



Note: Predicted Nitrogen Dioxide EU Limit Value Exceedences in North Lanarkshire

Document Control

Client	Transport Scotland	Principal Contact	Jo Blewett
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Report Prepared By:	Dr Ben Marner
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Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
12 Airedale Road, London SW12 8SF Tel: 0208 673 4313
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
 Companies House Registration No: 2814570

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1 Introduction

- 1.1 The European Union has set limit values for concentrations of nitrogen dioxide. Achievement of these values is a national obligation. The limit value for nitrogen dioxide is an annual mean concentration of $40 \mu\text{g}/\text{m}^3$ to be achieved by 2010. This is the same concentration as the UK annual mean objective, which had to be achieved by 2005. The UK objective only applies where members of the public are likely to spend significant periods of time (e.g. residential properties). The limit value is being taken to apply everywhere to which the public has access. It does not apply on factory premises or industrial installations, in the carriageways of roads, or on the central reservation except where there is normally pedestrian access to the central reservation.
- 1.2 In June 2008, a new Ambient Air Quality Directive (2008/50/EC) came into force, consolidating the 1996 Air Quality Framework Directive (96/62/EC) and the first three of four “daughter” Directives (99/30/EC, 2000/69/EC and 2002/3/EC). The air quality limit values set out in these Directives were unchanged. However, the new Directive does allow Member States to apply for time extensions until 2011 for PM_{10} and until 2015 for nitrogen dioxide, for complying with the limit values, based on meeting strict conditions and assessment by the European Commission.

2 Prediction of Limit Value Exceedence

- 2.1 AEA have carried out a modelling study for the whole of the UK for Daughter Directive reporting purposes. Their model uses a simplified method whereby traffic flows for every “A” road and motorway have been used to calculate emissions (as in the National Atmospheric Emissions Inventory). These emissions have then been scaled using different adjustment factors dependent upon road type and traffic volume as shown in Figure 1. This is necessary because, on a national level, the dispersion characteristics¹ of “A” roads tend to be different from those of motorways. These scaled emissions have then been factored to predict typical road contributions to nitrogen oxides (NO_x) concentrations² based upon the relationship between link-specific emissions and measurements at automatic monitoring sites³. Since these monitoring sites were typically 5m from the kerb of roads, the predicted concentrations will be broadly representative of concentrations 5m

¹ Which is the cumulative effect of a range of different factors such as traffic speeds, fleet compositions, surrounding building density and topography etc.

² The road contribution is the total concentration minus the local background.

³ After subtracting the predicted background from the measurements.

from kerbs. Finally, nitrogen dioxide concentrations are derived from the predicted nitrogen oxides concentrations using a complex relationship which is built into the AEA model. The modelling method does not take specific account of very local conditions. It also takes no account of whether there is relevant public access to the area 5m from the kerb of any road.

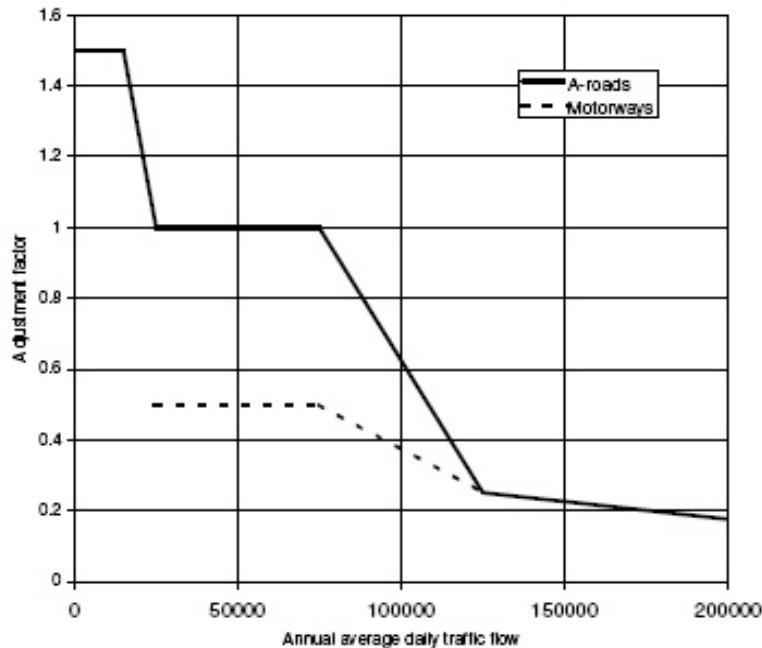


Figure 1: Adjustment Factors Applied to Road Link Emissions in the AEA Model (taken from UK air quality modelling for annual reporting 2006 on ambient air quality assessment under Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC AEAT/ENV/R/2502 Issue 1 September 2007)

- 2.2 The AEA model splits the A8 between Baillieston Junction and the overpass of Bo'Ness Road into eight sections as shown in Figure 2. Predicted concentrations are set out in Table 1, which indicate that the limit value will be exceeded in 2010 and in 2015 beside all of these road sections.
- 2.3 The current traffic data held in the NAEI and used in the AEA model contain flows between 65,000 and 70,000 vehicles per day on this section of the A8. Figure 1 shows that the predicted emissions along this "A" Road are twice those that would have been predicted if the A8 had been classified as a motorway. Thus, if all other inputs to the AEA model had stayed the same, but the A8 had been classified as the M8, the road contribution to NO_x concentrations would have been 50% lower. Table 2 predicts how reducing the road contribution to NO_x concentrations by 50% affects the total predicted nitrogen dioxide concentrations. It does this using the recently updated NO_x to NO₂ calculator published by AEA⁴. If the A8 had been classified as a motorway, the highest

⁴ The results will thus be slightly different to those calculated within the AEA daughter directive reporting model, but should correspond closely with those that would have been predicted by AEA.

predicted concentration in 2015 would have been 34 $\mu\text{g}/\text{m}^3$, instead of the 48 $\mu\text{g}/\text{m}^3$ derived for the A8 as a trunk road, i.e. as a motorway the concentrations would all be below the EU limit value.

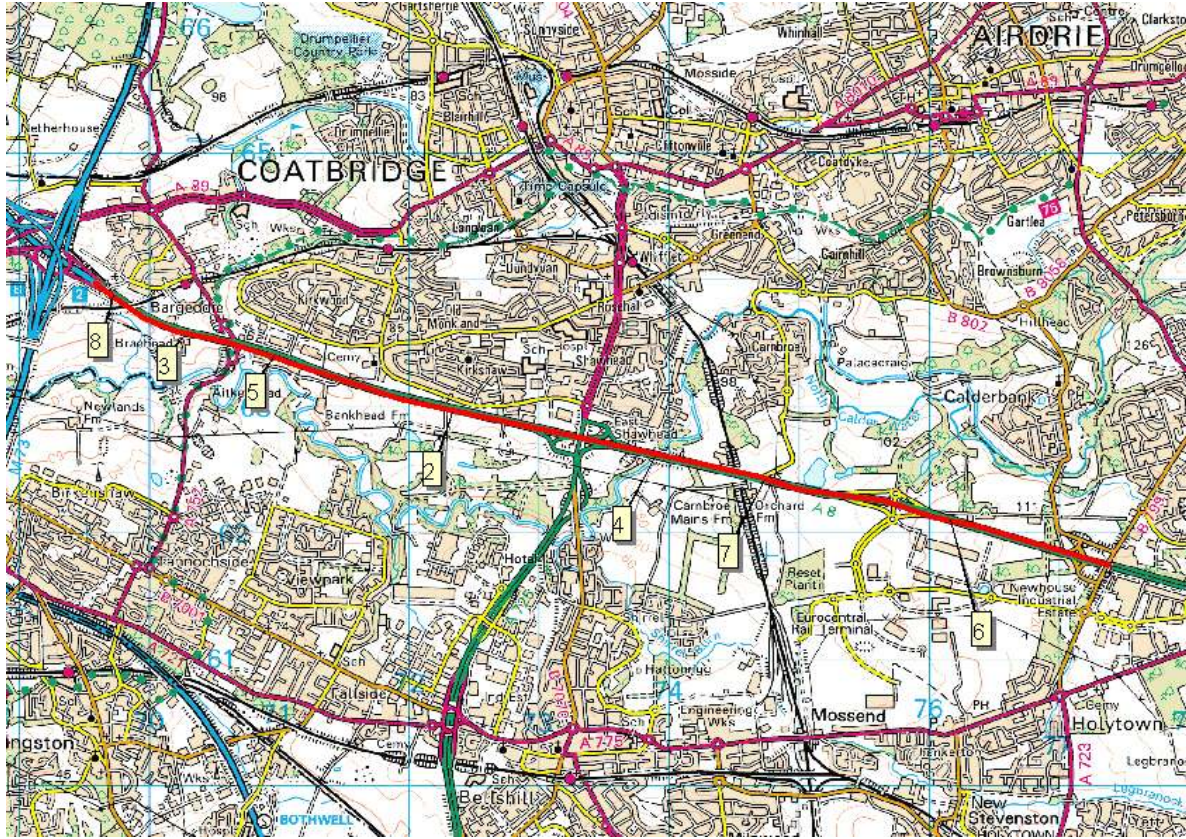


Figure 2: Links in AEA Model where a Limit Value Exceedence has Been Predicted (Numbers Are Labels to Correspond with Table 1) © Crown copyright 2009. All rights reserved. License number 100046099

Table 1: Annual Mean Concentrations beside Eight Road Links Predicted by the AEA Model ($\mu\text{g}/\text{m}^3$)

Link	Predicted Total Concentration ($\mu\text{g}/\text{m}^3$)		
	2008	2010	2015
1	75	67	48
2	67	60	43
3	75	67	48
4	66	59	42
5	67	60	43
6	66	59	42
7	66	59	42
8	75	67	48

Table 2: The Effect of Using a Different Road-NO_x Multiplier on Predicted Annual Mean Nitrogen Dioxide Concentrations in 2015

Link	Results from AEA Model		Predicted Results if the A8 were Classified as a Motorway	
	2015 Predicted Road Contribution to NO _x	2015 Predicted Total NO ₂ Concentration	2015 Predicted Road Contribution to NO _x multiplied by 0.5	2015 Predicted Total NO ₂ Concentration ^a
1	120	48	51	34
2	100	43	42	29
3	120	48	51	34
4	97	42	42	28
5	100	43	42	29
6	97	42	42	28
7	97	42	42	28
8	120	48	51	34

^a Calculated using the Adjusted Road NO_x, the AEA background NO₂, and the new AEA NO_x to NO₂ Calculator published at www.airquality.co.uk

3 Concentration Profiles with Distance from Roads

- 3.1 As is shown in Figure 3, concentrations of nitrogen dioxide reduce rapidly with increasing distance from roads. It would be expected that a concentration of 67 µg/m³ 5m from the kerb of the A8 in 2010 would fall below 40 µg/m³ approximately 30m from the kerb.

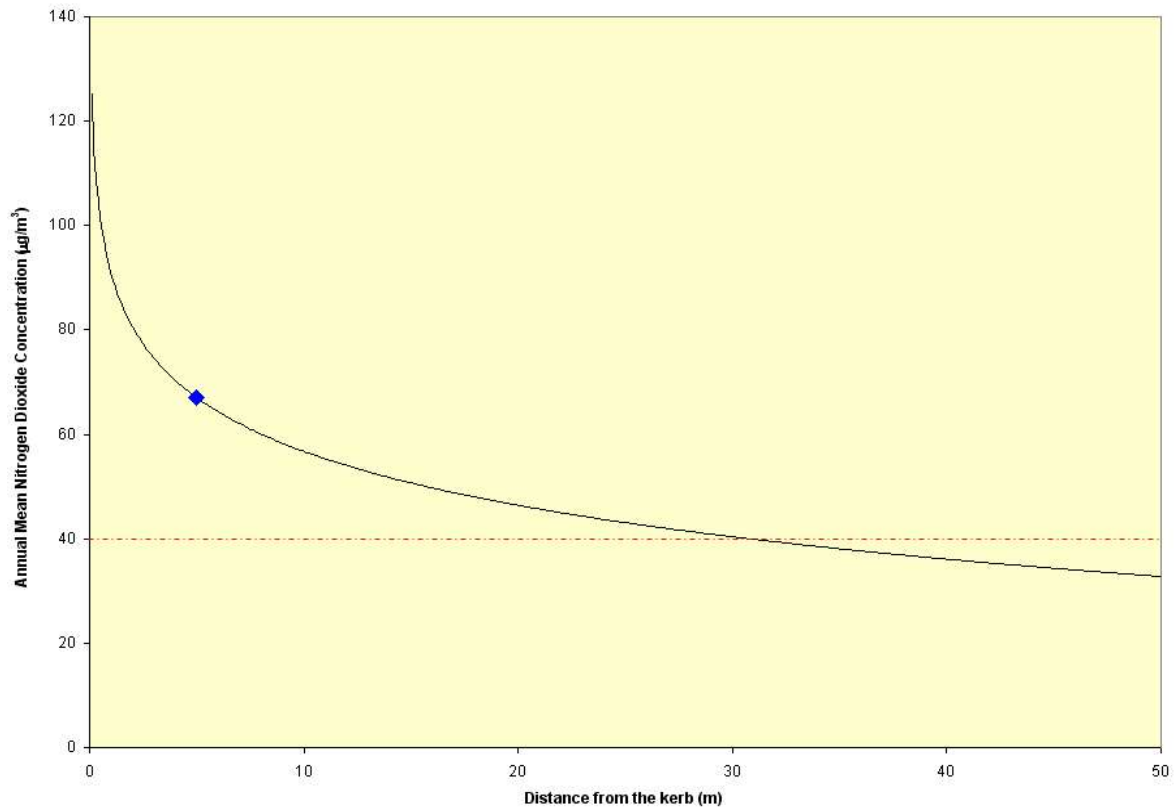


Figure 3: Typical Rate of Change in Annual Mean Nitrogen Dioxide Concentrations on Moving Away From a Road (red line shows the Limit Value) - calculated using the tool provided as part of LAQM TG(09), using AEA's prediction a $67\mu\text{g}/\text{m}^3$ concentration 5m from the kerb in 2010 and AEA's latest predicted background nitrogen dioxide concentrations in 2010

4 Measured Concentrations

- 4.1 North Lanarkshire Council has measured annual mean nitrogen dioxide concentrations at four locations along this section of road. The approximate locations of these monitors are shown in Figure 4 and the results are set out in Table 3.

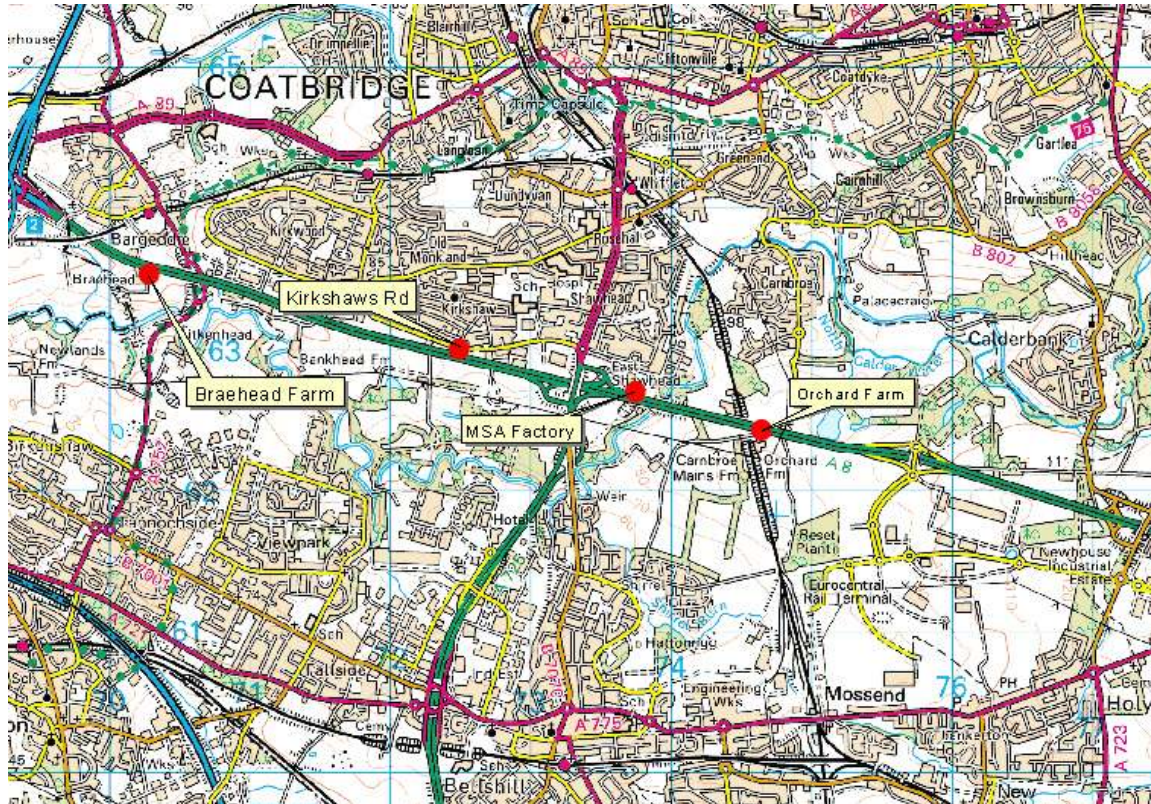


Figure 4: North Lanarkshire Council Diffusion Tube Locations © Crown copyright 2009. All rights reserved. License number 100046099

Table 3: North Lanarkshire Council’s Measured Annual Mean Nitrogen Dioxide Concentrations with Projections to 2010 ($\mu\text{g}/\text{m}^3$)

	2003	2004	2005	2006	2007	2010 ^a
Braehead Farm (East), Bargeddie	38	40	38	49	47	42
MSA Factory, Shawhead	37	37	35	41	48	43
Orchard Farm East	32	32	30	38	39	35
Kirkshaws Road, Coatbridge	-	48	-	-	-	-

^a Projected from the 2007 Measurements using national projection factors.

5 The M8 Baillieston to Newhouse Scheme

5.1 The M8 Baillieston to Newhouse Scheme (Figure 5) will provide a motorway standard route along this section of the A8, and also re-route traffic away from most of the A8 where AEA have predicted limit value exceedences. The Environmental Impact Assessment carried out for this scheme involved detailed dispersion modelling. The model was verified against measurements

carried out by North Lanarkshire Council during 2004 and was used to predict concentrations with and without the scheme at a number of locations at which the UK objectives apply. The model was not run to predict concentrations 5m from the kerb. The two receptors which represent residential properties closest to the A8 were 16m and 28m from the kerb respectively. They are shown in Figure 6 and the predictions are shown in Table 4.

- 5.2 As explained above, the road contribution to nitrogen dioxide concentrations is the total concentration minus the local background. The modelling method assumed that the local background will not be changed as a result of the Scheme. The road contributions to nitrogen dioxide concentrations at both receptors are set out in Table 45, as is the reduction that the M8 Baillieston to Newhouse Scheme would bring.

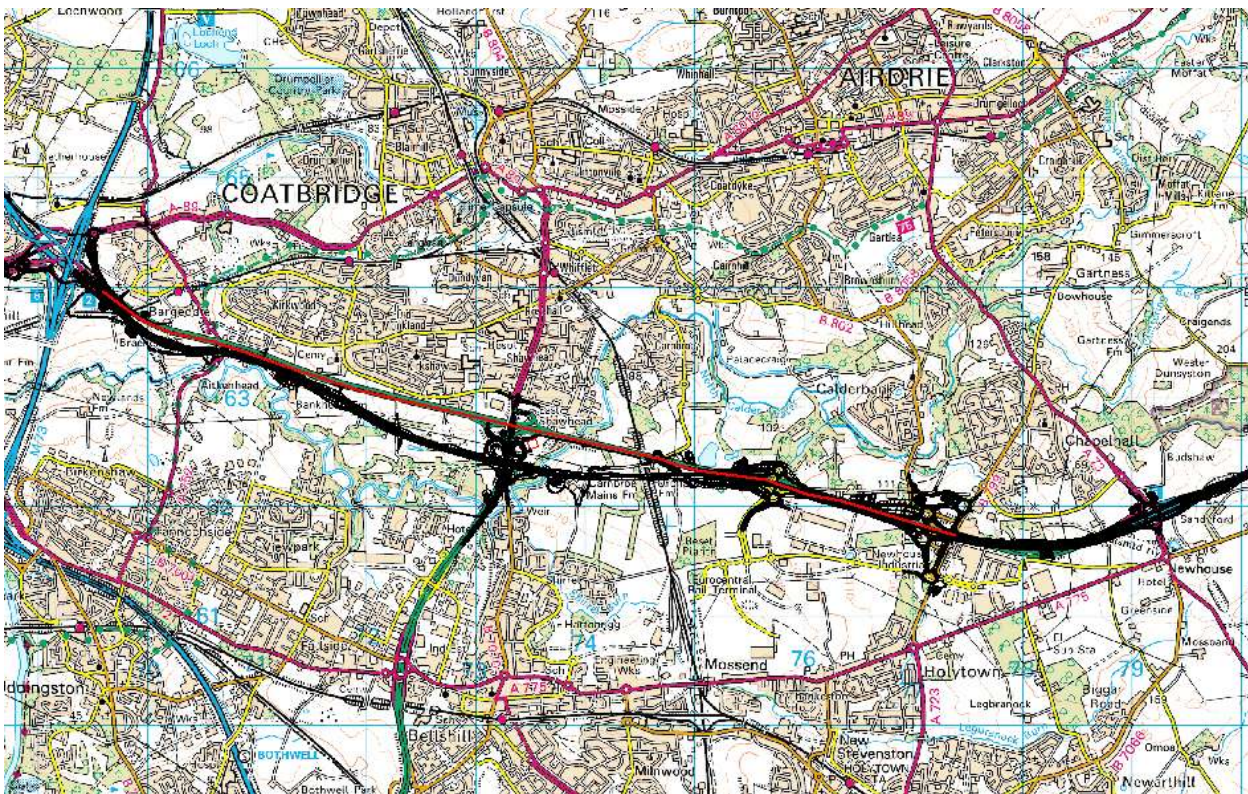


Figure 5: M8 Baillieston to Newhouse Scheme (black lines) and the Sections of the A8 where Limit Value Exceedences have been Predicted (red lines) © Crown copyright 2009. All rights reserved. License number 100046099

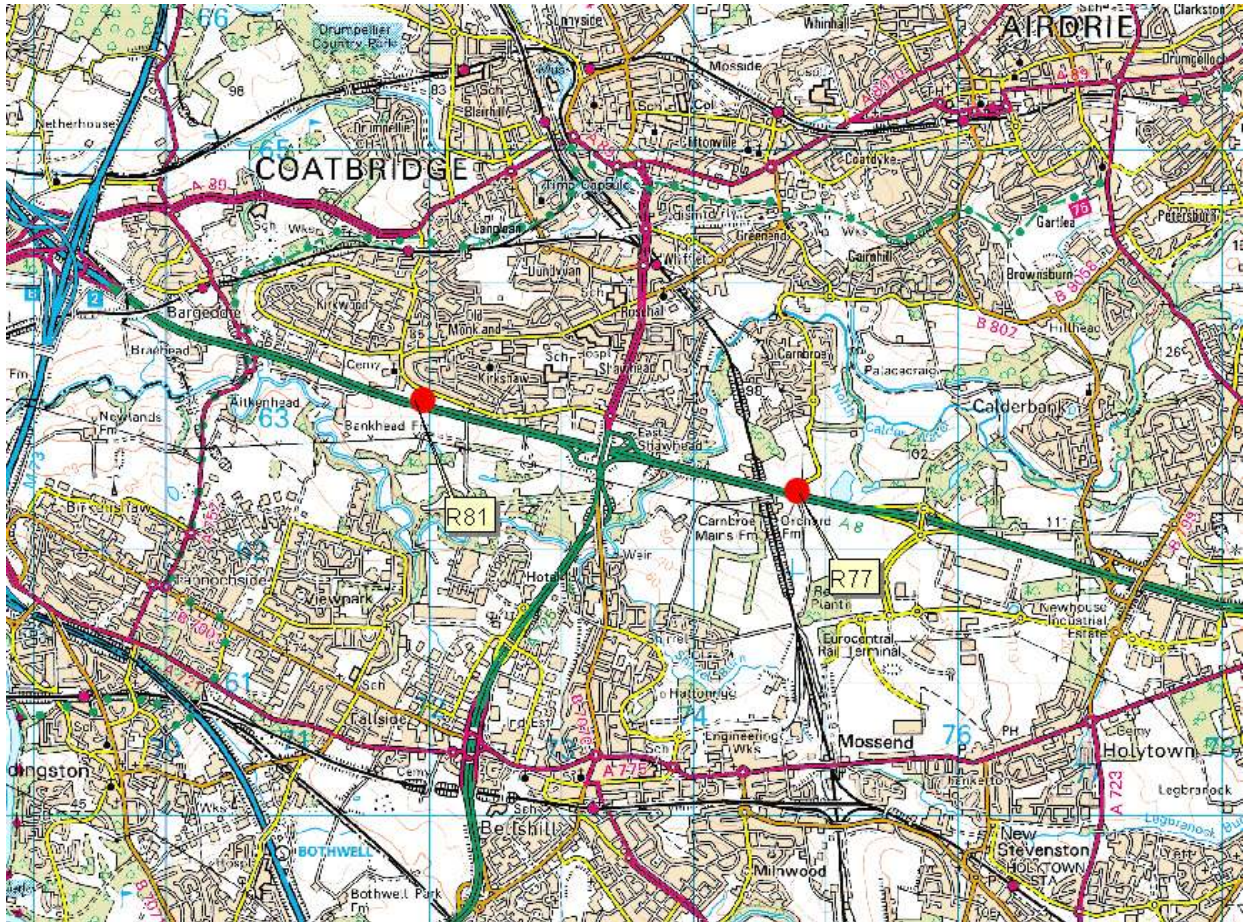


Figure 6: Receptors Closest to the A8 that were Modelled as Part of the M8 Baillieston to Newhouse EIA © Crown copyright 2009. All rights reserved. License number 100046099

Table 4: Modelled Annual Mean Nitrogen Dioxide Concentrations ($\mu\text{g}/\text{m}^3$) Predicted in the M8 Baillieston to Newhouse EIA

Distance from Kerb	R	Description	2004	2010 Without Scheme	2010 With Scheme	% Change due to Scheme
16m	77	Ivycott, Cambroe Road, Coatbridge	42.8	36.0	31.3	-13%
28m	81	Higherness Way, Coatbridge	36.7	30.1	26.7	-11%

Table 5: The Road Contribution to Annual Mean Nitrogen Dioxide Concentrations ($\mu\text{g}/\text{m}^3$) Predicted in the M8 Baillieston to Newhouse EIA⁵

Distance from Kerb	R	Description	2010 Without Scheme	2010 With Scheme	% Change due to Scheme
16m	77	Ivycott, Cambroe Road, Coatbridge	19.9	15.2	-24%
28m	81	Higherness Way, Coatbridge	13.6	10.2	-25%

⁵ The EIA work was carried out before AEA published its latest background maps and thus the background concentrations were different from those in Table 1.

6 Discussion

- 6.1 The AEA model has used simplistic modelling approach which has predicted exceedences of the level of the EU limit value 5m from the kerb of the A8 between Baillieston and Newhouse. The concentrations predicted by this model are higher than those from local monitoring or from the locally-verified dispersion model. To some extent this difference may be explained by concentrations being assessed at different distances from the road but it may also relate to the simplistic method used in the AEA modelling, which assumes that the A8 has dispersion characteristics¹ typical of a UK 'A' road, which are very different from those of a typical motorway.
- 6.2 Based on AEAs predictions (and assuming the limit value applies 5m from the kerb), a 20% reduction in annual mean nitrogen dioxide concentrations would be required for the limit value not to be exceeded 5m from the kerb of the A8 between Baillieston and Newhouse in 2015 (see Table 1).
- 6.3 The M8 Baillieston to Newhouse Scheme will provide a motorway standard road covering the length of the A8 where AEA have predicted exceedences. Along most of this length, the Scheme will re-route traffic away from the current A8 alignment, but along some of the route the works would entail upgrading the existing roadway to motorway standard. The assumptions which underpin the AEA model are such that without changing any other inputs to the model, reclassifying the A8 as a motorway would reduce the contribution of the road to predicted NOx concentrations by 50%. On its own, this would be sufficient to reduce the predicted nitrogen dioxide concentrations below the limit value in 2015.
- 6.4 The impacts of the physical works planned as part of the M8 Baillieston to Newhouse Scheme have been assessed as part of the EIA. This showed that the Scheme will reduce the road component of nitrogen dioxide concentrations by approximately 25% at worst-case residential locations near to the A8.
- 6.5 Taking account of these issues, there is no reason to expect that the EU limit value would be exceeded in 2015 between Baillieston and Newhouse if the M8 Scheme is in place before this date.