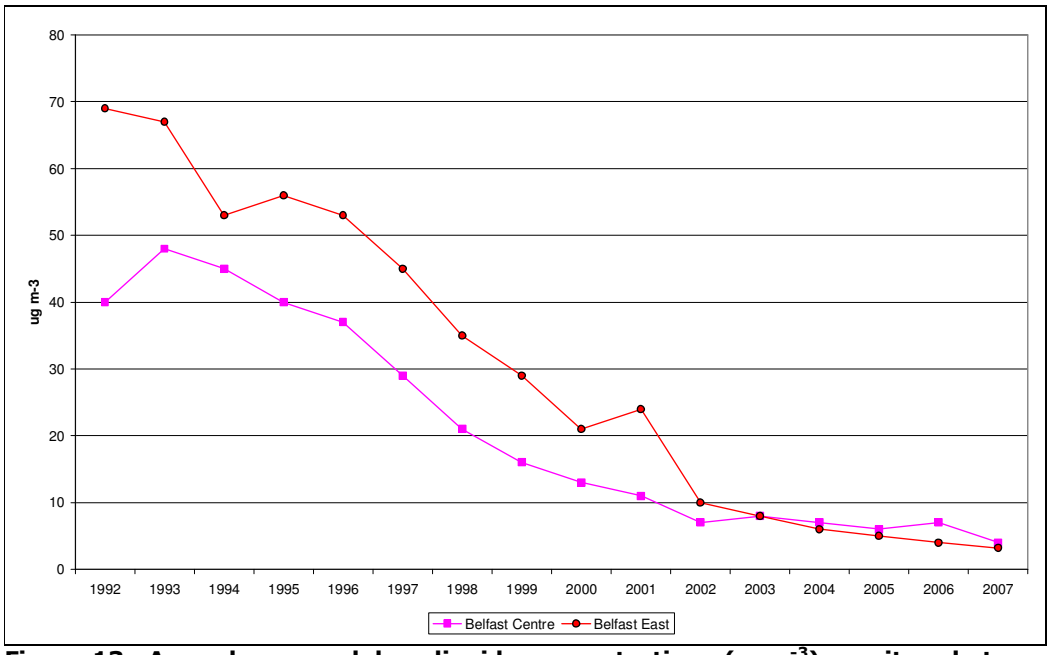

Figure 13. Annual mean sulphur dioxide concentrations (ugm^{-3}) monitored at Belfast Centre Site and Belfast East since 1992.

2.7 Particulate Matter

2.7.1 PM_{10}

Particulate matter (size fraction 10um) concentrations have been monitored at the Belfast Centre site since 1992 and at Belfast Clara Street since 1998. These urban background monitoring sites were affiliated to Defra's Automatic Urban and Rural Network (AURN). In October 2007 the Clara Street site was dropped from this network. In April 2002, Belfast City Council established a kerbside monitoring location on the Westlink (Appendix 1). In 2006, due to the major road rebuilding scheme along the M1-Westlink corridor the Westlink site was closed and relocated to the Stockman's Lane Site. These council operated sites are calibrated and operated under the same principles as Defra's Automatic Urban and Rural Network, they undergo regular independent audits and the data is independently collated, scaled and verified before disseminating

Table 14 in Appendix 2 summarises all PM_{10} monitoring results collected since 1992. Where data capture fell below 9 months, annual means were adjusted to provide an estimate of the annual mean using the procedure set out in LAQM.TG(03) (Box A1.3, page A1-16).

An exceedence of the 2004 National Air Quality Strategy Objective and the 2005 EU Limit Value for annual means last occurred at the Belfast Centre site in 1993. The number of 24 hour means that exceeded the 50 ugm-3 concentration fell below the objective level of 35 times per year in 1997. No exceedence of either the annual mean or the 24 hour means have ever been monitored at Clara Street. Using the Year Adjustment Calculator and predicting forward to 2010 would indicate that urban background concentrations fall below the 20 ugm-3 level. Figure 14 clearly demonstrates a downward trend for urban background concentrations of PM10 throughout the city and that the Objectives are unlikely to be breached for background areas.

However, monitoring at the Westlink and Stockman's Lane have shown breaches of both the annual mean and the 24-hour Objectives. In 2003, there were 60 days above the 50 ugm-3 concentration at the Westlink site, breaching the 24 hour Objective. The annual mean at the Stockman's Lane site breaches the 2004 Objective and in the years 2006 and 2007 there were 49 and 106 days respectively that exceeded the 50 ugm-3 concentrations. Due to the short data sets, it is not yet possible to determine any significant trends at these locations but it is highly likely that breaches of the 2005 EU Limit Values will continue to occur up to and after 2010 at these locations.

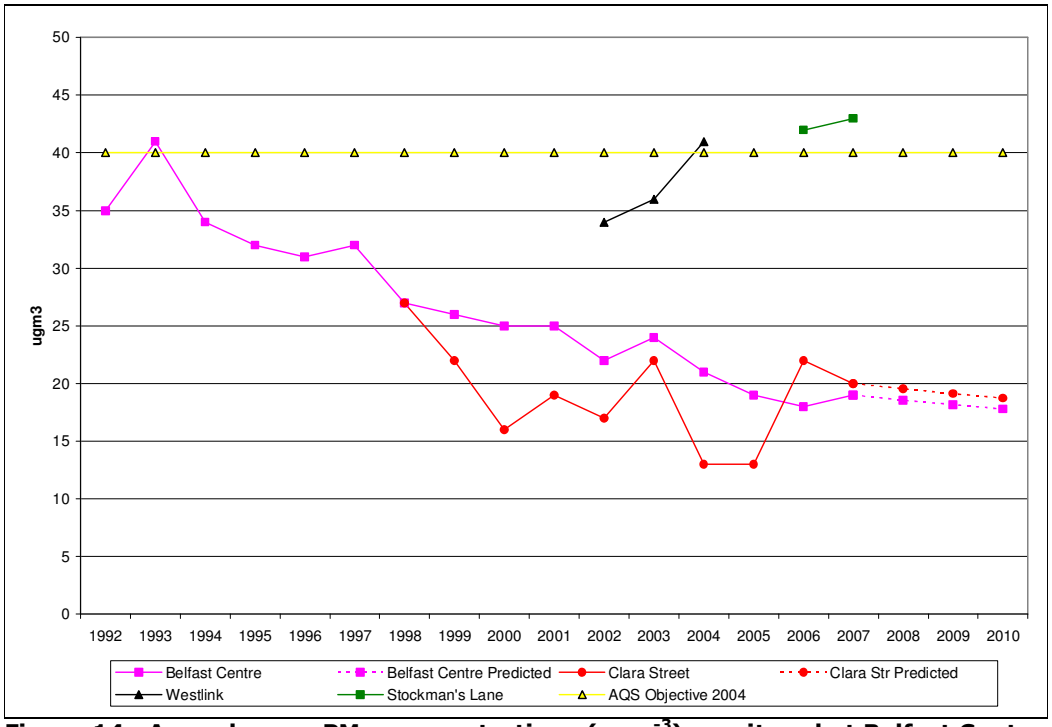

Figure 14. Annual mean PM_{10} concentrations (ugm^{-3}) monitored at Belfast Centre Site, Clara Street, Westlink and Stockman's Lane since 1992. Background concentrations predicted forward to 2010

2.7.2 $PM_{2.5}$

Particulate matter (size fraction 2.5 um) concentrations were monitored at the Belfast Centre site as part of the Defra's UK Particle Monitoring Research Programme during the period 2001 to October 2007. This instrument was operated by Belfast City Council under contract from the National Physical Laboratory and was subjected to rigorous QA/QC and data management procedures. Table 15 in Appendix 2 summarises this data and provides an annual mean.

The average annual mean background concentration for this monitoring period was 20.6 ugm-3, slightly above the EU 2015 limit value for the urban background concentration. In 2008 an AURN affiliated instrument will be installed in the Belfast Centre Site. This will determine the mean annual background concentrations on which the necessary 20% exposure reduction figure can be determined in accordance with the new EU Air Quality Directive.

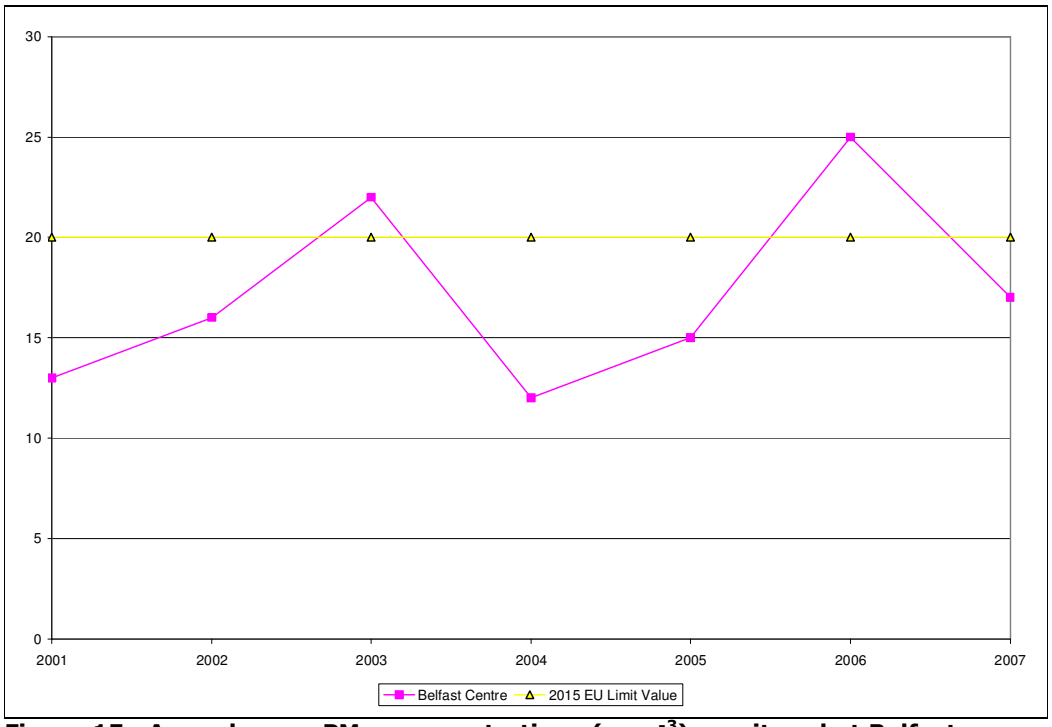

Figure 15. Annual mean $PM_{2.5}$ concentrations (ugm^{-3}) monitored at Belfast Centre Site, 2001 to 2007.

2.7.3 Particulate Matter monitoring

Between 2001 and 2006 Belfast City Council operated a further four particulate matter monitoring instruments. These monitored total PM10 fraction using a Condensation Particulate Counter, particulate carbon, particulate nitrate and a range of ions including chloride, nitrate and sulphate. This monitoring was part of the Defra's UK Particle Monitoring Research Programme. Data for years 2005 to 2006 are available in Table 16 to 21 in Appendix 2. Further data and information relating to this monitoring is available at www.airquality.co.uk/archive/particle_data.php

2.8 Ozone

Ozone concentrations have been monitored at the Belfast Centre site since 1992. The continuous real time ozone monitoring equipment is affiliated to Defra's Automatic Urban and Rural Network (AURN). Belfast Centre site is classed as an Urban Centre site and representative of typical population exposure in the city centre (Appendix 1).

Table 23 in Appendix 2 summarises ozone monitoring results collected since 1992. Where data capture fell below 9 months, annual means were adjusted to provide an estimate of the annual mean using the procedure set out in LAQM.TG(03) (Box A1.3, page A1-16). Data verification and QA/QC procedures are as per the AURN protocol.

No National Air Quality Strategy Objective for ozone currently exists. Provisional values of no more than 10 days where the 8-hour mean exceeds 100 ugm-3 have been proposed for the National Air Quality Strategy. Figure 16 demonstrates that the objective has not been breached since 1995, although it came close in 2003. The EU 2020 Objective of a max 8-hour mean (120 ugm-3) has been breached in seven of the 16 years of monitoring.

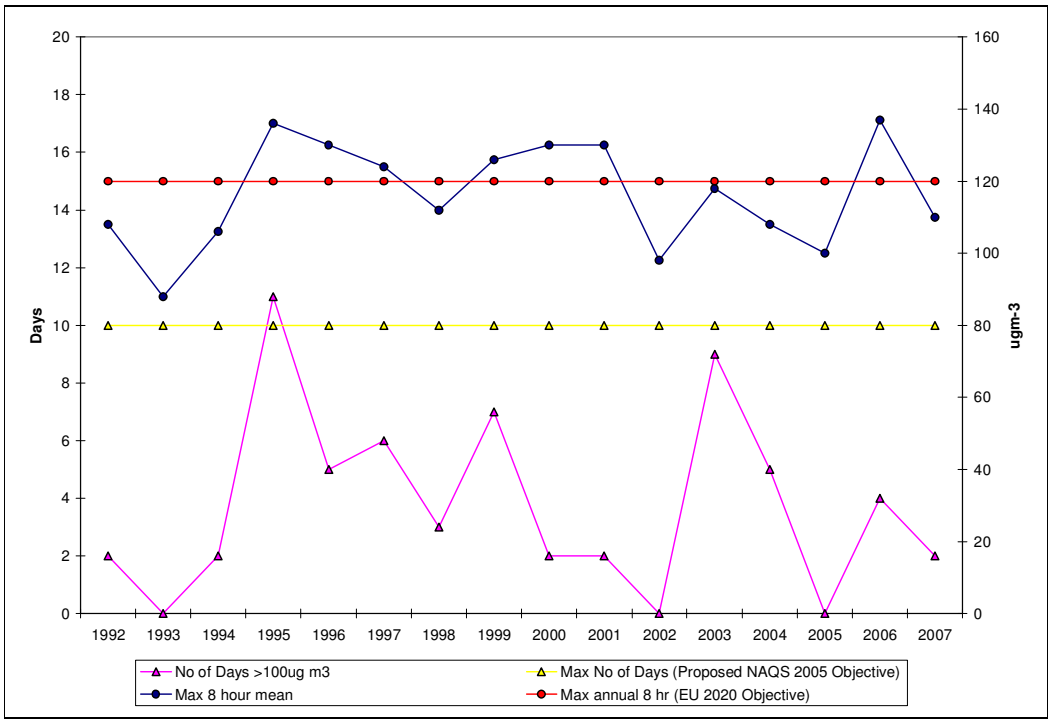

Figure 16. Number of days when the 8-hour mean exceeded 100 ugm-3 and the max 8-hour mean ozone (ugm^{-3}) concentrations monitored at Belfast Centre Site since 1992.

Figure 17 shows a general increasing trend in urban background annual mean ozone concentrations since monitoring began.

Figure 17. Annual mean ozone (ugm^{-3}) monitored at Belfast Centre Site since 1992 including trend line of annual mean ozone over the past 15 years.

2.9 Polycyclic Aromatic Hydrocarbons

Speciated PAHs were monitored at the Clara Street Site from 2001 to 2006. Table 22 in Appendix 2 provides annual means for a selection of PAHs. Further annual and quarterly urban background PAH data for Belfast is available at www.airquality.co.uk/archive/data/pah

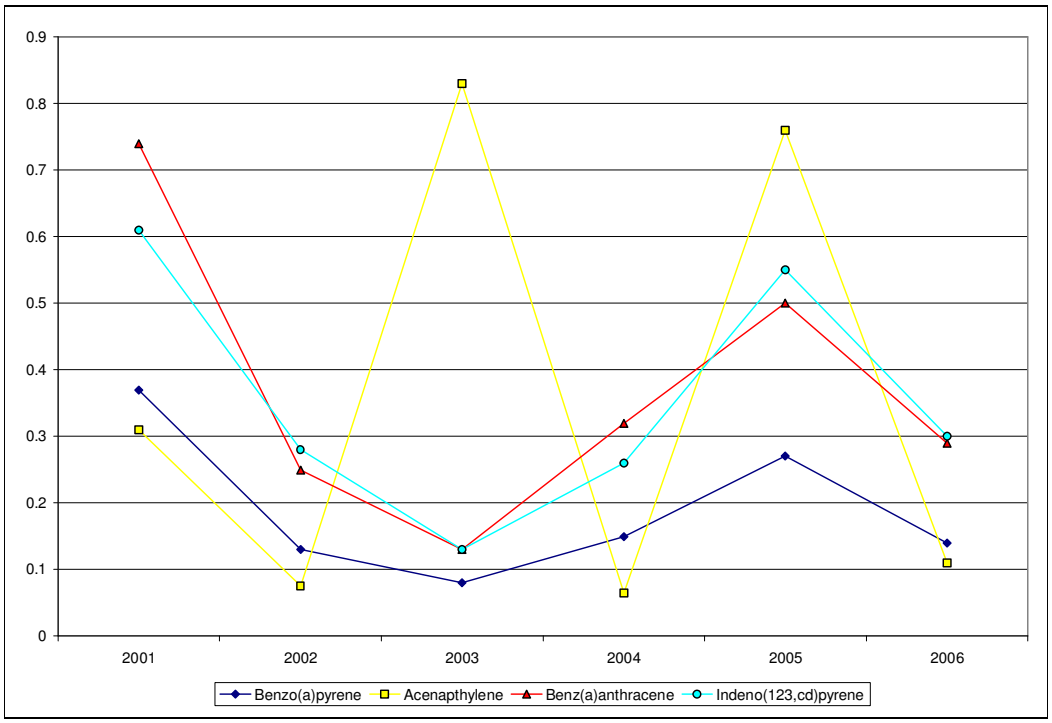

Figure 18. Selected polycyclic aromatic hydrocarbons monitored at Clara Street, 2001 to 2006.

3.0 New Local Developments

3.1 Part A & B Processes

All Part A & B processes within Belfast are listed in Appendix 4. a comparison of the current processes and those identified in the 2006 Update and Screening Assessment were under taken and no new processes that could influence local air quality were identified.

3.2 New Part C Processes

Belfast City Council's Part C database was compared with that held in 2006. A total of 25 licences have been revoked, 12 of which were for petrol filling stations. 15 new processes have been licensed during that period, none were considered to have a negative impact on air quality.

3.3 New Retail Developments

The Environmental Protection Unit of Belfast City Council received details of applications for planning permission for three major retail developments within the city during 2007. These developments were considered to have the potential to have a negative impact on local air quality and were identified as such by using the guidance issued by the NSCA in 2006 (National Society for Clean Air, 2006).

Air quality assessments submitted in support of these developments concluded that their impact was insignificant and that the nitrogen dioxide and particulate matter objectives would not be at risk. Details of these applications are included in Table 24, Appendix 5.

3.4 New Road Schemes

A major road development scheme is currently under way on the M1-Westlink corridor. This programme is having obvious impact on certain parts of the road network in the Belfast area and potentially contributing to elevated nitrogen dioxide and particulate matter monitored within the declared AQMA. The scheme is due to be complete by February 2009, six months earlier than planned. Continued road traffic flow monitoring and air quality monitoring will determine the overall impact of this major road scheme.

3.5 New Mineral and Landfill Developments

No new mineral extraction developments have been established or applied for since the 2006 USA. The Dargan Road landfill was closed to domestic waste in May 2006. All works carried out at the site are now in relation to restoration works and capping. The waste transfer station located on the site is now operational. Plans to develop the landfill (the North Foreshore) are still being finalised. A risk assessment submitted to the Council's Development Department concluded that the proposed development and the landfill gas utilisation plant would have a minimal impact on local air quality.

3.6 New Mixed Use Developments

The Environmental Protection Unit of Belfast City Council received details of applications for planning permission for 3 large retail developments and 28 mixed use developments within the city during 2007. Developments ranged from small scale apartment developments to large mixed use projects covering several hectares. Air quality assessments submitted in support of these developments concluded that their individual impact was insignificant and that the nitrogen dioxide and particulate matter objectives were not at risk. Several developments proposed mitigation measures during the construction phase that centred on controlling fugitive emissions of particulate matter. Details of these applications are included in Table 25, Appendix 5.

Air quality issues are now routinely considered during every planning application. The citing of a crèche facility in the M1-Westlink AQMA raised concerns of sensitive exposure being exposed to poor air quality. A detailed dispersion model of the area concluded that adequate protection of the receptors could be attained by restricting the hours spent out doors during rush hour periods (07:30 to 09:30 and 16:30 to 18:30, Monday to Friday).

Two areas of the city are currently undergoing large scale redevelopment; the Titanic Quarter and the Sirocco Quays. The Titanic Quarter development includes residential apartments, office space, bars, restaurants, hotels, leisure facilities and entertainment and initial phases cover 17 hectares. The 6.5 hectare Sirocco Quays development proposes 2,000 apartments, hotel, childcare facilities, elderly care facilities and a supermarket. Assessments of the cumulative impact of these developments are currently being completed by the developers and any necessary mitigation measures will be considered.

4.0 Progress on the Implementation of the Action Plan

The 2007 Action Plan Progress Report identified 51 initiatives assigned to Belfast City Council, 36 (70%) were assigned the Green Category. These Actions are considered to have be enacted and completed and will therefore not be considered further. Table 1 shows those Actions that were assigned Amber or Red Categories and are ranked in order of their Cost Effectiveness Score.

The highest Cost Effectiveness Score for an Action yet to be completed is the development of memorandum of understanding between the Planning Service and Belfast City Council. This would influence the development of the city in a manner where air quality considerations are given due consideration. It was assigned a Medium Timescale (3 to 5 years), a relatively high impact (6 out of 10) and a costing of 7 (less than £100,000) to implement, giving a total score of 42. This is the highest-ranking Cost Effective Action within the plan.

In order to address this Action, Belfast City Council have established an internal group to develop a Belfast specific policy and guidance document that can be adopted by the planning service. This document will then be used to lobby the Planning Service for a memorandum of understanding regarding air quality control and development. Various stages of progression have been identified for this project and the final completion of this Action is timetable to be complete by April 2009. This would mean that the most Cost Effective Action within the plan is enacted and completed before the end of the assigned timescale period.

The second highest Cost Effective Score (28) assigned to Belfast City Council is the review of the Transport Policy. A Transport Policy Review working group has been established within the council who have secured agreement from the Chief Officers to undertake this review. Terms of Reference are currently being drawn up which proposes a 7 staged approach which will include; reviewing the existing policy, researching and consulting on the main issues, reviewing current transport activities, appraising policy options, developing an appropriate policy, training and delivery. The production of a draft policy and presentation to the committee is due in October 2008. This is well within the allotted medium timescale period for this Action.

Belfast City Council continues to promote cycling and walking activities amongst its staff and the city. The success of the up take in cycling in the city is apparent and discussed later in this chapter. The Bike to Work Scheme was introduced to council employees in June 2007 and has so far been taken up by over 110 individuals. This scheme and the green transport options available to staff are now included in the staff induction programme. In addition, the council has taken a pro-active role and shown civic leadership in the manner by which it now advises other large organisations about these schemes. Advice and information has been provided to organisations such as the PSNI, DRD, Translink and other councils.

The installation of cycling facilities continues. Access to secure bike racks, shower and changing facilities have now been established at the Adelaide exchange and are available to council staff based in the city centre. Bike racks at the Cecil Ward Building are due to be installed shortly.

Additional council progress with assigned actions include; the issuing of a tender for the supply of a new fuel use management system, the inclusion and delivery of new Euro IV emission standard lorries into the fleet and the continued consideration of car pooling or sharing schemes for council staff.

Table 1. Air quality actions under local authority control and those identified during the 2007 Progress Report as being in progress.

Option	Approach	Action	Timescale	Impact	Cost	Cost Effectiveness Score
Policies that contribute to lower air pollution levels.	Influence policy development for the city through the development of corporate policies and responses to promote more sustainable development.	Lobby for the development of a memorandum of understanding between the Planning Service and Belfast City Council.	M	6	7	42
	Review current Belfast City Council Transport Policy.	Investigate options for more effective travel planning for Council employees and for other public sector organisations based on the findings from travel pattern surveys.	M	4	7	28
Walking and cycling facilities	Continue to promote healthy travel, bike to work etc in partnership with other agencies	Install cycle parks at Council buildings	M	3	7	21
		Promote the availability of Cycle Usage Mileage for Council employees.	M	3	7	21
		Promote and support cycling initiatives through the Belfast City Council Active Living Initiatives.	S	3	7	21
Policies that contribute To Lower Air Pollution Levels.	Review current Belfast City Council Transport Policy.	Develop an updated Environmental Package transport policy.	M	3	7	21
		Participate in Active Living Weeks in conjunction with the Investing for Health Strategy.	S	3	7	21
	Enforcement within smoke control areas	Carry out informal sampling of solid fuels at bagging plants within Belfast for sulphur content	S	3	7	21
Marketing and Education Initiatives	Education campaign for young people highlighting the health problems related to air pollution	Develop and deliver a targeted education campaign via the Council's web site or published material.	M	3	7	21
	Review current Belfast City Council Transport Policy.	Participate in Active Living Weeks in conjunction with the Investing for Health Strategy.	S	3	7	21
Better Vehicle Fleet Manage-ment	Establish a programme to enable vehicle fuel consumption efficiency to be improved.	Purchase software to enable a baseline survey to be undertaken and subsequent fuel usage logging to be introduced.	M	2	7	14
	Establish a Belfast City Council fleet management action plan.	Improve procedures for recording and monitoring fuel usage.	M	2	7	14
	Establish a mobile plant and infrastructure plant management plan	Establish a baseline study of fuel usage by mobile plant used within Belfast City Council's Parks & Cemeteries Service Section.	M	2	7	14

Option	Approach	Action	Timescale	Impact	Cost	Cost Effectiveness Score
Policies that contribute To Lower Air Pollution Levels.	Support the regeneration of Belfast's major arterial routes as part of a regional regeneration agenda	Develop and implement integrated regeneration plans for designated Arterial Routes across the City (including the lower Ormeau Road) in order to tackle problems of economic, social, physical and environmental decline.	M	2	7	14
Marketing and Education Initiatives	Promote the use of alternative fuels and vehicle types via the Energy Saving Trust	Promote emissions testing amongst large organisations in Belfast	M	2	7	14
	Reduce pollution arising from the burning of either commercial or domestic garden waste.	Implement further work to publicise the health effects of pollution from domestic and commercial burning.	M	1	7	7
	Development and implement a policy for dealing with commercial and domestic bonfires.	Implement annual education programme for Tyre Distributors to encourage environmentally friendly disposal.	S	1	7	7
Walking and cycling facilities	Continue to promote healthy travel, bike to work etc in partnership with other agencies	Promote the Walk and Bike to Work Days.	S	1	7	7
Encourag-ing large organisat-ions to consider greener options	Power Council buildings with electricity generated from a renewable source such as wind power.	Switch electricity tariff in Council buildings to an environmentally friendly tariff based upon renewable energy.	S	1	7	7
	Adoption of the Belfast City Council Draft Carbon reduction programme.	Manage landfill gas generation at the Belfast City Council North Foreshore site.	L	1	5	5
		Introduce combined heat and power plants at selected Council facilities.	S	1	5	5

A key performance indicator for traffic related emissions is clearly road traffic counts. Data required to describe the contribution to ambient levels of air quality from various vehicle types or traffic flow conditions is not currently available. In the 2007 Detailed Assessment traffic flow data for specific areas of Belfast were provided by external contractors and funded through the Local Air Quality Grant Scheme. It is proposed that in order to determine emissions from traffic flows within Belfast further studies are carried out to determine the fleet composition and emission rates. This would involve a combination of temporary real time roadside vehicle emission monitoring and traffic surveys. It is envisaged that this study will be funded through the Local Air Quality Grant Scheme. This work will provide an accurate picture of the contribution to ambient levels of air quality from the vehicle types using the road network.

In the meantime, the Road Service annual traffic count data provides some evidence of the road traffic patterns with Belfast. As a whole Northern Ireland's road network experienced a 0.7% increase for the period 2005 to 2006, (Road Service, 2006). Traffic count data collected from the motorway network within Belfast itself indicates that there was an overall decrease in the number of vehicles using the motorways in 2006. This has been attributed to the on going major road works scheme along the M1-Westlink corridor.

Conversely, the traffic counts for non-motorways within Belfast have shown percentage changes ranging from a reduction of 6% to an increase of 9.3% for the same period. Over the five-year period, the arithmetic average increase in traffic levels across the road network of Belfast ranges from 1 to 2% per annum. Appendix 6 shows the locations of the road traffic count location operated in Belfast by Road Service.

It is therefore apparent that although the major road works on the M1-Westlink are having an effect on the traffic flows on the motorway network, elsewhere within Belfast traffic flows continue to increase by between 1 and 2% per annum.

Table 2. Percentage changes in motorway traffic in Belfast 2001 to 2006

CP No.	Location	2002 – 2003 % change	2003 – 2004 % change	2004 – 2005 % change	2005 – 2006 % change
201	Broadway - Stockman's Lane (J'ct 2)	10.4	0	3.9	-12.5
202	Fortwilliam Interchange – Outbound	-2.5	11.8	1.6	-2.4
203	Fortwilliam Interchange – Inbound	7.8	3.1	1.0	-1.4
204	Greencastle (J'ct 2) – Sandyknowes	11.3	3.5	-0.8	-0.5
206	Greencastle – Whiteabbey	-0.1	0.4	3.9	-4.4
213	Westlink, Belfast, south of Roden Street	-	-1.1	2.9	-15.9
227	Stockman's Lane J'ct (above roundabout)	-2.8	-	-	-13.2
230	Blacks Road on – slip	-8.4	2.6	9.1	-6.0
231	Blacks Road off – slip	-0.8	-2.8	6.9	12.8
290	Westlink, Clifton Street, towards M1	-	4.2	-3.9	-6.8
291	Westlink, Clifton Street, towards M2	2.2	2.2	0.7	-7.4
Arithmetic mean		**1.9**	**2.4**	**2.5**	**-5.2**

Table 3. Percentage changes in non-motorway traffic in Belfast 2002 to 2006

CP No.	Location	2002 – 2003 % change	2003 – 2004 % change	2004 – 2005 % change	2005 – 2006 % change
210	Shore Road, Belfast at Shore Crescent	-7.9	1.6	-4.6	3.4
211	Antrim Road, Belfast, at zoo	-4.0	-20.4	20.2	-0.6
502	Holywood By-Pass east of Belfast Rd	-	8.5	-3.7	9.3
209	Sydneham By-Pass, at airport	0.7	2.7	5.7	0.7
222	Parkway, Belfast	-0.8	-4.0	11.9	0
217	Comber Road, Belfast, S.E. of New Line	1.2	3.2	0.8	1.7
221	Upper knockbreda Road, Belfast	-1.1	5.8	-2.9	2.7
787	Belfast, Saintfield Road (Nr Knockbracken Rd S at KFC)	-	-	-	0.1
225	Kings Bridge, Belfast	-3.7	1.4	-0.8	0.6
226	Governors Bridge, Belfast	-1.1	-0.4	2.5	-1.8

CP No.	Location	2002 – 2003 % change	2003 – 2004 % change	2004 – 2005 % change	2005 – 2006 % change
208	Lisburn Road, Belfast, at King's Hall	-	-	-	9.1
220	Shaws Bridge, Belfast	7.5	-1.1	-1.1	-2.2
224	Upper Malone Road, Belfast, at Lady Dixon Park	2.3	4.9	-4.3	2.4
528	Hillhall Road, Lisburn, near Ballyaghlis	-5.5	3.5	-0.3	3.8
527	Belfast - Lisburn, at Lambeg	6.4	5.4	-0.3	2.8
521	Blacks Road - Saintfield Road (J'ct 6)	7.9	5.1	3.7	-6.0
525	Belfast - Lisburn, at Derriaghy	1.7	2.0	-1.7	4.1
529	Drumbeg Road, near Lisburn	7.8	1.2	2.0	-0.4
523	Lisburn - Hillsborough (at Harry's Road)	-2.3	-0.8	10.8	0.6
223	Stewartstown Road, Belfast, at Kells Avenue	10.8	-1.4	-0.9	0.9
Arithmetic mean		**1.2**	**1.0**	**2.1**	**1.6**

In terms of vehicle ownership, 49% of households in Belfast have access to one or more cars (1.13 cars per household) this has remained steady for the past 3 years. (Department of Regional Development (Northern Ireland) Roads Service, 2007). This, and the general annual increases in traffic flow, would indicate that although overall vehicle fleet numbers are not increasing the use of these vehicles is increasing.

In terms of travelling behaviour only 12% of distance travelled in Belfast was on public transport, this too has remained relatively constant over the past 3 years. 67% of commuters get to work in a car or van, 10% uses the buses, and 16% walk (Figure 19). Again, no significant change in these behaviours has been reported over the last three years (Department of Regional Development (Northern Ireland) Roads Service, 2007).

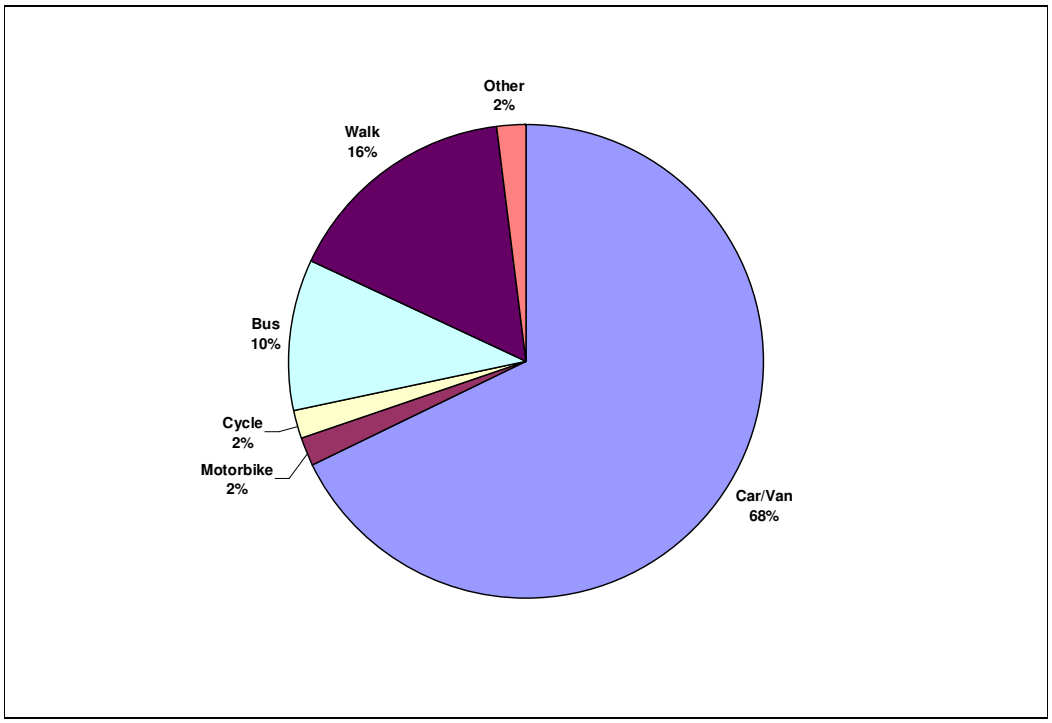

Figure 19. Method of travel to work, 2004 to 2006

However, on a more positive note there exists plentiful evidence that cycling has seen a huge increase throughout Belfast.

There are 10 permanent automated cycle counters in Belfast maintained by Roads Service. Table 4 shows the results from these counters for the period 2000 to 2006, based upon calculations of average daily use during May, June and September. The table also shows the percentage rise. One of the sites on Ormeau Bridge is particularly impressive showing an increase of 127% in 6 years (Road Service Consultancy, 2007).

Sustrans has undertaken successive Route User Surveys at various sites on the National Cycle Network throughout the UK and Northern Ireland including five in Belfast. These studies involved interviewers staffing sites for four 12-hour periods on week days and weekends during term time and the school holidays. During this time, an accurate count was made of all route user types and a substantial number of interviews were conducted in order to gain a deeper understanding of trends in usage. These surveys have shown an even higher percentage increase in cycle use suggesting that the various initiatives to promote cycling within the Plan are having a positive impact.

Table 4. Increases in Average Daily Cycle Flows within Belfast Between 2004 to 2006

	2004 ADCF	2006 ADCF	% Increase
Ormeau Bridge (Road Service ATC)	72	92	28
Ormeau Bridge (Road Service ATC)	145	295	103
Ormeau Park Entrance (Sustrans)	472	954	102
Botanic Avenue (Road Service ATC)	47	153	226
Botanic Avenue (Road Service ATC)	25	61	144
Hawthornden Way (Road Service)	8	10	25
Comber Greenway (Sustrans)	123	555	351
Royal Avenue (Road Service ATC)	29	38	31
Laganside (Sustrans Survey)	449	1910	325
Stranmillis (Road Service ATC)	163	255	56
Hawlers Way-Laganside (Sustrans)	1047	1452	39
M5 Foreshore (Road Service ATC)	94	138	47
Albertbridge (Road Service ATC)	61	83	36

In terms of bus route provision, a key Action within the Plan for Translink is the increase of service provision on core routes. This would appear to be having some success in that more people are using the bus network within Belfast. Translink's own data indicates that passenger numbers are up 14%, equivalent to 50,000 people or over 950 additional full busloads per week (http://www.translink.co.uk/arbetterbusservices.asp).

Translink is committed to improving service frequencies to between five and ten minutes on all 12 bus corridors. They will initially enhance the Antrim Road, Shore Road and Upper Newtownards Road. Other corridors will be enhanced later. The network will also be extended to the University of Ulster at Jordanstown, Lisburn and Carryduff, Belvoir and Hydebank. Airport services to the Belfast International and George Best Belfast City Airports were re-branded, with service frequency enhanced to every 10 minutes during peak hours.

Another key Action within the Plan is the commitment to upgrade vehicles within the bus fleet with cleaner emissions that meet the ever tightening Euro Standards. By analysing the fleet composition in terms of Euro Standards it is possible to determine the effect of this action has on emissions of NOx and particulate matter.

Using the Euro Emission Standards presented in Table 5 and the fleet composition in Table 6 it is clear that although the overall fleet has increased by 12% from 2005 to 2008 the emissions from this fleet have initially declined and then remained constant.

Table 5. Euro Emission Standards for diesel engines, g/kWh

	NOx	PM
Euro I	8.0	0.36
Euro II	7.0	0.25
Euro III	5.0	0.1
Euro IV	3.5	0.02

Source: www.dieselnet.com/standards/eu/hd.php#stds

Table 6. Number of buses in the Belfast fleet by Euro Class

Year	Pre Euro	Euro I	Euro II	Euro III	Euro IV	Total
2005	136	66	58	99	0	359
2006	71	56	63	179	0	369
2007	72	50	68	199	0	389
2008	66	52	69	202	12	401

Figure 20 shows that despite the increase in the bus fleet (from 359 in 2005 to 401 in 2008) the emissions of particulates saw a significant decrease between the years 2005 and 2006 and they now remain below the 100 grams per kilo watt hour.

Figure 21 also demonstrates that despite the increasing bus fleet, NOx emissions remain relatively constant at around 2,500 grams per kilo watt hour. These figures are encouraging, as the rolling programme of removing older less clean vehicles will have a significant impact on improving emission rates from this source despite the projected increase in the bus fleet required to improve and the level of service.

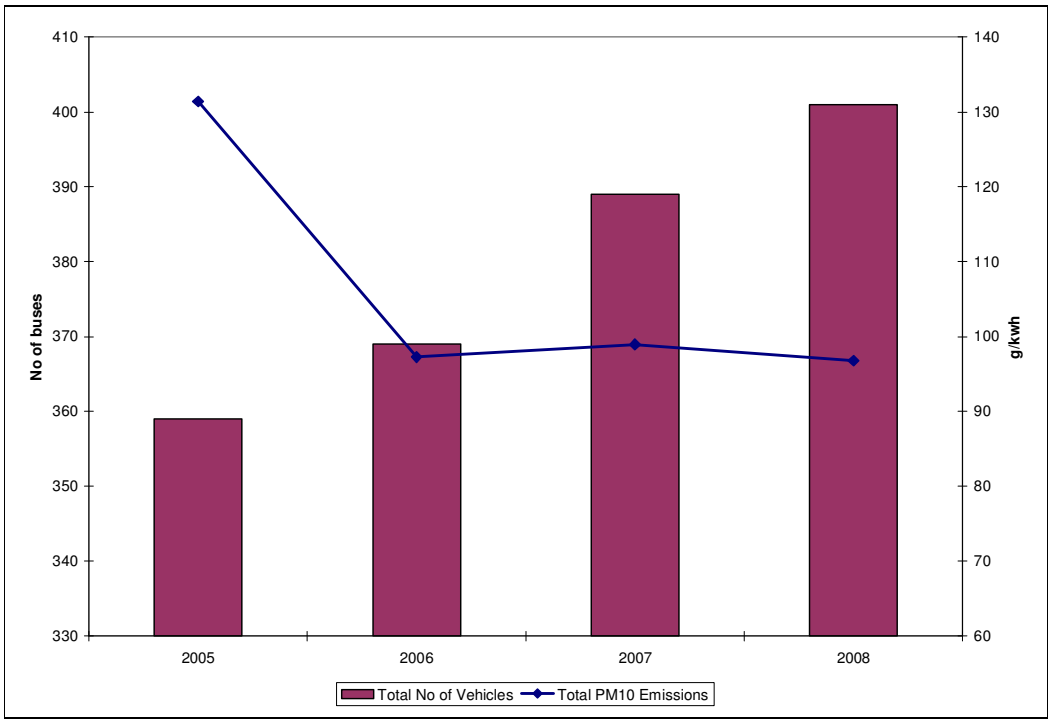

Figure 20. Total number of Ulster Bus and Metro Fleet operating in Belfast and particulate matter emissions, 2005 to 2006.

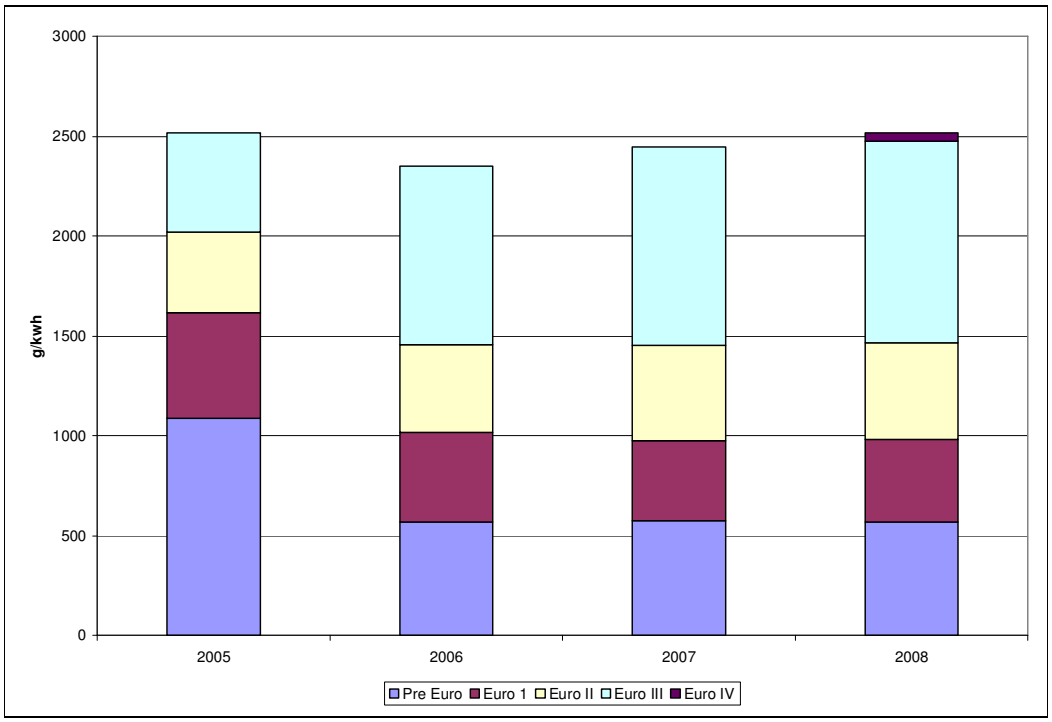

Figure 21. NOx emissions from total Ulster Bus and Metro Fleet operating in Belfast, 2005 to 2006.

5.0 Transportation Measures

The Regional Transportation Strategy (RTS) for Northern Ireland 2002-2012 identifies strategic transportation investment priorities and considers potential funding sources and affordability of planned initiatives over the strategy period. The RTS is a 'daughter document' of the Regional Development Strategy (RDS) that sets out the spatial development framework for Northern Ireland up to 2025. The purpose of the RTS is to support the RDS and to make a significant contribution over the 10 years towards achieving the longer-term vision for transportation contained in the RDS. Its stated aim is 'to have a modern, sustainable, safe transportation system which benefits society, and the environment and which actively contributes to social inclusion and every one's quality of life' (Department for Regional Development (Northern Ireland), 2007).

In 2007, the DRDNI published its first monitoring report on the progress of the Belfast Metropolitan Plan and the Regional Strategic Transport Network Transport Plan, two of the three Transport Plans used to progress the RTS. The report concludes that there has been good progress on increasing cycling journeys but concedes an increase in the number of people making journeys by private car across the Northern Ireland network. An 8% decrease in AM Peak flows speeds (2001 to 2007 period) and an AM peak bus speed decrease of 12.8% (2001 to 2006 period) were reported. A 15% growth in Metro Passenger numbers (2001 to 2007, equates to 50,000 additional passengers or an extra 1,000 full busloads every week) was also reported. Four further Quality Bus Corridors are planned. These will be on the Saintfield Road, Newtownards Rd, Falls Rd, and for the City Express. A master plan for more such routes is being developed. (Department of Regional Development, 2007).

Additionally, in April 2008 the Northern Ireland Department of Regional Development commissioned report into the provision of a rapid transport network for Belfast was published. This report concluded that the most appropriate transport system was a modern high-class rapid transit bus based system. It recommended that the £111 million already secured from the Regional Development Minister for a rapid transit system would be more effectively spent on a bus based system rather then one that used a light rail-based system. This report is currently out for consultation.

6.0 Conclusions

Relevant Air Quality Objectives for carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide are being met throughout the city and no evidence to suggest that they are in jeopardy has been found.

Decreasing trends in urban background concentrations of nitrogen dioxide are evident over the past 15 years of monitoring. Monitored exceedences of the annual mean nitrogen dioxide objective have been regularly recorded within the four Air Quality Management Areas. Exceedences of the hourly mean nitrogen dioxide objective have been monitored in the M1-Westlink AQMA. Roadside concentrations exhibit a slight downward trend and when projected forward these trends suggest that by 2010 annual mean nitrogen dioxide concentrations may possibly be below the objective in the Ormeau Road AQMA and Cromac Street and Albertbridge Street AQMA. The area around the old Westlink Air Quality Monitoring Station is predicted to be beneath the objective by 2016. At best, the area around the Stockman's Lane Air Quality Monitoring Station will be beneath the objective by 2020, although two predictions would indicate that this area is unlikely to meet the objective.

Decreasing trends in urban background particulate matter (PM_{10}) are also evident. No discernable downward trend in particulate matter are evident in the M1-Westlink AQMA. Both the annual mean and 24-hour objective are unlikely to be met in this area by 2010.

All developments that are consulted on by the Planning Service are screened by staff of the Environmental Health Service on the significance of the impact of the development on air quality management. Several new developments have occurred throughout Belfast since the last Updating Screening Assessment. These developments were identified during the planning application process and where necessary an air quality assessment was requested. The impact of these developments was then assessed and any necessary development specific mitigation measures were identified. Careful consideration of the City Centre and two large proposed developments (the Titanic Quarter and the Sirocco Quays developments) will continue. Increased monitoring by Belfast City Council and detailed dispersion modelling by developers in these areas should highlight any possible breaches of the Objectives.

Further progress with the Air Quality Action Plan was also identified. Belfast City Council is making good progress with two high ranking Cost Effective Score Actions and completion is on target to occur within the allotted Timescales. Further evidence is presented to support the improved emissions because of upgrading bus fleets and the large increases in the use of bicycles within the city. Traffic disruption within the city is evident from the M1-Westlink upgrade and encouragingly this work is reported to be ahead of schedule. Although air quality benefits will no doubt be gained after the cessation of these works, little evidence can be found of a change in car use and transportation patterns. Data relating to types of vehicle use in Belfast and their emissions is not currently available. Belfast City Council proposes further traffic flow and traffic emission studies to be undertaken in 2008.

Belfast City Council would like to thank their various partners within the Belfast City Air Quality Action Plan group for providing data presented in this report.

7.0 References:

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Appendix 1. Air Quality Monitoring Stations

Belfast Centre

Site Name: Belfast Centre
Site Type: Urban Centre
Site Comments: Lombard St. Irish Grid Coords: J333898 374358

Monitoring Network: Partisol research network

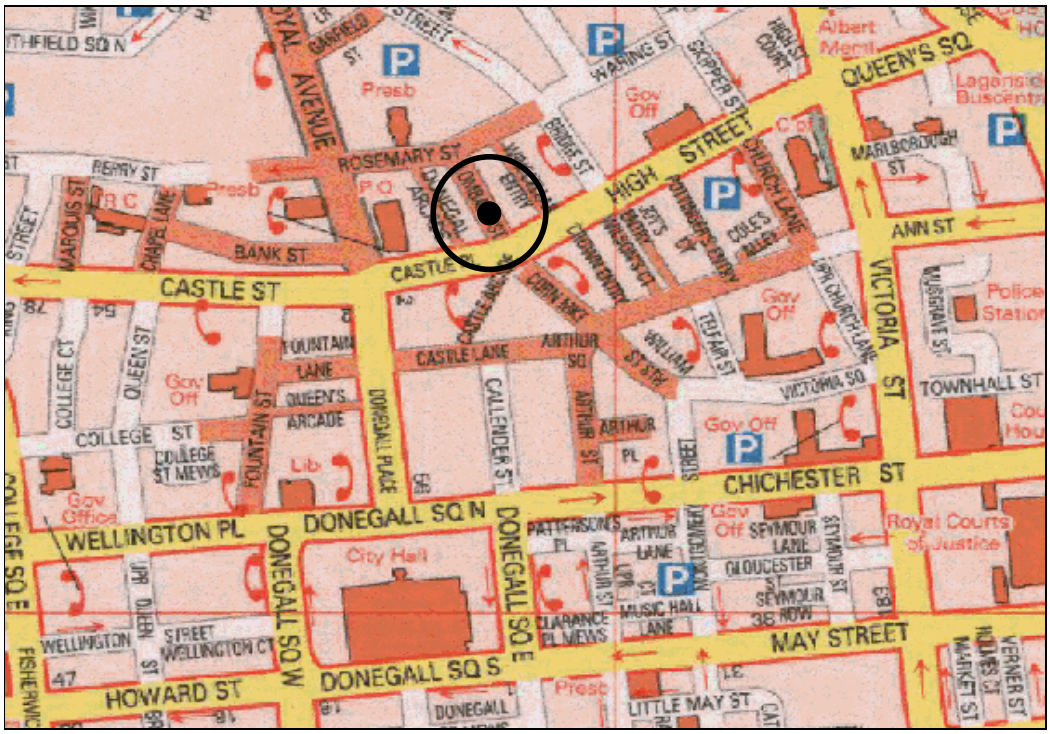
Parameter	Date Started	Date Ended
PM10 particulate matter (Daily measured)	03/02/2001	12/05/2004
PM2.5 particulate matter (Daily measured)	03/02/2001	07/10/2007

Monitoring Network: Non-Automatic Hydrocarbon Network

Parameter	Date Started	Date Ended
Benzene	07/05/2002	Ongoing
1,3-butadiene	20/05/2003	18/09/2007

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Carbon monoxide	08/03/1992	Ongoing
Nitric oxide	08/03/1992	Ongoing
Nitrogen dioxide	08/03/1992	Ongoing
Ozone	08/03/1992	Ongoing
PM10 particulate matter (hourly Measured)	08/03/1992	Ongoing
Sulphur dioxide	08/03/1992	Ongoing
Nitrogen oxides as nitrogen dioxide	08/03/1992	Ongoing
Enclosure Temperature	08/03/1992	Ongoing

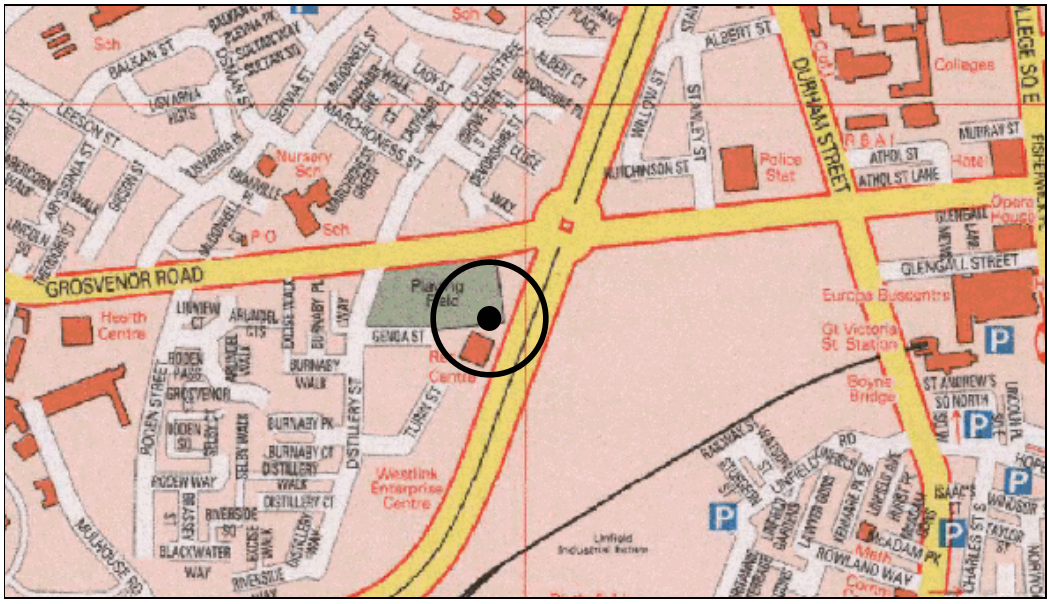


Westlink

Site Name: Belfast Westlink
Site Type: Roadside
Site Comments: Irish Grid Coords: J332989373793

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Nitric oxide	04/04/2002	27/02/2006
Nitrogen dioxide	04/04/2002	27/02/2006
Nitrogen oxides as nitrogen dioxide	04/04/2002	27/02/2006
PM10 particulate matter (hourly Measured)	04/04/2002	15/01/2006

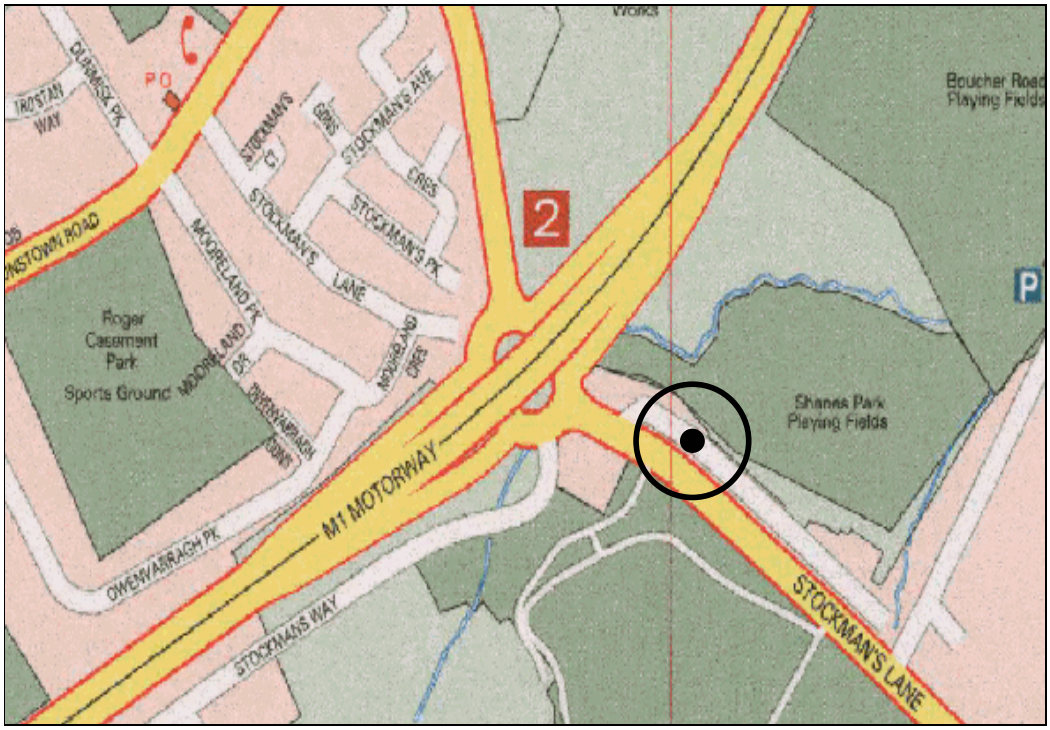


Stockman's Lane

Site Name: Belfast Stockman's Lane
Site Type: Roadside
Site Comments: Irish Grid Coords: J331004 371230

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Nitric oxide	13/04/2006	Ongoing
Nitrogen dioxide	13/04/2006	Ongoing
Nitrogen oxides as nitrogen dioxide	13/04/2006	Ongoing
PM10 particulate matter (hourly Measured)	13/04/2006	Ongoing



Upper Newtownards Road

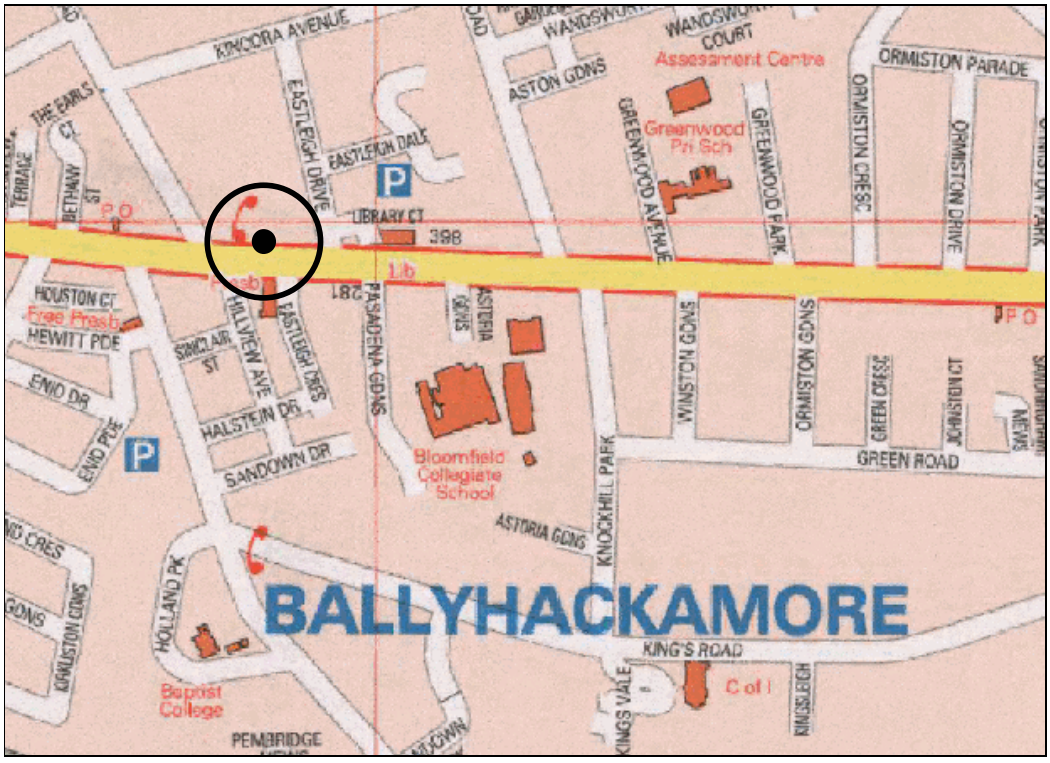
Site Name: Belfast Roadside
Site Type: Roadside
Site Comments: Irish Grid Coords: J337911 373972

Monitoring Network: Non-Automatic Hydrocarbon Network

Parameter	Date Started	Date Ended
Benzene	07/05/2002	09/10/2007
1,3-butadiene	20/05/2003	18/09/2007

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Nitric oxide	01/04/2002	Ongoing
Nitrogen dioxide	01/04/2002	Ongoing
Nitrogen oxides as nitrogen dioxide	01/04/2002	Ongoing

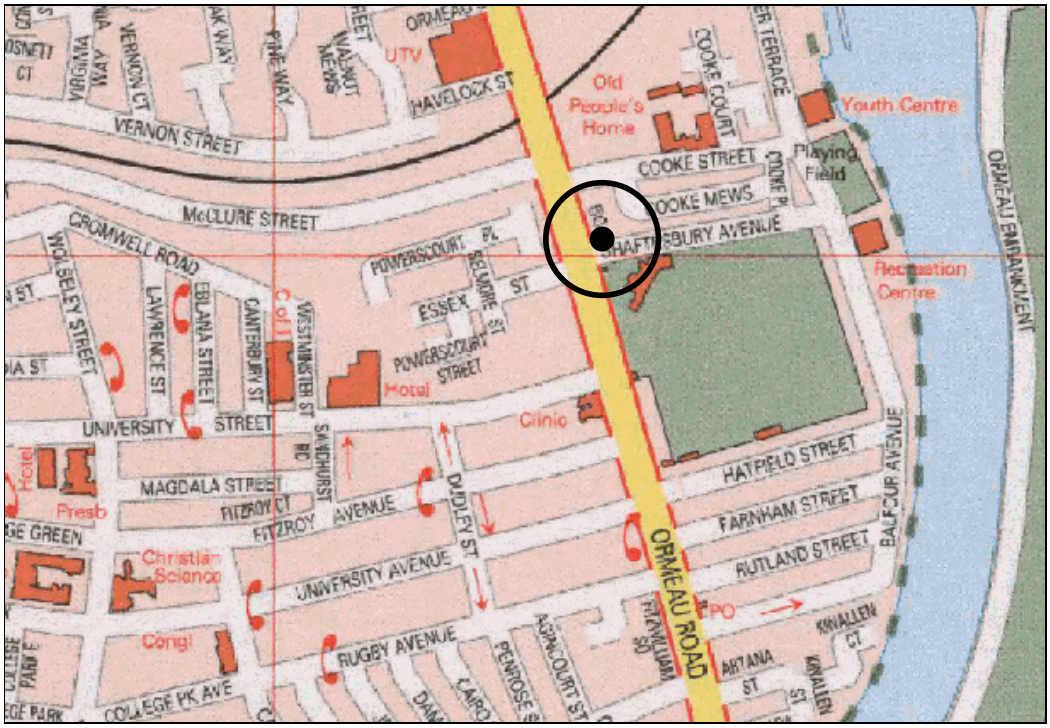


Ormeau Road

Site Name: Belfast Ormeau Road
Site Type: Roadside
Site Comments: Irish Grid Coords: J334272 373012

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Nitric oxide	24/05/2006	Ongoing
Nitrogen dioxide	24/05/2006	Ongoing
Nitrogen oxides as nitrogen dioxide	24/05/2006	Ongoing

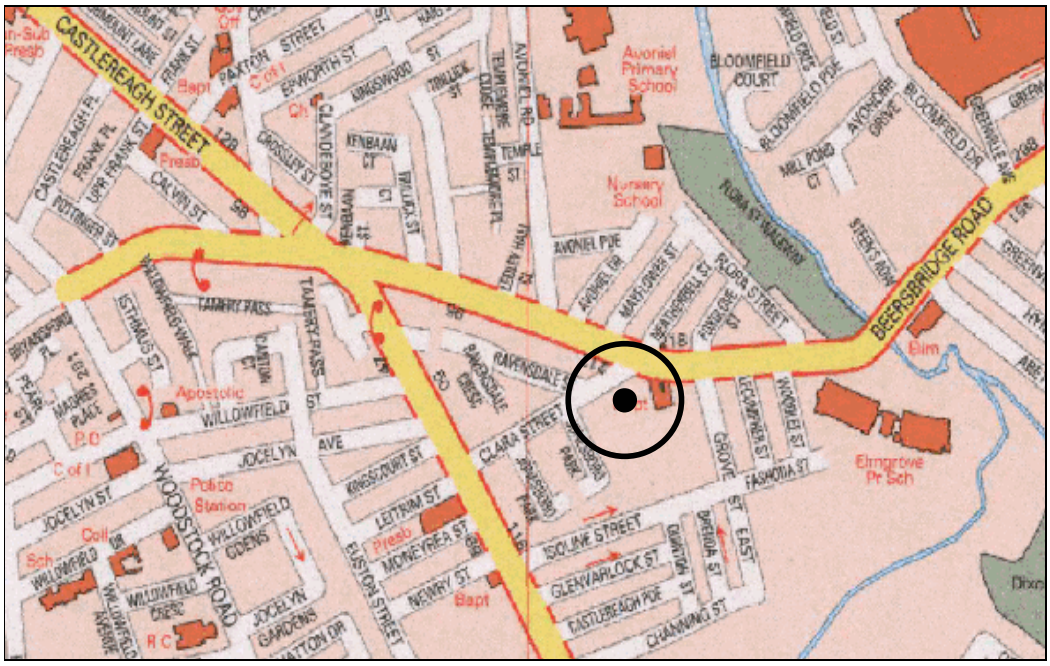


Clara Street

Site Name: Belfast Clara Street
Site Type: Suburban
Site Comments: Irish Grid Coords: J336093 373468

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
PM10 particulate matter (hourly Measured)	06/01/1998	01/10/07
Polycyclic Aromatic Hydrocarbons	01/01/2001	31/12/2006

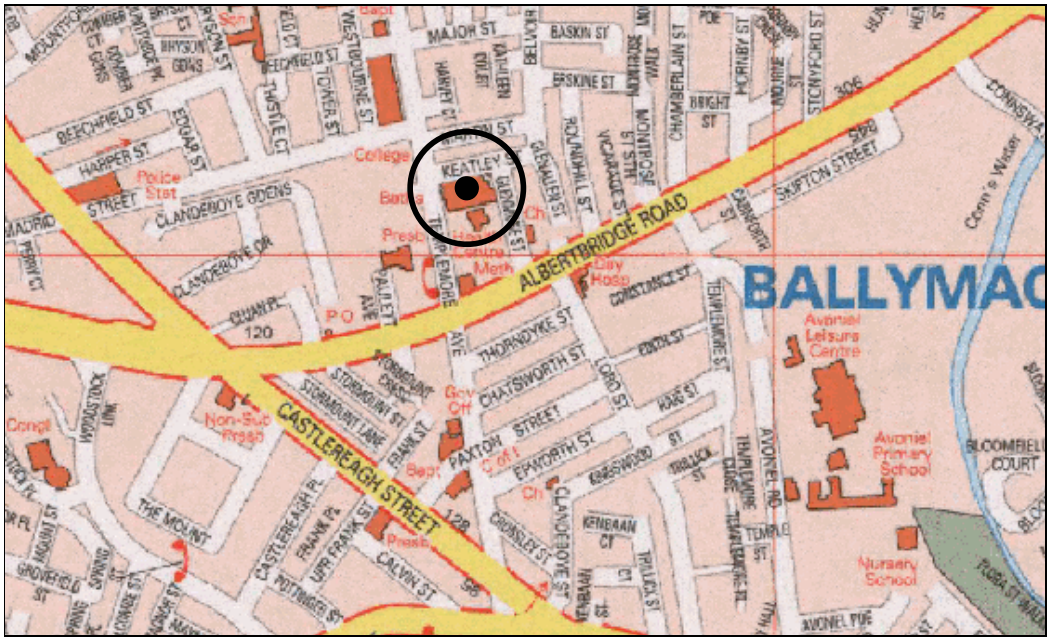


Templemore Avenue

Site Name: Belfast Templemore Avenue
Site Type: Urban Background
Site Comments: Irish Grid Coords: J335682 374053

Monitoring Network: Northern Ireland Automatic Urban Network

Parameter	Date Started	Date Ended
Sulphur dioxide (Automatic)	06/09/1989	13/12/2006
Sulphur Dioxide	04/04/1961	31/12/2005
Black Smoke	04/04/1961	01/10/2006



Appendix 2. Air Quality Monitoring Data

Table 7. Carbon Monoxide Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean carbon monoxide mg m^{-3}	Max running 8-Hour Mean mg m^{-3}	Number of 8-Hour means exceeding 10 mg m^{-3}	Exceedence of the 2005 EU limit value
Belfast Centre						
1992	79	R	0.9	11.9	5	Yes
1993	97	R	0.8	12.3	1	Yes
1994	97	R	0.8	15.6	2	Yes
1995	95	R	0.7	16.3	4	Yes
1996	96	R	0.6	9.4	0	No
1997	96	R	0.8	8.2	0	No
1998	91	R	0.5	4	0	No
1999	94	R	0.5	4.3	0	No
2000	81	R	0.4	3.5	0	No
2001	60	R	0.4	5.5	0	No
2002	97	R	0.3	3.6	0	No
2003	79	R	0.2	2.7	0	No
2004	96	R	0.2	2.8	0	No
2005	95	R	0.2	3.5	0	No
2006	82	R	0.2	1.9	0	No
2007	95	P	0.2	1.7	0	No

Table 8. Benzene Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean benzene µg m^{-3}	Max recorded value µg m^{-3}	Exceedence of 2010 EU limit value
Belfast Centre					
2002	69	R	1.03	2.05	No
2003	100	R	1.17	2.83	No
2004	93	R	1.18	2.86	No
2005	87	R	1.06	2.37	No
2006	100	R	0.92	2.70	No
2007	98	R	0.62	1.27	No
2010 Projected	-	-	0.57	-	No
Belfast Roadside					
2002	65	R	2.48	3.87	No
2003	96	R	2.68	5.07	No
2004	93	R	2.69	5.33	No
2005	83	R	2.80	5.17	No
2006	96	R	1.73	4.81	No
2007	97.5	P	1.27	2.54	No
2010 Projected	-	-	1.16	-	No

Table 9. 1,3-Butadiene data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean 1,3-butadiene µg m^{-3}	Max recorded value µg m^{-3}	Exceedence of 2003 National Air Quality Strategy Objective
Belfast Centre					
2003	83	R	0.089	0.43	No
2004	90	R	0.057	0.16	No
2005	100	R	0.02	0.11	No
2006	100	R	0.03	0.25	No
2007	75	R	0.09	0.41	No
Belfast Roadside					
2003	81	R	0.0925	0.16	No
2004	86	R	0.073	0.14	No
2005	96	R	0.050	0.16	No
2006	92	R	0.0525	0.11	No
2007	75	R	0.09	0.23	No

Table 10. Lead Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean Lead µg m^{-3}	Max recorded value µg m^{-3}	Exceedence of 2008 National Air Quality Strategy Objective
Belfast Harbour Estate Site Code 25					
2000	94	R	0.012	0.0411	No
Belfast Centre					
2008	7	P (December 2007 to January 2008)	0.00657	0.0133	No

Table 11. Nitrogen dioxide continuous monitoring data:

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean nitrogen dioxide µg m^{-3}	Number of 1 hour means exceeding 200 µg m^{-3}	Annual Mean over 40 µg m^{-3} Exceedence of 2005 National Air Quality Strategy Objective	More then 18 exceedences of 200 µg m^{-3} Exceedence of 2005 National Air Quality Strategy Objective
Belfast Centre						
1992	74	R	43	3	Yes	No
1993	97	R	42	7	Yes	No
1994	95	R	39	0	No	No
1995	95	R	39	15	No	No
1996	96	R	38	3	No	No
1997	96	R	39	0	No	No
1998	93	R	34	0	No	No
1999	97	R	35	0	No	No
2000	81	R	30	0	No	No
2001	85	R	32	3	No	No
2002	95	R	30	3	No	No
2003	95	R	32	0	No	No
2004	92	R	28	0	No	No
2005	54	R	34	4	No	No
2006	91	R	34	5	No	No
2007	91	P	32	0	No	No
Westlink (P* Ratified by Data Provider)						
2002	92	P*	46	30	Yes	Yes
2003	94	R	53	27	Yes	Yes
2004	92	R	46	20	Yes	Yes
2005	49	R	40	3	Yes	No
Belfast Roadside (P* Ratified by Data Provider)						
2002	91	P*	46	2	Yes	No
2003	96	R	45	0	Yes	No
2004	92	R	42	0	Yes	No
2005	55	R	48	0	Yes	No
2006	89	R	43	0	Yes	No
2007	82	P	45	0	Yes	No
Ormeau Road						
2007	75	P	34	1	No	No
Stockman's Lane						
2006	68	R	63	4	Yes	No
2007	86	P	64	15	Yes	No

Table 12. Nitrogen dioxide diffusion tube data

Calendar Year	Data Capture %	Unadjusted Annual Mean µg m^{-3}	Bias Adjusted Mean µg m^{-3}	Annual Adjusted Mean Over 40 µg m^{-3} Exceedence of 2005 Objective
301 Ormeau Road (Roadside) Irish Grid Coords: J334503 372175				
2003	100	37	43	Yes
2004	100	30	38	No
2005	75	22	24	No
2006	100	34	40	Yes
2007	92	33	33	No
400 Ormeau Road Irish Grid Coords: J335006 370795				
2003	100	27	32	No
2004	100	26	33	No
2005	100	26	28	No
2006	100	28	33	No
2007	100	25	25	No
Black's Road Irish Grid Coords: J329782 369522				
2003	100	38	45	Yes
2004	100	29	37	No
2005	100	36	38	No
2006	100	33	39	No
2007	92	40	40	Yes
Cromac Street (A) Irish Grid Coords: J334220 373852				
2003	100	38	45	Yes
2004	100	37	47	Yes
2005	100	36	38	No
2006	100	38	45	Yes
2007	83	42	42	Yes
East Bridge Street (Roadside) Irish Grid Coords: J335010 373972				
2004	100	34	43	Yes
Ravenhill Rd (Roadside) Irish Grid Coords: J335014 373942				
2004	100	34	43	Yes
2005	92	26	28	No
2006	83	29	35	No
2007	100	31	31	No
Stockman's Lane (Roadside) Irish Grid Coords: J331004 371230				
2003	100	35	41	Yes
2004	100	32	41	Yes
2005	100	29	31	No
2006	83	45	53	Yes
2007	92	44	44	Yes
Upper Newtownards Road (Roadside)				

Calendar Year	Data Capture %	Unadjusted Annual Mean µg m^{-3}	Bias Adjusted Mean µg m^{-3}	Annual Adjusted Mean Over 40 µg m^{-3} Exceedence of 2005 Objective
Irish Grid Coords: J337911 373972				
2003	100	34	40	Yes
2004	100	29	37	No
2005	100	29	31	No
2006	100	31	37	No
2007	100	33	33	No
Westlink (Kerbside) Irish Grid Coords: J332989 373793				
2003	100	45	53	Yes
2004	100	35	44	Yes
2005	100	35	38	No
Cromac Street (B) (Roadside) Irish Grid Coords: J334116 373521				
2003	100	35	41	Yes
Knock Road (Roadside) Irish Grid Coords: J338718 373918				
2005	100	33	35	No
Milner Street (Roadside) Irish Grid Coords: J332476 373434				
2003	100	38	44	Yes
2004	50	32	41	Yes
2005	66	27	29	No
2006	100	35	41	Yes
2007	92	39	39	No
Great George's Street (Kerbside) Irish Grid Coords: J333981 375102				
2003	100	47	55	Yes
2004	100	40	51	Yes
2005	100	38	40	Yes
2006	92	42	49	Yes
2007	92	40	40	Yes
Donegall Square South (City Hall) (Urban Centre, Background) Irish Grid Coords: J333837 373950				
2003	100	41	48	Yes
2004	100	34	43	Yes
2005	100	34	37	No
2006	100	35	41	Yes
2007	100	42	42	Yes
Lisburn Road (Kerbside) Irish Grid Coords: J332441 371875				
2004	100	25	32	No
2005	83	29	31	No
2006	100	29	34	No
2007	92	33	33	No
Belfast Centre, Lombard Street (Urban Centre) Irish Grid Coords: J333898 374358				

Calendar Year	Data Capture %	Unadjusted Annual Mean µg m^{-3}	Bias Adjusted Mean µg m^{-3}	Annual Adjusted Mean Over 40 µg m^{-3} Exceedence of 2005 Objective
2003	100	32	37	No
2004	100	27	34	No
2005	100	26	29	No
2006	100	28	34	No
2007	100	33	33	No
Primary School, North Road (Urban Background) Irish Grid Coords: J337550 374151				
2003	100	17	20	No
2004	100	20	25	No
2005	100	21	22	No
2006	92	18	21	No
2007	100	15	15	No
Royal Victoria Hospital (Urban Background) Irish Grid Coords: J332521 373707				
2003	100	26	30	No
2004	100	18	23	No
2005	66	19	20	No
2006	83	19	23	No
2007	100	21	21	No
Short Strand (Junction Bridge End / Sydenham Flyover) (Roadside) Irish Grid Coords: J334980 374253				
2004	100	28	36	No
2005	50	40	43	Yes
2006	75	33	39	No
2007	100	22	22	No
Victoria Street (near junction with High St) (Roadside) Irish Grid Coords: J334200374408				
2004	100	35	44	Yes
2005	100	30	33	No
2006	92	41	48	Yes
2007	100	38	38	No
Whitewell Road (Urban Background) Irish Grid Coords: J333562 380450				
2004	100	25	32	No
2005	92	22	23	No
2006	100	21	24	No
2007	92	23	23	No
Saintfield Road (Southern Approaches) (Roadside) Irish Grid Coords: J335670 370620				
2003	100	38	45	Yes
Station Road (Roadside) Irish Grid Coords: J337181 375493				
2003	100	24	28	No
2007	100	26	23	No
Upper Malone Road (House of Sport) (Roadside) Irish Grid Coords: J332373 369850				

Calendar Year	Data Capture %	Unadjusted Annual Mean µg m^{-3}	Bias Adjusted Mean µg m^{-3}	Annual Adjusted Mean Over 40 µg m^{-3} Exceedence of 2005 Objective
2003	100	34	40	Yes
2007	100	27	27	No
Ivan Street Irish Grid Coords: J334173 376383				
2005	42	33	35	No
Donegal Road (Kerbside) Irish Grid Coords: J333021 373122				
2006	83	45	33	No
2007	92	31	31	No
Shaftesbury Square (Roadside) Irish Grid Coords: J333594 373282				
2006	50	39	46	Yes
2007	100	38	38	No
Grosvener Rd and Falls Road Junction (Roadside) Irish Grid Coords: J332251 373877				
2007	100	29	29	No
Falls Road and Anderstown Junc (Roadside) Irish Grid Coords: J330715 372519				
2007	100	29	29	No
Knocknagoney Road (Sydneham Bypass) (Suburban) Irish Grid Coords: J338298 376602				
2007	92	29	29	No

Table 13. Sulphur Dioxide Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean sulphur dioxide µg m^{-3}	Number of 15-minute means exceeding 266 µg m^{-3}	Number of 1 hour means exceeding 350 µg m^{-3}	Number of 24 hour means exceeding 125 µg m^{-3}
Belfast Centre						
1992	78	R	40	316 Exceedence of 2005 Objective	43 Exceedence of 2004 Objective	12 Exceedence of 2004 Objective
1993	97	R	48	436 Exceedence of 2005 Objective	53 Exceedence of 2004 Objective	13 Exceedence of 2004 Objective
1994	97	R	45	388 Exceedence of 2005 Objective	52 Exceedence of 2004 Objective	8 Exceedence of 2004 Objective
1995	96	R	40	346 Exceedence of 2005 Objective	54 Exceedence of 2004 Objective	9 Exceedence of 2004 Objective
1996	97	R	37	326 Exceedence of 2005 Objective	45 Exceedence of 2004 Objective	10 Exceedence of 2004 Objective
1997	96	R	29	141 Exceedence of 2005 Objective	8	4 Exceedence of 2004 Objective
1998	89	R	21	47 Exceedence of 2005 Objective	3	2
1999	95	R	16	5	0	0
2000	80	R	13	16	0	0
2001	90	R	11	2	0	0
2002	97	R	7	2	0	0
2003	91	R	8	0	0	0
2004	95	R	7	0	0	0
2005	95	R	6	0	0	0
2006	94	R	7	0	0	0
2007	84	R	4	0	0	0
Belfast East						
1992	98	R	69	1176 Exceedence of 2005 Objective	179 Exceedence of 2004 Objective	50 Exceedence of 2004 Objective
1993	99	R	67	824 Exceedence of 2005 Objective	125 Exceedence of 2004 Objective	35 Exceedence of 2004 Objective
1994	99	R	53	453 Exceedence of 2005 Objective	59 Exceedence of 2004 Objective	18 Exceedence of 2004 Objective

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean sulphur dioxide µg m^{-3}	Number of 15-minute means exceeding 266 µg m^{-3}	Number of 1 hour means exceeding 350 µg m^{-3}	Number of 24 hour means exceeding 125 µg m^{-3}
1995	92	R	56	579 Exceedence of 2005 Objective	106 Exceedence of 2004 Objective	14 Exceedence of 2004 Objective
1996	99	R	53	656 Exceedence of 2005 Objective	108 Exceedence of 2004 Objective	22 Exceedence of 2004 Objective
1997	99	R	45	500 Exceedence of 2005 Objective	58 Exceedence of 2004 Objective	20 Exceedence of 2004 Objective
1998	89	R	35	199 Exceedence of 2005 Objective	19	9 Exceedence of 2004 Objective
1999	99	R	29	98 Exceedence of 2005 Objective	5	5 Exceedence of 2004 Objective
2000	99	R	21	38 Exceedence of 2005 Objective	2	0
2001	94	R	24	139 Exceedence of 2005 Objective	13	5 Exceedence of 2004 Objective
2002	97	R	10	5	0	0
2003	97	R	8	0	0	0
2004	97	R	6	0	0	0
2005	99	R	5	0	0	0
2006	96	R	4	0	0	0

Table 14. Particulate Matter (PM_{10}) Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean PM_{10} µg m^{-3}	Number of 24 hour means exceeding 50 µg m^{-3}	More then 35 exceedences of the 24 hour mean. Exceedence of 2004 Objective
Belfast Centre					
1992	79	R	35	44	Yes
1993	96	R	41 Exceedence of 2004 Objective	86	Yes
1994	95	R	34	38	Yes
1995	95	R	32	35	Yes
1996	95	R	31	44	Yes
1997	96	R	32	41	Yes
1998	94	R	27	20	No
1999	97	R	26	15	No
2000	81	R	25	8	No
2001	81	R	25	15	No
2002	98	R	23	8	No
2003	97	R	24	26	No
2004	96	R	21	10	No
2005	95	R	19	7	No
2006	96	R	18	7	No
2007	94	P	19	5	No
Clara Street					
1999	95	R	22	12	No
2000	93	R	16	2	No
2001	92	R	19	14	No
2002	94	R	17	8	No
2003	95	R	22	34	No
2004	92	R	13	5	No
2005	95	R	13	6	No
2006	100	R	22	4	No
2007	80	P	20	7	No
Westlink					
2002	50	R	34	32	No
2003	98	R	36	63	Yes
2004	95	R	41	30	No
Stockman's Lane					
2007	100	P	43	114	Yes

Table 15. Particulate Matter ($PM_{2.5}$) Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean Daily Measured $PM_{2.5}$ µg m^{-3}	Exceedence of 2015 EU Limit Value of 20 µg m^{-3}
Belfast Centre				
2001	73	R	13	No
2002	89	R	16	No
2003	45	R	22	Yes
2004	90	R	12	No
2005	64	R	15	No
2006	23	R	25	Yes
2007	70	R	17	No

Table 16. CPC Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Hourly Mean Particulate Counts per cm3
Belfast Centre			
2005	79	R	26,190
2006	85	R	22,231

Table 17. Nitrate Particulate Matter

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Hourly Mean Nitrate µg m^{-3}
Belfast Centre			
2005	92	R	0.4
2006	69	R	0.5

Table 18. Carbon Particulate Matter

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Hourly Mean Organic Carbon µg m^{-3}	Annual Hourly Mean Elemental Carbon µg m^{-3}
Belfast Centre				
2005	10	R	0.87	1.16
2006	44	R	2.8	0.76

Table 19. Gravimetric Chloride

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual daily Mean Gravimetric Chloride µg m^{-3}
Belfast Centre			
2002	90	R	1.38
2003	88	R	1.82
2004	72	R	2.02
2005	62	R	1.98
2006	96	R	2.30

Table 20. Gravimetric Nitrate

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual daily Mean Gravimetric Nitrate µg m^{-3}
Belfast Centre			
2002	90	R	1.38
2003	88	R	1.82
2004	74	R	2.02
2005	60	R	1.98
2006	96	R	2.21

Table 21. Gravimetric Sulphate

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual daily Mean Gravimetric Sulphate µg m^{-3}
Belfast Centre			
2002	90	R	2.26
2003	88	R	1.87
2004	74	R	1.65
2005	65	R	2.18
2006	96	R	2.38

Table 22. Selected Speciated Polycyclic Aromatic Hydrocarbons

Calendar Year	Ratified (R) Provisional (P)	Annual Mean Benzo(a)pyrene ng m^{-3}	Annual Mean Acenaphthylene ng m^{-3}	Annual Mean Benz(a) anthracene ng m^{-3}	Annual Mean Indeno(123,cd) pyrene ng m^{-3}	Annual Mean Chrysene ng m^{-3}
Clara Street						
2001	R	0.37	0.31	0.74	0.61	2.4
2002	R	0.13	0.075	0.25	0.28	1.1
2003	R	0.08	0.83	0.13	0.13	0.28
2004	R	0.15	0.065	0.32	0.26	0.65
2005	R	0.27	0.76	0.5	0.55	0.91
2006	R	0.14	0.11	0.29	0.3	0.6

Table 23. Ozone Data

Calendar Year	Data Capture %	Ratified (R) Provisional (P)	Annual Mean µg m^{-3}	Max Daily 8 Hour Mean µg m^{-3}	Days with max daily 8hr mean >100 µg m^{-3}	Exceedence of 2005 Objective
Belfast Centre						
1992	81	R	36	108	2	No
1993	97	R	32	88	0	No
1994	95	R	36	106	2	No
1995	96	R	38	136	11	Yes
1996	96	R	34	130	5	No
1997	95	R	34	124	6	No
1998	94	R	42	112	3	No
1999	96	R	44	126	7	No
2000	81	R	42	130	2	No
2001	90	R	38	130	2	No
2002	96	R	37	98	0	No
2003	97	R	42	118	9	No
2004	96	R	43	108	5	No
2005	95	R	40	100	0	No
2006	92	R	42	137	4	No
2007	95	P	43	110	2	No

Appendix 3. 2007 Bias Adjusted Nitrogen Dioxide Diffusion Tube Results

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2007	01/02/2007	42.0	38.0	32.0	37	5.0	13	12.5
2	01/02/2007	01/03/2007	38.0		26.0	32	8.5	27	76.2
3	01/03/2007	04/04/2007	76.0	28.0	40.0	48	25.0	52	62.1
4	04/04/2007	02/05/2007	26.0	43.0	33.0	34	8.5	25	21.2
5	02/05/2007	30/05/2007	10.0	7.0	2.0	6	4.0	64	10.0
6	30/05/2007	04/07/2007	26.0	38.0	34.0	33	6.1	19	15.2
7	04/07/2007	01/08/2007	27.0	27.0	22.0	25	2.9	11	7.2
8	01/08/2007	29/08/2007	28.0	28.0	28.0	28	0.0	0	0.0
9	29/08/2007	03/10/2007	32.0	32.0	26.0	30	3.5	12	8.6
10	03/10/2007	31/10/2007	42.0	37.0	21.0	33	11.0	33	27.3
11	31/10/2007	28/11/2007	40.0	37.0	32.0	36	4.0	11	10.0
12	28/11/2007	02/01/2008	58.0	48.0	48.0	51	5.8	11	14.3
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
34	94	Good	Good
44	99	Poor Precision	Good
40	96	Poor Precision	Good
44	95	Poor Precision	Good
28	100	Poor Precision	Good
26	90	Good	Good
21	76	Good	Good
20	92	Good	Good
23	81	Good	Good
38	80	Poor Precision	Good
35.7	100	Good	Good
39.6	100	Good	Good
Overall survey -->		Poor precision	Good Overall DC

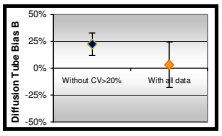
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Lombard Street (16, 19, 20)

Precision: 7 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 7 periods of data
Bias factor A 0.83 (0.76 - 0.91)
Bias B 21% (10% - 31%)
Diffusion Tubes Mean: 34 μgm^{-3}
Mean CV (Precision): 11 caution
Automatic Mean: 29 μgm^{-3}
Data Capture for periods used: 90%
Adjusted Tubes Mean: 29 (26 - 31) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 1 (0.82 - 1.26)
Bias B 0% (-21% - 22%)
Diffusion Tubes Mean: 33 μgm^{-3}
Mean CV (Precision): 23 caution
Automatic Mean: 33 μgm^{-3}
Data Capture for periods used: 92%
Adjusted Tubes Mean: 33 (27 - 41) μgm^{-3}



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Version 03 - November 2006

Adjustment of SINGLE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tube Measurements

Site Name/ID	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Mean	Valid periods
Royal Vicotria Hopsital 1	18.0	4.0	30.0	27.0	21.0	16.0	15.0	15.0	14.0	30.0	33.0	32.0		21.3	12
Black's Rd 2	44.0	42.0	36.0	35.0	25.0		19.0	36.0	45.0	49.0	54.0	52.0		39.7	11
Cromic Street 3	33.0	48.0	47.0	41.0	8.0		21.0		49.0	53.0	66.0	55.0		42.1	10
Ravenhill Road 4	45.0	34.0	27.0	28.0	12.0	28.0	13.0	33.0	33.0	37.0	44.0	35.0		30.8	12
North Road 6	14.0	17.0	15.0	10.0	12.0	11.0	10.0	13.0	15.0	20.0	20.0	27.0		15.3	12
Donegal Square North 7	47.0	40.0	37.0	29.0	54.0	43.0	34.0	33.0	43.0	32.0	53.0	53.0		41.5	12
Milner Street 8	47.0	20.0	41.0	15.0	7.0	39.0	15.0	27.0		23.0	38.0	49.0		29.2	11
Short Strand 9	16.0	3.0	15.0	9.0	15.0	11.0	12.0	14.0	14.0	51.0	58.0	49.0		22.3	12
301 Ormeau 10	27.0	37.0	36.0	28.0	27.0	23.0	18.0		20.0	42.0	47.0	53.0		32.5	11
400 Ormeau 11	7.0	25.0	32.0	21.0	5.0	25.0	26.0	29.0	29.0	20.0	45.0	34.0		24.8	12
Knock Road 12		42.0	24.0	22.0	12.0	45.0	12.0	37.0	45.0	36.0	64.0	60.0		36.3	11
Great George 13	31.0	33.0	35.0	33.0	8.0	48.0		49.0	37.0	36.0	62.0	63.0		39.5	11
Lisburn Road 14	35.0	30.0	31.0	48.0	2.0		27.0	29.0	29.0	42.0	43.0	49.0		33.2	11
Shaftesbury Sq 15	44.0	35.0	27.0	44.0	6.0	41.0	33.0	43.0	45.0	45.0	39.0	56.0		38.2	12
Victoria Street 18	37.0	28.0	52.0	36.0	12.0	46.0	32.0	40.0	38.0	30.0	53.0	50.0		37.8	12
Whitewell Road 25	28.0	26.0	25.0	24.0	8.0	24.0		27.0	23.0	14.0	23.0	29.0		22.8	11
Donegall Rd 26	28.0	27.0	34.0	26.0		16.0	5.0	20.0	22.0	38.0	61.0	60.0		30.6	11
Grosvener + Falls 27	47.0	30.0	35.0	22.0	14.0	27.0	31.0	29.0	36.0	33.0	44.0	55.0		33.6	12
Falls Rd 28	45.0	24.0	32.0	20.0	7.0	29.0	20.0	28.0	23.0	35.0	35.0	45.0		28.6	12
Sydenham Bypass 29	43.0		30.0	25.0	14.0	17.0	30.0	25.0	25.0	32.0	40.0	37.0		28.9	11
Station Rd 30	22.0	31.0	13.0	30.0	6.0	18.0	4.0	23.0	25.0	25.0	37.0	36.0		22.5	12
House of Sport 31	37.0	35.0	30.0	34.0	15.0	23.0	27.0	26.0	17.0	20.0	30.0	33.0		27.3	12
Mean Stockmans (17, 21, 22)	39.0		40.0	28.0	29.0	36.0	37.0	42.0	44.6	58.0	70.0	63.0		44.2	11
Mean Roadside (5, 23, 24)	38.0	35.0	29.0	22.0	16.0	29.0	28.0	30.6	36.0	40.0	46.7	48.0		33.2	12

Adjusted measurement (95% confidence interval) with all the data 12 periods used in this calcuations Bias Factor A 1 (0.82 - 1.26) Bias B 0% (-21% - 22%) Tube Precision: 23 Automatic DC: 92%	
Adjusted with 95% CI	21 (17 - 27)
Adjusted with 95% CI	40 (33 - 50)
Adjusted with 95% CI	42 (35 - 53)
Adjusted with 95% CI	31 (25 - 39)
Adjusted with 95% CI	15 (13 - 19)
Adjusted with 95% CI	42 (34 - 52)
Adjusted with 95% CI	29 (24 - 37)
Adjusted with 95% CI	22 (18 - 28)
Adjusted with 95% CI	33 (27 - 41)
Adjusted with 95% CI	25 (20 - 31)
Adjusted with 95% CI	36 (30 - 46)
Adjusted with 95% CI	40 (32 - 50)
Adjusted with 95% CI	33 (27 - 42)
Adjusted with 95% CI	38 (31 - 48)
Adjusted with 95% CI	38 (31 - 48)
Adjusted with 95% CI	23 (19 - 29)
Adjusted with 95% CI	31 (25 - 39)
Adjusted with 95% CI	34 (28 - 42)
Adjusted with 95% CI	29 (23 - 36)
Adjusted with 95% CI	29 (24 - 36)
Adjusted with 95% CI	23 (18 - 28)
Adjusted with 95% CI	27 (22 - 34)
Adjusted with 95% CI	44 (36 - 56)
Adjusted with 95% CI	33 (27 - 42)

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Appendix 4. Part A and Part B Processes Licensed in Belfast.

IPC No.	Site Operator Name	Site Address	Council Area	Section No.	Process Type	Determined/Pending
0002/98B	Belfast Terminal	Airport Road west BELFAST BT2 7BA	Belfast CC	Section 1.4	Petroleum	Determined
0006/98B	NuStar Terminals Limited	Airport Road Sydenhem BELFAST BT3 9DY	Belfast CC	Section 1.4	Petroleum	Determined
0012/98B	Calor Gas Northern Ireland Ltd	(Jetty Berth Number) 3 Airport Road West Sydenham BELFAST BT3 9EE	Belfast CC	Section 1.1	Gas/Odourisation	Determined
0019/99B	Charles Tennant & Co (NI) Ltd	9 Airport Road West BELFAST BT3 9ED	Belfast CC	Section 6.3	Roadstone coating	Determined
0058/99B	Lagan Bitumen Ltd.	Airport Road West BELFAST BT 3 9ED	Belfast CC	Section 6.3	Roadstone coating	Determined
0109/00B	Whitemountain Quarries Ltd	Blackmountain Quarry 243 Upper Springfield Road BELFAST BT17 0LT	Belfast CC	Section 3.3 & 6.3	Mineral/Quarry & Roadstone coating	Determined
0157/01B	DCC Energy (NI) Ltd (Flogas)	Airport Road West BELFAST BT3 9ED	Belfast CC	Section 1.1	Gas Odourisation	Determined
0168/01B	DARD - Veterinary Science Division	Stoney Road Stormont BELFAST BT4 3SB	Belfast CC	Section 5.1	Incinerator	Determined

Appendix 5. Planning Applications that may have a Negative Impact on Air Quality within Belfast.

Table 24. New Retail Developments that had a potential to have a negative impact on air quality in the 2006-07 period

Code	Address	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
Retail developments within or in close proximity to the Westlink-M1 AQMA				
	None Received			
Retail developments within or in close proximity to the Cromac Street AQMA				
	None Received			
Retail developments within or in close proximity to the Ormeau Road AQMA				
	None Received			
Retail developments within or in close proximity to the Newtownards Road AQMA				
74361	Laburnum Road, Prince Regent Road	14 indoor soccer pitches, playing fields, health and fitness club (2,323 sqm), crèche, bar, retail and retail store (1,400 sqm)	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
Retail developments outside of AQMAs				
96494	Grt Victoria Street, Central Belfast	11 storey mixed retail and office block with car parking	Detailed dispersion model predicted insignificant impact on local air quality for PM10 and NO2	None proposed as none required
	Castlereagh Road, East Belfast	8,172 m2 food store with 618 car parking spaces	Detailed dispersion model predicted insignificant impact on local air quality for PM10 and NO2	None proposed as none required

Table 25. Mixed Use and Residential Developments that had a potential to have a negative impact on air quality in the 2006-07 period

Code	Address	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
Developments within or in close proximity to the Westlink-M1 AQMA				
78758	Durham Street	238 Residential apartments with 143 car parking spaces	Detailed dispersion model predicted no significant negative impact on existing local air quality nor exposure to exceedences of Objectives in 2010	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
	Devonshire Tradas	24 social houses	Detailed dispersion model predicted no exposure to exceedences of Objectives by 2008 at the nearest receptor	Major road alterations to the adjoining Westlink predicted to have significant positive improvement to localised air quality.
92339	Little Corporation Street	255 Residential apartments with 87 car parking spaces	Detailed dispersion model predicted no significant negative impact on existing local air quality nor exposure to exceedences of Objectives in 2009	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
075854	Milner Street	206 apartments	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations nor exposure to exceedences of Objectives by 2010.	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
76775	Great Patrick Street	280 Apartments, 59 car parking spaces, 60 sqm retail	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations	Construction mitigation measures included control of movement of haulage vehicles, wheel

Code	Address	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
			nor exposure to exceedences of Objectives	washes, covering of loads and damping
76036	Whitla Street	80 apartments and associated parking	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations nor exposure to exceedences of Objectives by 2010	None detailed
80236	Townsend Street	Child day care and crèche centre	No modelled annual NO2 and PM10 exceedences predicted at the development in 2008	Hours of outdoor activities by crèche users to be restricted between the hours of 07:30 to 09:30 and 16:30 to 18:30 Monday to Friday.
77597	460-464 Donegal Road	104 dwellings and associated parking	No significant impact predicted	None required
77368	94 Broadway	2 apartments	No significant exposure predicted	None required
74995	Blacks Road – Finaghy Rd North	Proposed mixed use residential and business park development	Outline permission being sought	
90986	Blackstaff Way	Commercial storage warehouse and ancillary offices	No significant impact predicted	None required
87739	Henry Place	3 storey complex and day care facilities	No exceedences predicted	None required
Developments within or in close proximity to the Cromac Street AQMA				
74445	Bridge End	175 apartments, café and associated car parking	DMRB screening assessment concluded minimal localised impact on NO2 nor exposure to exceedences of objectives	None required

Code	Address	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
92798	East Bridge Street	325 apartments with 229 parking spaces	Detailed dispersion model predicted no significant negative impact on existing local air quality nor exposure to exceedences of NO2 and PM10 Objectives by 2010	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
Developments within or in close proximity to the Ormeau Road AQMA				
	Annadale Embankment	220 Residential units	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations	Construction mitigation measures included control of movement of haulage vehicles, wheel washes, covering of loads and damping
90025	Ormeau Road	47 apartments, 885 sqm of retail and 47 parking places	Detailed dispersion model predicted no significant negative impact on existing local air quality nor exposure to exceedences of Objectives in 2009	None required
99264	Ormeau Road	7 storey, 86 apartments, 6 retails units and 66 car parking spaces	Air quality assessment pending	
75605	Ormeau Road	8 storey office	Air quality assessment pending	
Developments within or in close proximity to the Newtownards Road AQMA				
92885	Hawthornden Road	Residential dwellings	No predicted exposure of NO2 objectives at nearest receptor	None required
Developments outside of AQMAs				
92639	Donegall Quay	341 Apartments, 267 car parking spaces and 1,288	Detailed dispersion model predicted no	Construction mitigation measures

Code	Address	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
		sqm retail	significant negative impact on existing local air quality.	included control of movement of haulage vehicles, wheel washes, covering of loads and damping
78442	Antrim Road	Outline planning permission for 110 residential units	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations	None proposed as none required
87453	Crumlin Road	174 Apartments	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations	Increase distance between road and sensitive receptors, design buildings to promote free flowing air movements, and dense planting of trees and shrubs.
75022	65-71 Dublin Road	8 storey mixed use	No impact predicted	No parking associated with development proposed.
76367	Finaghy North	12 Apartments	No predicted impact	Informative regarding potential exposure to objectives
87743	Ligoniel Road	116 apartments	Impact predicted to be negligible therefore assessment not required	
75216 and 94130	Queens Road	Large development involving residential, offices, car parking and education establishment	Air Quality Assessment on-going	

Appendix 6. Road Service Traffic Count Data and Locations within Belfast.

Table 7
7 Day (AADT)

ROAD No.	C P No.	Location	ANNUAL AVERAGE DAILY TRAFFIC (AADT)								
			2002	% + or -	2003	% + or -	2004	% + or -	2005	% + or -	2006
201	M1	Broadway - Stockman's Lane (J'ct 2)	54,670	10.4	60,370	0.0	60,370	3.9	62,710	-12.5	54,850
202	M2	Fortwilliam Interchange - Outbound	44,450	-2.5	43,350	11.8	48,460	1.6	49,220	-2.4	48,050
203	M2	Fortwilliam Interchange - Inbound	43,870	7.8	47,300	3.1	48,750	1.0	49,260	-1.4	48,550
204	M2	Greencastle (J'ct 2) - Sandyknowes	55,350	11.3	61,630	3.5	63,760	-0.8	63,250	-0.5	62,940
206	M5	Greencastle - Whiteabbey	32,360	-0.1	32,330	0.4	32,470	3.9	33,730	-4.4	32,240
208	A1	Lisburn Road, Belfast, at King's Hall							20,960	9.1	22,870
209	A2	Sydneham By-Pass, at airport	49,540	0.7	49,890	2.7	51,230	5.7	54,130	0.7	54,530
210	A2	Shore Road, Belfast at Shore Crescent	14,980	-7.9	13,790	1.6	14,010	-4.6	13,360	3.4	13,820
211	A6	Antrim Road, Belfast, at zoo	15,150	-4.0	14,540	-20.4	11,570	20.2	13,910	-0.6	13,820
213	A12	Westlink, Belfast, south of Roden Street	-	-	62,100	-1.1	61,430	2.9	63,210	-15.9	53,180
217	A22	Comber Road, Belfast, S.E. of New Line	10,320	1.2	10,440	3.2	10,770	0.8	10,860	1.7	11,050
220	A55	Shaws Bridge, Belfast	30,210	7.5	32,470	-1.1	32,110	-1.1	31,750	-2.2	31,040
221	A55	Upper knockbreda Road, Belfast	37,660	-1.1	37,240	5.8	39,390	-2.9	38,250	2.7	39,270

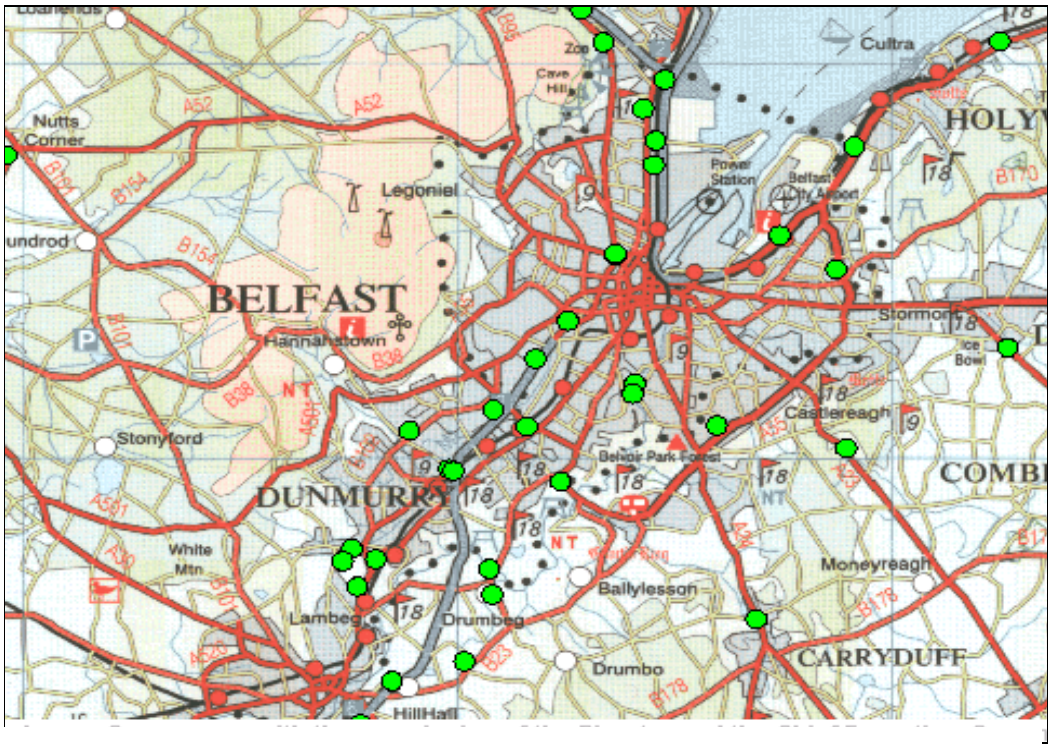
Table 7
7 Day (AADT)

ROAD No.	C P No.	Location	ANNUAL AVERAGE DAILY TRAFFIC (AADT)								
			2002	% + or -	2003	% + or -	2004	% + or -	2005	% + or -	2006
222	A55	Parkway, Belfast	21,610	-0.8	21,430	-4.0	20,570	11.9	23,020	0.0	23,030
223	B102	Stewartstown Road, Belfast, at Kells Avenue	16,620	10.8	18,410	-1.4	18,150	-0.9	17,980	0.9	18,150
224	B103	Upper Malone Road, Belfast, at Lady Dixon Park	7,960	2.3	8,140	4.9	8,540	-4.3	8,170	2.4	8,370
225	C/UC	Kings Bridge, Belfast	15,320	-3.7	14,750	1.4	14,960	-0.8	14,840	0.6	14,930
226	C/UC	Governors Bridge, Belfast	16,120	-1.1	15,940	-0.4	15,880	2.5	16,280	-1.8	15,990
227	M1	Stockman's Lane J'ct (above roundabout)	50,520	-2.8	49,130	-	-	-	56,190	-13.2	48,770
230	M1	Blacks Road on - slip	13,910	-8.4	12,740	2.6	13,070	9.1	14,260	-6.0	13,400
231	M1	Blacks Road off - slip	13,170	-0.8	13,070	-2.8	12,700	6.9	13,580	12.8	15,320
290	A12	Westlink, Clifton Street, towards M1	-	-	30,330	4.2	31,600	-3.9	30,380	-6.8	28,320
291	A12	Westlink, Clifton Street, towards M2	35,840	2.2	36,640	2.2	37,450	0.7	37,710	-7.4	34,910
502	A2	Holywood By-Pass east of Belfast Rd	-	-	42,530	8.5	46,150	-3.7	44,450	9.3	48,580
521	M1	Blacks Road - Saintfield Road (J'ct 6)	40,540	7.9	43,740	5.1	45,990	3.7	47,710	-6.0	44,850
523	A512	Lisburn - Hillsborough (at Harry's Road)	34,790	-2.3	33,980	-0.8	33,695	10.8	37,320	0.6	37,550

Table 7
7 Day (AADT)

ROAD No.	C P No.	Location	ANNUAL AVERAGE DAILY TRAFFIC (AADT)								
			2002	% + or -	2003	% + or -	2004	% + or -	2005	% + or -	2006
524	A1	McKinstry Road, Dunmurry, south of Cutts	-	-	11,120	2.4	11,390	5.7	12,040	39.8	16,830
525	A1	Belfast - Lisburn, at Derriaghy	10,310	1.7	10,490	2.0	10,700	-1.7	10,520	4.1	10,950
527	B23	Belfast - Lisburn, at Lambeg	13,290	6.4	14,140	5.4	14,910	-0.3	14,870	2.8	15,290
528	B103	Hillhall Road, Lisburn, near Ballyaghlis	12,100	-5.5	11,440	3.5	11,840	-0.3	11,810	3.8	12,260
529	A513	Drumbeg Road, near Lisburn	4,470	7.8	4,820	1.2	4,880	2.0	4,980	-0.4	4,960
787	A24	Belfast, Saintfield Road (Nr Knockbracken Rd S at KFC)	-	-	-	-	-	-	29,990	0.1	30,030

Source: TRAFFIC and TRAVEL INFORMATION 2006 INCORPORATING ANNUAL TRAFFIC CENSUS AND VEHICLE KILOMETRES OF TRAVEL. Road Service, 2007.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Zoo
Cave Hill
Nutts Corner
A52
Legoniel
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Belfast City Airport
HOLY
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Hannahstown
B38
Stormont
Ice Bowl
Castlereagh
Stonyford
Belvoir Park Forest
COMBI
DUNMURRY
A591
White Mtn
A30
Moneyreagh
Ballylesson
Lambeg
Drumbeg
CARRYDUFF
Drumbo
B178
HillHall