Air Quality Action Plan for the M25

within

The Borough of Reigate and Banstead

April 2004 (Final).

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Abbreviations and Definitions

AADT	Annual Average Daily Traffic Flow.
AQMA	Air Quality Management Area.
DETR	Department of the Environment, Transport and the Regions.
DEFRA	Department of the Environment, Food and Rural Affairs (formerly DETR).
DfT	Department of Transport (formerly DETR)
DMRB	Design Manual for Roads and Bridges.
EU	European Union.
HA	The Highways Agency.
HGV	Heavy Goods Vehicle.
m^3	cubic metre.
NAEI	National Atmospheric Emissions Inventory.
NETCEN	National Environmental Technology Centre, UK.
NO_2	Nitrogen Dioxide.
NO_x	Oxides of Nitrogen (mainly NO and NO_2 expressed as NO_2 equivalent).
ppb	part(s) per billion.
TEMPRO	Trip End Model Program.
µg	microgram (1 millionth of a gram).
µg m^{-3} (µg/m^3)	microgram(s) per cubic metre.

Executive Summary

Previous studies of air quality in Reigate and Banstead (AQC, 2001, 2003) had identified that nitrogen dioxide concentrations were unlikely to meet the Governments 2005 annual average objective for nitrogen dioxide (NO_2) of 40 µg m^{-3} (equivalent to the 2010 EU limit value), within a 30 m strip either side of the M25 carriageway. Consequently the council declared an air quality management area (AQMA) in April 2002 that encompassed this area, as required under Section 83(1) of the Environment Act 1995.

Under section 84(2) of the Act the council is also required to draw up an action plan stating what measures it intends to implement in order to meet the Governments 2005 objective value. The purpose of the action plan is to help the UK government deliver the EU limit values, in this case for nitrogen dioxide in 2010.

The most recent and detailed study of the M25 AQMA, which took place in May 2003 and was based on monitored data, found that no more than four properties would fail to meet the 2005 Government objective, and that these were located to the north of the M25 near to junction 7. The study also suggested that the exceedence of the objective might be due in part to the breakdown of traffic flow on the M25, as vehicles travelling anticlockwise attempt to exit the motorway at junction 7 (M23).

Subsequent modelling of the affected area beyond 2005 as part of this action plan, and in consultation with the Highways Agency (HA), indicates that all four properties will meet the 40 µg m^{-3} annual average objective by 2008, assuming a 'business as usual' approach. This modelling also indicates that concentrations will continue to fall until at least 2015 (the last year modelled), and that concentrations in 2010 at the 'worst case' receptor will be at least 10 % below the 2010 EU limit value of 40 µg m^{-3}.

A series of options are briefly examined in this report aimed at reducing the concentrations of nitrogen dioxide, and so meeting the nitrogen dioxide objective earlier than 2008 e.g. reduced speed limits, road charging etc, although all were disproportionately expensive compared to a ‘business as usual’ approach.

Therefore, the main proposal of the action plan is to continue to monitor the concentrations of NO_2 along the M25 until at least 2010, to confirm that the concentrations of the pollutant are falling as predicted and so will meet the 2010 EU limit value, and to keep the Highways Agency informed of these results.

The Highways Agency will examine lane discipline on the anticlockwise approach to junction 7 on the M25, with a view to improving traffic flow through the junction, and also undertake a review of safety at junction 7. Depending on the findings of these studies, the signage and lane markings on the anticlockwise approach to junction 7 may be improved. While this measure is primarily a safety proposal, if any changes in road signage lead to a reduction in flow breakdown then this would lead to some improvement in air quality, although the impact of this measure on the annual average concentrations is likely to be relatively small.

Finally, the plan suggests that as articulated HGVs make up only 7.1 % of the traffic on the M25 and yet are responsible for 33 % of the nitrogen oxides (NO_x) at the affected properties, compared to cars which make up 76.5 % of the traffic but are responsible for only 19.5 % of the NO_x, that Government encourages a further tightening of the Euro engine standards for articulated lorries, so that more research is directed into improving emissions from these vehicles.

1.0 Introduction

Section 83(1) of the Environment Act 1995 requires local authorities to designate as air quality management areas (AQMAs), those areas where the air quality standards as set out in the Air Quality Strategy (2000), the Air Quality Regulations (England) 2000, the Air Quality (Amendment) Regulations 2002, and the Air Quality Strategy Addendum document (2003), are unlikely to be achieved. When an authority has designated an air quality management area, it is required under section 84(2) of the act to draw up an action plan setting out what it intends to do to meet these objectives.

On 30th April 2002 Reigate and Banstead Borough Council declared a 30 m strip either side of the M25 carriageway an AQMA. This decision was based on the findings of the Stage 3 assessment of air quality in the borough (AQC, 2001), which found that nitrogen dioxide (NO_2) concentrations at properties within this 30 m strip were unlikely to meet the Governments 2005 annual average objective for NO_2 of 40 µg m^{-3}.

This report therefore covers the proposed actions to be taken by the council, and others, in pursuit of achieving the 2005 UK Government annual average objective for NO_2 of 40 µg m^{-3}, and the 2010 EU annual average limit value for NO_2 which is also 40 µg m^{-3}, as the purpose of the UK Government objective values is to help the UK meet its obligations arising from the EU air quality framework and daughter directives (DEFRA, 2003).

This report only covers actions to be taken in respect of the AQMA relating to the M25, and does not cover the AQMA declared in Horley near to Gatwick Airport.

2.0 Background to the Action Plan

The original Stage 3 assessment (AQC, 2001) examined fifteen properties that were closest to the M25 using computer modelling (a bespoke version of Breeze roads), and found that the annual average NO_2 concentrations would be over the 40 µg m^{-3} limit in 2005 at a number of properties (Table 2.1).

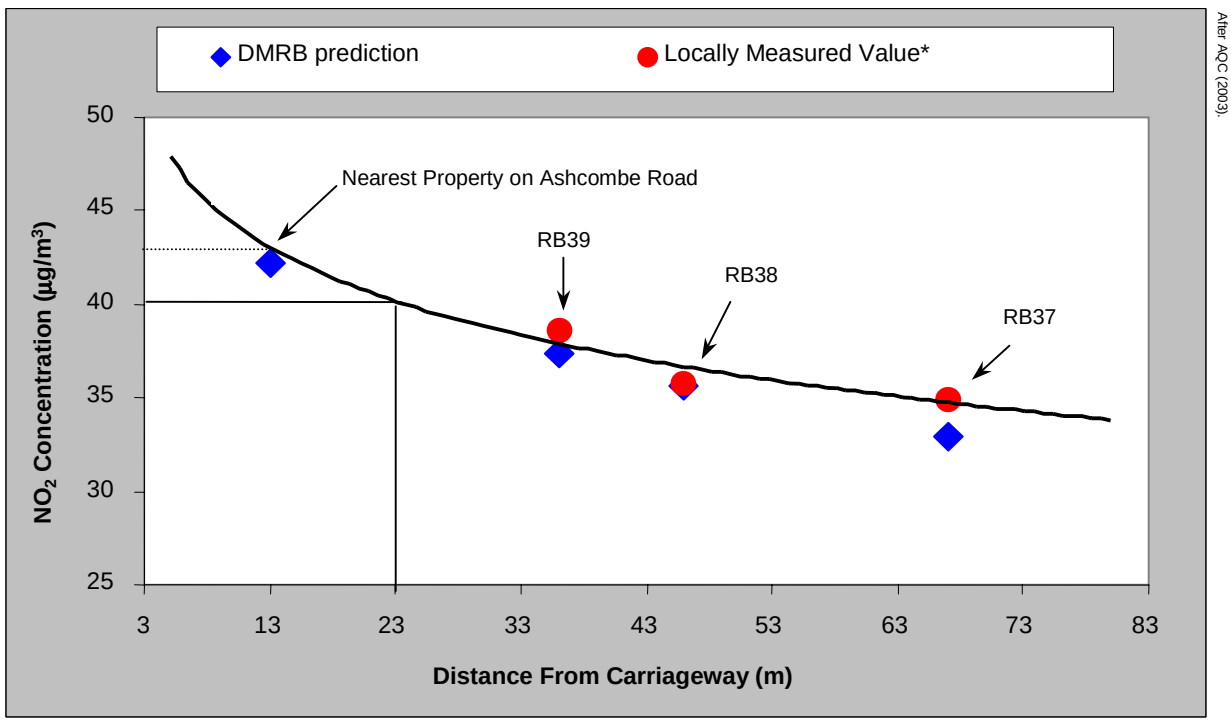
NO_2 Concentration (µg m^{-3})	Number of affected Properties
60 - 95	9
56 - 60	5
54 - 56	1
50 - 54	11
46 - 50	0
42 - 46	1
38 -42	0

Table 2.1: Modelled NO_2 Concentrations at Fifteen Properties closest to the M25 based on the Stage 3 assessment (from AQC, 2001).

Following the declaration of the AQMA a total of 14 diffusion tubes, each located at a different property, were installed to measure concentrations of NO_2 over a one year period. The tubes were changed monthly in accordance with the UK national diffusion tube network, and the data corrected based on co-located tubes at the council's real time monitoring site in Horley. In addition, two real time monitors were installed (one to the north of the carriageway and one to the south) for 3 months in order to obtain a better understanding of how NO_2 concentrations were varying throughout the day, and how big an influence wind direction had on the pollutant concentrations recorded.

The Stage 4 assessment (AQC, 2003) examined all of the above information in detail, and concluded that the annual average NO_2 concentrations in 2005 would in fact be below the UK objective value for 2005 at the majority of the properties within the AQMA based on the monitored data. The exception to this was a group of properties on Ashcombe Road within 23 m of the carriageway (four properties in total), located to the north of the M25 just before junction 7 (Figure 2.1). These properties were predicted to be over the 2005 NO_2 annual average objective value, based on monitoring data collected from Ashcombe Road scaled forward to 2005 (Figure 2.2) using factors published by DEFRA (DEFRA, 2003a).

Figure 2.1: Location of Ashcombe Road in Relation to the M25 and Junction 7 M25 / M23.



After AQC (2003).

Line derived from monitoring study carried out alongside M25 between J13 and 14 (Hickman *et al*., 2002). For full details of the method see M25 Stage 4 assessment.
*Measured values scaled forward to 2005 using projection factors (DEFRA, 2003a).
RBXX: Diffusion Tube number. Locations are shown in Figure 2.1.

Figure 2.2: Modelled and Projected 2005 NO_2 Concentrations at Ashcombe Road.

Although the Ashcombe Road properties are close to the M25, there are other properties very close to the to the M25 where the 2005 objective will be met. For example Sturt's Lane (Figure 2.3) is 16 m from the M25 and is closer to the M25 than all but one of the Ashcombe Road properties, and yet the NO_2 concentration in 2005 is predicted to be 36 µg m^{-3} based on projected real time data (AQC, 2003), whereas at Ashcombe Road concentrations are predicted to be 42 µg m^{-3} at 16 m from the carriageway (Figure 2.2). At both sites the M25 is in a cutting and the properties located to the north / north east of the carriageway. Although traffic flow on the M25 past Sturt's Lane is 7 - 8 % lower (J9/8) than on the M25 past Ashcombe Road (J8/7), the differences in flow are not sufficient to explain all of the differences in projected NO_2 concentrations.

One of the observations made in the Stage 4 assessment (AQC, 2003) was that NO_x concentrations at Ashcombe Road tended to be higher than elsewhere due to a combination of:

i) flow breakdown of the traffic flow on the approach to junction 7 (M23), and hence higher emissions from vehicles.
ii) a higher background concentration due to emissions from the M23, and junction 7 itself.

The source apportionment work undertaken in the Stage 4 assessment (AQC, 2003) examined the contribution of different sources to the NO_x concentration at the closest receptor on Ashcombe Road (Table 2.2 and Figure 2.4), and this clearly demonstrated that the M25 is by far the biggest source of NO_x, and thus is also responsible for a large proportion of the traffic derived NO_2.

	Annual Average Speed Modeled kph (mph)	NO_x	
		µg/m^3	%
Artic. HGVs on M25	95 (59)	44.5	33.2
Rigid HGVs on M25	95 (59)	12.7	9.5
Buses on M25	110 (68)	2.8	2.1
Cars on M25	110 (68)	26.1	19.5
LGVs on M25	110 (68)	7.2	5.4
Total M25	-	93.4	69.7
Total A23	-	0.3	0.2
Total Rockshaw Road	-	0.1	0.1
Background Concentration	-	40.3	30.0
Total	-	134.1	100

Table 2.2: Source Contributions to NO_x Concentrations at the nearest Receptor to the M25 on Ashcombe Road.

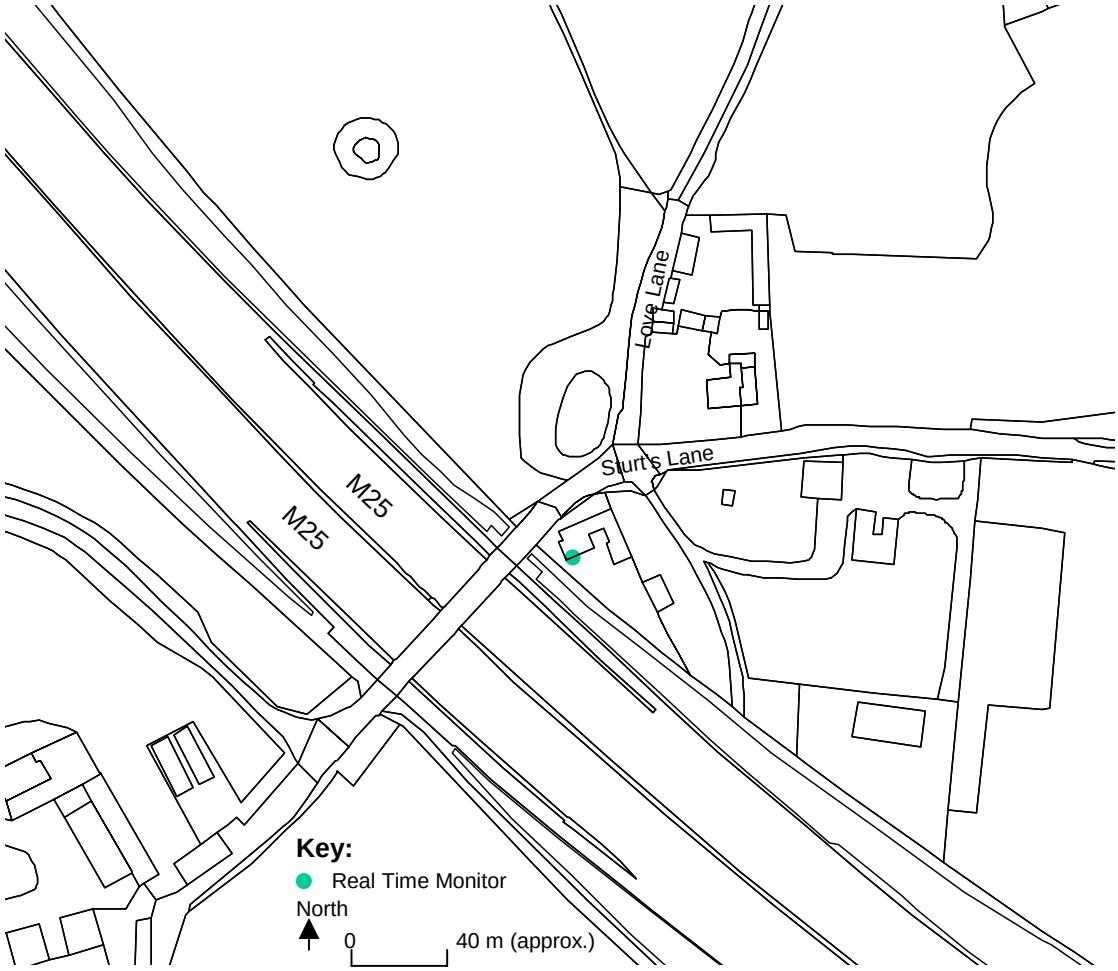


Figure 2.3: Location of Sturt's Lane Residence.

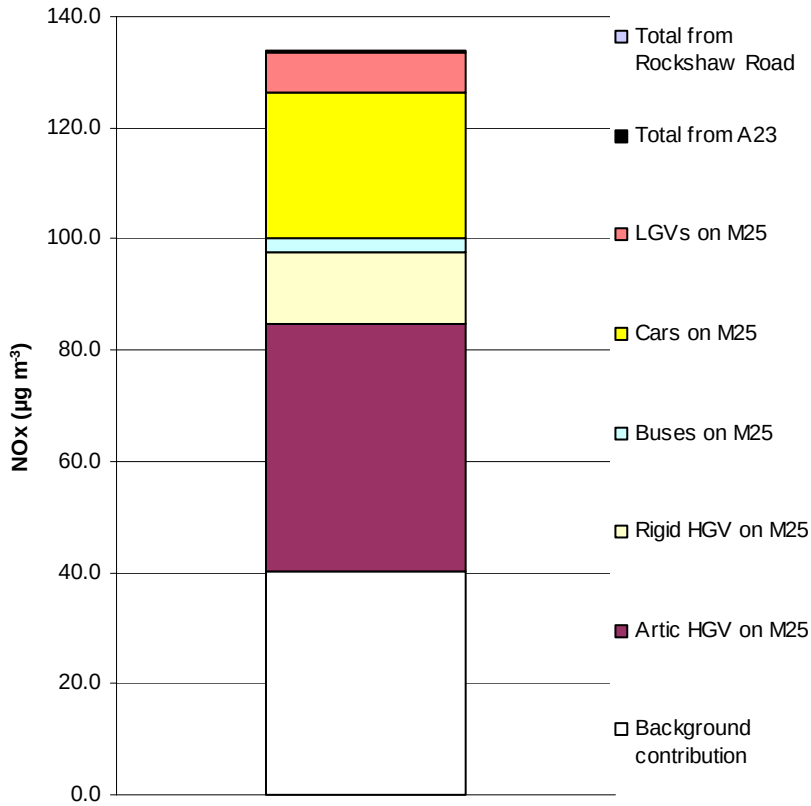


Figure 2.4: Source Contributions to NO_x Concentrations (µg m^{-3}) at the nearest Receptor to the M25 on Ashcombe Road (AQC, 2003).

Table 2.2 demonstrates that even if all traffic were removed from the A23 and Rockshaw Road, this would have a negligible impact on the NO_x concentrations at the nearest receptor on Ashcombe Road, and thus the NO_2 concentrations. It clearly shows that the NO_x contribution from the M25 is more than double that of the background NO_x concentration, and while the background contribution to the NO_2 concentration will be higher than is apparent from the NO_x distribution in Table 2.2, as more of the NO will have reacted to form NO_2, Table 2.2 clearly shows that the M25 should be the first area where efforts are made to control / reduce emissions.

The Stage 4 assessment (AQC, 2003) found that a reduction in the NO_x concentration from 134.1 µg m^{-3} to 114.4 µg m^{-3} would be sufficient for NO_2 concentrations at the nearest receptor on Ashcombe Road to meet the 40 µg m^{-3} objective in 2005. To meet this target in 2005 requires (AQC, 2003):

i) a 35 % reduction in the number of HGVs predicted for 2005.

ii) a 76 % reduction in the number of cars predicted for 2005.

iii) a 21 % reduction in all vehicles predicted for 2005.

iv) an imposed speed limit of 56 mph for all vehicles (as opposed to the average speeds used in Table 2.2.

3.0 Nitrogen Dioxide Concentrations beyond 2005

The Stage 4 assessment clearly demonstrated that traffic on the M25 made a significant contribution to the exceedence of the Governments annual average NO_2 objective in 2005. However, it is apparent from DEFRAs technical guidance (DEFRA, 2003) that emissions factors for vehicles are improving on a yearly basis, and therefore the concentrations of both NO_x and NO_2 were calculated for the nearest receptor i.e. worst case receptor on Ashcombe Road from 2005 to 2015 (Figure 3.1, Table 3.1, and Figure 3.2,).

The NO_x / NO_2 concentrations were determined using the DMRB spreadsheet (v1.02, November 2003), using data derived from the Surrey Traffic Model, and also the NAEI and TEMPRO data sets, assuming that traffic growth follows a 'middle of the road' scenario. The approach used to produce the data is set out in detail in Appendix A, and follows the approach used in the Stage 4 assessment.

Figure 3.1: NO_x and NO_2 Concentrations at the nearest Receptor on Ashcombe Road.

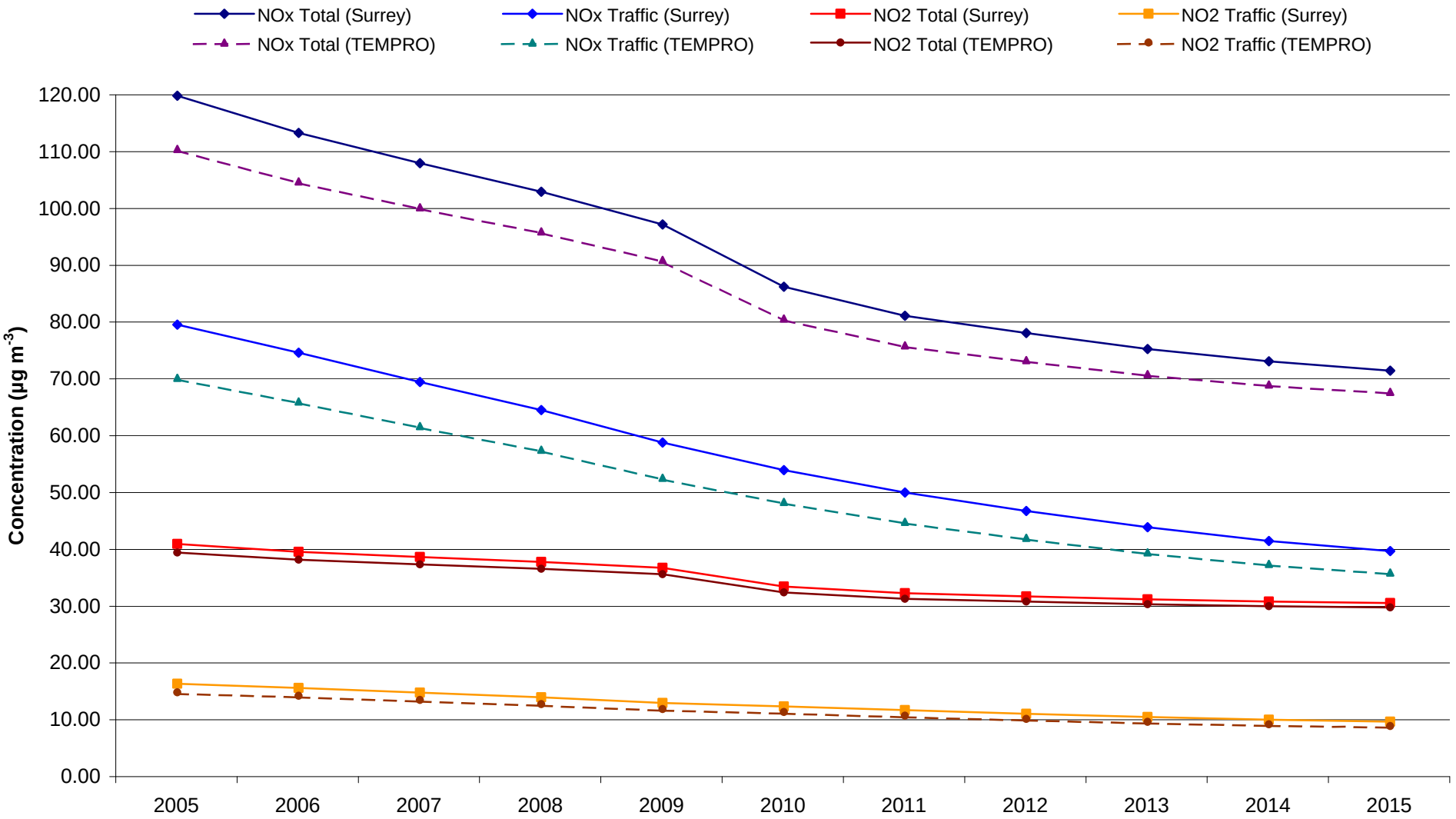


Figure 3.2: NO_2 derived from Traffic at the nearest Receptor to M25 (%).

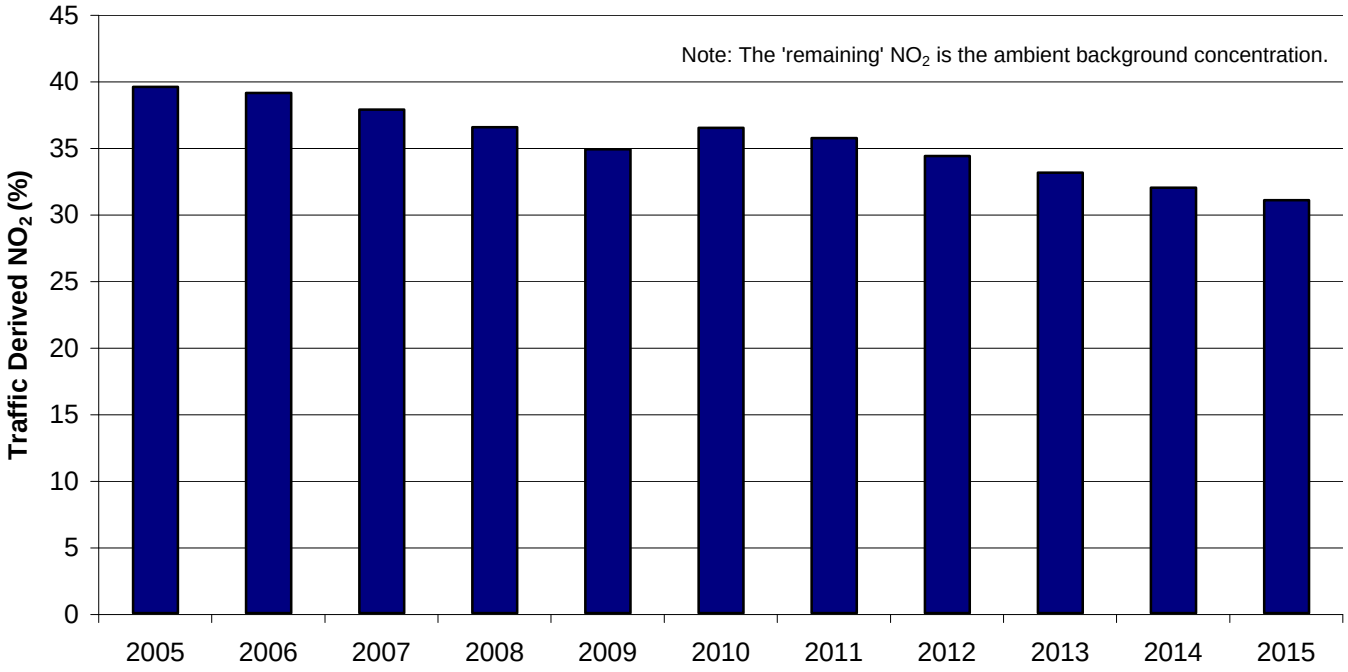


Table 3.1: NO_x and NO_2 Concentrations at the nearest Receptor to the M25.

	Annual Mean Total (µg m^{-3})		Annual Mean Background (µg m^{-3})		Annual Mean Traffic (µg m^{-3})		*Annual Mean Total (µg m^{-3})*		*Annual Mean Background (µg m^{-3})*		*Annual Mean Traffic (µg m^{-3})*	
Year	NO_x	**NO_2**	NO_x	NO_2	NO_x	NO_2	*NO_x*	***NO_2***	*NO_x*	*NO_2*	*NO_x*	*NO_2*
2005	119.5	**40.7**	40.3	24.6	79.3	16.1	*110.2*	***39.2***	*40.3*	*24.6*	*69.9*	*14.6*
2006	113.0	**39.3**	38.7	23.9	74.3	15.4	*104.5*	***37.9***	*38.7*	*23.9*	*65.8*	*13.9*
2007	107.7	**38.4**	38.5	23.9	69.2	14.5	*100.0*	***37.1***	*38.5*	*23.9*	*61.4*	*13.2*
2008	102.7	**37.5**	38.4	23.8	64.2	13.7	*95.7*	***36.3***	*38.4*	*23.8*	*57.3*	*12.5*
2009	96.9	**36.5**	38.4	23.8	58.5	12.7	*90.7*	***35.4***	*38.4*	*23.8*	*52.3*	*11.6*
2010	85.9	**33.2**	32.3	21.1	53.7	12.1	*80.3*	***32.2***	*32.3*	*21.1*	*48.1*	*11.1*
2011	80.8	**32.0**	31.1	20.6	49.7	11.4	*75.7*	***31.0***	*31.1*	*20.6*	*44.6*	*10.4*
2012	77.8	**31.4**	31.3	20.7	46.5	10.8	*73.0*	***30.5***	*31.3*	*20.7*	*41.8*	*9.9*
2013	75.0	**30.9**	31.4	20.7	43.6	10.2	*70.6*	***30.1***	*31.4*	*20.7*	*39.2*	*9.4*
2014	72.8	**30.5**	31.6	20.8	41.2	9.8	*68.7*	***29.7***	*31.6*	*20.8*	*37.2*	*8.9*
2015	71.2	**30.3**	31.8	20.9	39.4	9.4	*67.4*	***29.5***	*31.8*	*20.9*	*35.7*	*8.6*

Notes:

Values have been generated using DMRB.

Figures in unitalicised type are from the Surrey Road traffic model.

Figures in *italics* are from the NAEI database and TEMPRO (see Appendix A for method).

Figures in **bold** are those that should be considered relative to the 2010 EU limit value of 40 µg m^{-3}.

The DMRB model was used for this work given the generally good agreement between the modelled DMRB values and the projected monitored values on Ashcombe Road (Figure 2.2). Nevertheless, the predicted value for 2005 (Figure 3.1) for the nearest receptor to the M25 at 39.2 or 40.7 µg m^{-3} (depending on the data set) is below the predicted value in the Stage 4 assessment of 43 µg m^{-3} (Figure 2.2). The reason for this discrepancy in the values is unclear, however the key point to note from Figure 3.1 is the continued decline in NO_2 concentrations at the nearest / worst case receptor from 2005 to 2015.

The Stage 4 assessment (AQC, 2003) indicated that once the NO_x concentrations fell below 114.4 µg m^{-3} then the NO_2 standard would be met. From Figure 3.1 and Table 3.1 this situation will occur in 2006 with concentrations continuing to fall until at least 2015. Even allowing for the offset of 3 µg m^{-3} between this analysis and that of the Stage 4 assessment (Figure 2.2), the nearest / worse case receptor on Ashcombe Road would meet the 2005 objective in 2009, and by 2010 NO_2 concentrations would be 36 µg m^{-3} with the 3 µg m^{-3} offset, or 33 µg m^{-3} if the values from this analysis are correct. Thus the worst case receptor is predicted to be at least 10 % below the EU limit value by 2010.

Nevertheless, despite the continued falls in the NO_x and NO_2 concentrations, it should be pointed out that even by 2015 the M25 is predicted to still contribute over 55 % of the NO_x exposure at the nearest receptor to the M25, and be responsible for 30 % of the NO_2 exposure (Figure 3.2) i.e. NO_2 concentrations will still be about one third higher than they otherwise would be due to traffic on the M25.

4.0 Action Planning

The key points to consider in drawing up any action plan for this section of the M25 within Reigate and Banstead are set out in Table 4.1.

4.1 Flow Breakdown and the Highways Agency

As responsibility for the M25 lies with the Highways Agency (HA), rather than Reigate and Banstead BC, a meeting was arranged with the HA in November 2003 to discuss the findings of the Stage 4 assessment. The HA had identified that concentrations of NO_2 were likely to fall below the EU limit value by 2008 (Hackman, 2003) as part of their own assessment of the Stage 4 report, and thus were in broad agreement with our own findings. The Agency had also identified potential problems with lane discipline and associated flow breakdown on the anticlockwise approach to J7 on the M25, although primarily from a safety aspect, rather than an air quality perspective.

It was agreed at the meeting that any improvements in traffic flow anticlockwise on the approach to J7 *might* lead to some improvement in air quality on Ashcombe Road, and although the degree of improvement would be difficult to quantify, it would be an additional positive impact over and above any improvement in road safety.

The Agency indicated that it would be undertaking two studies on J7. The first would be into lane discipline problems on the anticlockwise approach to J7, and the second would be an analysis of the accidents that occur on the J7 slip roads. These two studies would be likely to cost in the region of £40 - 45K, and any junction improvements would be likely to take the form of additional / improved road signage and road markings costing a further £40 - 50K.

4.2 Speed Limits

The Stage 4 assessment had suggested that a blanket 53 mph (85 kph) speed limit would result in the 2005 objective value / 2010 EU limit value being met in 2005. If implemented this would not necessarily need to be permanent, just in place for 3 to 4 years before improvements in vehicle emissions enable the EU limit value to be met.

The Highways Agency has argued that a blanket speed reduction may not necessarily produce the reductions in air pollution that are predicted by modelling, especially for NO_x (HA, 2003). This is based on the fact that the optimum speed in terms of minimising NO_x is from 31 to 50 mph (50 to 80 kph), with higher emissions at both higher and lower speeds. Thus if an average

Site Specific Considerations.	Generic Considerations.
• A maximum of four properties are predicted to be over the 2005 objective value. • The M25 is by far the biggest contributor to the NO_x concentrations at the worst case receptor - 66 % in 2005, and is responsible for 39 % of the NO_2 exposure. • Articulated HGVs are responsible for 33 % of the NO_x exposure at the worst case receptor in 2005 (Table 2.2), compared to cars which contribute 19.5 % of the NO_x. Yet cars make up 77 % of all traffic on the M25, compared to articulated HGVs which make up just 7.2 %. • The exceedence of the objective at the worst case receptor is not just due to the volume of traffic on the M25, but may in part be due to flow breakdown on the anticlockwise approach to J7 (M23). • The worst case receptor will meet the 2010 objective by 2008/9 assuming 'middle of the road' traffic growth and even allowing for a 10 % model error, due to the predicted improvements in vehicle emissions over this time. • Predicted improvements in vehicle emissions mean that NO_2 concentrations will continue to fall beyond 2008/9, assuming that traffic increases at a 'business as usual' rate. • The Highways Agency is responsible for the M25, and as such is outside of the control of Reigate and Banstead BC. • Motorways are among the safest roads in the UK, and thus where possible traffic should be kept on these roads. • Smoother driving techniques are possible on the motorway network due to the road size, design, and layout of road junctions, and therefore vehicle engines can run for extended periods at their optimum efficiency in terms of reduced emissions.	• The key role of the action plan is to help the UK Government deliver the EU limit values for some of the pollutants (DEFRA, 2003), in this case the 2010 NO_2 annual average objective of 40 $\mu g\ m^{-3}$. • Any measures taken to improve air quality need to be proportionate in terms of their costs and benefits. • The UK sustainable development strategy (DETR, 2000) places an emphasis on the effective protection of the environment within a wider context of social and economic progress, and thus infers the need for well targeted action in managing the worst environmental risks first, and for investing in prevention rather than cure.

Table 4.1: Site Specific and Generic Considerations for the M25 Action Plan within Reigate and Banstead.

speed of 50 mph (80 kph) is made up of flow at 19 mph (30 kph) during daytime congestion, and 75+ mph (120+ kph) during night time free flow, the emissions will be much greater than if a constant average of 50 mph (80kph) were assumed.

However, the proposal here would be for a fixed and enforced speed limit of 50 mph (80 kph) (the Stage 4 suggested 53 mph / 85 kph) as:

i) this would 'prevent' the higher emissions associated with speeds over 50 mph, which would occur during night time free flow.

ii) it would reduce the incidences of flow breakdown, and so the low speeds and higher emissions associated with stop / start driving.

iii) the lower speed might also help improve road safety on the anticlockwise approach to J7, as there is a greater time for the drivers to respond to the approaching junction.

Arguments have been put forward that the lowering of speed limits on motorways can lead to increased journey times, or a perception amongst the public of increased journey times (NSCA, 2001). However, experience on the M25 suggests that where a motorway has a particularly high traffic flow, reductions in the speed limit can help improve the flow of traffic, and thus improve journey times, hence the variable speed limits introduced on some sections of the M25.

It should also be pointed out that reductions in the speed limit would also lead to decreased CO_2 emissions, and while the emission of CO_2 causes no immediate problems at a local level it could help the UK towards reducing its national emissions of CO_2.

However, as the Highways Agency has doubts over the effectiveness of a reduced speed limit in practice on reducing NO_x concentrations, it was decided not to proceed with the idea of lowering the speed limit to 50 mph over the Reigate and Banstead section of the M25.

Nevertheless, a definitive study is needed to examine the impact on air quality in practice of reduced speeds on motorways, particularly on NO_x and NO_2 concentrations, and for the results to be published in a peer reviewed journal. As a study is supposedly underway in Sheffield to examine this specific topic (HA, 2003, section 2.5.4), should any conclusive results arise from this work, then the issue of lower speed limits on the M25 will be discussed with the Highways Agency again if the improvements anticipated by the current action plan do not occur.

4.3 Road Charging / Tolls

There are various schemes in operation around the UK at the present time that involve the driver paying a charge to use certain roads e.g. the London congestion charge, or the M6 toll road. However, any form of road charging as a means of reducing traffic on the M25 is not considered appropriate for this action plan due to:

i) the high capital and long term revenue costs of such a scheme, and as such a scheme would have to be introduced at a national level.

ii) the fact that even with a 'business as usual' approach the worst case receptor is predicted to meet the 2010 EU limit value for NO_2, with continued reductions in NO_2 concentrations beyond 2010, which is the ultimate objective of any air quality action plan.

iii) the problem of traffic moving off the motorway if a charging scheme applies only to the M25, and onto the major A-roads within the Borough. This would result in a far greater number of residential properties being affected by air pollution than the current 1 - 4 properties on Ashcombe Road, coupled with a potential increase in noise, CO_2 emissions (as engines tend not to operate as efficiently), and road traffic accidents as A roads are not as 'safe' as motorways.

Therefore road charging schemes are not considered an appropriate method for reducing NO_x / NO_2 concentrations on Ashcombe Road.

4.4 Council Purchase of Affected Properties

The purchase of houses affected by high levels of air pollution, whether by voluntary agreement or compulsory purchase order, has been an option used by councils elsewhere in the UK (NSCA, 2001). However, this is considered wholly inappropriate in this situation given that:

i) residents in Ashcombe Road do not feel that the air pollution is an especially significant health threat that warrants moving house (RB, 2003).

ii) the 2010 EU annual average NO_2 objective will be met by 2008/9 at the worst case receptor, and at the other properties affected before this date.

iii) the cost of such a scheme would be high, with individual properties in Surrey costing over £250K each in addition to legal costs, and also compensation payments if compulsory purchase orders were used.

iv) the approach fails to tackle the source / cause of the problem, contrary to the principles of the UK sustainable development strategy (Table 4.1), and against the principle of the 'polluter pays'.

4.5 Land Use Planning

The AQMA has been entered into the Councils planning system together with an informative stating the pollutants of concern within the AQMA. The planning department also refer developments within the AQMA to the Environmental Health department for an opinion, and where planning permission is granted within an AQMA the developer / owner is made aware of the presence of the AQMA.

4.6 Monitoring

It is proposed to continue with the current diffusion tube survey within Ashcombe Road until at least 2010, to confirm that NO_2 concentrations are declining as predicted. The tube surveys to date have proven a reliable and cost effective method of measuring NO_2 concentrations. Therefore, a real time monitor at this stage is not considered necessary, as an existing real time monitor elsewhere within the borough is used to calculate the tube correction factors, and as the aim of this monitoring is to simply maintain a 'watching brief' on the annual average NO_2 concentrations within Ashcombe Road.

The cost of the tube monitoring program until 2010 will be less than £1K, although this excludes officer time of approximately one to two hours per month to run the tube survey, which is accommodated within other tube survey work.

4.7 Actions to be taken at a National Level

One of the findings of the Stage 4 source apportionment study (AQC, 2003) was that articulated HGVs while representing only 7.2 % of the traffic on the M25, contributed 33 % of the NO_x exposure at the worst case receptor on Ashcombe Road. When the background NO_x concentration is no longer considered, articulated lorries are responsible for 48 % of all traffic derived NO_x in this section of the M25 (AQC, 2003) compared to just 28 % for cars, and yet cars make up 77 % of the road traffic.

Thus while it is important that the Government encourages tighter emissions standards to be introduced at the European level for all types of vehicles, tougher emission standards related to articulated lorries and promoting research into minimising emissions from heavy duty diesel vehicle engines should be encouraged as a priority. As these vehicles are likely to be a significant traffic source of NO_x / NO_2 especially on the motorway and trunk road networks in the UK.

However, punitive taxes and charges against articulated vehicles should be avoided where possible, as the emissions per tonne of vehicle weight (assuming a loaded vehicle) are better for articulated lorries than for cars.

4.8 Summary of the Proposals

Table 4.2 summarises the 'actions' that Reigate and Banstead BC will undertake to help the Government achieve the EU limit value of 40 µg m^{-3} (annual average) for nitrogen dioxide by 2010.

Table 4.2 also includes an approximate time scale, costs, and gives an indication of the potential advantages and disadvantages of each action / scheme. These actions are considered a proportionate response to the problem of poor air quality near to the M25 in Reigate and Banstead given the small number of properties affected, the small current exceedence of the standard (i.e. less than 10 %), and the high probability that the 2010 EU limit value for nitrogen dioxide will be met assuming a 'business as usual' scenario.

Table 4.2: Summary of Proposed Actions for the M25 Air Quality Management Area.

Action	Responsible	Start Date	Completion Date	Cost (£)	Potential Benefits	Potential Problems	Comments
Safety and lane discipline review of J7 M25.	HA	End 2003	April 2004	£40 to 50K	- Identification of possible safety improvements. - Identification of possible improvements in road signage to minimise flow breakdown.	None.	There is the possibility that no cost effective improvements will be identified. Thus from an air quality perspective no change. However, this action is not critical to improving air quality.
Improve Signing / Road markings on anticlockwise approach to J7 M25.	HA	After April 2004[a]	April 2005? subject to confirmation	£40 to 50K	If implemented: - Improved safety. - Potential for improved traffic flow. - If traffic flow improved potential reduction in NO_x emissions.	None. - All works are on an existing site, and the motorway is in a cutting at this point. - Any changes in the location of the signs will not be noticeable away from the motorway itself.	Recognised that (if) any change in NO_x emissions may have no detectable impact on measured concentrations at the affected properties. However this action is not critical to improving air quality.
Continue with Diffusion Tube Survey.	RBBC (Pollution Team)	June 2002	Dec. 2010 (minimum)	£1K (+ officer time of 1-2 hours per month for Ashcombe road sites).	- The most cost effective method of demonstrating that compliant with EU limit value. - Over two to three years will give an indication of the general trend in concentrations. - Used to inform the HA about general trends.	Sites for tubes are in place. - Possible continuity problems if residents no longer wish to participate in the study, and so sites have to be moved.	This is the most important part of the action plan, as this is the only method of ensuring that the projected improvements in vehicle emission factors, and thus concentrations of NO_2, actually happens in practice.
On going review of the Sheffield study into reduced speed limits on M'ways, and practical impact on air quality.	RBBC (Pollution Team)	2003	?	£0 to RBBC but + officer time.	- Might indicate if a fixed 50 mph limit does reduce emissions in practice, as suggested by modelling. - If it does, such a limit will also reduce CO_2 emissions, and noise pollution.	- Study may need to continue for several years to differentiate between improvements due to lower vehicle emission factors, changes in traffic flow, and weather variations.	This study could be critical if the improvements in vehicle emission factors do not occur in practice, or if traffic growth is far faster than predicted. Most models show that a reduced speed results in a significant reduction in pollution, as the higher emissions associated with speeds over 50 mph are no longer present. Lower speeds also tend to lead to improved traffic flow, and so the very slow speeds also associated with high emissions also occur less often.
Make central Government aware of the disproportionate emissions from articulated vehicles.	RBBC / HA	2003	on going	£0	- Tighter Euro standards for heavy duty diesel engines associated with articulated vehicles. - In the longer term would lead to lower emissions on this section of the M25, and providing that the emissions were lower under all engine operating conditions this would have benefits across the UK, Europe, and to a lesser extent other parts of the world.	- Long time frame - will not help at this stage to meet the 2010 EU limit value. - Risk that government goes for a simple tax on these vehicles, which does not encourage any improvement in emissions. - Risk of road pricing for these vehicles on motorways, resulting in greater use of A-roads. Thus a greater number of residents are affected by poor air quality than at present, and even higher overall emissions due to the greater amount of stop / start driving. Plus potential increase in accident risk, and greater number of people affected by increased noise.	Important that improvements are made in the emission factors of the engines used in these vehicles, rather than other measures.

HA: Highways Agency; RBBC: Reigate and Banstead Borough Council; [a] dependant on findings of above survey, and confirmation of financial budget for 2004/5.

5.0 Consultation

Local residents within the M25 air quality management area were consulted on the action plan, in addition to the following organisations:

Crawley Borough Council.
DEFRA.
East Elmbridge and Mid Surrey Primary Care Trust.
Environment Agency Thames Region (SE Area).
Epsom & Ewell Borough Council.
Gatwick Airport Ltd.
Greater London Authority.
Highways Agency (HA).
London Borough of Croydon.
London Borough of Sutton.
Mole Valley District Council.
Mott MacDonald Ltd.
Mouchel Consulting (M25 Sphere).
Surrey County Council.
Tandridge District Council.

5.1 Responses to the Consultation

One informal response was received by telephone from a resident within the M25 AQMA regarding the effect of the pollution on their health, and why something could not be done sooner to reduce the pollution levels. A response was also received from the GLA by email, which stated that they had no formal comments to make on the report.

Two formal responses to the consultation were received from Tandridge District Council, and DEFRA. Tandridge DC noted the proposals in the report, and stated that the conclusions in the action plan were reasonable and practical proposals.

DEFRA stated that the action plan 'fulfils the requirements of the action planning process, and for certain elements represents an example of best practice'. Nevertheless, a series of comments were made in the response and these are dealt with below:

1. *The action plan could be improved through more explicit consideration of the HA in local air quality management in the introduction to the plan. Residents and neighbouring authorities should also be consulted.*

The key aim of the action plan was to examine practical, cost effective, and workable solutions to the air quality problems on the M25, rather than produce a report overly concerned with organisations supposed roles and responsibilities, particularly as the role of the HA (Highways Agency) in local air quality management is set out in the report by the HA 'The role of the Highways Agency in Local Air Quality Management' (HA, 2003), a document referred to in the action plan.

Residents and the neighbouring authorities were consulted – see above list. Residents affected by air pollution either within a current or proposed AQMA are always consulted when a report deals specifically with that AQMA, in addition to the statutory consultees.

2. *The plan would benefit from the inclusion of joint working with neighbouring authorities faced with similar AQMA objectives in the vicinity of the M25 in order to highlight the need for a co-ordinated approach to action planning on the M25.*

   The authorities on either side of Reigate and Banstead, Tandridge DC and Mole Valley DC, have not declared air quality management areas based on their assessments of air quality around the M25, and therefore are not producing action plans related to traffic on the M25. Nevertheless, the M25 is discussed at meetings of the Surrey air quality group, and the council does have informal discussions with local authorities affected by the M25 outside of Surrey. However, as the main proposal in the action plan is 'business as usual' with the predicted improvements in vehicle emissions resulting in the annual average NO_2 objective being met, this 'action' is unlikely to impact on the scenarios that other authorities around the M25 are considering. Thus the need for formal joint working in the action plan was unnecessary.

   A co-ordinated approach is needed to action planning on the M25 where actions other than 'business as usual' are considered, and no doubt on other motorways around the UK. However, as local authorities have no statutory powers over the Highways Agency, the direction and co-ordination needs to come from central government via DfT and DEFRA. This central co-ordination is particularly important as the main 'problems' on the M25 are traffic volume and vehicle emissions, both of which can only be improved by national / EU measures, as discussed briefly in sections 4.3 and 4.7 of the report.

3. *Where possible, assessment of the proposed measures should be undertaken to establish the impacts on pollutant levels. Wider non air quality impacts should also be identified.*

The purpose of sections 4.1 to 4.7 of the report was to screen a series of potentially practical methods of reducing air pollution which did, where appropriate, consider the wider advantage / disadvantages of such measures. At this stage the impacts on predicted concentrations were not quantified as it was very apparent from the screening exercise that the majority of the approaches simply could not compete with a 'business as usual' approach, which gave the required improvement in NO_2 concentrations by 2008, due to the likely time taken to implement the scheme and / or cost. Thus there simply was no need to quantify the extent of the impact in any detail for measures ruled out at this stage.

However, the proposed actions that the council intends to take have been quantified where appropriate. For example, the 'business as usual' approach has been fully quantified in terms of the predicted reductions that will occur in pollutant concentrations up until 2015.

The other proposed measures such as improved road markings and signage on the motorway are subject to a study by the Highways Agency. Consequently until the proposed changes (if any) are known it is difficult to even begin to quantify what effect this will have on pollutant concentrations. At this stage it can only be stated that improved traffic flow ***might*** (as stated in section 4.1) lead to an improvement in air quality, but at this stage this is far from certain, and if no changes are made then obviously the concentration of NO_2 will follow the business as usual approach modelled.

Wider non air quality measures have been identified where appropriate for the proposed actions, for example improved road safety with improved road signage and markings on the approach to the M23. Other proposed actions such as continuing monitoring to confirm that the concentrations of NO_2 are declining have no quantifiable impact on NO_2 concentrations nor wider non air quality implications. The action to follow the HA study on traffic speeds in Sheffield near the M1, and making central government aware of the contribution from HGVs on the M25, again has no quantifiable impact in terms of the proposed action in the action plan, but these issues have been quantified in the wider context of this work. For example, a constant 50 mph speed limit on this section of the M25 ***in theory*** would reduce NO_2 concentrations below the 2005 objective value for NO_2 in 2005 (see section 4.2), while the disproportionate impact of HGVs has also been quantified (Section 4.7).

4. *The council should include further consideration to the setting of explicit time scales for implementation of the measures.*

   Table 4.2 in the report has the known time scales shown. The HA safety and lane discipline review is due for completion towards the end of April 2004, and consequently an exact date has not been specified for the works (if any) in 2004/5 by the HA until the outcome of the report is known.

   The tube survey dates are clearly shown in the table, while the 'business as usual' model shows that the NO_2 annual average objective should be met in 2008. Thus this is one target that can be assessed in the progress report, although of greater importance is that the tube survey shows an overall downward trend in NO_2 concentrations from 2004 to 2010, rather than focusing solely on concentrations in 2008.

   The study on reduced speed limits on the M1 in Sheffield had no completion date stated in the HA report, and hence none could be specified. Currently it is unclear when this project will commence, as discussions with the HA by email indicate that it had yet to begin in March 2004. Although a study examining the effectiveness of reduced speed limits on air pollution in practice has yet to take place, it was noted with interest that the DfT, in the air quality technical notes accompanying the white paper on the future of air transport, does consider the use of a 40 mph speed limit in the vicinity of Heathrow Airport as a means of reducing air pollution.

   The action for making the government aware of the disproportionate emissions from HGVs was left open, as the work is still under discussion by the EU. A letter was sent to the DfT on this subject in March 2004, and a response received in April saying that they were aware of the issue, and were currently in discussion with the EU on the subject.

5. *Consideration to screening of the properties has not been discussed as a possible option. The council should include some consideration to this possibility.*

   As stated in the answer to point 3 above, the purpose of the action plan was to summarise a series of *potentially practical* options aimed at improving air quality on Ashcombe Road. It should be explained that at this point on the M25 the hard shoulder is bounded by an 8 to 10 m high vertical concrete wall. At the top is a 5 to 6 m wide concrete slope inclined at approximately 50º. Then there is a 2.5 m high wooden fence behind which is the garden of the relevant residence.

While this author is aware that a mechanism exists whereby a plant can utilise NO_2, it is unclear what 'volume' of vegetation is required to reduce ambient NO_2 concentrations by 1-3 µg m^{-3}, and whether this could realistically be achieved in a roughly 5 m wide strip of land (assuming the householder is prepared to plant their garden in such away). Consequently this approach was not considered a practical option, and therefore was not considered in the action plan.

Appendix A.

Traffic Modelling Data.

Calculation of NO_x and NO_2 Data - 2005 to 2015

Concentrations of NO_x and NO_2 at the nearest receptor in Ashcombe Road to the M25 were calculated used the Design Manual for Roads and Bridges (DMRB) spreadsheet v. 1.02 (November 2003).

Background concentrations of NO_x and NO_2 were determined from the national background concentration maps (DEFRA, 2003a). The background concentrations used are the average of mapped concentrations in the 4^{th} 1x1 km grid square away from the M25 both north and south, and also transposed 1 square west, to avoid bias from the A23 emissions, and thus double counting of local emission sources as per the method set out in the technical guidance (DEFRA, 2003).

Where published background maps were not available, the map nearest to the year under consideration was corrected using a correction factor derived from the air quality archive (DEFRA, 2003a), using the method set out on the Stanger modelling website (Stanger, 2003).

TEMPRO Data

The M25 traffic flow data used in the TEMPRO modelling are based on traffic counts on the stretch of motorway adjacent to Ashcombe Road. A23 traffic flow data were also taken from the adjacent link. Both counts were obtained from the National Atmospheric Emissions Inventory (NAEI, 2003) and were conducted in 2000. Traffic data for Rockshaw Road are estimates based on direct observation at the site, and were assumed to be 5000 AADT, with 1 % HGV traffic in 2000. However, any errors associated with the Rockshaw road data are likely to be negligible, as source apportionment undertaken as part of the stage 4 suggests that this road contributes < 0.1% of the NO_x concentrations.

The traffic flow data has been adjusted to predict the 2005 to 2015 flows by generating a local traffic growth factor for Reigate and Banstead using TEMPRO v.4.2.2 (TEMPRO, 2003), and the associated trend data (v.1.4 9/5/02) for the southeast. This factor has then been used to weight the National TEMPRO traffic growth factor, which has then been applied to a National Road Traffic Forecast (NRTF) factor as per Equation A1. The factors used are summarised in Table A1.

(Reigate and Banstead TEMPRO factor / GB TEMPRO factor) x NRTF factor (Equation A1)

	TEMPRO			NRTF					
	GB	Reigate		Car	LGVs	Rigid HGVs	Artic HGVs	PSVs	Total Traffic
2005	1.056	1.0600		1.0840	1.1268	1.0388	1.1331	1.0371	1.0914
2006	1.067	1.0720		1.1007	1.1518	1.0465	1.1601	1.0449	1.1101
2007	1.079	1.0875		1.1175	1.1786	1.0543	1.1906	1.0527	1.1269
2008	1.091	1.1025		1.1343	1.2054	1.0620	1.2212	1.0605	1.1437
2009	1.103	1.1175		1.1511	1.2321	1.0698	1.2518	1.0684	1.1604
2010	1.115	1.1335		1.1679	1.2589	1.0775	1.2824	1.0762	1.1772
2011	1.127	1.1485		1.1847	1.2857	1.0853	1.3129	1.0840	1.1940
2012	1.134	1.1575		1.2015	1.3161	1.0950	1.3471	1.0918	1.2127
2013	1.142	1.1655		1.2183	1.3464	1.1047	1.3813	1.0996	1.2313
2014	1.150	1.1745		1.2351	1.3768	1.1143	1.4155	1.1074	1.2500
2015	1.157	1.1825		1.2519	1.4071	1.1240	1.4496	1.1152	1.2687

Table A.1: TEMPRO and NRTF factors applied to Calculate Traffic Flows from NAEI 2000 data.

Surrey Data

The Surrey traffic data was obtained directly from Surrey County Council, as an output run from the Surrey road traffic model.

Finally, the Surrey model traffic data, and the TEMPRO derived traffic data were then run separately in the DMRB spreadsheet to produce the data in Figure 3.1 and Table 3.1. However, the DMRB calculations do not take into account traffic flow along Ashcombe Road, which in these circumstances will be insignificant.

References

AQC (2001) *Stage 3 Local Air Quality Review and Assessment - NO_2 and PM_{10}.* Report No. A35870100/yb/1743/final. Air Quality Consultants / Stanger Science and Environment, Bristol, UK, July 2001.

AQC (2003) *Further Assessment (Stage 4) of Air Quality within Four Air Quality Management Areas in Reigate and Banstead.* Air Quality Consultants, Bristol, UK, May 2003.

DEFRA (2003) *Local Air Quality Management - Technical Guidance.* Report No. LAQM. TG (03). HMSO, London.

DEFRA (2003a) Local Air Quality Management Tools. *www.airquality.co.uk*.

DEFRA (2003b) *Local Air Quality Management - Policy Guidance.* Report No. LAQM. PG (03). HMSO, London.

DETR (2000) *Sustainable Development: A better Quality of Life. A Strategy for Sustainable Development for the UK*. HMSO, London.

HA (2003) *The Role of the Highways Agency in Local Air Quality Management*. Draft Report of 24/7/03 and Final Report of 12/11/03. Highways Agency, UK.

Hackman, M. (2003) Highways Agency response to M25 Stage 4 consultation.

Hickman, A.J., McCrae, I.S., Cloke, J., Davies, G.J. (2002) *Measurements of Roadside Air Pollution Dispersion*. Report No. PR/SE/445/02. TRL Ltd. *www.trl.co.uk*.

NAEI (2003) National atmospheric emission inventory database *www.naei.co.uk*.

NSCA (2001) *Air Quality: Planning for Action (Part 2)*. National Society for Clean Air, Brighton, UK.

RB (2003) Telephone and personal communications with residents in three of the affected properties on Ashcombe Road as part of the Stage 4 consultation process. June to September 2003.

SEIPH (1999a) *Stage 1 Review and Assessment Report for Reigate and Banstead Borough Council.* South East Institute of Public Health, June 1999.

SEIPH (1999b) *Stage 2 Review and Assessment Report for Reigate and Banstead Borough Council.* South East Institute of Public Health, November 1999.

Stanger (2003) *Guidance note for use of projection factors for background and roadside pollutant concentrations.* Casella Stanger / Yvonne Brown 13/02/03.

TEMPRO (2003) Trip End Model Presentation Program v.4.2.2. Department of Transport / Hartley McMaster Ltd. *www.tempro.org.uk*.