ENV/254/17
09.11.01

Report on the Third Stage Review and Assessment of Air Quality in the Suffolk Coastal District.

November 2001

Written by Denise Bint and Tim Davidson
Environmental Services Department

Report on the Third Stage Review and Assessment of Air Quality in the Suffolk Coastal District.

November 2001

Written by Denise Bint and Tim Davidson
Environmental Services Department

Table of Contents

List of Appendices

Appendix A Monthly Nitrogen Dioxide air quality concentrations recorded by diffusion tubes at Felixstowe, Woodbridge and Melton since 1993.

Appendix B Monthly Sulphur Dioxide air quality concentrations recorded by diffusion tubes at Felixstowe during 2000 and 2001.

Appendix C Summary of traffic data obtained for the A14 and A1156 roads from Suffolk County Council, Environment & Transport Department. Data used for input into the BREEZE roads computer model by Entec U.K Limited for estimating Nitrogen Dioxide levels.

Appendix D Information collected and assumptions made for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.

Appendix E Information collected and assumptions made for continued Second Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using High Road West, Felixstowe.

Appendix F Information collected and assumptions made for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.

Appendix G Reports from Entec U.K Limited on Stage 3 Local Air Quality Review and Assessment for Suffolk Coastal District Council.

Executive Summary

As part of the requirements of Part IV of the Environment Act 1995, the Government adopted the United Kingdom Air Quality Strategy as a statement of its policies with respect to the assessment and management of air quality. In January 2000, the Government adopted the revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland. The strategy continues to represent a comprehensive approach to maintaining and improving the quality of ambient air in the United Kingdom. It sets health-based air quality objectives to be achieved by prescribed target dates, and the process by which the strategy is to be implemented.

National policies on air pollution are expected to deliver a significant improvement in air quality throughout the country. The strategy recognises, however, that there is an important local dimension to air quality. Local authorities are required by the Environment Act 1995 to carry out periodic reviews of air quality within their areas to assess present and likely future quality against the air quality objectives prescribed in the Air Quality (England) Regulations 2000. These Regulations set objectives for seven pollutants: Benzene, 1,3-Butadiene, Lead, Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}).

The Review and Assessment of air quality in the Suffolk Coastal District is being carried out in three stages in accordance with the methodology detailed in the pollutant specific guidance issued by the Department of the Environment, Transport and the Regions (DETR).

Suffolk Coastal's First Stage Review and Assessment Report (February 1999) indicated that, for Benzene and 1,3-Butadiene, the risk of the air quality objectives being exceeded was negligible and further review and assessment of these pollutants is not necessary at this time.

Suffolk Coastal's Second Stage Review and Assessment Report (August 2000) indicated that, for Lead and Carbon Monoxide, the risk of the air quality objectives being exceeded was negligible and further review and assessment of these pollutants is not necessary at this time.

This document reports on the Third Stage of the review and assessment process, and includes continued Second Stage investigations where necessary, for the pollutants Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}). The aim of this report is to determine whether there is a significant risk that any of the specific emission sources identified for the above pollutants in Suffolk Coastal's Second Stage Report could lead to an exceedance of the air quality objectives. If the Third Stage review and assessment indicates that objectives are likely to be exceeded, at any location, then the local authority is under a duty to declare an Air Quality Management Area (AQMA). The authority will then be required to prepare a written action plan to improve air quality within its area in order to achieve the objectives.

This Third Stage review and assessment has used computer modelling techniques, data from diffusion tubes and continuous monitoring equipment, and information from previous studies.

The continued Second Stage and Third Stage review and assessments in this report were undertaken by Suffolk Coastal District Council and Entec U.K Limited, employed on behalf of Suffolk Coastal District Council.

The conclusions of this Third Stage review and assessment are as follows:

The risk of the air quality objectives being exceeded for the following emission sources of Nitrogen Dioxide and Particulate Matter (PM_{10}) is negligible, and further review and assessment will not be necessary at this time;

Nitrogen Dioxide

- Traffic using the A14 trunk road:
- Traffic using High Road West, Felixstowe

Particulate Matter

- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton:
- Traffic using High Road West, Felixstowe:
- Traffic using Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge
- PM_{10} levels from the combined emission "footprint" of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry, and Foxhall Landfill Site.

An exceedance of the air quality objectives cannot be ruled out for the following emission sources of Sulphur Dioxide and Particulate Matter (PM_{10}) due to insufficient information to date, therefore **further on-going review and assessment is considered necessary;**

Sulphur Dioxide

- Emissions from shipping at the Port of Felixstowe

Particulate Matter (PM_{10})

- Emissions from shipping at the Port of Felixstowe.
- PM_{10} levels from the combined emission "footprint" of Roadworks (1952) Limited and Sinks Pit Quarry.

There is a risk of the air quality objectives being exceeded for the following emission sources of Nitrogen Dioxide and consideration will be given to the designation of an AQMA at each location;

Nitrogen Dioxide

- Emissions from traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton.
- Emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.

Details of the form that the above further review and assessment will take are outlined in the Summary and Recommendations section of this report (Chapter 6).

For further information concerning this report, please contact;

Environmental Services Department (Pollution Control), Suffolk Coastal District Council, Melton Hill, Woodbridge, Suffolk IP12 1AU

Telephone 01394 444306
Fax 01394 444354
Email SCDC@suffolkcoastal.gov.uk

1. Introduction

This is the Third Stage Review and Assessment Report for Suffolk Coastal District Council which assists with the local air quality management process as laid down by Part IV of the Environment Act 1995.

The overall purpose of the review and assessment process is to enable local authorities to appraise current and future air quality for their area against the objectives in the Air Quality Regulations, see Table 1. The Government recommends a phased approach involving three stages when conducting a review and assessment of air quality. All local authorities must undertake an initial First Stage screening process reviewing sources of pollution in the area followed, if necessary, by a more detailed Second Stage survey using simple monitoring and modelling techniques. If these surveys indicate that a prescribed air quality objective is likely to be exceeded by the relevant future year, then a Third Stage detailed assessment using accurate modelling, monitoring or other techniques should be undertaken. If the Third Stage review indicates that objectives are likely to be exceeded, at any location, then the local authority is under a duty to declare an Air Quality Management Area. The authority will then be required to prepare a written action plan to improve air quality within its area in order to achieve the objectives.

Suffolk Coastal District Council have undertaken the First and Second Stage review and assessment process in February 1999 and August 2000 respectively. The First and Second Stage Review and Assessment Reports identified which of the relevant specified National Air Quality Strategy pollutants, as well as localities of concern for each, should be the focus of this Third Stage Review and Assessment. In accordance with the Council's statutory obligations, the First and Second Stage reports were submitted to the Department of the Environment, Transport and the Regions (DETR). The DETR had no adverse comments to make with respect to either the First or Second Stage Reports. The DETR did, however, have three comments with respect to the Second Stage Report;

1. Full details of monitoring Quality Assurance (QA)/ Quality Control (QC) and site description of each Nitrogen Dioxide diffusion tube monitoring station should be provided. (QA/QC procedures are discussed in-depth in the report prepared by Entec U.K Limited, attached as Appendix G, and site descriptions are provided in Appendix A).

2. Two Nitrogen Dioxide diffusion tube sites exceed 40 $\mu g/m^3$ in 1999 (FLX 1 and WBG 1) and should be reviewed carefully if there is relevant public exposure. This risk can be re-examined in the next review and assessment due for completion in 2003. (Suffolk Coastal District Council has decided to address this aspect in this Third Stage Report, see Chapter 3).

3. The approach to PM_{10} is precautionary and further work will need to determine more precisely the risk of exceedance of the air quality objective in the combined circumstances described. (This refers to the sites at Sinks Pit and Foxhall, both of which are covered in Chapter 5).

This Third Stage Review and Assessment Report should be read in conjunction with the both the Suffolk Coastal First and Second Stage Review and Assessment Reports (1999, 2000).

Table 1 Objectives specified in the Air Quality (England) Regulations 2000 for the purposes of Local Air Quality Management

Pollutant	Objective		Date to be achieved by
	Concentration *	Measured as	
Benzene	16.25 μg/m^3 (5 ppb)	Running annual mean	31 December 2003
1,3-Butadiene	2.25 μg/m^3 (1 ppb)	Running annual mean	31 December 2003
Carbon monoxide	11.6 mg/m^3 (10 ppm)	Running 8-hour mean	31 December 2003
Lead	0.5 μg/m^3	Annual mean	31 December 2004
	0.25 μg/m^3	Annual mean	31 December 2008
Nitrogen dioxide	200 μg/m^3 (105 ppb) not to be exceeded more than 18 times a year (equivalent to the 99.8th percentile)	1-hour mean	31 December 2005
	40 μg/m^3 (21 ppb)	Annual mean	31 December 2005
Particles (PM_{10})	50 μg/m^3 not to be exceeded more than 35 times a year (equivalent to the 90th percentile)	24-hour mean	31 December 2004
	40 μg/m^3	Annual mean	31 December 2004
Sulphur dioxide	266 μg/m^3 (100 ppb) not to be exceeded more than 35 times a year (equivalent to the 99.9th percentile)	15-minute mean	31 December 2005
	350 μg/m^3 (132 ppb) not to be exceeded more than 24 times a year (equivalent to the 99.7th percentile)	1-hour mean	31 December 2004
	125 μg/m^3 (47 ppb) not to be exceeded more than 3 times a year (equivalent to the 99th percentile)	24-hour mean	31 December 2004

***** conversions of ppb and ppm to μg/m^3 and mg/m^3 at 20°C and 1013 mb

In the case of short averaging periods, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedances of the air quality standard over a particular time-scale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events, such as November 5th.

Since Suffolk Coastal reported on the First Stage of the review and assessment process, the Government has published the revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR 1999, 2000) and has replaced the Air Quality Regulations 1997 with the Air Quality (England) Regulations 2000. These new regulations have the effect of tightening five of the existing objectives: for benzene, 1,3-butadiene, carbon monoxide, lead, and nitrogen dioxide (the hourly objective). The objectives for sulphur dioxide and nitrogen

dioxide (the annual objective) remain the same. For particulates, since the existing objective is now considered to be unachievable, the Government has replaced the objective with the less stringent European Union limit value, which is currently the only alternative nationally recognised target. The Government has also set a number of new objectives to reflect the limit values agreed in the European Union Air Quality Daughter Directive for sulphur dioxide, nitrogen dioxide, lead and particulates (PM_{10}). As before, there is no objective for ozone; action in pursuit of this will be taken at national level. The full list of objectives as they appear in the Air Quality (England) Regulations 2000 can be seen in Table 1 above.

There are a number of other differences between the new 2000 Regulations and the 1997 Regulations. The relevant time period now varies from objective to objective, between the years 2003 and 2008. All pollutant objectives are also presented using a consistent measurement method; micrograms per cubic metre ($\mu g/m^3$) and milligrams per cubic metre (mg/m^3), as compared with parts per billion (ppb) and parts per million (ppm). This report states levels of pollutants in $\mu g/m^3$ or mg/m^3. This is simpler and has the advantage of being consistent with EU Air Quality Daughter Directive limit values.

Government guidance contained in *Framework for Review and Assessment of Air Quality* (DETR 2000) states that authorities which have completed part of their review and assessment (eg – Stage 1 but not Stage 2 or 3) before the introduction of the new regulations will **not** need to redo the stages already carried out, but should shift the focus of the remaining part of their review and assessment with immediate effect to the new objectives.

A review of the Suffolk Coastal First Stage findings was, however, carried out in the Second Stage Review and Assessment Report in light of the revised air quality objectives. It established that the changes to the objectives alone did not necessitate any additional emissions sources in the District being progressed through to the Second or Third Stage of the review and assessment process. There were, however, some additional sources reviewed in the Second Stage Report, in light of the alterations to the *Review and Assessment: pollutant specific guidance - LAQM.TG4(00)* (DETR 2000). These can be seen for each of the pollutants considered in the Second Stage Review and Assessment Report.

The summary and recommendations from the Suffolk Coastal First Stage Review and Assessment Report demonstrated that the risk of exceedance of the air quality objectives for benzene and 1,3-butadiene is negligible and, therefore, the objectives will be met by the relevant target dates. Further review and assessment of these pollutants will not be necessary at the present time. The First Stage Review and Assessment demonstrated, however, that there is a significant risk that air quality objectives for Lead, Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}) would not be met at locations within the Suffolk Coastal District by the relevant target dates. For the stated emission sources of these pollutants, a Second Stage review and assessment is necessary to determine the risk of exceedance more precisely.

The summary and recommendations from the Suffolk Coastal Second Stage Review and Assessment Report demonstrated that the risk of exceedance of the air quality objectives for Lead and Carbon Monoxide is negligible and, therefore, the objectives will be met by the relevant target dates. Further review and assessment of these pollutants will not necessary at the present time. The Second Stage Review and Assessment has demonstrated, however, that there is a significant risk that air quality objectives for Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}) would not be met at locations within the Suffolk Coastal District by the relevant target dates. For the stated emission sources of these pollutants, continued Second Stage Review and Assessment (where applicable), and Third Stage review and assessment is necessary to determine the risk of exceedance more precisely. A list of each emission source to be reviewed can be seen overleaf.

Nitrogen Dioxide (NO_2)

- Traffic using the A14 trunk road.

- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton, due to planned developments at the former RAF Bentwaters air-base, Rendlesham, and St Audry's, Melton. This is to include elevated levels of NO_2 seen from the current monitoring site at the Melton crossroads.

- Emissions from traffic monitored at High Road West, Felixstowe and Lime Kiln Quay Road/Thoroughfare/St John's Street junction, Woodbridge using NO_2 diffusion tubes.

Sulphur Dioxide (SO_2)

- Shipping at the Port of Felixstowe.

Particulate Matter (PM_{10})

- Shipping at the Port of Felixstowe.

- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton due to planned developments at the former RAF Bentwaters air-base, Rendlesham and St Audry's, Melton.

- Emissions from traffic at High Road West, Felixstowe, and Lime Kiln Quay Road/Thoroughfare/St John's Street junction, Woodbridge.

- The emission 'Footprint' of White Mountain Roadstone Limited, traffic using the A12 and uncontrolled and fugitive emissions from Foxhall Four Quarry and Foxhall Landfill Site at Brightwell, Suffolk.

- The emission 'Footprint' of Roadworks (1952) Limited and Sinks Pit Quarry, Kesgrave, Suffolk.

The aim of this Third Stage Review and Assessment Report is to provide continued Second Stage screening (where applicable) and, where necessary, detailed and robust Third Stage review and assessment of these pollutants and emission sources. The Third Stage includes sophisticated modelling and monitoring tools and ensures that any assumptions within the process are considered in-depth and that the data collected and used is quality-assured to a high standard.

External expertise, in the form of the consultancy firm **Entec UK Limited**, has been employed to undertake a number of continued Second Stage, and all Third Stage review and assessments in this report. Where Entec UK Limited have undertaken the review and assessment for a particular emission source it has been stated in the relevant section of this report.

The report prepared by Entec UK Limited, detailing all of their investigations and findings, should be read in conjunction with this report, and is attached as Appendix G.

2. Continued Second Stage and Third Stage Review And Assessment Methodology

The methodology used in the compilation of this report is in accordance with the DETR's review and assessment Technical Guidance, specifically the *Review and Assessment: pollutant specific guidance - LAQM.TG4(00)* (DETR 2000) hereafter referred to as LAQM.TG4(00), which replaces the *Review and Assessment: pollutant specific guidance - LAQM.TG4(98)* (DETR 1998) hereafter referred to as LAQM.TG4(98).

This report covers both continued Second Stage and Third Stage review and assessment where applicable. The review and assessment process requires the local authority to estimate pollutant concentrations in a future year. In order to carry out such predictions, it is necessary to consider the sources which release the pollutant, how these emissions will change in future years and how these emissions are dispersed in the atmosphere. For some pollutants, such as NO_2 and PM_{10}, it is also necessary to consider the complex chemical transformation reactions which occur. All of these processes are subject to a degree of uncertainty which must be borne in mind. Whilst it is not possible to accurately quantify the overall level of uncertainty, it is recommended that authorities modify their approach at different stages in the review and assessment process in order to reflect the requirement for an increasing level of confidence for the predicted impacts.

For the purpose of review and assessment, authorities are required to focus their work upon locations where members of the public are regularly present and likely to be exposed over the averaging period of the objective. This should include locations where likely future developments may affect exposure to existing sources of air pollution or may result in new sources. The following approach is suggested in LAQM.TG4(00) to define relevant locations for review and assessment:

- For the annual mean objectives (for NO_2 and PM_{10}) the review and assessment should focus upon all background locations where members of the public might regularly be exposed, and building facades of residential properties, schools, hospitals, libraries, etc;

- For the 24-hour mean and 8-hour mean objectives (for PM_{10} and SO_2) the review and assessment should focus upon all locations where the annual mean objective applies and also gardens of residential properties;

- For the 1-hour mean objectives (for NO_2 and SO_2) the review and assessment should focus upon all locations where the annual mean, 24-hour and 8-hour objectives apply, and also kerbside sites (i.e. -pavements of busy shopping streets) parts of car parks and railway stations, etc, which are not fully enclosed, and any outdoor locations to which the public might reasonably be expected to have access.

- For the 15-minute mean objective (for SO_2) the review and assessment should focus upon all locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.

Authorities should not consider exceedances of the objectives at any location where public exposure over the relevant averaging period would not be realistic.

For the **Second Stage review and assessment** paragraph 1.12 of LAQM.TG4(00) advises that; "… the Second Stage review and assessment is only intended to provide additional screening of pollutant concentrations in the area. It is not intended that it should provide accurate predictions of existing or future air quality across the whole of the authority's area.

Rather, authorities should focus upon those locations where the maximum impact is expected to occur, bearing in mind the potential for public exposure. If this Second Stage screening indicates that there is a risk that an air quality objective may not be met by the relevant future year, then the authority will need to undertake a Third Stage review and assessment"

For Second Stage review and assessment, it is recommended that a conservative approach is taken towards the assumptions that are used. This will tend to over-estimate the predicted concentrations such that, despite the degree of uncertainty that might be expected, the authority can be reasonably confident that it has identified all areas at risk of exceeding the air quality objectives.

LAQM.TG4(00) advises two alternative approaches to the Second Stage Review and Assessment, one based on monitoring data and the other based on screening models. This report has mainly focused on the latter. The general approach adopted in this report is that of a precautionary approach, as required in the above guidance.

The following Second Stage methodology was used in this report;

1. The revised Highways Agency's Design Manual for Roads and Bridges (DMRB) model (in accordance with LAQM.TG4(00)) to assess emission sources from road transport. DMRB model details can be seen later in this Chapter. The model was run using a computer spreadsheet produced by Stanger Science and Environment for calculating the DMRB model predictions.

2. LAQM.TG4(00) guidance, most specifically for overlapping and fugitive pollutant sources.

For the **Third Stage review and assessment** paragraphs 1.13, 1.14 and 1.15 of LAQM.TG4(00) advise that; "… For the Third Stage review and assessment, the authority is expected to undertake a detailed and accurate appraisal of the potential impacts. This does not necessarily mean that expensive and/or sophisticated modelling and monitoring tools have to be used, but does require that the assumptions within the review and assessment process are considered in depth, and the data which are collected or used are quality-assured to a high standard. This is to ensure that authorities are confident in decisions that they reach at the conclusion of the Third Stage review and assessment … Failure to achieve an air quality objective by the relevant future year will be the crucial factor in the designation of an Air Quality Management Area (AQMA) … Within the Third Stage review and assessment local authorities should focus upon the **likelihood** of the air quality objectives being exceeded … The Third Stage review and assessment requires that the authority determines both the magnitude and the geographical extent of the likelihood of any exceedances of the objectives …"

LAQM.TG4(00) also advises that "… due to the potential wide variety of sources and local circumstances that may prevail, it is not possible to be prescriptive for the Third Stage review and assessment. For this reason, it is expected that authorities will make use of the Helpdesks during this stage of the review and assessment process … "

Although, as stated above, LAQM.TG4(00) cannot be prescriptive on methodology for Third Stage review and assessment it does advise that it is likely that a combination of complex modelling, increased specificity of data to input into models (i.e traffic flow data, vehicle speeds etc), and monitoring to validate any models used will be necessary.

The following Third Stage methodology was used in this report;

1. Increased specificity of traffic data for use in modelling. This includes updated traffic flow data, actual junction counts (where necessary), increased accuracy of Heavy Goods Vehicle and traffic speed data, and increased accuracy of future traffic predictions.

2. Modelling of emissions from road traffic using the air dispersion model 'BREEZE ROADS', details later in this Chapter.

3. Monitoring of Oxides of Nitrogen (NO_x) for the review and assessment NO_2 using an API 200A NO_x analyser (chemiluminescent techniques), detailed later in this Chapter. This monitoring was undertaken in order to validate the BREEZE ROADS modelling undertaken.

The guidance given in LAQM.TG4(00) and used in this report is summarised in the review and assessment of each pollutant. A brief outline of the DMRB methodology, BREEZE ROADS model, and the NO_x/NO_2 monitoring equipment used is given below.

2.1 Design Manual for Roads and Bridges Methodology

The Design Manual for Roads and Bridges (DMRB), hereafter referred to as DMRB, includes a simple methodology for estimating the concentrations of air pollutants in the vicinity of roads. This methodology has been used for many years as a screening tool, primarily in support of assessments of new road building projects. The methodology is attractive as it implicitly includes the change in vehicle technologies year by year. It consists of a number of tables which allow the user to input vehicle flows of heavy and light vehicles, vehicle speeds and the year under consideration. A series of look-up tables are used to correct for vehicle speed, the year and the proportion of Heavy Duty Vehicles, to provide estimates of concentrations up to 200m from a road (beyond which it is presumed that the road traffic has no impact on ambient concentrations). A suitable version of the DMRB model in spreadsheet form has been developed by Stanger Science and Environment on behalf of the DETR. This spreadsheet is available on the internet and has been used in the preparation of this report. The internet site is http://www.stanger.co.uk/airqual/modelhlp

The DMRB requires input data on annual average daily traffic flows (AADT), annual average speeds and the fraction of Heavy Duty Vehicles (N.B data provided by Suffolk County Council refers to Heavy Goods Vehicles – HGVs). This information can be obtained from Suffolk County Council Environment and Transport Department, incorporating projections for future years based on National Road Traffic Forecasts (NRTF).

The DMRB also requires information on the distance of the receptor location from the road of concern. The nearest relevant receptor locations (as defined earlier in this Chapter) were, therefore, identified for each section of road considered as part of this review and assessment. Details of these receptor locations are given in the review and assessment of each pollutant.

The DMRB can provide default values for the background pollutant concentration, but guidance in LAQM.TG4(00) recommends that values from pollution climate mapping or actual monitoring data (diffusion tube data in the case of Suffolk Coastal District Council) are used in preference. Diffusion tubes can produce data which is equivalent to continuous reference methods and is useful for monitoring general trends over a number of years. However, the accuracy of the diffusion tube method is questionable; laboratories within the United Kingdom have been shown to systematically under or over-read diffusion tube concentrations by up to 30%. For this reason, **background** concentrations used in the review

and assessment of nitrogen dioxide have been obtained from the National Air Quality Archive. Background values for other pollutants have also been obtained from the Archive. This archive of information has been prepared for the United Kingdom by the National Environmental Technology Centre (NETCEN) and may be viewed on the internet (at http://www.aeat.co.uk/netcen/airqual). The information is in the form of a series of interactive maps which allow the user to identify local authority boundaries and to select a particular area of interest in order to get the estimated concentration for individual 1 km x 1 km grid squares.

For each pollutant, the annual mean background estimates have been combined with the annual mean roadside predictions from the DMRB to derive the final estimated concentration. This is then compared with the relevant air quality objective.

2.2 BREEZE ROADS Air Dispersion Modelling

BREEZE ROADS is a more complex, air dispersion model designed to predict air quality impacts of Carbon Monoxide (CO), Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) from moving and idling traffic at or alongside roads and road junctions. This model has been used in the Third Stage review and assessment to predict NO_2 concentrations at receptor locations for specified roads and junctions within the Suffolk Coastal District to determine whether the objective is likely to be exceeded in 2005.

The model itself incorporates enhanced versions of previously released models;

CALQHC … a roadway model designed to predict air pollutant concentrations near highways and arterial streets due to emissions from traffic operating under free-flow conditions and when idling
CALQHCR … an enhanced version of CALQHC, this model can process a year of hourly meteorological data, vehicular emissions and traffic volume in one model run.
CALINE4 … includes similar model theory as in CALQHC, but has an advanced method for calculating NO_2 concentrations.

2.3 Monitoring Equipment for Nitrogen Dioxide (NO_2)

Monitoring for concentrations of NO_x was undertaken for a three month period at a relevant receptor location for the A14 trunk road to provide validation data for the BREEZE ROADS modelling undertaken within the Suffolk Coastal District.

The equipment used was an API 200A NO_x analyser (chemiluminescent techniques). This is the same instrumentation used in the DETR Urban Rural Network which monitors NO_2 levels at sites throughout the United Kingdom.

The meter is a continuous analyser that uses a data logger to record the 15-minute and hourly average NO_x concentrations at the site, for use in comparison with the objectives. The chemiluminescent methodology is based on the luminescence from an activated NO_2 species produced in the meter. A volume of air is drawn into an evacuated chamber. Nitrogen Oxide (NO) within the sample then reacts with ozone (O_3) present in the chamber to produce an activated molecular NO_2 species. The radiation given off by this reaction in the form of luminescence is then measured and the concentration of NO_x within the sample recorded.

3. Review and Assessment of Nitrogen Dioxide (NO_2)

3.1 Background

Nitrogen Dioxide (NO_2) is a gas produced by the reaction of Nitrogen and Oxygen in combustion processes in air. Nitrogen Oxide (NO) is formed initially and this is subsequently oxidised to form NO_2. In the atmosphere NO and NO_2 are always found together and are collectively known as Oxides of Nitrogen (NO_x). The largest source is human combustion of fossil fuels, i.e. - petrol, oil, coal and gas.

NO_2 is an irritant known to have serious effects, such as severe lung damage if inhaled at high concentrations and sometimes death. NO_2 has also been demonstrated to have effects at lower levels found in the environment, it is a respiratory irritant, can exacerbate asthma and may increase susceptibility to infections.

3.2 Standards and Objectives

The National Air Quality Regulations 1997 set two provisional objectives for NO_2 to be achieved by 31 December 2005:

- An annual mean concentration of 40 $\mu g/m^3$
- A maximum 1-hour mean concentration of 286 $\mu g/m^3$

The Revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR 1999; 2000) includes changes to the maximum 1-hour concentration. These changes were based on limit values set in the Air Quality Daughter Directive which was agreed at Environment Council in June 1998 and both objectives are to be achieved by 31 December 2005:

- An annual mean concentration of 40 $\mu g/m^3$
- A 1-hour mean concentration of 200 $\mu g/m^3$ with a maximum of 18 exceedances in a year (approximately equivalent to the 99.8^{th} percentile of hourly means).

The new 1-hour objective is slightly more stringent than the original. Government-funded modelling studies suggest that, in general, achieving the annual mean concentration is more demanding than achieving the 1-hour mean. If the annual mean is achieved, the modelling suggests that the 1-hour objective will also be achieved.

The Government has recently agreed further reductions in industrial emissions as part of the EC Combustion Plant Directive and The National Emissions Ceiling Directive. More stringent control of vehicle emissions is also expected as part of the Auto-Oil programme. These will all serve to further reduce NO_x emissions by 2005. National studies have indicated that the annual mean objective is expected to be met at all urban background locations outside of London, but that the objective may be exceeded more widely at roadside sites near busy road links. LAQM TG4(00) suggests that, in general, only those local authorities with relevant locations in close proximity to busy roads are expected to proceed beyond the Second Stage Review and Assessment, although there are some areas with potentially significant industrial sources which will also need to be considered further.

3.3 Review and Assessment of NO_2

In Suffolk Coastal's Second Stage Review and Assessment Report (2000) the following sources of NO_2 were identified as warranting continued Second Stage investigation and then, if applicable, Third Stage review and assessment:

- Traffic using the A14 trunk road;
- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton, due to planned developments at the former RAF Bentwaters air-base, Rendlesham, and St Audry's, Melton. This is to include elevated levels of NO_2 seen from the current monitoring site at the Melton crossroads;
- Emissions from traffic monitored at High Road West, Felixstowe using NO_2 diffusion tubes.
- Emissions from traffic monitored at Lime Kiln Quay Road / Thoroughfare / St John's Street junction, Woodbridge using NO_2 diffusion tubes.

3.4 Third Stage Review and Assessment of NO_2 levels from traffic using the A14 trunk road within Suffolk Coastal.

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation, in the form of Third Stage review and assessment, would be necessary to determine whether NO_2 emissions from traffic using the A14 trunk road would cause an exceedance of the objectives by the end of 2005.

External expertise, in the form of Entec UK Limited, was employed to undertake the Third Stage review and assessment. The investigation included detailed computer modelling of road traffic emissions along the A14 using the BREEZE Roads model, together with three months of continuous NO_2 monitoring at a relevant receptor location to the A14 to validate the modelling results.

Traffic flow information was provided by Suffolk County Council, Environment and Transport Department to input into the BREEZE Roads model and is summarised in Appendix C.

Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G.

The findings of Entec UK Limited are as follows;

> "The maximum predicted ground level annual average NO_2 concentration at a residential property is 35.2 $\mu g/m^3$ in 2005. Systematic errors of the model have been compensated for, by comparing modelled concentrations against continuous monitoring adjacent to the A14. Exceedance of the annual mean NO_2 objective of 40$\mu g/m^3$ in 2005 is unlikely. "

The predictions from the BREEZE Roads modelling undertaken by ENTEC UK Limited show that the annual mean NO_2 objective is not likely to be exceeded at receptor locations on the A14 by the end of 2005. **Therefore further review and assessment <u>will not</u> be necessary for NO_2.**

3.5 Continued Second Stage Review and Assessment of recorded NO_2 levels and emissions from traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton.

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation, in the form of continued Second Stage review and assessment, would be necessary for the A1152 including specifically the intersection of the A1152 and B1438 at Melton (hereafter referred to in this report as the Melton crossroads). The A1152 and the Melton crossroads do not currently have an Annual Average Daily Traffic flow (AADT) in exceedance of 20,000 vehicles, which is the criterion needed for a First Stage review and assessment. Planned future developments, however, at the former RAF Bentwaters air-base, Rendlesham and at the St Audrys Hospital site, Melton may mean that the AADT exceeds 20,000 vehicles by the objective date, the end of 2005. We have also been made aware of a third development at Sutton Hoo which will increase the amount of traffic using the A1152 and Melton crossroads. Traffic details from this development will, therefore, also be included in this review and assessment.

At the time of the Second Stage Review and Assessment Report (2000) it was not possible to obtain sufficient traffic flow data necessary to run the DMRB computer model required by LAQM.TG4(00) for the A1152 and the Melton crossroads. Consequently, continued Second Stage review and assessment was necessary in order to achieve this.

In addition, in the Second Stage Review and Assessment Report (2000), the revised Government guidance, LAQM.TG4(00), provided a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site in the centre of the Melton crossroads since 1999, see Appendix A for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), annual average levels of NO_2 (measured by diffusion tubes) from 1996 onwards were predicted forward to the year 2005 to assess whether there would be the possibility of exceeding the objective (see Table 2). At the Melton crossroads site, however, the diffusion tubes had only been in place since December 1999 and, therefore, only 6 months of data for the year 2000 was available to provide an annual average figure for use in the Second Stage review and assessment. Projection forward of the annual average for the kerbside site at that time indicated an exceedance of the objective in 2005, see Table 2 below.

Table 2 Summary table of the annual average NO_2 concentration, from diffusion tube monitoring data, for the kerbside site at Melton crossroads, Melton during 2000 and projection of these concentrations forward to the year 2005 (full data set in Appendix A)

Year Monitoring Undertaken	Monitored Concentration ($\mu g/m^3$)	Projected Concentration for 2005 ($\mu g/m^3$)
2000 (incomplete data set used in Second Stage Report)	49.60	**43.54**
2000 (full data set)	49.55	**43.49**

The full data set and annual average NO_2 level for 2000 is now available for the Melton crossroads site, see Appendix A, and has been predicted forward to the year 2005, see Table 2. **Projection forward of the complete 2000 NO_2 kerbside data for the Melton crossroads continues to indicate an exceedance of the objective in 2005.** This trend of elevated NO_2 levels is also continuing in the 2001 data recorded to date by the diffusion tubes, see Appendix A.

It must, however, be stated that the kerbside tube at the Melton crossroads is sited on one of the island crossings in the centre of the road, and not directly on a building or boundary façade (which would be the receptor location). For this reason in January 2001 an additional diffusion tube site has been placed approximately 1 metre from the kerbside, which is more representative of the receptor locations, see Appendix A. To date the results from this site are marginally higher than the original site in the centre of the junction. Results from our original site are, therefore, at the present time comparable to levels which would be seen at receptor locations.

The spreadsheet produced by Stanger Science and Environment for calculating the DMRB model output was, therefore, run for all sections of the A1152 from the Woods Lane roundabout at Melton through to the Bentwaters roundabout at Rendlesham. This specifically includes the Melton crossroads. For the purposes of the calculation, the A1152 was divided into sections dependant on differences in traffic flows, speeds or percentage of Heavy Goods Vehicles (see Appendix D). The DMRB model estimates the annual mean NO_2 contribution from traffic using sections of the A1152 at the end of 2005, and produces an estimate of the total annual average NO_2 concentration at the specified location. This consists of the estimated annual mean background NO_x level (derived from the National Air Quality Archive) plus the contribution of annual mean NO_x from the road traffic. These levels of NO_x are then automatically calculated into annual mean NO_2 levels by the spreadsheet. DMRB model details can be seen in Chapter 2 of this report.

Traffic information for each section of the A1152 was obtained from Suffolk County Council, Environment and Transport Department and can be seen in Appendix D. To obtain the traffic information for the Melton crossroads a 1-day, 12-hour manual traffic count was undertaken at the crossroads during October 2000. This manual count enabled the recording of total traffic counts for each leg of the junction and also the direction in which each vehicle moved. A summary of the traffic count results can be seen in Appendix D.

In order to produce an Annual Average Daily Traffic flow (AADT) from the traffic count it was necessary to factor up the 12-hour count to a 24-hour count. The manual count was undertaken from 07:00 to 19:00 hours, which covers the hours of high traffic flow. Suffolk County Council provided a factor to take the traffic data up to a 24-hour count. This factor was calculated from 7-day, 24-hour automatic traffic counts undertaken on both the Woods Lane leg and the Wilford Bridge leg of the crossroads during March 2001. The factor was calculated as an average of the two sets of data and Suffolk County Council stated that the time difference between our traffic count and the 24-hour counts is not of concern. A summary of calculations can be seen in Appendix D.

The AADT from the counts undertaken in 2000 and 2001 was then predicted forward using general traffic growth factors to the year 2005 by Suffolk County Council. These figures can be seen in the calculation summary in Appendix D.

In addition to general traffic growth, the A1152 and specifically the Melton crossroads will have future traffic increases from three developments with detailed planning consent in this area. These are;

St. Audry's development, Melton - this is a part conversion and part redevelopment of the former St Audry's hospital site. It will include both domestic dwellings and business, commercial and social uses. There is a total of 243 dwellings and 5 commercial/sports and social applications with detailed planning consent at the site. Further details regarding the nature of the commercial/sports and social applications can be seen in Appendix D.

Sutton Hoo development, Sutton - this development is being undertaken by The National Trust in order to open up a site of archaeological importance to the public. It will include a visitors centre, a residential conference and study centre, a viewing platform to see the burial mounds and associated car parking and residential facilities.

Rendlesham Enterprise Park and New Rendlesham - this is the redevelopment of the former RAF Bentwaters air-base at Rendlesham. This is a very large planning application which has permission granted for development up to the year 2010. It consists of an application for 1200 houses which constitute 'New Rendlesham', 600 of which are already on site, and an application for commercial use which constitutes 'Rendlesham Enterprise Park'.

Traffic predictions have been obtained for the majority of the St Audry's and the Sutton Hoo development, both of which will be in use by the end of 2005, see Appendix D for details. In the case of Rendlesham Enterprise Park and New Rendlesham, however, the planning permission for development of the site runs until 2010, and it is not possible to predict interim growth rates for the development. LAQM.TG4(00) states that local authorities must predict whether NO_2 objectives will be exceeded by traffic using the A1152 and Melton crossroads by the end of the year 2005. There is currently no way to predict how much of the Rendlesham site will be in use by 2005 and, therefore, how much additional traffic it will add to the A1152 and Melton crossroads. For this reason it has been decided that traffic increases from the Rendlesham development will not be included in this review and assessment report. To assess future NO_2 levels on the A1152 and Melton crossroads it will be necessary to ascertain actual traffic increases. In order to do this it has been decided that traffic counts will be taken yearly up to 2005 on this road. Each year the figures will be used to run the Second Stage review and assessment DMRB model and a Third Stage review and assessment model, where necessary, in order to continually assess the A1152 and Melton crossroads with respect to Local Air Quality Management and any new guidance issued.

Traffic predictions for the St Audry's development were difficult to make as some of the development was already in place at the time of our traffic count in October 2000 and would therefore have already been included. The total number of dwellings built and in use by October 2000 was provided by Suffolk Coastal Planning and Leisure, Development and Policy section and deducted from the 243 applied for. Traffic generated from the remaining houses not in use was then calculated, a summary of calculations and assumptions can be seen in Appendix D. Site knowledge from the Suffolk Coastal Planning and Leisure Department was used to determine which of the commercial/sports and social uses, if any, were in use in October 2000 and should not be added to our future traffic increases. The percentage of traffic from the St Audrys development which will use each section of the A1152 and Melton crossroads was then estimated, see diagrams in Appendix D. The worst case scenario was taken at all times and details of calculations and assumptions can be seen in Appendix D. These figures were then used to calculate the AADT for each section of the A1152 and Melton crossroads.

Traffic predictions for the Sutton Hoo development were obtained from Suffolk County Council Highways Agency in the original Planning Application of January 1996 and can be

seen in Appendix D. All predictions will be added to the October 2000 traffic count as the development was not in place at that time. The percentage of traffic from the Sutton Hoo development which will use each section of the A1152 and Melton crossroads was then estimated, see diagrams in Appendix D. The worst case scenario was taken at all times and details of calculations and assumptions can be seen in Appendix D. These figures were then used to calculate the AADT for each section of the A1152 and Melton crossroads.

Suffolk County Council provided information regarding the percentage of Heavy Goods Vehicles (HGVs) using each section of the A1152 and Melton crossroads from traffic counts undertaken at a number of points on the A1152, see Appendix D.

Average traffic speeds for the A1152 have been calculated from the National Speed Limit, which is 30 mph (48 km/hr) on all sections which have been assessed. The traffic speed at the Melton crossroads has been lowered to 15 mph (24 km/hr) due to the junction being characterised by periods of standing traffic.

The nearest receptor location was identified for each section of the A1152 (as defined in DMRB in Chapter 2 of this report). It was decided, in the case of the Melton crossroads, that the model would be run for the closest receptor on each of the four corners of the junction. To model the worst case scenario DMRB was run at all locations for the garden, if an exceedance of the annual mean objective was noted and the house façade itself was farther from the road then DMRB was additionally run for this also.

A summary of the results can be seen in Table 3, input data is summarised in Appendix D.

In accordance with the guidance in LAQM.TG4(00), it may be assumed, as a worst case scenario, that the 99.8^{th} percentile of 1-hour mean NO_2 concentrations will not exceed five times the predicted annual mean at background sites (those beyond 30m from the kerbside), and 3.5 times the predicted annual mean at roadside/kerbside sites (those within 30m of the kerbside). These calculations for each receptor location can also be seen in Table 3.

The results from the DMRB spreadsheet in Table 3 above were compared to the relevant air quality objectives for NO_2 as specified in Table 1 in the first chapter of this report. For receptors close to the façade of a building, the relevant objective is the annual mean of $40\mu g/m^3$. For receptors in outdoor locations where short-term exposures are likely, the relevant objective is the 1-hour mean of 200 $\mu g/m^3$, not to be exceeded more than 18 times per year.

Guidance in LAQM.TG4(00) advises that where there is an exceedance of the annual mean NO_2 objective, there will also be a risk that the 1-hour mean NO_2 objective will be exceeded and, in such scenarios, the local authority should proceed to a Third Stage review and assessment for both objectives.

Table 3 A1152 and Melton crossroads - Projected annual mean and 1-hour mean NO_2 concentrations for 2005 derived from DMRB (for details see Appendix D).

Road segment reference (refer to Appendix C for traffic data for each 'link' of road)	**Receptor description** (distance to receptor from centre of road)	DMRB **Annual mean NO_2** calculation (estimated background level # + traffic contribution) ($\mu g/m^3$)	Conversion to **99.8th percentile of 1-hour mean NO_2** using x3.5 (kerbside) multiplications of annual mean from LAQM.TG4(00) ($\mu g/m^3$)	Progression to Stage 3 **YES/NO**
A1152 (Link 1) from **Woods lane roundabout, Woodbridge to Melton crossroads**, Melton (average speed of 30 mph)	Façade of nearest garden, Melton (5m)	25.21	88.24	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 1** – corner of The Street and Wilford Bridge Road (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7.6m, B1438 = 4.2m)	40.17	140.60	**NO** (only 1-hour objective applies for garden)
A1152 & B1438 (Link 2) **Melton crossroads receptor 1** – corner of The Street and Wilford Bridge Road (average speed of 15 mph)	Façade of nearest house, Melton (A1152 = 12.5m, B1438 = 6.8m)	39.67	138.85	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 2** – corner of Wilford Bridge Road and Melton Road (average speed of 15 mph)	Façade of nearest garden (boundary), Melton (A1152 = 12.9m, B1438 = 7m)	39.60	138.60	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 3** – corner of Melton Road and Woods Lane (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7m, B1438 = 7m)	37.95	132.83	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 4** – corner of Woods Lane and The Street (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7.5m, B1438 = 6.8m)	37.96	132.86	**NO**
A1152 (Link 3) **Melton crossroads to Wilford Bridge roundabout** (average speed of 30mph)	Façade of nearest garden, Melton (4.3m)	28.12	98.42	**NO**
A1152 (Link 4) **Wilford Bridge roundabout to B1084 junction** (average speed of 30mph)	Façade of nearest garden, Bromeswell (5.7m)	20.20	70.70	**NO**
A1152 (Link 5) **B1084 junction to Bentwaters roundabout, Rendlesham** (average speed of 30mph)	Façade of nearest garden, Eyke (4.5m)	20.63	72.21	**NO**

taken from the National Air Quality Archive

The predictions in Table 3 show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is only likely to be exceeded for the garden of receptor location 1 on the Melton crossroads. When modelling a garden LAQM.TG4(00) advises that the annual mean objective does not apply, instead the 99.8th percentile of 1-hour mean NO_2 is applicable. For this receptor location the 99.8th percentile of 1-hour mean NO_2 calculated is below the objective level of 200 $\mu g/m^3$ and therefore it is not likely to be exceeded. The predictions of the annual mean NO_2 concentration at the house of receptor location 1 on the Melton crossroads are below the objective of 40 $\mu g/m^3$ and, therefore, the objective is not likely to be exceeded.

Therefore, the predictions in Table 3 show that the annual mean and 99.8th percentile of 1-hour mean NO_2 objectives are <u>not likely</u> to be exceeded at relevant receptor locations on the A1152 or Melton crossroads at the end of 2005.

LAQM.TG4(00) advises, from these results, that further review and assessment will not be necessary. However, the high annual average NO_2 readings seen for the kerbside diffusion tube site at the Melton crossroads in 2000 are continuing to be shown in the 2001 levels measured to date (see Appendix A). **It was, therefore, decided that further review and assessment for the Melton crossroads only would be necessary.** This will be in the form of Third Stage computer modelling, together with an analysis of diffusion tube accuracy. The Third Stage review and assessment of the Melton crossroads is covered in the next section of this report.

3.6 Third Stage Review and Assessment of recorded NO_2 levels and emissions from traffic using the crossroads of the A1152 and B1438 at Melton (the Melton crossroads).

The continued Second Stage review and assessment, undertaken in section 3.5 above, of emissions of NO_2 from traffic using the Melton crossroads concluded that further Third Stage review and assessment was necessary.

External expertise, in the form of Entec UK Limited, was employed to undertake the Third Stage review and assessment. The investigation comprised of detailed computer modelling of road traffic emissions of NO2 at the Melton crossroads using the BREEZE Roads model. The model was validated using diffusion tube results.

Traffic flow information from the Second Stage DMRB modelling in Section 3.5 of this report was used to run the BREEZE Roads model and is summarised in Appendix D.

Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G.

The findings of Entec UK Limited are as follows;

> "The maximum predicted ground level annual average NO_2 concentration at a residential property is 39.2 $\mu g/m^3$ in 2005.
>
> Systematic errors of the model have been compensated for, by comparing modelled concentrations against diffusion tube monitoring in Woodbridge and Melton.
>
> Although exceedances of the annual NO_2 objective of 40 $\mu g/m^3$ in 2005 are not shown, due to proximity of the modelled values to the objective concentration, an exceedance cannot be ruled out. It is recommended that the 36 $\mu g/m^3$ contour line should be used to assist in defining the extent of an AQMA."

The predictions from the BREEZE Roads modelling undertaken by Entec UK Limited, therefore, show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded at relevant receptor locations on the Melton crossroads by the end of 2005. However, due to systematic errors in the model they advise that the 36 $\mu g/m^3$ contour line be used as an indicator for likely exceedances.

Modelled predictions at a residential property of 39.2 $\mu g/m^3$ in 2005 are higher than 36 $\mu g/m^3$ and there is, therefore, the possibility of an exceedance of the standards for NO_2 in 2005.

We accept the findings of Entec UK Limited to consider the designation of an Air Quality Management Area (AQMA) on the 36 $\mu g/m^3$ contour line due to the errors involved in modelled predictions.

It is to be noted that the BREEZE Roads model was validated using diffusion tube data collected at sites in Woodbridge and Melton. The diffusion tube methodology has, however, inherent inaccuracies which are discussed in Chapter 3 of the Road Traffic Report produced by Entec UK Limited (Appendix G).

In considering the designation of an AQMA at the Melton crossroads further investigation will be undertaken to include assessment of diffusion tube accuracy, upon which the model validation was based. This will include further and more accurate modelling undertaken at the Melton crossroads.

In addition, a continuous monitoring program will be set up at the Melton crossroads to measure NO_2 concentrations at a relevant receptor location, and further traffic flow information will be collected for the junction in order that we can continue to assess NO_2 levels over time.

3.7 Continued Second Stage Review and Assessment of recorded NO_2 levels and emissions from traffic using High Road West, Felixstowe

The Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for High Road West Felixstowe. This road was not considered in the First Stage Report as it did not have either a predicted Annual Average Daily Traffic Flow (AADTF) in exceedance of 20,000 vehicles by 2005, or any recorded annual average diffusion tube levels over 30 ppb (57.3 $\mu g/m^3$), which was the Government Guidance at that time, LAQM.TG4(98). The junction was, however, highlighted in the Second Stage Report in light of the revised Government Guidance LAQM.TG4(00). The new guidance provides a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site near the Police Station, High Road West, Felixstowe since 1993, see Appendix A for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), annual average levels of NO_2 (measured by diffusion tubes) from 1996 onwards were predicted forward to the year 2005 to assess whether there would be the possibility of exceeding the objective (see Table 4). Projection forward of the 1999 kerbside data indicates a marginal exceedance of the objective in 2005. Projection forward of the 2000 kerbside data at the time of our Second Stage report did not indicate an exceedance of the objective in 2005. At the time of the Second Stage Report data for the year 2000 was not complete and levels had only been recorded up to June.

The full data set and annual average NO_2 level for 2000 is now available, and has been predicted forward to the year 2005 (Table 4). **Projection forward of the complete 2000 kerbside data for this site does not indicate an exceedance of the objective in 2005.**

Table 4 Summary table of the annual average NO_2 concentration, from diffusion tube monitoring data, for the kerbside site at High Road West, Felixstowe from 1996 to 2000 and projection of these concentrations forward to the year 2005 (full data set in Appendix A)

Year Monitoring Undertaken	Monitored Concentration ($\mu g/m^3$)	Projected Concentration for 2005 ($\mu g/m^3$)
1996	47.56	37.57
1997	28.12	22.90
1998	35.37	29.73
1999	47.06	**40.41**
2000 (incomplete data set used in Second Stage Report)	44.89	38.55
2000 (full data set)	44.35	38.93

To take a precautionary approach, it was decided to run the spreadsheet produced by Stanger Science and Environment, for calculating the DMRB model output, as specified in LAQM.TG4(00), to predict NO_2 emissions from traffic on this stretch of High Road West in 2005. This model estimates the annual mean NO_2 contribution from traffic using High Road West at the end of 2005, and produces an estimate of the total annual average NO_2 concentration at the specified location. This consists of the estimated annual mean background NO_x level (derived from the National Air Quality Archive) plus the contribution of annual mean NO_x from the road traffic. These levels of NO_x are then automatically calculated into annual mean NO_2 levels by the spreadsheet. Model details can be seen in Chapter 2 of this report.

To obtain the traffic information necessary to run the DMRB model, Suffolk Coastal District Council commissioned a 7-day, 24-hour, automatic traffic count in the vicinity of the Police Station, High Road West during November 2000. A summary of the traffic count results, together with the exact location of the count can be seen in Appendix E.

From this count the Annual Average Daily Traffic flow (AADT) was calculated for this section of High Road West.

Traffic data from the count undertaken in 2000 was then predicted forward to the year 2005 by Suffolk County Council, Environment and Transport Department, these figures can be seen in the summary in Appendix E.

The traffic count data produced the percentage of Heavy Goods Vehicles (HGVs) and average vehicle speeds for this section of High Road West for input into the DMRB spreadsheet model, see details in Appendix E.

The nearest relevant receptor location was identified for this section of High Road West (as defined in DMRB in Chapter 2 of this report), and data entered into the spreadsheet.

A summary of the results can be seen in Table 5, input data is summarised in Appendix E.

In accordance with the guidance in LAQM.TG4(00), it may be assumed, as a worst case scenario, that the 99.8th percentile of 1-hour mean NO_2 concentrations will not exceed five times the predicted annual mean at background sites (those beyond 30m from the kerbside), and 3.5 times the predicted annual mean at roadside/kerbside sites (those within 30m of the kerbside). These calculations for each receptor location can also be seen in Table 5.

Table 5 High Road West, Felixstowe – Predicted annual mean and 1-hour NO_2 concentrations for 2005 derived from DMRB (for details see Appendix E).

Receptor description (distance to receptor from centre of road)	DMRB **Annual mean NO_2** calculation (estimated background level # + traffic contribution)	Conversion to **99.8th percentile of 1-hour mean NO_2** using x3.5 (kerbside) multiplications of annual mean from LAQM.TG4(00)	Progression to **Stage 3**
Façade of nearest domestic garden (8.0 m)	21.47 μg/m^3	75.15 μg/m^3	**NO**

taken from the National Air Quality Archive

The results from the DMRB spreadsheet in Table 5 above were compared to the relevant air quality objectives for NO_2 as specified in Table 1 in the first chapter. For receptors close to the façade of a building, the relevant objective is the annual mean of 40 ug/m^3. For receptors in outdoor locations where short-term exposures are likely, the relevant objective is the 1-hour mean of 200 ug/m^3 , not to be exceeded more than 18 times per year.

Guidance in LAQM.TG4(00) advises that where there is an exceedance of the annual mean NO_2 objective, there will also be a risk that the 1-hour mean NO_2 objective will be exceeded and, in such scenarios, the local authority should proceed to a Third Stage review and assessment for both objectives.

The predictions in Table 5 show that the annual mean objective of 40 μg/m^3 is not likely to be exceeded at the nearest receptor location on this section of High Road West, Felixstowe at the end of 2005.
Both the year 2000 diffusion tube data calculations and the DMRB predictions show that the annual mean NO_2 objective (and therefore also the 1-hour NO_2 objective) is not likely to be exceeded at the end of 2005 on this section of High Road West, Felixstowe. **Therefore, further review and assessment <u>will not</u> be necessary**.

3.8 Continued Second Stage Review and Assessment of recorded NO_2 levels and emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge

The Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge. This junction was not considered in the First Stage Report as it did not have either a predicted Annual Average Daily Traffic Flow (AADT) in exceedance of 20,000 vehicles by 2005, or any recorded annual average diffusion tube levels over 30 ppb (57.3 $\mu g/m^3$), which was the Government Guidance at that time, LAQM.TG4(98). The junction was, however, highlighted in the Second Stage Report in light of the revised Government Guidance LAQM.TG4(00). The new guidance provides a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction in Woodbridge since 1997 see Appendix F for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), annual average levels of NO_2 (from the diffusion tubes) from 1997 onwards were predicted forward to the year 2005 to assess whether there would be the possibility of exceeding the objective, see Table 6 below. Projection forward of 1999 and 2000 kerbside data indicates an exceedance of the objective in 2005. At the time of the Second Stage Report data for the year 2000 was not complete, levels had only been recorded to June 2000.

Table 6 Summary table of the annual average NO_2 concentration, from diffusion tube monitoring data, for the kerbside site at the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge from 1996 to 2000 and projection of these concentrations forward to the year 2005 (full data set in Appendix A)

Year Monitoring Undertaken	Monitored Concentration ($\mu g/m^3$)	Projected Concentration for 2005 ($\mu g/m^3$)
1997	22.69	18.48
1998	25.88	21.75
1999	47.85	**41.09**
2000 (incomplete data set used in Second Stage Report)	53.90	**46.28**
2000 (full data set)	52.12	**45.75**

The full data set and annual average NO_2 level for 2000 is now available, and has been predicted forward to the year 2005, see Table 6. **Projection forward of the complete 2000 kerbside data for this site continues to indicate an exceedance of the objective in 2005.**

At the time of the Second Stage review and assessment Suffolk County Council were unable to provide any traffic data for this junction. Consequently it was not possible to run the DMRB model to predict NO_2 emissions from traffic using this junction at the end of 2005, as specified in LAQM.TG4(00).

The DMRB model estimates the annual mean NO_2 contribution from traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction at the end of 2005, and produces an estimate of the total annual average NO_2 concentration at the specified location. This consists of the estimated annual mean background NO_x level (derived from the National Air Quality Archive) plus the contribution of annual mean NO_x from the road traffic. These levels of NO_x are then automatically calculated into annual mean NO_2 levels by the spreadsheet. Model details can be seen in Chapter 2 of this report.

To obtain the traffic information necessary to run the DMRB model, Suffolk Coastal District Council commissioned a 1-day, 12-hour manual traffic count at the junction during November 2000. This manual count has enabled us to record, in addition to total traffic counts, which direction each vehicle moved in. A summary of the traffic count results together with the exact location of the count can be seen in Appendix F.

In order to produce an Annual Average Daily Traffic flow (AADT) from the traffic count it was necessary to factor up the 12-hour count to a 24-hour count. The manual count was undertaken from 07:00 to 19:00 hours, which covers the hours of high traffic flow. Suffolk County Council provided us with a factor to take the traffic data up to a 24-hour count. This factor was calculated from a 5-day, 24-hour, automatic traffic count undertaken further along the B1438 at Lime Kiln Quay during the time of our manual count, a summary of calculations can be seen in Appendix F.

Traffic data from the count undertaken in 2000 was then predicted forward to the year 2005 by Suffolk County Council, Environment and Transport Department, these figures can be seen in the summary in Appendix F.

Suffolk County Council were able to provide details regarding the percentage of Heavy Goods Vehicles (HGVs) using the B1438 from their automatic count at Lime Kiln Quay, but were unable to provide average traffic speed figures for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction. As this junction is characterised by periods of standing traffic and consists of a sharp bend it was decided to run the DMRB model for two different speeds in order to try and represent the average speed (the requirement of the model). These were 10 mph (16 km/hr) and 15 mph (24 km/hr), see details in Appendix F.

The nearest relevant receptor location was identified for this junction (as defined in DMRB in Chapter 2 of this report) to run the model for. This was a property on the corner of Lime Kiln Quay Road and The Thoroughfare. It was also decided that the model would be run for the building upon which the diffusion tube site is currently located (since April 1999), as the annual average NO_2 levels recorded by the tubes predict an exceedance of the objective in 2005. This site was modelled using traffic data from the Melton Hill leg of the junction only as it is not on the actual junction itself, see Appendix E for details.

A summary of the results can be seen in Table 7 below, input data is summarised in Appendix E.

In accordance with the guidance in LAQM.TG4(00), it may be assumed, as a worst case scenario, that the 99.8th percentile of 1-hour mean NO_2 concentrations will not exceed five times the predicted annual mean at background sites (those beyond 30m from the kerbside), and 3.5 times the predicted annual mean at roadside/kerbside sites (those within 30m of the kerbside). These calculations for each receptor location can also be seen in Table 7.

Table 7 Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge – Predicted annual mean and 1-hour NO_2 concentrations for 2005 derived from DMRB (for details see Appendix E).

Receptor description (distance to receptor from centre of road)	DMRB **Annual mean NO_2** calculation (estimated background level # + traffic contribution)	Conversion to **99.8th percentile of 1-hour mean NO_2** using x3.5 (kerbside) multiplications of annual mean from LAQM.TG4(00)	Progression to **Stage 3**
Façade of nearest building / garden on **actual junction** (corner of Lime Kiln Quay Road/The Thoroughfare). Traffic speed of **15 mph**. (12.8 m)	26.28 μg/m^3	91.98 μg/m^3	**NO**
Façade of nearest building / garden on **actual junction** (corner of Lime Kiln Quay Road/The Thoroughfare). Traffic speed of **10 mph**. (12.8 m)	29.18 μg/m^3	102.13 μg/m^3	**NO**
Façade of nearest building / garden to **diffusion tube site** (The Thoroughfare near Sun Lane). Traffic speed of **15 mph**. (5.2 m)	25.58 μg/m^3	89.53 μg/m^3	**NO**
Façade of nearest building / garden to **diffusion tube site** (The Thoroughfare near Sun Lane). Traffic speed of **10 mph**. (5.2 m)	28.54 μg/m^3	99.89 μg/m^3	**NO**

taken from the National Air Quality Archive

The results from the DMRB spreadsheet in Table 7 above were compared to the relevant air quality objectives for NO_2 as specified in Table 1 in the first chapter. For receptors close to the façade of a building, the relevant objective is the annual mean of 40 $\mu g/m^3$. For receptors in outdoor locations where short-term exposures are likely, the relevant objective is the 1-hour mean of 200 $\mu g/m^3$, not to be exceeded more than 18 times per year.

Guidance in LAQM.TG4(00) advises that where there is an exceedance of the annual mean NO_2 objective, there will also be a risk that the 1-hour mean NO_2 objective will be exceeded and, in such scenarios, the local authority should proceed to a Third Stage review and assessment for both objectives.

The predictions in Table 7 show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded at the nearest receptor locations on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, or at the kerbside diffusion tube site on in Woodbridge at the end of 2005.

LAQM.TG4(00) advises, from these results, that further review and assessment will not be necessary. However, the high annual average NO_2 readings seen for the kerbside diffusion tube site at this junction in 1999 and 2000 are continuing to be shown in the 2001 levels measured to date (see Appendix A). **It was, therefore, decided that further review and assessment in the form of Third Stage computer modelling, together with an analysis of diffusion tube accuracy would be necessary.** The Third Stage review and assessment is covered next in the next section of the report.

3.9 Third Stage Review and Assessment of recorded NO_2 levels and emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge

The continued Second Stage review and assessment, undertaken in section 3.8 above, of emissions of NO_2 from traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge concluded that further Third Stage review and assessment was necessary.

External expertise, in the form of Entec UK Limited, was employed to undertake the Third Stage review and assessment. The investigation comprised of detailed computer modelling of road traffic emissions of NO_2 at the junction using the BREEZE Roads model. The model was validated using diffusion tube results.

Traffic flow information from the Second Stage DMRB modelling in Section 3.8 of this report was used to run the BREEZE Roads model and is summarised in Appendix F.

Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G.

The findings of Entec UK Limited are as follows;

> "The maximum predicted ground level annual average NO_2 concentration at a residential property is 38.0 $\mu g/m^3$ in 2005.
>
> Systematic errors of the model have been compensated for, by comparing modelled concentrations against diffusion tube monitoring in Woodbridge and Melton.

> Although exceedances of the annual NO_2 objective of 40 $\mu g/m^3$ in 2005 are not shown, due to the uncertainty surrounding modelled predictions an exceedance of the objective cannot be ruled out. It is recommended that the 36 $\mu g/m^3$ contour line should be used to assist in defining the extent of an AQMA."

The predictions from the BREEZE Roads modelling undertaken by Entec UK Limited, therefore, show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded at relevant receptor locations on the Woodbridge junction by the end of 2005. However, due to systematic errors in the model they advise that the 36 $\mu g/m^3$ contour line be used as an indicator for likely exceedances.

Modelled predictions at a residential property of 38 $\mu g/m^3$ in 2005 are higher than 36 $\mu g/m^3$ and there is, therefore, the possibility of an exceedance of the standards for NO_2 in 2005.

We accept the findings of Entec UK Limited to consider the designation of an Air Quality Management Area (AQMA) on the 36 $\mu g/m^3$ contour line due to the errors involved in modelled predictions.

It is to be noted that the BREEZE Roads model was validated using diffusion tube data collected at sites in Woodbridge and Melton. The diffusion tube methodology has, however, inherent inaccuracies which are discussed in Chapter 3 of the Road Traffic Report produced by Entec UK Limited (Appendix G).

In considering the designation of an AQMA at the Woodbridge junction further investigation will be undertaken to include assessment of diffusion tube accuracy, upon which the model validation was based. This will include further and more accurate modelling undertaken at the Woodbridge junction.

In addition, further traffic flow information will be collected for the junction in order that we can continue to assess NO_2 levels over time.

3.10 Conclusion

This continued Second Stage and Third Stage review and assessment has identified that, for the following NO_2 sources, the risk of the air quality objectives being exceeded at relevant locations in the Suffolk Coastal District is negligible and, therefore, **further review and assessment <u>will not</u> be necessary;**

- **Traffic using the A14 trunk road:**

- **Traffic using High Road West, Felixstowe.**

This continued Second Stage and Third Stage review and assessment has identified that, for the following NO_2 sources, **there is a risk that the air quality objectives may be exceeded at relevant locations in 2005;**

- **Emissions from traffic using the crossroads of the A1152 and B1438 at Melton (the Melton crossroads).** The predictions from the BREEZE Roads modelling show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded by the end of 2005. However, due to systematic errors in the model it is accepted that the 36 $\mu g/m^3$ contour line be used to consider the designation of an AQMA for the crossroads. This consideration will include assessment of the accuracy of diffusion tubes used, in order to undertake more

accurate modelling, together with a continuous monitoring program and further traffic flow assessments at the crossroads.

- **Emissions from traffic using the Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge.** The predictions from the BREEZE Roads modelling show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded by the end of 2005. However, due to systematic errors in the model it is accepted that the 36 $\mu g/m^3$ contour line be used to consider the designation of an AQMA for the crossroads. This consideration will include assessment of the accuracy of diffusion tubes used, in order to undertake more accurate modelling, together with further traffic flow assessments at the junction.

4. Review and Assessment of Sulphur Dioxide (SO_2)

4.1 Background

SO_2 at normal temperature and pressure is a gas. It is soluble in water to form an acidic solution, as found in acid rain. In the United Kingdom, the principle source of SO_2 is burning of sulphur-containing fuels, such as coal and oil.

SO_2 is a respiratory irritant when inhaled. Short-term, high level exposure causes irritation of the eyes, nose and throat and chemical injury of the airways leading to breathing difficulties. Longer-term lower level exposure can give chest tightness and narrowing of airways. It has been demonstrated that asthma sufferers may be susceptible to SO_2 and it can provoke asthma attacks.

4.2 Standards and Objectives

The National Air Quality Regulations 1997 set a 15-minute mean objective of 226 $\mu g/m^3$ to be achieved by 31 December 2005.

The Revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR 1999; 2000) retains the 15-minute mean, and additionally adopts two new standards based on limit values set in the Air Quality Daughter Directive, these are both to be achieved by 31 December 2004.

The three current SO_2 air quality objectives are:

- A 15-minute mean concentration of 226 $\mu g/m^3$ with a maximum of 35 exceedances in a year (approximately equivalent to the 99.9^{th} percentile) to be achieved by 31 December 2005;

- A 1-hour mean concentration of 350 $\mu g/m^3$ with a maximum of 24 exceedances in a year (approximately equivalent to the 99.7^{th} percentile) to be achieved by 31 December 2004;

- A 24-hour mean concentration of 125 $\mu g/m^3$ with a maximum of 3 exceedances in a year (approximately equivalent to the 99^{th} percentile) to be achieved by 31 December 2004.

Of the three objectives, the 15-minute mean is the most stringent. The Government anticipates that if the 15-minute mean is achieved, then the other two objectives will also be achieved.

LAQM.TG4(00) advises that the 15-minute objective is currently widely exceeded in the United Kingdom at both urban and rural sites. These exceedances are associated with emissions from both large and small combustion plants and domestic coal burning. Exceedances of the 1-hour and 24-hour objectives are confined to Belfast where there is still widespread domestic coal burning.

4.3 Review and Assessment of SO_2

In Suffolk Coastal's Second Stage Review and Assessment Report (2000) the following source of SO_2 was identified as warranting continued Second Stage investigation and then, if applicable, Third Stage review and assessment:

- Emissions of SO_2 from shipping at the Port of Felixstowe.

4.4 Continued Second Stage review and assessment of emissions from shipping at the Port of Felixstowe

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary to determine whether SO_2 emissions from shipping activities at the Port of Felixstowe would cause an exceedance of the objectives at the end of 2004/2005.

LAQM.TG4(00) identifies that at major ports, such as Felixstowe, SO_2 emissions from shipping movements have the potential to impact significantly where there is the potential for public exposure within close proximity (within about 500 metres). Felixstowe is regarded as one of the United Kingdom's major ports by virtue of the large volume of container freight that passes through it each year. In 1999, a total of 7,200 vessel movements were identified at the Port and it handled approximately 2.7 million shipping containers. (Information on vessel movements was obtained from the Greater London Authority who operate the DETR emissions helpline. Information on containers was obtained from Suffolk Coastal Port Health Department). A potential for public exposure exists at Felixstowe due to the location of a number of domestic properties within 500 metres of the docking area.

It was envisaged that a DETR funded research project involving modelling pollutant emissions from different vessel types would be able to provide the means to determine SO_2 emissions at the Port of Felixstowe and predict the likelihood of any future exceedances of the objectives. This research, however, has not been completed in time for this review and assessment report.

To assist in determining whether there may currently be elevated levels of SO_2 from shipping activities at the Port of Felixstowe, Suffolk Coastal District Council have been monitoring SO_2 levels using diffusion tubes at three sites in Felixstowe since September 2000. A complete year of data has not yet been obtained, but measurements to date give an indication of SO_2 levels at the three sites which can be compared. A summary of the annual average results can be seen in Table 8 below, full details including site descriptions can be seen in Appendix B.

The first monitoring site is located at a distance from the Port of Felixstowe docking area equivalent to the closest domestic properties (Carr Road site). The second site is located at the closest domestic properties to the sea-front, in direct line of the shipping lanes (Manor Terrace site). The third site is at a location away from the Port of Felixstowe and the sea-front (Brinkley Way site). Further details of all sites can be seen in Appendix B.

From Table 8 below it can be seen that levels near the Port of Felixstowe docking area (Carr Road) are elevated above those seen at the other sites, especially the background site (Brinkley Way). Similarly the levels recorded at the sea-front (Manor Terrace) are slightly elevated above the background location.

Although the annual average results are not directly comparable to the objectives the levels indicate that there is an elevation of SO_2 concentrations near to the Port of Felixstowe, and further investigation is necessary.

Table 8 Summary table showing annual average SO_2 concentrations recorded at 3 sites in Felixstowe during 2000 and 2001 (for details see Appendix B).

Site *	Year 2000 #	Year 2001 #
FLX 1 – Lampost at Carr Road, Felixstowe (near Port of Felixstowe)	17.3 $\mu g/m^3$	12.9 $\mu g/m^3$
FLX 2 – Lampost at Carr Road, Felixstowe (near Port of Felixstowe)	15.9 $\mu g/m^3$	11.8 $\mu g/m^3$
FLX 3 – Lampost at Manor Terrace, Felixstowe (on sea-front)	11.3 $\mu g/m^3$	9.4 $\mu g/m^3$
FLX 4 – Lampost at Manor Terrace, Felixstowe (on sea-front)	11.9 $\mu g/m^3$	9.2 $\mu g/m^3$
FLX 5 – Lampost at Brinkley Way, Felixstowe (Background site)	7.8 $\mu g/m^3$	6.3 $\mu g/m^3$
FLX 6 – Lampost at Brinkley Way, Felixstowe (Background site)	10.0 $\mu g/m^3$	7.1 $\mu g/m^3$

* Each site has two duplicate tubes located on the same lampost for increased accuracy of results.

Year 2000 annual average obtained using only 4 months of data (September to December 2000). Year 2001 annual average obtained using only 4 months of data (January to April 2001). Monitoring is still continuing at all sites.

External expertise, in the form of Entec UK Limited, has been employed to undertake continued Second Stage review and assessment on SO_2 emissions from shipping activities at the Port of Felixstowe. Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G. Entec have investigated shipping activities at the Port of Felixstowe and have researched other studies undertaken on emissions of SO_2 from shipping to determine their findings and any relevance to the Port of Felixstowe.

The findings of Entec UK Limited are as follows;

> "There has been no short term air quality monitoring data assessment of emissions from shipping at the Port of Felixstowe. Modelling of shipping emissions would be associated with a significant amount of uncertainty, particularly as the assessment is for short term peak SO_2 concentrations."
>
> "The proposed methodology for further review and assessment of SO_2 emissions from in-port shipping at the Port of Felixstowe is to set-up a minimum 6-month SO_2 monitoring programme. The proposed automatic SO_2 monitoring programme will be used to monitor short-term averaging periods relevant to the 15-minute, 1-hour and 24-hour SO_2 air quality objectives."

This continued Second Stage review and assessment has shown that there is the likelihood that SO_2 objectives in the vicinity of the Port of Felixstowe may be exceeded at the end of 2004/2005 due to emissions from shipping. **Therefore, further review and assessment will be necessary**.

This will be in the form of a Third Stage review and assessment, undertaking a minimum 6-month SO_2 monitoring programme to run for three summer and three winter months at a suitable relevant receptor location (as specified in LAQM.TG4(00)). The monitoring exercise will be started during 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Port of Felixstowe.

Whilst reviewing emissions from shipping activites at the Port of Felixstowe, Entec UK Limited have recommended that, due to the scale of operations at the Port of Felixstowe, emissions of NO_2 and PM_{10} from non-shipping sources should be looked at within the review and assessment process. This has not been high-lighted by LAQM.TG4(00), but will be examined during the next review and assessment process which must be completed by the end of the year 2003.

4.5 Conclusion

This continued Second Stage and Third Stage review and assessment has identified that there is a risk of the SO_2 air quality objectives being exceeded at relevant locations in the Suffolk Coastal District due to emissions from shipping at the Port of Felixstowe and**, therefore further review and assessment will be necessary.**

This will be in the form of a **Third Stage review and assessment**, undertaking a minimum 6-month SO_2 monitoring programme to run for three summer and three winter months at a suitable relevant receptor location (as specified in LAQM.TG4(00)). The monitoring exercise will be started during 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Port of Felixstowe.

5. Review and Assessment of Particulate Matter (PM_{10})

5.1 Background

Particulate Matter is comprised of a variety of constituents, dependant on the nature of the specific source. It is characterised and defined by the diameter of the particles produced. The particles of concern are those less than 10 μm in diameter and these are known as PM_{10}. Particulate Matter is comprised of three main sources:

- **Primary Particles**: these are emitted directly from combustion processes, such as road traffic and power generation. These particles are generally less than 2.5 μm and are often below 1 μm in diameter.

- **Secondary Particles**: these are formed in the atmosphere, following their release as gases, by chemical processes. They are mainly formed from the oxidation of sulphur and nitrogen oxides to acids which are then neutralised by ammonia from agricultural sources (sulphates and nitrates formed from emissions of SO_2 and NO_x). The atmospheric persistence of particles formed in this way allows particles from European sources to reach the United Kingdom. These particles are generally less than 2 μm in diameter.

- **Coarse/Other Particles**: these are from a wide variety of non-combustion sources, including dust re-suspended from road traffic and mineral extraction works, and natural sources such as sea salt and pollen. The proximity of the Suffolk Coastal District to the North Sea coast and a number of estuaries gives rise to a high proportion of these coarse particulates. These particles are generally greater than 2 μm in diameter.

Study into the health effects of particles to date has been limited. It is widely held though that it is the smaller particles, especially those below 4 μm diameter, that are of particular concern. These can penetrate deep into the body and cause a range of effects from asthma and bronchitis to potentially causing death. Those most at risk from particulates are children, the elderly and those who already suffer from a heart or lung complaint.

5.2 Standards and Objectives

The National Air Quality Regulations 1997 set the objective for PM_{10} as a daily maximum running 24-hour mean of 50 $\mu g/m^3$ with a maximum of four exceedances in a year (approximately equivalent to the 99^{th} percentile of 24-hour means) to be achieved by 31 December 2005.

The Revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR 1999; 2000) includes changes to the original 24-hour mean objective, and adopts also an annual mean objective (see below). Revised objectives were proposed because work carried out by the Airborne Particles Expert Group indicated that the original objective was unrealistic and limit values set in the Air Quality Daughter Directive (AQDD) which were agreed at Environment Council in June 1998 were more acheivable and are set out as below. The revised 24-hour objective is less stringent than the original in that the number of exceedances in a year has increased considerably. Monitoring studies also suggest that the new 24-hour objective is more stringent than the annual mean objective. The two current

objectives are based on measurements using the European gravimetric transfer reference sampler or equivalent and are both to be achieved by 31 December 2004:

- An annual mean concentration of 40 μg/m^3 (gravimetric);
- A fixed 24-hour mean concentration of 50 μg/m^3 (gravimetric) with a maximum of 35 exceedances in a year.

LAQM.TG4(00) advises that the proposed 24-hour mean objective is potentially a difficult standard against which to carry out an assessment, due to day-to-day variations in PM_{10} concentration and composition. It is, therefore, recommended that the initial stages of review and assessment (Stage 1 and 2) are carried out by calculating the annual mean PM_{10} concentration and then estimating the 90th percentile concentration. The 90th percentile of daily means in a calendar year is approximately equivalent to 35 exceedance days. An empirical relationship between the annual mean concentration and the 90th percentile of daily means has been derived from analysis of UK monitoring data. Any approach based upon an empirical relationship needs to be precautionary and a "best fit" line has been drawn which ensures exceedances will not be underestimated, apart from in very extreme circumstances. This gives the equation:

PM_{10} (90th percentile of daily means) = PM_{10} (annual mean) x 1.79

The proposed 24-hour objective is, therefore, highly unlikely to be exceeded if the annual mean concentration is below 28 μg/m^3 (gravimetric):

PM_{10} (90th percentile of daily means) = **28** μg/m^3(annual mean) x **1.79**
Therefore, PM_{10} (90th percentile of daily means) = **50.12** μg/m^3

LAQM.TG4(00) states that the principal focus of Local Air Quality Management should be towards the control of PM_{10} emissions at a local level. Government research confidently expects PM_{10} concentrations to fall by the end of 2004 when the objectives are to be met. Analysis has indicated that, with existing national policy measures and "atypical" meteorology (a higher frequency of easterly winds occurring about once every five years and transporting pollutants from mainland Europe to the United Kingdom), exceedances of the objectives might be found in the following areas and, therefore, these areas should form the focus of more detailed review and assessment:

- urban background sites in central London;
- areas adjacent to busy roads, particularly within major urban areas;
- areas with significant emissions from domestic burning of solid fuel;
- areas in the vicinity of industrial plant or which have significant uncontrolled or fugitive emissions.

5.3 Review and Assessment of PM_{10}

In Suffolk Coastal's Second Stage Review and Assessment Report (2000) the following sources of PM_{10} were identified as warranting continued Second Stage investigation and then, if applicable, Third Stage Review and Assessment:

- Shipping at the Port of Felixstowe;
- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton due to planned developments at the former RAF Bentwaters air-base, Rendlesham and St Audry's, Melton. This is to include elevated levels of NO_2 seen from the current monitoring site at the Melton crossroads;
- Emissions from traffic using High Road West, Felixstowe;
- Emissions from traffic using Lime Kiln Quay Road / Thoroughfare / St John's Street junction, Woodbridge;
- The emission "footprint" of White Mountain Roadstone Limited, traffic using the A12 and uncontrolled and fugitive emissions from Foxhall Four Quarry and Foxhall Landfill Site at Brightwell, Suffolk;
- The emission footprint of Roadworks (1952) Limited and Sinks Pit Quarry, Kesgrave, Suffolk.

5.4 Continued Second Stage review and assessment of PM_{10} emissions from shipping at the Port of Felixstowe

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary to determine whether PM_{10} emissions from shipping activities at the Port of Felixstowe would cause an exceedance of the objectives at the end of 2004.

LAQM.TG4(00) identifies that at major ports, such as Felixstowe, PM_{10} emissions from shipping movements have the potential to impact significantly where there is the potential for public exposure within close proximity (within about 500 metres). Felixstowe is regarded as one of the United Kingdom's major ports by virtue of the large volume of container freight that passes through it each year. In 1999, a total of 7,200 vessel movements were identified at the Port and it handled approximately 2.7 million shipping containers. (Information on vessel movements was obtained from the Greater London Authority who operate the DETR emissions helpline. Information on containers was obtained from Suffolk Coastal Port Health Department). A potential for public exposure exists at Felixstowe due to the location of a number of domestic properties within 500 metres of the docking area.

It was envisaged that a DETR funded research project involving modelling pollutant emissions from different vessel types would be able to provide us with the means to determine PM_{10} emissions at the Port of Felixstowe and predict the likelihood of any future exceedances of the objectives. This, however, has not been possible at this time.

External expertise, in the form of Entec UK Limited, has been employed to undertake continued Second Stage review and assessment of PM_{10} emissions from shipping activities at

the Port of Felixstowe. Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G. Entec have investigated shipping activities at the Port of Felixstowe itself, and have researched other studies undertaken on emissions of SO_2 and PM_{10} from shipping to determine their findings and any relevance to the Port of Felixstowe.

The findings of Entec UK Limited are as follows;

> "There has been no short term air quality monitoring data assessment of emissions from shipping at the Port of Felixstowe. Modelling of shipping emissions would be associated with a significant amount of uncertainty."
>
> "A further assessment of PM_{10} from in-port shipping emissions will be made after review of the initial 6-month SO_2 monitoring survey at the Port. Upon review of the SO_2 monitoring results it will be possible to assess the SO_2 concentrations and in turn to consider the potential implications for other pollutants, including PM_{10}."
>
> "The proposed methodology for further review and assessment of SO_2 emissions from in-port shipping at the Port of Felixstowe is to set-up a minimum 6-month SO_2 monitoring programme. The proposed automatic SO_2 monitoring programme will be used to monitor short-term averaging periods relevant to the 15-minute, 1-hour and 24-hour SO_2 air quality objectives."

This continued Second Stage review and assessment has shown that there is the likelihood that PM_{10} objectives in the vicinity of the Port of Felixstowe may be exceeded at the end of 2004 due to emissions from shipping. **Therefore, further review and assessment will be necessary**.

The DETR monitoring help-line has advised, as have Entec UK Limited, that it will be possible to assess PM_{10} levels using the results from monitored levels of SO_2 in the 6-month programme to be undertaken at the Port of Felixstowe (to be started during 2001), see Chapter 4 of this report for details. This will be possible using proportional calculations obtained from previous studies, in particular the Southampton Dibden Terminal study, see Entec's report in Appendix G for details.

Whilst reviewing emissions from shipping activites at the Port of Felixstowe, Entec UK Limited have recommended that, due to the scale of operations at the Port of Felixstowe, emissions of NO_2 and PM_{10} from non-shipping sources should be looked at within the review and assessment process. This has not been high-lighted by LAQM.TG4(00), but will be looked at during the next review and assessment process which must be completed by the end of the year 2003.

5.5 Continued Second Stage Review and Assessment of recorded PM_{10} levels and emissions from traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton.

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation, in the form of continued Second Stage review and assessment, would be necessary for the A1152 including specifically the intersection of the A1152 and B1438 at Melton (hereafter referred to in this report as the Melton crossroads). The A1152 and the Melton crossroads do not currently have an Annual Average Daily Traffic flow (AADT) in exceedance of 25,000 vehicles, which is the criterion neede for a First Stage review and

assessment. Planned future developments, however, at the former RAF Bentwaters air-base, Rendlesham and at the St Audry's Hospital site, Melton may mean that the AADT exceeds 25,000 vehicles by the objective date, the end of 2004. We have also been made aware of a third development at Sutton Hoo which will increase the amount of traffic using the A1152 and Melton crossroads. Traffic details from this development will, therefore, also be included in this review and assessment.

At the time of the Second Stage Review and Assessment Report (2000) it was not possible to obtain sufficient traffic flow data necessary to run the DMRB computer model required by LAQM.TG4(00) for the A1152 and the Melton crossroads. Consequently, continued Second Stage review and assessment was necessary in order to achieve this.

In addition, in the Second Stage Review and Assessment Report (2000), the revised Government guidance, LAQM.TG4(00), provided a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site in the centre of the Melton crossroads since 1999, see Appendix A for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), levels of NO_2 recorded at this monitoring site indicated that there could be an exceedance of the objective in 2005, for further details see section 3.5 in Chapter 3 of this report. As PM_{10} and NO_2 share road traffic as a common emission source it was suspected that PM_{10} levels could be elevated at this site and further Second Stage review and assessment would be necessary.

The spreadsheet produced by Stanger Science and Environment for calculating the DMRB model output was, therefore, run for all sections of the A1152 from the Woods Lane roundabout at Melton through to the Bentwaters roundabout at Rendlesham. This specifically includes the Melton crossroads. For the purposes of the calculation, the A1152 was divided into sections dependant on differences in traffic flows, speeds or percentage of Heavy Goods Vehicles (see Appendix D). The DMRB model estimates the annual mean PM_{10} contribution from traffic using sections of the A1152 at the end of 2004, and produces an estimate of the total annual average PM_{10} concentration at the specified location. This consists of the estimated annual mean background PM_{10} level (derived from the National Air Quality Archive) plus the contribution of annual mean PM_{10} from the road traffic. DMRB model details can be seen in Chapter 2 of this report.

Traffic information for each section of the A1152 was obtained from Suffolk County Council, Environment and Transport Department and can be seen in Appendix C. To obtain the traffic information for the Melton crossroads a 1-day, 12-hour manual traffic count was undertaken at the crossroads during October 2000. This manual count enabled the recording of total traffic counts for each leg of the junction and also the direction in which each vehicle moved. A summary of the traffic count results can be seen in Appendix D.

In order to produce an Annual Average Daily Traffic flow (AADT) from the traffic count it was necessary to factor up the 12-hour count to a 24-hour count. The manual count was undertaken from 07:00 to 19:00 hours, which covers the hours of high traffic flow. Suffolk County Council provided a factor to take the traffic data up to a 24-hour count. This factor was calculated from 7-day, 24-hour automatic traffic counts undertaken on both the Woods Lane leg and the Wilford Bridge leg of the crossroads during March 2001. The factor was calculated as an average of the two sets of data and Suffolk County Council stated that the time difference between our traffic count and the 24-hour counts is not of concern. A summary of calculations can be seen in Appendix D.

The AADT from the counts undertaken in 2000 and 2001 was then predicted forward using general traffic growth factors to the year 2005 by Suffolk County Council. These figures can be seen in the calculation summary in Appendix D.
In addition to general traffic growth, the A1152 and specifically the Melton crossroads will have future traffic increases from three developments with detailed planning consent in this area. These are;

St. Audry's development, Melton - this is a part conversion and part redevelopment of the former St Audry's hospital site. It will include both domestic dwellings and business, commercial and social uses. There is a total of 243 dwellings and 5 commercial/sports and social applications with detailed planning consent at the site. Further details regarding the nature of the commercial/sports and social applications can be seen in Appendix D.

Sutton Hoo development, Sutton - this development is being undertaken by The National Trust in order to open up a site of archaeological importance to the public. It will include a visitors centre, a residential conference and study centre, a viewing platform to see the burial mounds and the associated car parking and residential facilities.

Rendlesham Enterprise Park and New Rendlesham - this is the redevelopment of the former RAF Bentwaters air-base at Rendlesham. This is a very large planning application which has permission granted for development up to the year 2010. It consists of an application for 1200 houses which constitute 'New Rendlesham', 600 of which are already on site, and an application for commercial use which constitutes 'Rendlesham Enterprise Park'.

Traffic predictions have been obtained for the majority of the St Audry's and the Sutton Hoo development, both of which will be in use by the end of 2004, see Appendix D for details. In the case of Rendlesham Enterprise Park and New Rendlesham, however, the planning permission for development of the site runs until 2010, and it is not possible to predict interim growth rates for the development. LAQM.TG4(00) states that local authorities must predict whether NO_2 objectives will be exceeded by traffic using the A1152 and Melton crossroads by the end of the year 2004. There is currently no way to predict how much of the Rendlesham site will be in use by 2004 and, therefore, how much additional traffic it will add to the A1152 and Melton crossroads. For this reason it has been decided that traffic increases from the Rendlesham development will not be included in this review and assessment report. To assess future PM_{10} levels on the A1152 and Melton crossroads it will be necessary to ascertain actual traffic increases. In order to do this it has been decided that traffic counts will be taken yearly, up to 2004, on this road. Each year the figures will be used to run the Second Stage review and assessment DMRB model and a Third Stage review and assessment model, where necessary, in order to continually assess the A1152 and Melton crossroads with respect to Local air Quality Management and any new guidance issued.

Traffic predictions for the St Audry's development were difficult to make as some of the development was already in place at the time of our traffic count in October 2000 and would therefore have already been included. The total number of dwellings built and in use by October 2000 was provided by Suffolk Coastal Planning and Leisure, Development and Policy section and deducted from the 243 applied for. Traffic generated from the remaining houses not in use was then calculated, a summary of calculations and assumptions can be seen in Appendix D. Site knowledge from the Suffolk Coastal Planning and Leisure Department was used to determine which of the commercial/sports and social uses, if any, were in use in October 2000 and should not be added to our future traffic increases. The percentage of traffic from the St Audry's development which will use each section of the A1152 and Melton crossroads was then estimated, see diagrams in Appendix D. The worst case scenario was taken at all times and details of calculations and assumptions can be seen in Appendix D. These figures were then used to calculate the AADT for each section of the A1152 and Melton crossroads.

Traffic predictions for the Sutton Hoo development were obtained from Suffolk County Council Highways Agency in the original Planning Application of January 1996 and can be seen in Appendix D. All predictions will be added to the October 2000 traffic count, as the development was not in place at that time. The percentage of traffic from the Sutton Hoo development which will use each section of the A1152 and Melton crossroads was then estimated, see diagrams in Appendix D. The worst case scenario was taken at all times and details of calculations and assumptions can be seen in Appendix D. These figures were then used to calculate the AADT for each section of the A1152 and Melton crossroads.

Suffolk County Council provided information regarding the percentage of Heavy Goods Vehicles (HGVs) using each section of the A1152 and Melton crossroads from traffic counts undertaken at a number of points on the A1152, these can all be seen in Appendix D.

Average traffic speeds for the A1152 were calculated from the National Speed Limit which is 30 mph (48 km/hr) on all sections which have been assessed. The traffic speed at the Melton crossroads has been lowered to 15 mph (24 km/hr) due to the junction being characterised by periods of standing traffic.

The nearest receptor location was identified for each section of the A1152 (as defined in DMRB in Chapter 2 of this report). It was decided, in the case of the Melton crossroads, that the model would be run for the closest receptor on each of the four corners of the junction. To model the worst case scenario DMRB was run at all locations for the garden, if an exceedance of the annual mean objective was noted and the house façade itself was farther from the road then DMRB was additionally run for this also.

A summary of the results can be seen in Table 9, input data is summarised in Appendix D.

Guidance in LAQM.TG4(00) advises that where the total annual mean PM_{10} concentration is predicted to be greater than 28 $\mu g/m^3$ there is a risk of the objective being exceeded and the authority should proceed to a Third Stage review and assessment.

The predictions in Table 9, from the DMRB spreadsheet, show that the criterion of 28 $\mu g/m^3$ is not likely to be exceeded at relevant receptor locations on the A1152 or the Melton crossroads at the end of 2004. **Therefore, further review and assessment <u>will not</u> be necessary for PM_{10}.**

Table 9 A1152 and Melton crossroads - Projected annual mean PM_{10} concentrations for 2004 derived from DMRB (for details see Appendix D).

Road segment reference (refer to Appendix C for traffic data for each 'link' of road)	**Receptor description** (distance to receptor from centre of road)	DMRB **Annual mean PM_{10}** calculation (estimated background level # + traffic contribution) ($\mu g/m^3$)	Progression to Stage 3 **YES/NO**
A1152 (Link 1) from **Woods lane roundabout, Woodbridge to Melton crossroads**, Melton (average speed of 30 mph)	Façade of nearest garden, Melton (5m)	24.00	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 1** – corner of The Street and Wilford Bridge Road (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7.6m, B1438 = 4.2m)	25.94	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 2** – corner of Wilford Bridge Road and Melton Road (average speed of 15 mph)	Façade of nearest garden (boundary), Melton (A1152 = 12.9m, B1438 = 7m)	25.57	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 3** – corner of Melton Road and Woods Lane (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7m, B1438 = 7m)	25.60	**NO**
A1152 & B1438 (Link 2) **Melton crossroads receptor 4** – corner of Woods Lane and The Street (average speed of 15 mph)	Façade of nearest garden, Melton (A1152 = 7.5m, B1438 = 6.8m)	25.60	**NO**
A1152 (Link 3) **Melton crossroads to Wilford Bridge roundabout** (average speed of 30mph)	Façade of nearest garden, Melton (4.3m)	24.27	**NO**
A1152 (Link 4) **Wilford Bridge roundabout to B1084 junction** (average speed of 30mph)	Façade of nearest garden, Bromeswell (5.7m)	23.52	**NO**
A1152 (Link 5) **B1084 junction to Bentwaters roundabout, Rendlesham** (average speed of 30mph)	Façade of nearest garden, Eyke (4.5m)	23.55	**NO**

taken from the National Air Quality Archive

5.6 Continued Second Stage Review and Assessment of PM_{10} levels from traffic emissions on High Road West, Felixstowe

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for High Road West Felixstowe. This road was not considered in the First Stage Report as it did not have a predicted Annual Average Daily Traffic Flow (AADT) in exceedance of 25,000 vehicles by 2004, which was the Government Guidance at that time, LAQM.TG4(98). The junction was, however, highlighted in the Second Stage Report in light of the revised Government Guidance LAQM.TG4(00). The new guidance provides a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site near the Police Station, High Road West, Felixstowe since 1993, see Appendix A for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), levels of NO_2 recorded at this monitoring site indicated that there could be an exceedance of the objective in 2005, for further details see section 3.6 in Chapter 3 of this report. As PM_{10} and NO_2 share road traffic as a common emission source it was suspected that PM_{10} levels could be elevated at this site and further Second Stage review and assessment would be necessary.

Although NO_2 has been assessed earlier in this report and found not to cause an exceedance of the objective in 2005 (see section 3.6 in Chapter 3), it was decided to run the spreadsheet produced by Stanger Science and Environment, for calculating the DMRB model output, as specified in LAQM.TG4(00), to predict PM_{10} emissions from traffic on this stretch of High Road West in 2004. This model estimates the annual mean PM_{10} contribution from traffic using High Road West at the end of 2004, and produces an estimate of the total annual average PM_{10} concentration at the specified location. This consists of the estimated annual mean background PM_{10} level (derived from the National Air Quality Archive) plus the contribution of annual mean PM_{10} from the road traffic. Model details can be seen in Chapter 2.

To obtain the traffic information necessary to run the DMRB model, Suffolk Coastal District Council commissioned a 7-day, 24-hour, automatic traffic count in the vicinity of the Police Station, High Road West during November 2000. A summary of the traffic count results, together with the exact location of the count can be seen in Appendix E.

From this count the Annual Average Daily Traffic flow (AADT) was calculated for this section of High Road West.

Traffic data from the count undertaken in 2000 was then predicted forward to the year 2004 by Suffolk County Council, Environment and Transport Department, these figures can be seen in the summary in Appendix E.

The traffic count data produced the percentage of Heavy Goods Vehicles (HGVs) and average vehicle speeds for this section of High Road West for input into the DMRB spreadsheet model, see details in Appendix E.

The nearest relevant receptor location was identified for this section of High Road West (as defined in DMRB in Chapter 2), and data entered into the spreadsheet.

A summary of the results can be seen in Table 10 below, input data is summarised in Appendix E.

Table 10 High Road West, Felixstowe – Predicted annual mean PM_{10} concentrations for 2004 derived from DMRB (for details see Appendix E).

Receptor description (distance to receptor from centre of road)	DMRB **Annual mean PM_{10}** calculation (estimated background level # + traffic contribution)	Progression to **Stage 3**
Façade of nearest domestic garden (8.0 m)	23.95 $\mu g/m^3$	**NO**

taken from the National Air Quality Archive

Guidance in LAQM.TG4(00) advises that where the total annual mean PM_{10} concentration is predicted to be greater than 28 $\mu g/m^3$ there is a risk of the objective being exceeded and the authority should proceed to a Third Stage review and assessment.

The predictions from the DMRB spreadsheet in Table 10 above show that the criterion of 28$\mu g/m^3$ is not likely to be exceeded at the nearest receptor location on this section of High Road West, Felixstowe at the end of 2004. **Therefore further review and assessment will not be necessary for PM_{10}.**

5.7 Continued Second Stage Review and Assessment of PM_{10} levels from traffic using Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge. This road was not considered in the First Stage Report as it did not have a predicted Annual Average Daily Traffic Flow (AADT) in exceedance of 25,000 vehicles by 2004, which was the Government Guidance at that time, LAQM.TG4(98). The junction was, however, highlighted in the Second Stage Report in light of the revised Government Guidance LAQM.TG4(00). The new guidance provides a method of predicting forward to 2005 (by means of a calculation) any measured annual average NO_2 data from 1996 onwards. Suffolk Coastal have been undertaking NO_2 diffusion tube monitoring at a number of sites for several years, including a kerbside monitoring site on this junction since 1997, see Appendix E for site details and monitoring results.

In the Suffolk Coastal Second Stage Report (2000), levels of NO_2 recorded at this monitoring site indicated that there could be an exceedance of the objective in 2005, for further details see section 3.7 in Chapter 3 of this report. As PM_{10} and NO_2 share road traffic as a common emission source it was suspected that PM_{10} levels could be elevated at this site and further Second Stage review and assessment would be necessary.

The spreadsheet produced by Stanger Science and Environment for calculating the DMRB model output, as specified in LAQM.TG4(00), was run to predict PM_{10} emissions from traffic using this junction in 2004. This model estimates the annual mean PM_{10} contribution from

traffic using the junction at the end of 2004, and produces an estimate of the total annual average PM_{10} concentration at the specified location. This consists of the estimated annual mean background PM_{10} level (derived from the National Air Quality Archive) plus the contribution of annual mean PM_{10} from the road traffic. The spreadsheet additionally calculates the 90^{th} percentile of daily means for PM_{10}. Model details can be seen in Chapter 2.

To obtain the traffic information necessary to run the DMRB model, Suffolk Coastal District Council commissioned a 1-day, 12-hour manual traffic count at the junction during November 2000. This manual count has enabled us to record, in addition to total traffic counts, which direction each vehicle moved in. A summary of the traffic count results together with the exact location of the count can be seen in Appendix F.

In order to produce an Annual Average Daily Traffic flow (AADT) from the traffic count it was necessary to factor up the 12-hour count to a 24-hour count. The manual count was undertaken from 07:00 to 19:00 hours, which covers the hours of high traffic flow. Suffolk County Council provided a factor to take the traffic data up to a 24-hour count. This factor was calculated from a 5-day, 24-hour, automatic traffic count undertaken further along the B1438 at Lime Kiln Quay during the time of the manual count, a summary of calculations can be seen in Appendix F.

Traffic data from the count undertaken in 2000 was then predicted forward to the year 2004 by Suffolk County Council, Environment and Transport Department, these figures can be seen in the summary in Appendix F.

Suffolk County Council were able to provide details regarding the percentage of Heavy Goods Vehicles (HGVs) using the B1438 from their automatic count at Lime Kiln Quay, but were unable to provide average traffic speed figures for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction. As this junction is characterised by periods of standing traffic and consists of a sharp bend it was decided to run the DMRB model for two different speeds in order to try and represent the average speed (the requirement of the model). These were 10 mph (16 km/hr) and 15 mph (24 km/hr), see details in Appendix F.

The nearest relevant receptor location was identified for this junction (as defined in DMRB in Chapter 2 of this report) to run the model for. This was a property on the corner of Lime Kiln Quay Road and The Thoroughfare. It was also decided that the model would be run for the building upon which our NO_2 diffusion tube site is currently located (since April 1999), as the annual average NO_2 levels recorded by the tubes predict an exceedance of the objective in 2005. This site was modelled using traffic data from the Melton Hill leg of the junction only as it is not on the actual junction itself, see Appendix F for details.

A summary of the results can be seen in Table 11 below, input data is summarised in Appendix F.

Table 11 Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge – Predicted annual mean PM_{10} concentrations for 2004 derived from DMRB (for details see Appendix F).

Receptor description (distance to receptor from centre of road)	DMRB **Annual mean PM_{10}** calculation (estimated background level # + traffic contribution)	Progression to **Stage 3**
Façade of nearest building / garden on **actual junction** (corner of Lime Kiln Quay Road/The Thoroughfare). Traffic speed of **15 mph**. (12.8 m)	24.24 μg/m^3	**NO**
Façade of nearest building / garden on **actual junction** (corner of Lime Kiln Quay Road/The Thoroughfare). Traffic speed of **10 mph**. (12.8 m)	24.52 μg/m^3	**NO**
Façade of nearest building / garden to **diffusion tube site** (The Thoroughfare near Sun Lane). Traffic speed of **15 mph**. (5.2 m)	24.17 μg/m^3	**NO**
Façade of nearest building / garden to **diffusion tube site** (The Thoroughfare near Sun Lane). Traffic speed of **10 mph**. (5.2 m)	24.43 μg/m^3	**NO**

taken from the National Air Quality Archive

Guidance in LAQM.TG4(00) advises that where the total annual mean PM_{10} concentration is predicted to be greater than 28 μg/m^3 there is a risk of the objective being exceeded and the authority should proceed to a Third Stage review and assessment.

The predictions from the DMRB spreadsheet in Table 11 above show that the criterion of 28 μg/m^3 is not likely to be exceeded at the nearest receptor location or the NO_2 diffusion tube monitoring site on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge at the end of 2004. **Therefore further review and assessment will not be necessary for PM_{10}.**

5.8 Continued Second Stage review and assessment of PM_{10} levels from the combined emission "footprint" of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry, and Foxhall Landfill Site

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for the combined emission 'footprint' of the above activities, to be referred to collectively in this report as the Foxhall Four site. Second Stage review and assessment of each of the above sources in isolation concluded that further review and assessment was not necessary. However, due to the proximity of the four sources it is necessary to take account of their potential combined impact as the worst case scenario.

External expertise, in the form of Entec UK Limited, has been employed to undertake the continued Second Stage review and assessment of the combined emissions from the four activities at this site. Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G. They have used guidance in LAQM.TG4(00), together with their own methods in order to calculate the total PM_{10} concentration at the closest receptor to the Foxhall Four site.

The findings of Entec UK Limited are as follows;

> "Using the evidence supported from the estimated short term calculations, and using an element of professional judgement it is unlikely that the combined source impacts will cause an exceedance of the PM_{10} air quality objective for 2004. The site is well operated and it is reasonable to suggest that the contribution of uncontrolled fugitive sources of PM_{10} will not have a significant impact on the annual average PM_{10} concentration in the vicinity of the Foxhall Four site."
>
> "This report indicates that the Foxhall Four site can be screened out from further review and assessment at the current time. However, the results from the proposed monitoring programme at the Sinks Pit quarry will be seen as relevant to the dust emissions from both quarry processes due to the observed similarity of the level of uncontrolled fugitive dust sources at each site. Therefore, if a significant problem is shown to exist at Sinks Pit it may be necessary to re-assess the fugitive dust emissions from the Foxhall site."

This continued Second Stage review and assessment has shown that the PM_{10} objectives at the nearest receptor location to the Foxhall Four site are not likely to be exceeded by the end of 2004. **Therefore, further review and assessment <u>will not</u> be necessary for PM_{10}.**

Entec UK limited have advised, however, that the results from PM_{10} monitoring to be undertaken at the Sinks Pit site (see next section in this Chapter for further details) should be taken into account. If they show a significant problem with fugitive PM_{10} emissions from the Sinks Pit site then the Foxhall Four site will be reassessed.

5.9 Continued Second Stage review and assessment of PM_{10} levels from the combined emission "footprint" of Roadworks (1952) Limited and Sinks Pit Quarry

The Suffolk Coastal Second Stage Review and Assessment Report (2000) concluded that further investigation in the form of continued Second Stage review and assessment would be necessary for the combined emission 'footprint' of the above activities, to be referred to collectively in this report as the Sinks Pit site. Second Stage review and assessment of each

of the above sources in isolation concluded that further review and assessment was not necessary. However, due to the proximity of the sources it is necessary to take account of their potential combined impact as the worst case scenario.

A site visit was undertaken with the Site Manager to determine which activities were undertaken on the site. There are several processes currently in operation with the potential for fugitive and uncontrolled emissions of PM_{10}, these are; Roadworks (1952) Limited – an authorised roadstone coating plant; sand and gravel extraction; stockpiling of aggregate materials; and a mobile crushing plant.

External expertise, in the form of Entec UK Limited, has been employed to undertake the continued Second Stage review and assessment of the combined emissions from the activities on this site. Entec's report detailing their investigation and findings should be read in conjunction with this report, and is attached in Appendix G. They have used guidance in LAQM.TG4(00), together with information gathered during the site visit to assess the likelihood that the PM_{10} objectives will be exceeded at the nearest receptor locations in 2004.

The findings of Entec UK Limited are as follows;

> "Professional judgement would also suggest that the contribution of PM_{10} from uncontrolled fugitive dust sources on site will not be significant enough to cause an exceedance of the air quality objective."
>
> "In agreement with the site operator and Suffolk Coastal District Council it has been decided that a PM_{10} monitoring programme should be carried out at a suitable relevant receptor location to the Sinks Pit site. This will provide evidence to assist with the screening assessment of this process. In order for the assessment to provide a more useful set of indicative monitoring results the survey will be carried out during a three month period over the summer months (perceived to be the worst case scenario for likely uncontrolled fugitive dust emissions)."
>
> "Nuisance dust complaints have been received from local residents about the Sinks Pit site. Nuisance dust particles are expected to be in the larger, visual, range of particle sizes than specifically PM_{10}. The types of dust associated with the operational activities at the Sinks Pit are expected to be larger particles, however, any elevated levels of nuisance dust may indicate elevated levels of PM_{10} from the emission source as well."

This continued Second Stage review and assessment has shown that there is the likelihood that the PM_{10} objectives may be exceeded by the end of 2004 at the nearest receptor locations. **Therefore, further review and assessment of the combined activities on this site <u>will</u> be necessary**.

Further investigation will be in the form of a Third Stage review and assessment, undertaking a three month monitoring programme to measure PM_{10} concentrations at a suitable relevant receptor location (as specified in LAQM.TG4(00)). In order for the assessment to provide a more useful set of indicative monitoring results the survey will be carried out during a three month period over the summer months (perceived to be the worst case scenario for likely uncontrolled fugitive dust emissions).

The monitoring exercise was commenced in June 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Sinks Pit site.

5.10 Conclusion of PM_{10} Review and Assessment

This continued Second Stage and Third Stage review and assessment has identified that, for the following PM_{10} sources, the risk of the air quality objectives being exceeded at relevant locations in the Suffolk Coastal District is negligible and, therefore, **further review and assessment will not be necessary;**

- **Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton:**

- **Traffic using High Road West, Felixstowe:**

- **Traffic using Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge**

- **PM_{10} levels from the combined emission "footprint" of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry, and Foxhall Landfill Site.**

This continued Second Stage and Third Stage review and assessment has identified that, for the following PM_{10} sources, **there is a risk of the air quality objectives being exceeded at relevant locations in the Suffolk Coastal District and, therefore further review and assessment will be necessary;**

- **Emissions from shipping at the Port of Felixstowe.** Further investigation will be in the form of a **Third Stage review and assessment**. The DETR monitoring help-line has advised, as have Entec UK Limited, that it will be possible to assess PM_{10} levels using the results from monitored levels of SO_2 in the 6-month programme to be undertaken at the Port of Felixstowe (to be started during 2001). This will be possible using proportional calculations obtained from previous studies, in particular the Southampton Dibden Terminal study, see Entec's report in Appendix G for details. The findings of this study will be presented in a further Third Stage review and assessment report for the Port of Felixstowe.

- **PM_{10} levels from the combined emission "footprint" of Roadworks (1952) Limited and Sinks Pit Quarry.** Further investigation will be in the form of a Third Stage review and assessment, undertaking a three month monitoring programme to measure PM_{10} concentrations at a suitable relevant receptor location. The monitoring exercise was commenced in June 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Sinks Pit site.

6. Summary & Recommendations

6.1 Summary

Suffolk Coastal's First Stage review and assessment demonstrated that it is likely the air quality objectives for Benzene and 1,3-Butadiene will be met in the Suffolk Coastal District by the relevant target dates, and further review and assessment of these pollutants will not be necessary at the present time.

Suffolk Coastal's Second Stage review and assessment demonstrated that it is likely the air quality objectives for Lead and Carbon Monoxide will be met in the Suffolk Coastal District by the relevant target dates, and further review and assessment of these pollutants will not be necessary at the present time.

This continued Second Stage and Third Stage review and assessment has demonstrated that it is likely the air quality objectives for the following emission sources of Nitrogen Dioxide, and Particulate Matter (PM_{10}) will be met at relevant locations in the Suffolk Coastal District by the relevant target dates;

Nitrogen Dioxide

- Traffic using the A14 trunk road:
- Traffic using High Road West, Felixstowe

Particulate Matter

- Traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton:
- Traffic using High Road West, Felixstowe:
- Traffic using Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge
- PM_{10} levels from the combined emission "footprint" of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry, and Foxhall Landfill Site.

This continued Second Stage and Third Stage review and assessment has demonstrated that we have insufficient information to date to confirm whether there is a significant risk that air quality objectives for the following emission sources of Sulphur Dioxide and Particulate Matter (PM_{10}) will be exceeded at relevant locations within the Suffolk Coastal District by the relevant target dates and, therefore, **further review and assessment is necessary**;

Sulphur Dioxide

- Emissions from shipping at the Port of Felixstowe

Particulate Matter (PM_{10})

- Emissions from shipping at the Port of Felixstowe.
- PM_{10} levels from the combined emission "footprint" of Roadworks (1952) Limited and Sinks Pit Quarry.

This continued Second Stage and Third Stage review and assessment has demonstrated that there is a significant risk that the air quality objectives for the following emission sources of Nitrogen Dioxide will not be met at relevant locations within the Suffolk Coastal District by 2005. Consideration will be given to the designation of an AQMA at each location;

Nitrogen Dioxide

- Emissions from traffic using the A1152, including specifically the crossroads of the A1152 and B1438 at Melton.
- Emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge

6.2 Recommendations

Sulphur Dioxide

- **Emissions from shipping at the Port of Felixstowe**. Further investigation will be in the form of a **Third Stage review and assessment**, undertaking a minimum 6-month SO_2 monitoring programme to run for three summer and three winter months at a suitable relevant receptor location (as specified in LAQM.TG4(00)). The monitoring exercise will be started during 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Port of Felixstowe.

Particulate Matter (PM_{10})

- **Emissions from shipping at the Port of Felixstowe**. Further investigation will be in the form of a **Third Stage review and assessment**. The DETR monitoring help-line has advised, as have Entec UK Limited, that it will be possible to assess PM_{10} levels using the results from monitored levels of SO_2 in the 6-month programme to be undertaken at the Port of Felixstowe (to be started during 2001). This will be possible using proportional calculations obtained from previous studies, in particular the Southampton Dibden Terminal study, see Entec's report in Appendix G for details. The findings of this study will be presented in a further Third Stage review and assessment report for the Port of Felixstowe.

- **PM_{10} levels from the combined emission "footprint" of Roadworks (1952) Limited and Sinks Pit Quarry**. Further investigation will be in the form of a **Third Stage review and assessment**, undertaking a three month monitoring programme to measure PM_{10} concentrations at a suitable relevant receptor location. The monitoring exercise was commenced in June 2001 and the findings of this study will be presented in a further Third Stage review and assessment report for the Sinks Pit site.

Nitrogen Dioxide

- **Emissions from traffic using the crossroads of the A1152 and B1438 at Melton (the Melton crossroads).** The predictions from the BREEZE Roads modelling show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded by the end of 2005. However, due to systematic errors in the model it is accepted that the 36 $\mu g/m^3$ contour line be used to consider the designation of an AQMA for the crossroads. This consideration will include assessment of the accuracy of diffusion tubes used, in order to undertake more accurate modelling, together with a continuous monitoring program and further traffic flow assessments at the crossroads.

- **Emissions from traffic using the Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge.** The predictions from the BREEZE Roads modelling show that the annual mean NO_2 objective of 40 $\mu g/m^3$ is not likely to be exceeded by the end of 2005. However, due to systematic errors in the model it is accepted that the 36 $\mu g/m^3$ contour line be used to consider the designation of an AQMA for the crossroads. This consideration will include assessment of the accuracy of diffusion tubes used, in order to undertake more accurate modelling, together with further traffic flow assessments at the junction.

7. References

1. *Air Quality Regulations 1997* – S.I.1997, No 3043. The Stationery Office.

2. *Air Quality (England) Regulations 2000* – S.I.1997, No 928. The Stationery Office

3. Department of the Environment and Transport, 1997. *The United Kingdom National Air Quality Strategy*. The Stationery Office.

4. Department of the Environment, Transport and the Regions, 1997. *Review and assessment: Pollutant Specific Guidance*. LAQM.TG4(98). DETR.

5. Department of the Environment, Transport and the Regions, 1999. *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 "Air Quality"*. The Stationery Office.

6. Department of the Environment, Transport and the Regions, 2000. *Framework for Review and Assessment of Air Quality*: LAQM.TG1(00). DETR.

7. Department of the Environment, Transport and the Regions, 2000. *Selection and use of dispersion models*. LAQM.TG3(00), (Draft consultation document). DETR.

8. Department of the Environment, Transport and the Regions, 2000. *Review and assessment: Pollutant Specific Guidance*. LAQM.TG4(00), (Draft consultation document). DETR.

9. Department of the Environment, Transport and the Regions, 2000. *National Air Quality Information Archive* – http://www.aeat.co.uk/netcen/airqual.

10. *Environment Act 1995*, Chapter 25. HMSO.

11. Stanger Science & Environment, 2000. *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 "Air Quality", Spreadsheet* – spreadsheet site is at: http://www.stanger,co.uk/airqual/modelhp/.

12. Suffolk Coastal District Council, 1999. *Report on the First Stage Review and Assessment of Air Quality in Suffolk Coastal*. Suffolk Coastal District Council 1999.

13. Suffolk Coastal District Council, 2000. *Report on the Second Stage Review and Assessment of Air Quality in the Suffolk Coastal District*. Suffolk Coastal District Council 2000.

Appendix A

Monthly Nitrogen Dioxide air quality concentrations recorded by diffusion tubes at Felixstowe, Woodbridge and Melton since 1993.

Figure A-1 **Site descriptions for current diffusion tube locations in 2001.**

Table A-1 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at four sites in Felixstowe during 1993 – 1996, figures in parts per billion (ppb). Annual average converted to micrograms per cubic metre (μ/m^3) and then calculated forward to the end of 2005.**

Table A-2 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe and Woodbridge during 1997, figures in parts per billion (ppb). Annual average converted to micrograms per cubic metre (μ/m^3) and then calculated forward to the end of 2005.**

Table A-3 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe and Woodbridge during 1998, figures in parts per billion (ppb). Annual average converted to micrograms per cubic metre (μ/m^3) and then calculated forward to the end of 2005.**

Table A-4 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 1999, figures in parts per billion (ppb). Annual average converted to micrograms per cubic metre (μ/m^3) and then calculated forward to the end of 2005.**

Table A-5 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 2000, figures in parts per billion (ppb). Annual average converted to micrograms per cubic metre (μ/m^3) and then calculated forward to the end of 2005.**

Table A-6 **Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 2001, figures in micrograms per cubic metre (μ/m^3). Annual average calculated forward to the end of 2005.**

Figure A-1

Site descriptions for current Nitrogen Dioxide diffusion tube locations in 2001.

There are currently one set of diffusion tube sites in each of the following locations, Felixstowe, Woodbridge and Melton. Each set of sites are in place to assess levels of Nitrogen Dioxide from road traffic emissions. Each location has one or more 'Kerbside' sites which are in place to assess levels of Nitorgen Dioxide directly at the roadside, and one or more 'Background' sites which are in place to show the general level of Nitrogen Dioxide in the area not from road traffic at the selected sites. These 'Background' sites enable levels recorded to be related to the road traffic source. Each site has Monthly and annual average results for each of the six diffusion tubes can be seen in Tables A-1 and A-2 which follow in this Appendix.

FELIXSTOWE

FLX 1 This is a 'Kerbside' site which records levels at the roadside of High Road West in Felixstowe, near to the Police Station. The site is located on a bus stop sign which is 1 metre from the roadside. The tube is situated 2 metres from the ground**.** The diffusion tube site is open, there are domestic houses along either side of the road but they are set back, approximately 15-20 metres from the kerb.

FLX 2 This is a second 'Kerbside' site on this section of High Road West. It is set slightly farther back from the kerbside, 2-3 metres, and is opposite a busy junction leading to the railway station. The tube is situated on a lampost and is 2 metres from the ground. The diffusion tube site is open, there are domestic houses along either side of the road but they are set back, approximately 15-20 metres from the kerb.

FLX 3 This is a 'Background' site for this area of Felixstowe. It allows the measurement of general levels of Nitrogen Dioxide in the area, for comparison with those seen at the kerbside of High Road West. The site is in Princes Road, a residential street which is greater than 100 metres from any busy roads. The tube is situated on a lampost and is 2 metres from the ground. The diffusion tube site is open, there are domestic houses along either side of the road but they are set back, approximately 10-15 metres from the kerb.

FLX 4 This is a second 'Background' site for this area of Felixstowe. It allows the measurement of general levels of Nitrogen Dioxide in the area, for comparison with those seen at the kerbside of High Road West. The site is in Lynwood Avenue, a quiet residential street greater than 100 metres from High Road West. The tube is situated on a lampost and is 2 metres from the ground. The diffusion tube site is open, there are domestic houses along either side of the road but they are set back, approximately 15-20 metres from the kerb.

FLX 5 This is a third 'Kerbside' site on the above section of High Road West. It is set slightly farther back from the kerbside, 3-4 metres, and is within the grounds of the Police Station very close to FLX 1. The tube is situated on a signpost and is 2 metres from the ground. The diffusion tube site is open, the Police Station building is 10-15 metres away.

WOODBRIDGE

WBG 1 This is a 'Kerbside' site which records levels at the roadside of The Thoroughfare, Woodbridge. The site is near Sun Lane and is 5-10 metres from the Lime Kiln Quay Road / The Thouroughfare / St. John's Street junction. This junction is controlled by traffic lights and is characterised by standing traffic at peak hours. The leg of the junction on which the diffusion tube is located is very narrow and enclosed by tall buidings, creating a canyon effect. The site is located on a traffic sign which is 1 metre from the roadside and has buildings less than 1 metre behind it, it is very enclosed. The tube is situated 2 metres from the ground**.**

WBG 3 The WBG 2 site has been discontinued as of 2001. This is a 'Background' site for Woodbridge. It allows the measurement of general levels of Nitrogen Dioxide for comparison with the kerbside levels in The Thoroughfare. The site is in Kingston Farm Road, a quiet residential street greater than 100 metres from any busy roads. The tube is situated on a lampost and is 2 metres from the ground. The diffusion tube site is open, there are domestic houses along either side of the road but they are set back, approximately 15-20 metres from the kerb.

WBG 4 This is a second 'Background' site for Woodbridge. It allows the measurement of general levels of Nitrogen Dioxide for comparison with the kerbside levels in The Thoroughfare. The site is located within Farlingaye High School in Ransom Road and is greater than 100 metres from any busy roads. The tube is situated on a school building drainpipe and is 2 metres from the ground. There is no traffic within 30-40 metres of the site.

MELTON

MEL 1 This is a 'Kerbside' site which records levels at the roadside of the A1152 and B1438 crossroads junction at Melton. The site is on a traffic crossing island in the centre of the junction. This junction is controlled by traffic lights and is characterised by standing traffic at peak hours. The site is relatively open, there are houses at the four corners of the junction but, due to it's width, it is not enclosed. The site is located on one of the traffic light and the tube is situated 2 metres from the ground**.**

MEl 2 This is a 'Background' site for this area of Melton. It allows the measurement of general levels of Nitrogen Dioxide in the area, for comparison with those seen at the kerbside of the Melton crossroads. The site is in Hall Farm Road, a quiet residential street greater than 100 metres from the junction. The tube is situated on the drainpipe of a residential property and is 2 metres from the ground.

MEL 3 This is a second 'Kerbside' site which records levels at the roadside of the A1152 and B1438 crossroads junction at Melton. The site is on the Wilford Bridge Road leg approximately 5 metres from the junction. This junction is controlled by traffic lights and is characterised by standing traffic at peak hours. The site is relatively open, there are houses at the four corners of the junction but, due to it's width, it is not enclosed. The site is located on a lampost 1-2 metres from the roadside, there is a building 3-5 metres from the site. The tube is situated 2 metres from the ground**.**

Table A-1

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at four sites in Felixstowe during 1993 - 1996, figures in parts per billion (ppb *). Annual average converted to micrograms per cubic metre ($\mu g/m^3$) and then calculated forward to the end of 2005

Year	Site	Time in Months												Annual Average	Conversion to $\mu g/m^3$ (x 1.91)	Conversion to 2005 Concentration ($\mu g/m^3$) #
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1993	FLX 1	no data	no data	no data	23.6	21.2	16.9	16.8	18.4	21.4	18.8	no data	27.2	**20.5**	**39.2**	**N/A**
	FLX 2	no data	no data	23.4	15.6	no data	no data	16.6	17	14.8	12.8	23.9	26	**18.8**	**35.9**	**N/A**
	FLX 3	no data	no data	19	15.6	10.6	7.4	13.2	13.8	12.3	11.2	20.8	21.9	**14.6**	**27.9**	**N/A**
	FLX 4	no data	no data	21.4	no data	10.8	8.8	11.9	13.2	12.6	10.8	21.3	23.5	**14.9**	**28.5**	**N/A**
1994	FLX 1	30.5	31.8	28.1	23.6	23.2	22.5	24.2	20.7	22.3	28.9	31.6	36.9	**27.0**	**51.6**	**N/A**
	FLX 2	26.7	24.8	23.2	18.1	13.9	16.1	18.2	14.4	19.7	26.3	26.6	26.5	**21.2**	**40.5**	**N/A**
	FLX 3	24.7	21.8	20	13.6	16.4	13.4	13.3	10.3	13.9	18.3	20.1	22.6	**17.4**	**33.2**	**N/A**
	FLX 4	23.1	21.7	20.1	15.3	10.2	11.3	12.6	10.7	13.1	21.9	22.2	22	**17.0**	**32.5**	**N/A**
1995	FLX 1	25.9	27.5	25.7	17.2	22.5	18.2	24.9	23.2	25.7	24.4	28.3	25.9	**24.1**	**46.0**	**N/A**
	FLX 2	21.9	24.7	22.2	no data	18.9	11.3	16.6	12.1	17.7	21.2	20.3	20.3	**18.8**	**35.9**	**N/A**
	FLX 3	19	20.2	13.4	10.8	14.4	10.9	13	8.7	14.9	11.3	19.9	18.6	**14.6**	**27.9**	**N/A**
	FLX 4	19	21.6	16.7	9.9	15	9.1	14.8	9.5	14.5	13.8	21.5	20	**15.5**	**29.6**	**N/A**
1996	FLX 1	no data	24.2	25.2	27.9	19.2	no data	21.6	no data	no data	29.7	30.7	20.7	**24.9**	**47.6**	**37.6**
	FLX 2	21.5	17.3	14.4	21.2	14.5	no data	17	16.4	12.3	24.6	24	17.5	**18.2**	**34.8**	**27.5**
	FLX 3	18.7	16.4	12.8	16.7	11.5	10.2	12.5	12.5	10.3	no data	25.4	18.5	**15.0**	**28.7**	**21.2**
	FLX 4	17.3	17.3	14.2	18.9	10.6	11	12.4	14.5	11.4	23	no data	15.1	**15.1**	**28.8**	**21.3**

KEY:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Intermediate site	Drainpipe on Police Station drainpipe, High Road West
FLX 3	Background site	Lampost outside 14 Princes gardens (changed from hanging basket on 14 Princes Gardens in October 1996)
FLX 4	Background site	Lampost outside 37 Lynwood Avenue (changed from Ranelagh Road Veterinary car park in October 1996)

* All figures for NO_2 diffusion tube measurements were recorded in ppb and have then been converted to $\mu g/m^3$

\# Conversion of 1996 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).
For Kerbside and Intermediate sites the conversion calculation is; measured 1996 NO_2 concentration x (0.79 / 1.00)
For Background sites the conversion calculation is; measured 1996 NO_2 concentration x (0.74 / 1.00)

Table A-2

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe and woodbridge during 1997, figures in part per billion (ppb *). Annual average converted to micrograms per cubic metre ($\mu g/m^3$) and then calculated forward to the end of 2005

Site	Time in Months												Annual Average	Conversion To $\mu g/m^3$ (x 1.91)	Conversion to 2005 Concentration ($\mu g/m^3$) #
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
FLX 1	31.3	27.8	no data	12.9	5.61	11.05	8.02	10.13	8.1	17.97	16.23	12.77	**14.72**	**28.12**	**22.90**
FLX 2	26.8	22.5	21.7	8	5.47	7.74	6.66	7.67	7.67	8.83	18.27	15.38	**13.06**	**25.00**	**20.31**
FLX 3	17.9	27.7	22.2	9.9	6.83	7.55	6.41	7.45	8.97	6.51	15.97	16.15	**12.80**	**24.40**	**18.85**
FLX 4	29.2	28.1	23.4	8.6	5.67	4.58	5.75	9.46	7.58	7.68	12.32	13.35	**12.97**	**24.77**	**19.09**
WBG 1	no data	no data	no data	16.1	7.25	14.23	13.29	14.25	11.17	10.11	14.45	6.06	**11.88**	**22.69**	**18.48**
WBG 2	no data	no data	no data	no data	7.32	3.76	7.7	9.87	8.03	10.19	9.34	10.47	**8.34**	**15.93**	**12.97**
WBG 3	no data	no data	no data	6.4	5.03	no data	4.92	6.34	5.53	3.31	15.49	9.24	**7.03**	**13.43**	**10.35**
WBG 4	no data	no data	no data	no data	4.53	5.64	6.3	6.25	4.45	7.75	12.36	9.22	**7.06**	**13.60**	**10.39**

Key:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Intermediate site	Drainpipe on Police Station drainpipe, High Road West
FLX 3	Background site	Lampost outside 14 Princes Gardens
FLX 4	Background site	Lampost outside 37 Lynwood Avenue
WBG 1	Kerbside site	Drainpipe on Suffolk Place, Lime Kiln Quay Road
WBG 2	Intermediate site	Drainpipe on 97a Thoroughfare
WBG 3	Background site	Lampost outside 8 Kingston Farm Road (changed from lampost outside 22 Westholme Close in July 1997)
WBG 4	Background site	Farlingaye High School, Ransom Road

* All figures for NO_2 diffusion tube measurements were recorded in ppb and have then been converted to $\mu g/m^3$

\# Conversion of 1997 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).
For Kerbside and Intermediate sites the conversion calculation is; measured 1997 NO_2 concentration x (0.79 / 0.97)
For Background sites the conversion calculation is; measured 1997 NO_2 concentration x (0.74 / 0.96)

Table A-3

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe and Woodbridge during 1998, figures in parts per billion (ppb *). Annual average converted to micrograms per cubic metre ($\mu g/m^3$) and then calculated forward to the end of 2005

Site	Time in Months												Annual Average	Conversion To $\mu g/m^3$ (x 1.91)	Conversion to 2005 Concentration ($\mu g/m^3$) #
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
FLX 1	12.8	18.7	12.1	15.3	no data	no data	10.39	14.22	19.28	24.6	30.9	26.9	**18.52**	**35.37**	**29.73**
FLX 2	13	17.4	11.2	7.3	no data	no data	9.91	11.12	12	18.9	24.9	22.9	**14.86**	**28.38**	**23.85**
FLX 3	14.4	19.2	12	13.5	no data	no data	11.8	7.9	11.54	19.2	26.8	27.2	**16.35**	**31.23**	**24.85**
FLX 4	14.7	25.9	9.8	9.4	no data	no data	6.11	8.6	15.12	17.2	25.1	24.8	**15.67**	**29.93**	**23.82**
WBG 1	10.6	10.9	9.8	8.1	no data	no data	10.21	10.15	15.08	16.3	24.2	20.2	**13.55**	**25.88**	**21.75**
WBG 2	10.8	13.9	12	12.3	no data	no data	7.15	11.03	4.54	15	21	19.6	**12.73**	**24.31**	**20.43**
WBG 3	9.9	12.7	13.5	10.4	no data	no data	5.41	7.56	9.06	11.9	18.4	16.8	**11.56**	**22.08**	**17.57**
WBG 4	9.1	12.2	9.2	10.8	no data	no data	4.94	7.88	9.54	12.2	18.1	15.4	**10.94**	**20.90**	**16.63**

Key:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Intermediate site	Drainpipe on Police Station drainpipe, High Road West
FLX 3	Background site	Lampost outside 14 Princes Gardens
FLX 4	Background site	Lampost outside 37 Lynwood Avenue
WBG 1	Kerbside site	Drainpipe on Suffolk Place, Lime Kiln Quay Road
WBG 2	Intermediate site	Drainpipe on 97a Thoroughfare
WBG 3	Background site	Lampost outside 8 Kingston Farm Road (changed from lampost outside 22 Westholme Close in July 1997)
WBG 4	Background site	Farlingaye High School, Ransom Road

N.B. Concentrations for **May and June 1998** are missing due to tubes not being supplied for June and those from May therefore being over-exposed

* All figures for NO_2 diffusion tube measurements were recorded in ppb and have then been converted to $\mu g/m^3$

\# Conversion of 1998 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).
For Kerbside and Intermediate sites the conversion calculation is; measured 1998 NO_2 concentration x (0.79 / 0.94)
For Background sites the conversion calculation is; measured 1998 NO_2 concentration x (0.74 / 0.93)

Table A-4

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 1999, figures in parts per billion (ppb *). Annual average converted to micrograms per cubic metre ($\mu g/m^3$) and then calculated forward to the end of 2005

Site	Time in Months												Annual Average	Conversion To $\mu g/m^3$ (x 1.91)	Conversion to 2005 Concentration ($\mu g/m^3$) #
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
FLX 1	27.9	30.2	31	17.9	21.8	18.8	13.9	19.4	26.5	31.4	26.7	30.2	**24.64**	**47.06**	**40.41**
FLX 2	20.9	23.6	26.4	15.2	18.4	16	13.8	16.2	20.8	22.9	19.1	24.7	**19.83**	**37.88**	**32.53**
FLX 3	26.3	25.6	25.7	9.8	14.1	11.1	13.8	12.3	17.7	19.6	no data	25.7	**18.34**	**35.03**	**28.80**
FLX 4	18.8	20.6	23	9	15	10.3	9.7	11.7	16.6	20.3	16.5	24.9	**16.37**	**31.27**	**25.71**
WBG 1	21.4	19.4	22.9	23.1	27.2	27.1	23.6	no data	29.5	25.5	30.8	no data	**25.05**	**47.85**	**41.09**
WBG 2	20.1	17.9	21	13.7	12.6	14.3	11.4	14.4	19.5	16.6	17.4	18.7	**16.47**	**31.46**	**27.01**
WBG 3	16.1	15.1	14.9	7.7	8.9	5.9	4.9	8.1	10.5	14.3	14.3	14.9	**11.30**	**21.58**	**17.74**
WBG 4	13.3	14.8	16.7	no data	9.2	9.9	6.7	8.7	13.8	17.8	15.5	18.1	**13.14**	**25.10**	**20.64**
MEL 1	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	27	**N/A**	**N/A**	**N/A**
MEL 2	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	**no data**	**no data**	**N/A**

Key:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Intermediate site	Drainpipe on Police Station drainpipe, High Road West
FLX 3	Background site	Lampost outside 14 Princes Gardens
FLX 4	Background site	Lampost outside 37 Lynwood Avenue
WBG 1	Kerbside site	Signpost outside 93 Thoroughfare (changed from drainpipe on Suffolk Place, Lime Kiln Quay Road in April '99)
WBG 2	Intermediate site	Drainpipe on 97a Thoroughfare
WBG 3	Background site	Lampost outside 8 Kingston Farm Road (changed from lampost outside 22 Westholme Close in July 1997)
WBG 4	Background site	Farlingaye High School, Ransom Road
MEL 1	Kerbside site	Traffic lights, Melton crossroads
MEL 2	Background site	Drainpipe on 106 hall Farm Road (changed from lampost outside 15/17 Hall Farm Close)

* All figures for NO_2 diffusion tube measurements were recorded in ppb and have then been converted to $\mu g/m^3$

\# Conversion of 1999 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).

For Kerbside and Intermediate sites the conversion calculation is; measured 1999 NO_2 concentration x (0.79 / 0.92)

For Background sites the conversion calculation is; measured 1999 NO_2 concentration x (0.74 / 0.90)

Table A-5

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 2000, figures in parts per billion (ppb *). Annual average converted to micrograms per cubic metre ($\mu g/m^3$) and then calculated forward to the end of 2005

Site	Time in Months												Annual Average	Conversion To $\mu g/m^3$ (x 1.91)	Conversion to 2005 Concentration ($\mu g/m^3$) #
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
FLX 1	31.2	27.5	23.4	19.6	15.8	no data	17.6	19.5	20.5	25.2	30	25.1	**23.22**	**44.35**	**38.93**
FLX 2	26.9	26.1	19.8	14.4	12.5	14.6	13.3	16.8	17.3	22.6	27.4	21.6	**19.44**	**37.13**	**32.59**
FLX 3	26.4	23.8	20.2	14.1	12.9	12.9	17.6	14.1	12.5	19.9	23.2	19.7	**18.11**	**34.59**	**29.42**
FLX 4	24.9	22.8	17.3	12	8.9	10.8	8	11.5	11.9	18.8	25.8	23.1	**16.32**	**31.17**	**26.51**
WBG 1	no data	27.9	30.4	26.5	28.6	27.7	26.9	26.9	25.1	26.9	28.4	24.9	**27.29**	**52.12**	**45.75**
WBG 2	20.2	20.5	17.4	16.6	12.5	12.6	9.7	12.8	13.8	16.6	19.9	19.3	**15.99**	**30.54**	**26.81**
WBG 3	16.9	13.1	13.2	10.4	no data	7.2	6	8.2	9.6	12.5	15.5	18.8	**11.95**	**22.82**	**19.41**
WBG 4	17.4	17.1	14.9	9.6	8	9.4	6.7	10.1	11.9	14.3	18.2	17.7	**12.94**	**24.72**	**21.03**
MEL 1	30.3	25.9	24.5	23.3	26	25.8	24.3	27.4	23.2	29.4	29.1	22.1	**25.94**	**49.55**	**43.49**
MEL 2	16.4	13.1	10.5	8.4	6.7	7	5.4	9.1	9.4	12.7	15.4	15.4	**10.79**	**20.44**	**17.39**

Key:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Intermediate site	Drainpipe on Police Station drainpipe, High Road West
FLX 3	Background site	Lampost outside 19 Princes Road (moved from lampost outside 14 Princes Gardens in November 2000)
FLX 4	Background site	Lampost outside 37 Lynwood Avenue
WBG 1	Kerbside site	Signpost outside 93 Thoroughfare (changed from drainpipe on Suffolk Place, Lime Kiln Quay Road in April '99)
WBG 2	Intermediate site	Drainpipe on 97a Thoroughfare
WBG 3	Background site	Lampost outside 8 Kingston Farm Road (changed from lampost outside 22 Westholme Close in July 1997)
WBG 4	Background site	Farlingaye High School, Ransom Road
MEL 1	Kerbside site	Traffic lights, Melton crossroads
MEL 2	Background site	Drainpipe on 106 hall Farm Road (changed from lampost outside 15/17 Hall Farm Close)

* All figures for NO_2 diffusion tube measurements were recorded in ppb and have then been converted to $\mu g/m^3$

\# Conversion of 2000 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).
For Kerbside and Intermediate sites the conversion calculation is; measured 2000 NO_2 concentration x (0.79 / 0.90)
For Background sites the conversion calculation is; measured 2000 NO_2 concentration x (0.74 / 0.87)

Table A-6

Monthly and annual average Nitrogen Dioxide (NO_2) concentrations recorded at sites in Felixstowe, Woodbridge and Melton during 2001, figures in micrograms per cubic metre ($\mu g/m^{3*}$). Annual average calculated forward to the end of 2005

Site	Time in Months												Annual Average	Conversion to 2005 Concentration ($\mu g/m^3$) #
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
FLX 1	55.3	47.2	43.4	38.7									**46.2**	**42**
FLX 2	51.8	47.4	42.9	34.6									**44.2**	**40.1**
FLX 3	44.4	39.2	38.6	26.4									**37.2**	**32.8**
FLX 4	43.8	36.1	36.7	18.1									**33.7**	**30**
FLX 5	49.1	45.5	41.6	34.4									**42.7**	**38.7**
WBG 1	52.4	56.9	53.5	52									**53.7**	**48.8**
WBG 3	34.7	26	26.9	15.5									**25.8**	**22.7**
WBG 4	37	30.4	27.9	19.5									**28.7**	**25.3**
MEL 1	57	56.7	47.3	48									**52.3**	**47.5**
MEL 2	28.9	23	19.7	13.9									**21.4**	**18.9**
MEL 3	57.8	54.9	50.2	47.2									**52.5**	**47.7**

N.B AS OF JANUARY 2001 ALL INTERMEDIATE SITES HAVE NOW BEEN DISCONTINUED

Key:

FLX 1	Kerbside site	Kerbside lampost outside Police Station, High Road West
FLX 2	Kerbside site	Lampost at 28 High Road West (moved from intermedaite site on Police Station as of January 2001)
FLX 3	Background site	Lampost outside 19 Princes Road (moved from lampost outside 14 Princes Gardens in November 2000)
FLX 4	Background site	Lampost outside 37 Lynwood Avenue
FLX 5	Kerbside site	Police Station sign (at front), High Road West
WBG 1	Kerbside site	Signpost outside 93 Thoroughfare (moved from drainpipe on Suffolk Place, Lime Kiln Quay Road in April '99)
WBG 3	Background site	Lampost outside 8 Kingston Farm Road (moved from lampost outside 22 Westholme Close in July 1997)
WBG 4	Background site	Farlingaye High School, Ransom Road
MEL 1	Kerbside site	Traffic lights, Melton crossroads
MEL 2	Background site	Drainpipe on 106 hall Farm Road (moved from lampost outside 15/17 Hall Farm Close)
MEL 3	Kerbside site	Lampost opposite Melton CPS, Wilford Bridge Road

* All figures for previous NO_2 diffusion tube measurements were recorded in ppb then converted to $\mu g/m^3$

\# Conversion of 2001 NO_2 concentration to 2005 concentration using correction factors in LAQM.TG4(00).
For Kerbside and Intermediate sites the conversion calculation is; measured 2001 NO_2 concentration x (0.79 / 0.87)
For Background sites the conversion calculation is; measured 2001 NO_2 concentration x (0.74 / 0.84)

Appendix B

Monthly Sulphur Dioxide air quality concentrations recorded by diffusion tubes at Felixstowe during 2000 and 2001.

Figure B-1 **Site descriptions for current diffusion tube locations in 2001.**

Table B-1 **Monthly and annual average Sulphur Dioxide (SO_2) concentrations recorded at sites in Felixstowe during 2000, sites set up in September 2000, figures in micrograms per cubic metre (μ/m^3).**

Table B-2 **Monthly and annual average Sulphur Dioxide (SO_2) concentrations recorded at sites in Felixstowe during 2001, figures in micrograms per cubic metre (μ/m^3).**

Figure B-1 Site descriptions for current diffusion tube locations in 2001.

There are currently three diffusion tube sites in Felixstowe. Each site has two tubes exposed for increased accuracy of results. At each site tubes are located on different faces of the same lampost. Monthly and annual average results for each of the six diffusion tubes can be seen in Tables B-1 and B-2 which follow in this Appendix.

FLX 1 Tube sited in Carr Road, Felixstowe, near to the Civic Amenity Site. Site is located close to the ship docking areas at the Port of Felixstowe. Tube is in this location to pick up any Sulphur Dioxide emissions coming from shipping at the Port of Felixstowe. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Carr Road, which is not a busy road. The site is fairly open in that there are no building facades nearby, there is a 2 metre high wooden fence directly behind the lampost.

FLX 2 Tube sited in Carr Road, Felixstowe, near to the Civic Amenity Site. Site is located close to the ship docking areas at the Port of Felixstowe. Tube is in this location to pick up any Sulphur Dioxide emissions coming from shipping at the Port of Felixstowe. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Carr Road, which is not a busy road. The site is fairly open in that there are no building facades nearby, there is a 2 metre high wooden fence directly behind the lampost.

FLX 3 Tube sited in Manor Terrace, Felixstowe. Site is on the sea front facing the route taken into the Port of Felixstowe by all ships docking there. Site is also fairly close to the Port of Felixstowe docking area. Tube is in this location to pick up any Sulphur Dioxide emissions coming from shipping at the Port of Felixstowe. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Manor Terrace, which is a quiet road. Site has residential housing approximately 4-5 metres behind it and it is open on the other side to the sea.

FLX 4 Tube sited in Manor Terrace, Felixstowe. Site is on the sea front facing the route taken into the Port of Felixstowe by all ships docking there. Site is also fairly close to the Port of Felixstowe docking area. Tube is in this location to pick up any Sulphur Dioxide emissions coming from shipping at the Port of Felixstowe. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Manor Terrace, which is a quiet road. Site has residential housing approximately 4-5 metres behind it and it is open on the other side to the sea.

FLX 5 Tube sited in Brinkley Way, Felixstowe. Site is inland and several kilometres from the Port of Felixstowe. Site is to act as a background to give general Sulphur Dioxide levels for this area. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Brinkley Way, which is a quiet residential road. Site is fairly open, are houses nearby but are 10-20 metres away.

FLX 6 Tube sited in Brinkley Way, Felixstowe. Site is inland and several kilometres from the Port of Felixstowe. Site is to act as a background to give general Sulphur Dioxide levels for this area. Tube is located approximately 2 metres above the ground on a lampost. Lampost is approximately 2 metres from the kerbside of Brinkley Way, which is a quiet residential road. Site is fairly open, are houses nearby but are 10-20 metres away.

Table B-1

Monthly and annual average Sulphur Dioxide (SO_2) concentrations recorded at sites in Felixstowe during 2000, sites set up in September, figures in micrograms per cubic metre (mg/m3)

SITE	TIME IN MONTHS												ANNUAL AVERAGE
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
FLX 1									16.4	no data	17.6	17.8	**17.3**
FLX 2									15.7	18.8	15.8	13.1	**15.9**
FLX 3									5.6	19.6	10.6	9.5	**11.3**
FLX 4									no data	11.4	10.7	13.5	**11.9**
FLX 5									8.0	8.2	6.8	8.0	**7.8**
FLX 6									17.1	8.5	7.3	7.1	**10.0**

Key:

FLX 1 Lampost at Carr Road Civic Amenity site, Felixstowe (moved from 37 Adastral Close in November 2000)
FLX 2 Lampost at Carr Road Civic Amenity site, Felixstowe (moved from 37 Adastral Close in November 2000)
FLX 3 Lampost at 23 Manor Terrace, Felixstowe (moved from car park sign at Manor Road Car Park in October 2000)
FLX 4 Lampost at 23 Manor Terrace, Felixstowe (moved from car park sign at Manor Road Car Park in October 2000)
FLX 5 Lampost at 5 Brinkley Way, Felixstowe
FLX 6 Lampost at 5 Brinkley Way, Felixstowe

Table B-2

Monthly and annual average Sulphur Dioxide (SO_2) concentrations recorded at sites in Felixstowe during 2001, figures in micrograms per cubic metre (mg/m3)

SITE	TIME IN MONTHS												ANNUAL AVERAGE
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
FLX 1	15.4	15.2	9.9	11.1									12.9
FLX 2	13.6	15.3	8.7	9.5									11.8
FLX 3	11.2	9.7	7.3	9.4									9.4
FLX 4	10.83	9.9	8.0	8.2									9.2
FLX 5	8.1	6.1	6.0	4.8									6.3
FLX 6	7.4	7.9	8.4	4.8									7.1

Key:

FLX 1 Lampost at Carr Road Civic Amenity site, Felixstowe (moved from 37 Adastral Close in November 2000)
FLX 2 Lampost at Carr Road Civic Amenity site, Felixstowe (moved from 37 Adastral Close in November 2000)
FLX 3 Lampost at 23 Manor Terrace, Felixstowe (moved from car park sign at Manor Road Car Park in October 2000)
FLX 4 Lampost at 23 Manor Terrace, Felixstowe (moved from car park sign at Manor Road Car Park in October 2000)
FLX 5 Lampost at 5 Brinkley Way, Felixstowe
FLX 6 Lampost at 5 Brinkley Way, Felixstowe

Appendix C

Summary of traffic data obtained for the A14 and A1156 roads from Suffolk County Council, Environment & Transport Department. Data used for input into the BREEZE roads computer model by Entec U.K Limited for estimating Nitrogen Dioxide levels.

Table C-1 Summary of traffic data obtained for the A14 and A1156 roads from Suffolk County Council, Environment & Transport Department. Data used for input into the BREEZE roads computer model by Entec U.K Limited for estimating Nitrogen Dioxide levels.

Description of Traffic Count Location	Annual Average Daily Traffic flow (AADT) in 1999	Annual Average Daily Traffic flow (AADT) in 2000	Annual Average Daily Traffic flow (AADT) in 2005	% Heavy Duty Vehicles	Average Speed in mph (km/hr)
A14 at Trimley Heath (East of the A12). Traffic count undertaken in 1999.	31,002	N/A	35,377	19.7	59.8 (96)
A14 East of Orwell Bridge and West of the A12. Traffic count undertaken in 2000.	N/A	43,887	48,890	17.9	63 (101)
A1156 at Warren Heath (West of the Sainsburys roundabout). Traffic count undertaken in 2000	N/A	22,394	24,947	8	36.6 (59)

N.B **for modelling purposes, Suffolk County Council does not predict significant changes in the percentage of Heavy Duty Vehicles or average speeds over the period specified in the table.**

Appendix D

Information collected and assumptions made for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.

Figure D-1 **Map showing the A1152, each of the five sections it was split into to, and the location of the traffic survey point at the Melton crossroads.**

Figure D-2 **Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model and the BREEZE roads computer model for the A1152 and Melton crossroads**

Figure D-3 **Summary diagram of 1-day, 12-hour traffic survey results undertaken on the intersection of the A1152 and the B1438 at Melton – the Melton crossroads.**

Figure D-4 **Diagram to show the assumptions made by Suffolk Coastal District Council as to the percentage of predicted future traffic flow from the St Audry's development, Melton which will use each section of the A1152.**

Figure D-5 **Diagram to show the assumptions made by Suffolk Coastal District Council as to the percentage of predicted future traffic flow from the Sutton Hoo development, Sutton which will use each section of the A1152**

Figure D-6 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.**
LINK 1 - A1152 from Woods Lane roundabout, Woodbridge to Melton crossroads, Melton.

Figure D-7 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.**
LINK 2 – Intersection of the A1152 and B1438 at the Melton crossroads, Melton.

Figure D-8 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads**
LINK 3 - A1152 from Melton crossroads, Melton to the Wilford Bridge roundabout, Bromeswell.

Figure D-9 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads**
LINK 4 - A1152 from the Wilford Bridge roundabout, Bromeswell to the B1084 junction, Bromeswell.

Figure D-10 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.**
LINK 5 - A1152 from the B1084 junction, Bromeswell to the Bentwaters roundabout, Rendlesham.

Information collected and assumptions made for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using the A1152, including the intersection with the B1438 at the Melton crossroads.

Traffic data for 2000 and 2001

The A1152 was split into five sections (Links 1-5), dependant on differences in traffic flows, speeds or percentage Heavy Goods Vehicles (HGVs). These sections are listed below and can be seen from Figure D-1 in this Appendix;

Link 1 -A1152 from Woods Lane roundabout, Woodbridge to Melton crossroads, Melton.
Link 2 - Intersection of the A1152 and B1438 at the Melton crossroads, Melton.
Link 3 - A1152 from Melton crossroads, Melton to the Wilford Bridge roundabout, Bromeswell.
Link 4 - A1152 from the Wilford Bridge roundabout, Bromeswell to the B1084 junction, Bromeswell.
Link 5 - A1152 from the B1084 junction, Bromeswell to the Bentwaters roundabout, Rendlesham.

Information was gathered from a number of traffic counts undertaken on sections of the A1152 during 2000 and 2001 by Suffolk County Council, Environment and Transport Department. The position of each traffic count can be seen on Figure D-1 in this Appendix, marked as a cross. Traffic count information used to run the DMRB computer model has been summarised and can be seen in Figure D-2 in this Appendix.

The 1-day, 12-hour traffic count undertaken on the Melton crossroads was commissioned to provide traffic flow data for each leg of the junction, together with the direction in which each vehicle moved. This information was necessary in order to run the Second and Third Stage computer models and ensured that traffic using the junction was not counted twice. A summary of the traffic flow data collected during this count can be seen in Figure D-3 in this Appendix, details regarding traffic count information can be obtained from Suffolk Coastal District Council.

The data collected for the A1152 was used as the base year data for 2000. In order for the DMRB model to predict pollutant levels in future years (2004/2005) it is necessary to input predicted traffic flow data for these years.

Traffic data for 2004 and 2005

For the majority of roads in the Suffolk Coastal District the traffic flows measured in a particular year are able to be predicted forward to future years via modelling undertaken by Suffolk County Council, Environment and Transport Department. This was undertaken for all sections of the A1152 and can be seen in the calculation summary for each section (Figures D-6 to D-10) later in this Appendix.

Traffic flows on the A1152, however, have an extra variable when predicting future traffic flows as there are three developments with detailed planning consent in this area which will impact on the traffic flows. These are the St Audry's development at Melton, the Sutton Hoo development at Sutton, and the Rendlesham Enterprise Park and New Rendlesham development at Rendlesham.

We have been able to obtain traffic predictions for the majority of the St Audry's and Sutton Hoo developments, details follow for each site in this Appendix.

In the case of Rendlesham Enterprise Park and New Rendlesham, however, the planning permission for development of the site runs until 2010, and it is not possible to predict interim growth rates for the development. LAQM.TG4(00) states it must be predicted as to whether the NO_2 objectives will be exceeded by traffic using the A1152 and Melton crossroads by the end of the year 2005. There is currently no way, however, to predict how much of the Rendlesham site will be in use by this time and therefore how much additional traffic it will add to the A1152 and Melton crossroads. For this reason it has been decided that traffic increases from the Rendlesham development will not be included in this review and assessment report. To assess future NO_2 levels on the A1152 and Melton crossroads it will be necessary to ascertain the actual traffic increases, to do this it has been decided that traffic counts will be taken yearly up to 2005 on this road. Each year the figures will be used to run the Second Stage review and assessment DMRB model and a Third Stage review and assessment model, where necessary, in order to continually assess the A1152 and Melton crossroads with respect to Local Air Quality Management and any new guidance issued.

Traffic predictions for the St. Audry's development, Melton

This is a part conversion and part redevelopment of the former St Audry's hospital site. It will include both domestic dwellings and business, commercial and social uses. There is a total of 243 dwellings and 5 commercial/sports and social applications with detailed planning consent at the site.

Traffic predictions for the St Audry's development were difficult to make as some of the development was already in place at the time of our traffic count in October 2000 and would therefore have already been included. It was decided that traffic produced from the development not in place at the time of the October 2000 traffic count would be added to the total traffic figure produced for this development. This was undertaken as follows;

Housing:

- Planning application has detail for **243 dwellings**

- Suffolk Coastal Planning and Leisure, Development and Policy Section record the number of completed dwellings and the date of completion of each. The number of **dwellings completed by 1 October 2000** was **119**.

- Therefore the **number of dwellings still to be completed** after this time was;

  243 – 119 = **126 dwellings**

- Suffolk County Council, Environment and Transport Department provided information regarding the number of predicted daily traffic 'trips' which would be made by each dwelling, this was **10 trips per day per dwelling**. This prediction was made using Trip Generation Factors for the this type of development.

- Therefore the number of traffic movements which will be added from the housing of this development is;

  126 dwellings x **10** trips per day = **1260 vehicles per day**.

Commercial / Sports and Social:

- There are five separate detailed planning applications for commercial / sports and social use at the St Audry's site, these are listed and detailed as follows;

- Planning application **C98/1397** – **Erection of sports club with associated facilities**. This application is to relocate existing sports pitches and build a new Sports and Social Club within the site. The car park makes provision for approximately 32 cars. At the time of the October traffic count this development was not fully operational in that the pitches were not in use. At this time we also do not have enough information as to likely traffic generation from this application. Many of the members may already dwell on the St Audry's site or nearby and therefore not use the A1152 or Melton crossroads. It has been decided at this time that future traffic generated from this application will not be added to the traffic figures. At the time of the next traffic count, later this year, the status of this application and any traffic predictions will be further investigated.

- Planning Application **C00/0086 – Alterations and extension to existing single-storey building to form four business units**. There is no further detail available at this time regarding type of business, number of employees, car parking spaces or predicted traffic generation for this application. Traffic generated by this application cannot be added to the traffic figures at this time. At the time of the next traffic count, later this year, the status of this application and any traffic predictions will be further investigated.

- Planning Application **C00/0631 – Change of use for former hospital ward blocks to offices and 47 car parking spaces**. The applicant estimates that the offices could have up to 50 employees total working in them from Monday to Friday and then 1 or 2 employees on a Saturday. It was decided, as a worst case scenario, to calculate traffic generated from 50 employees using the offices on every day of the week. It has been assumed that each employee will make two traffic movements per day (to and from work). Therefore;

50 employees x 2 movements per day = **100 vehicle movements per day**

- Planning Application **C00/1488 – Change of use from church to office for interior design business with furniture store**. The applicant estimates that there will be 3-4 employees on site at any one time, 1 visitor per day, 1 large lorry delivering furniture each week and 1 small van delivering fabrics each week. It was decided as a worst case scenario to assume 4 employees and 1 visitor on every day of the week and 2 HGVs once a week. It has been assumed that each will make two traffic movements per visit (to and from the premises). Therefore;

4 employees + 1 visitor x 2 movements per day = 10 vehicle movements per day
2 HGVs x 2 movements per week = 4 movements per week ÷ 7 days = 0.57 vehicle movements per day (1 to the nearest whole number)
10 + 1 = **11 vehicle movements per day**

- Planning Application **C01/0299 – Whitwell House development to office use**. This application will include car parking for 13 vehicles and 1 HGV. It was decided as a worst case scenario to assume 13 vehicles and 1 HGV will visit the premises on every day of the week. It has been assumed that each will make two traffic movements per day (to and from the premises). Therefore;

14 vehicles total x 2 movements per day = **28 vehicle movements per day**

- Total number of vehicle movements per day, known at this time, which could use the A1152 from commercial / sports and social applications at the St Audry's site is therefore; 100 + 11 + 28 = **139 vehicle movements per day**

The overall predicted future traffic usage from both domestic and commercial / sports and social uses at the St Audry's development after 1 October 2000 is;

1260 + 139 = **1399 vehicle movements per day.**

Traffic predictions for the Sutton Hoo development, Sutton

This development is being undertaken by The National Trust in order to open up a site of archaeological importance to the public. It will include a visitors centre, a residential conference and study centre, a viewing platform to see the burial mounds and the associated car parking and residential facilities necessary.

Traffic predictions for the Sutton Hoo site were estimated at the time of the application, in January 1996, by The Highways Authority. These will be in addition to the October 2000 traffic count as the development was not in place at that time, and are outlined below;

- Assume 50,000 visitors per year as worst case scenario (figure provided by the applicant)
- 15,000 of these are likely to arrive by coach
- 15,000 ÷ 50 (number of people per coach) = **300 coaches per year**
- 35,000 visitors will therefore arrive by other means. Assume a vehicle occupancy of 2.5 per vehicle. Therefore; 35,000 ÷ 2.5 = **14,000 other vehicles per year**
- Therefore 14,000 + 300 = 14,300 vehicle movements per year ÷ 364 days = **40 vehicle movements per day.**

These figures from the St Audry's and Sutton Hoo developments can then be added onto the traffic figure obtained for 2004 / 2005 after general traffic growth. However, not all of this traffic will use every section of the A1152 and Melton crossroads. Assumptions were therefore made by Suffolk Coastal District Council as to the percentage of traffic from each development that would use each section of the A1152. These assumptions are shown in the form of diagram swhich can be seen in Figures D-4 and D-5 in this Appendix.

All of this information was then used to calculate traffic input figures for the DMRB model for each section of the A1152 (Link 1-5), all calculations are explained in Figures D-6 to D-10 in this Appendix.

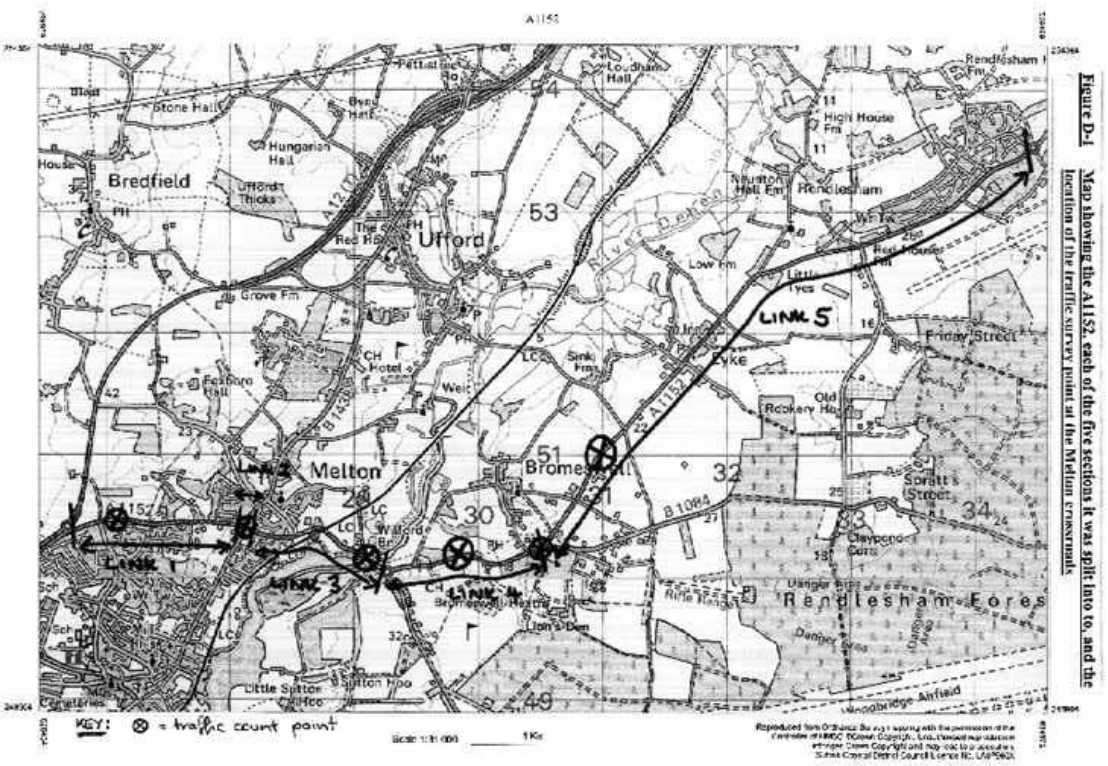


Figure D-1 Map showing the A1152, each of the five sections it was split into to, and the location of the traffic survey point at the Melton crossroads

Figure D-2

Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model and the BREEZE roads computer model for the A1152 and Melton crossroads

Road Link Description	Road Link reference	Annual Average Daily Traffic flow (AADT) 2000 (from traffic surveys)	Annual Average Daily Traffic flow (AADT) 2004 (calculated) *	Annual Average Daily Traffic flow (AADT) 2005 (calculated) *	% Heavy Duty Vehicles #	Average Speed In mph (km/hr equivalent) #
A1152 from Woods lane roundabout, Woodbridge to Melton crossroads, Melton.	Link 1	9,600	11,213	11,415	8.3	30 (48)
Intersection of the A1152 and B1438 at the Melton crossroads, Melton.	Link 2	A1152 = 10,495 B1438 = 7,657	A1152 =12,192 B1438 = 9,090	A1152 =12,412 B1438 = 9,250	8.3	15 (24)
A1152 from the Melton crossroads, Melton to the Wilford Bridge roundabout, Bromeswell.	Link 3	11,389	13,189	13,428	6.9	30 (48)
A1152 from the Wilford Bridge roundabout, Bromeswell to the B1084 junction, Bromeswell.	Link 4	4,542	5,675	5,770	11.1	30 (48)
A1152 from the B1084 junction, Bromeswell to the Bentwaters roundabout, Rendlesham	Link 5	4,060	5,148	5,233	11.1	30 (48)

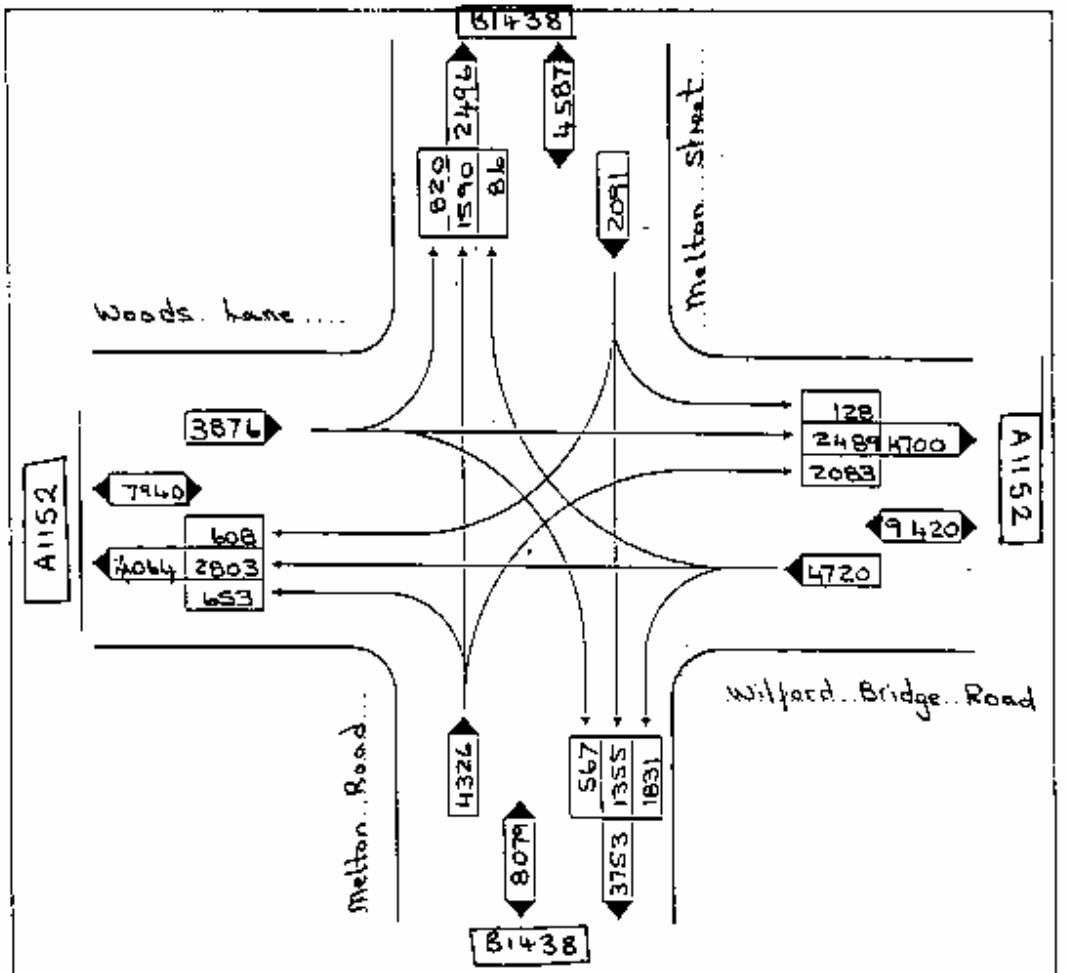
For detail of all calculations see Figures D-5 to D-9 in this Appendix.

* Traffic summary figures calculated by Suffolk Coastal District Council in conjunction with Suffolk County Council, Environment and Transport Department.

\# For modelling purposes, Suffolk County Council does not predict significant changes in the percentage of Heavy Duty Vehicles or average speeds over the period specified in the table.

Figure D-3

Summary diagram of 1-day, 12-hour traffic survey results undertaken on the intersection of the A1152 and the B1438 at Melton – the Melton crossroads.



SUFFOLK COUNTY COUNCIL

Location Melton ..... C.P. Ref ..1.....

Time ..0700..... to ..1900..... Vehicle Type(s) ..All.....

Day ..Thursday..... Date ...5.:10.:00.....

P.J Thompson MSc CEng FICE County Director of Environment & Transport

Figure D-4

Diagram to show the assumptions made by Suffolk Coastal District Council as to the percentage of predicted future traffic flow from the St Audry's development, Melton which will use each section of the A1152.

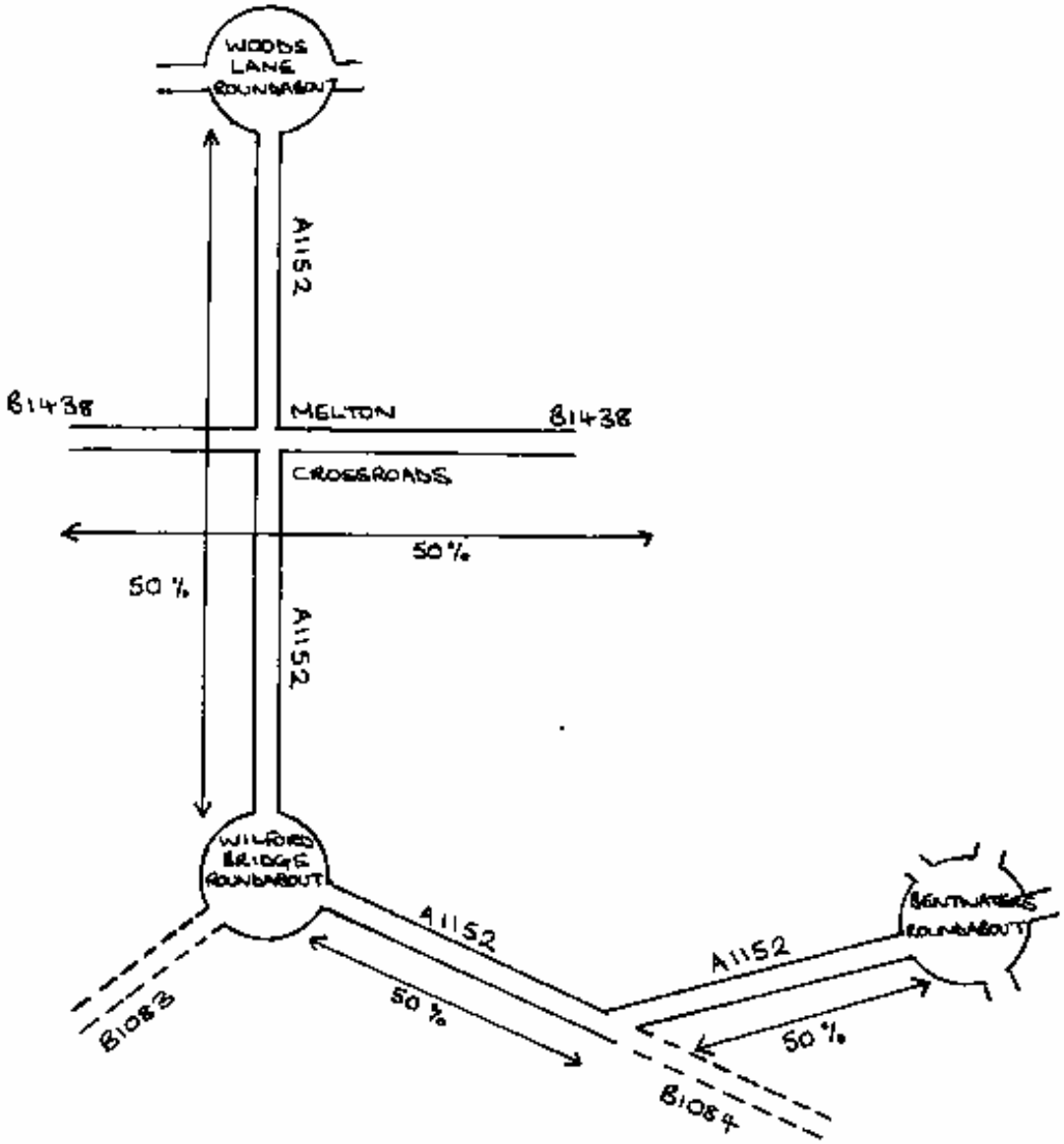


Figure D-5

Diagram to show the assumptions made by Suffolk Coastal District Council as to the percentage of predicted future traffic flow from the Sutton Hoo development, Sutton which will use each section of the A1152.

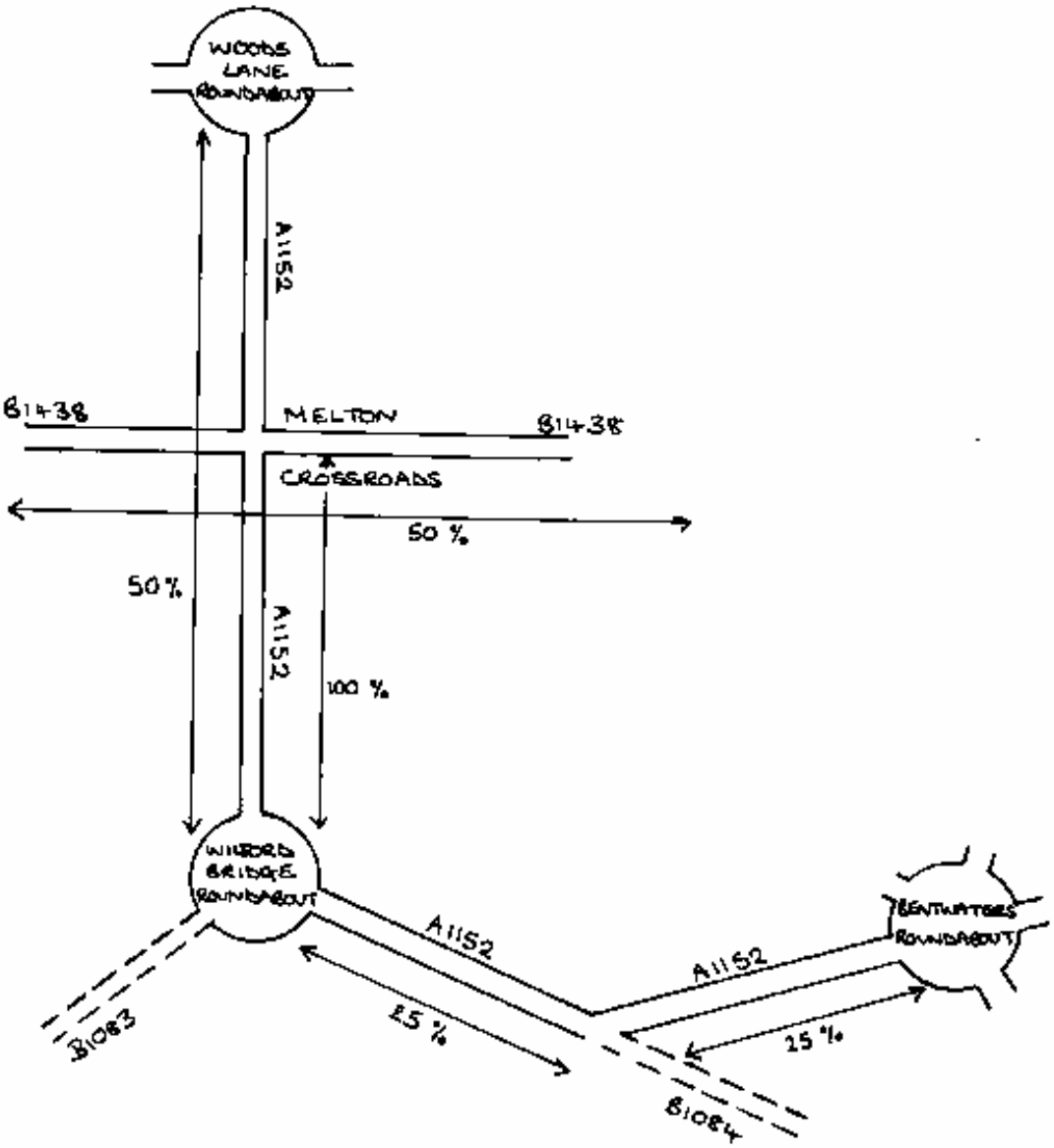


Figure D-6

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic

A1152, including the intersection with the B1438 at the Melton crossroads.

LINK 1 - A1152 from Woods Lane roundabout, Woodbridge to Melton crossroads, Melton.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 1-day, 12-hour traffic count taken during October 2000 at Melton crossroads, use amount of traffic counted using the Woods Lane leg of the junction, see traffic count summary earlier in figure D-3 in Appendix.
- Count gave **7,940** vehicles on this leg of the junction over **12 hours**.
- Suffolk County Council provided us with the means to factor up the 12-hour data to a **24-hour count** using data from a 7-day, 24-hour automatic count. This was undertaken in March 2001 on both legs of the A1152 leading to the junction (Woods Lane and Wilford Bridge Road). Suffolk County Council have stated that the time difference between our October 2000 count and the March 2001 count will not alter the factoring up figure. The factoring up figure is **1.209**, this is an average of the two sets of data.

Therefore **AADT** in **2000** is: 7,940 x 1.209 = **9,600 vehicles per day**

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

AADT in **2004** is: 9,600 x 1.093 = **10,493 vehicles per day**
AADT in **2005** is: 9,600 x 1.114 = **10,695 vehicles per day**

c) Calculated AADT in 2004/2005 (with Sutton Hoo and St. Audrys development traffic added, where necessary);

- Planned development of Sutton Hoo and the St Audrys hospital site has been explained earlier in this Appendix, together with traffic predictions for each development. Worse case scenario assumptions have been made by Suffolk Coastal District Council as to what percentage of this future traffic will use this section of the A1152, these can also be seen from Figures D-4 and D-5 earlier in this Appendix.
- It is assumed that **50%** of both **Sutton Hoo** and **St Audrys** traffic will use this section of the A1152; 50% Sutton Hoo (20 AADT) + 50% St Audrys (700 AADT) = **720 AADT**

- Therefore, AADT for this section of A1152 in 2004 and 2005 is;

  AADT in **2004** is: 10,493 + 720 = **11,213 vehicles per day** ÷ 24 = 467 vehicles per hour
  AADT in **2005** is: 10,695 + 720 = **11,415 vehicles per day** ÷ 24 = 476 vehicles per hour

d) Percentage of HGVs in 2004 and 2005;

- Traffic count on the A1152 and B1438 junction in October 2000 recorded approximately 3% HGVs. In the opinion of Suffolk County Council, Highways and Transport Department this figure was too low. From a recent traffic survey undertaken in March 2001 on Woods Lane the HGV percentage was **8.3%**. Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

e) Traffic speed (km/hr) in 2004 and 2005;

- Traffic speed is equal to the National Speed Limit on this section of road, **30 mph (48 km/hr)**. This speed has been used for 2004 and 2005 traffic modelling.

f) Receptor Site(s) = closest building, garden or boundary facade;

- Closest garden and building facade to this section of the A1152 is in Melton. Computer models need distances to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

  Distance to **kerbside** = **2m**

  Distance to **centre of road** = **5m**

g) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **16.3 μg/m^3**
  PM_{10} = **22.9 μg/m^3**

Figure D-7

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic

A1152, including the intersection with the B1438 at the Melton crossroads.

LINK 2 – Intersection of the A1152 and B1438 at the Melton crossroads, Melton.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 1-day, 12-hour traffic count taken during October 2000 at Melton crossroads, see traffic count summary earlier in figure D-3 in Appendix.
- For modelling traffic using a junction DMRB requires that the four legs of the junction are divided into two roads. Traffic flow data is input for each of these roads and DMRB then calculates emission levels using both sets of data. The Melton crossroads was, therefore divided into the A1152 and the B1438. Care must be taken not to count any of the traffic twice.
- The amount of traffic travelling on the **A1152** only – going straight over the junction was calculated from the traffic count summary in figure D-3. This was **5,292** vehicles **over 12 hours**.
- The amount of traffic travelling on the **B1438** only – going straight over the junction was calculated from the traffic count summary in figure D-3. This was **2,945** vehicles **over 12 hours**.
- The amount of remaining traffic, travelling across the junction using both the A1152 and the B1438 – turning from one road onto the other was calculated from the traffic count summary in Figure D-3. This was **6,776** vehicles **over 12 hours**.
- The amount of traffic using both roads, 6,776, was divided in half (**6,776 ÷ 2 = 3,388**) and each half added to the A1152 and B1438 traffic figure;

  A1152: 5,292 + 3,388 = **8,680 vehicles over 12 hours**

  B1438: 2,945 + 3,388 = **6,333 vehicles over 12 hours**

- Suffolk County Council provided us with the means to factor up the 12-hour data to a **24-hour count** using data from a 7-day, 24-hour automatic count. This was undertaken in March 2001 on both legs of the A1152 leading to the junction (Woods Lane and Wilford Bridge Road). Suffolk County Council have stated that the time difference between our October 2000 count and the March 2001 count will not alter the factoring up figure. The factoring up figure is **1.209**, this is an average of the two sets of data.

  Therefore **AADT** in **2000** is: **A1152:** 8,680 x 1.209 = **10,495 vehicles per day**
  B1438: 6,333 x 1.209 = **7,657 vehicles per day**

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

AADT in **2004** is:	**A1152:** 10,495 x 1.093	= **11,472 vehicles per day**
	B1438: 7,657 x 1.093	**= 8,370 vehicles per day**
AADT in **2005** is:	**A1152:** 10,495 x 1.114	= **11,692 vehicles per day**
	B1438: 7,657 x 1.114	**= 8,530 vehicles per day**

c) Calculated AADT in 2004/2005 (with Sutton Hoo and St. Audry's development traffic added, where necessary);

- Planned development of Sutton Hoo and the St Audry's hospital site has been explained earlier in this Appendix, together with traffic predictions for each development. Worse case scenario assumptions have been made by Suffolk Coastal District Council as to what percentage of this future traffic will use this section of the A1152, these can also be seen from Figures D-4 and D-5 earlier in this Appendix.
- It is assumed that **100%** of both **Sutton Hoo** and **St Audry's** traffic will use the Melton crossroads;

  100% Sutton Hoo (40 AADT) + 100% St Audry's (1399 AADT) = **1439 AADT**

- It was decided that this traffic flow figure would be divided equally between the A1152 and B1438;

  1439 ÷ 2 = **720 vehicles per day**

- Therefore, AADT for this section of A1152 in 2004 and 2005 is;

  <u>2004</u>; **A1152:** 11,472 + 720 = **12,192 vehicles per day** ÷ 24 **= 508 vehicles per hour**
  B1438: 8,370 + 720 = **9.090 vehicles per day** ÷ 24 **= 379 vehicles per hour**

  <u>2005</u>; **A1152:** 11,692 + 720 = **12,412 vehicles per day** ÷ 24 **= 518 vehicles per hour**
  B1438: 8,530 + 720 = **9.250 vehicles per day** ÷ 24 **= 386 vehicles per hour**

d) Percentage of HGVs in 2004 and 2005;

- Traffic count on the A1152 and B1438 junction in October 2000 recorded approximately 3% HGVs. In the opinion of Suffolk County Council, Highways and Transport Department this figure was too low. From recent traffic surveys undertaken in March 2001 on the Woods Lane and Wilford Bridge Road legs of the junction the HGV percentage recorded was 8.3% and 6.9% respectively. In order to take the worst case scenario it was decided that the higher figure of **8.3%** would be used for the junction. Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

e) Traffic speed (km/hr) in 2004 and 2005;

- The National Speed Limit approaching this junction from all four legs is 48 km/hr (30 mph). However, at this junction there are traffic lights and the traffic does queue at peak hours. For this reason it was decided to use a reduced average speed for the junction of **15 mph (24km/hr)**. This speed has been used for 2004 and 2005 traffic modelling.

f) Receptor Site(s) = closest building, garden or boundary facade;

- It was decided, due to traffic flow differences on the A1152 and B1438 that the DMRB model would be run for the closest receptor location on each of the four corners of the Melton crossroads. Computer models need distances to both the kerbside and the centre of the road in

order to predict pollutant levels, measurements as follows (in metres). For each receptor the distance from both the A1152 and B1438 is needed for input into the DMRB model.

- **Receptor 1**: Closest garden and building facade on the corner of The Street and Wilford Bridge Road;

A1152:	**Garden**	Distance to **kerbside**	=	**3.2m**
		Distance to **centre of road**	=	**7.6m**
	Building	Distance to **kerbside**	=	**8.1m**
		Distance to **centre of road**	=	**12.5m**
B1438:	**Garden**	Distance to **kerbside**	=	**1m**
		Distance to **centre of road**	=	**4.2m**
	Building	Distance to **kerbside**	=	**3.6m**
		Distance to **centre of road**	=	**6.8m**

Distances for both the garden and building were necessary for this receptor as it is the closest to the junction and the levels of NO_2 need to be modelled at both, the garden for the 1-hour standard and the building for the annual average standard.

- **Receptor 2**: Closest boundary facade on the corner of Wilford Bridge Road and Melton Road;

A1152:	**Boundary**	Distance to **kerbside**	=	**8.5m**
		Distance to **centre of road**	=	**12.9m**
B1438:	**Boundary**	Distance to **kerbside**	=	**3.2m**
		Distance to **centre of road**	=	**7m**

- **Receptor 3**: Closest garden facade on the corner of Melton Road and Woods Lane;

A1152:	**Garden**	Distance to **kerbside**	=	**3.2m**
		Distance to **centre of road**	=	**7m**
B1438:	**Garden**	Distance to **kerbside**	=	**3.2m**
		Distance to **centre of road**	=	**7m**

- **Receptor 4**: Closest garden facade on the corner of Woods Lane and The Street;

A1152:	**Garden**	Distance to **kerbside**	=	**3.2m**
		Distance to **centre of road**	=	**7.5m**
B1438:	**Garden**	Distance to **kerbside**	=	**3.6m**
		Distance to **centre of road**	=	**6.8m**

g) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x = 16.3 μg/m^3**
  PM_{10} = 22.9 μg/m^3

Figure D-8

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic

A1152, including the intersection with the B1438 at the Melton crossroads.

LINK 3 - A1152 from Melton crossroads, Melton to the Wilford Bridge roundabout, Bromeswell.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 1-day, 12-hour traffic count taken during October 2000 at Melton crossroads, use amount of traffic counted using the Wilford Bridge Road leg of the junction, see traffic count summary earlier in figure D-3 in Appendix.
- Count gave **9,420** vehicles on this leg of the junction over **12 hours**.
- Suffolk County Council provided us with the means to factor up the 12-hour data to a **24-hour count** using data from a 7-day, 24-hour automatic count. This was undertaken in March 2001 on both legs of the A1152 leading to the junction (Woods Lane and Wilford Bridge Road). Suffolk County Council have stated that the time difference between our October 2000 count and the March 2001 count will not alter the factoring up figure. The factoring up figure is **1.209**, this is an average of the two sets of data.

Therefore **AADT** in **2000** is: 9,420 x 1.209 = **11,389 vehicles per day**

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

AADT in **2004** is: 11,389 x 1.093 = **12,449 vehicles per day**
AADT in **2005** is: 11,389 x 1.114 = **12,688 vehicles per day**

c) Calculated AADT in 2004/2005 (with Sutton Hoo and St. Audry's development traffic added, where necessary);

- Planned development of Sutton Hoo and the St Audry's hospital site has been explained earlier in this Appendix, together with traffic predictions for each development. Worse case scenario assumptions have been made by Suffolk Coastal District Council as to what percentage of this future traffic will use this section of the A1152, these can also be seen from Figures D-4 and D-5 earlier in this Appendix.

- It is assumed that **100%** of the **Sutton Hoo** traffic and **50%** of the **St Audry's** traffic will use this section of the A1152;

  100% Sutton Hoo (40 AADT) + 50% St Audry's (700 AADT) = **740 vehicles per day**

- Therefore, AADT for this section of A1152 in 2004 and 2005 is;

  AADT in **2004** is: 12,449 + 740 = **13,189 vehicles per day** ÷ 24 **= 550 vehicles per hour**
  AADT in **2005** is: 12,688 + 740 = **13,428 vehicles per day** ÷ 24 **= 560 vehicles per hour**

d) Percentage of HGVs in 2004 and 2005;

- Traffic count on the A1152 and B1438 junction in October 2000 recorded approximately 3% HGVs. In the opinion of Suffolk County Council, Highways and Transport Department this figure was too low. From a recent traffic survey undertaken in March 2001 on Wilford Bridge Road the HGV percentage was **6.9%**. Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

e) Traffic speed (km/hr) in 2004 and 2005;

- Traffic speed is equal to the National Speed Limit on this section of road, **30 mph (48 km/hr)**. This speed has been used for 2004 and 2005 traffic modelling.

f) Receptor Site(s) = closest building, garden or boundary facade;

- Closest **garden** facade to this section of the A1152 is in Melton. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

  Distance to **kerbside** = **1.4m**

  Distance to **centre of road** = **4.3m**

g) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **16.3 μg/m^3**
  PM_{10} = **22.9 μg/m^3**

Figure D-9

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic

A1152, including the intersection with the B1438 at the Melton crossroads.

LINK 4 - A1152 from the Wilford Bridge roundabout, Bromeswell to the B1084 junction, Bromeswell.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 7-day, 24-hour traffic count taken during July 2000 on this section of the A1152, see map D-1 earlier in Appendix for location of traffic count.
- Count gave an **AADT** in 2000 of **4,542** vehicles on this section of the A1152.

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

  Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

  AADT in **2004** is: 4,542 x 1.093 = **4,965 vehicles per day**
  AADT in **2005** is: 4,542 x 1.114 = **5,060 vehicles per day**

c) Calculated AADT in 2004/2005 (with Sutton Hoo and St. Audry's development traffic added, where necessary);

- Planned development of Sutton Hoo and the St Audry's hospital site has been explained earlier in this Appendix, together with traffic predictions for each development. Worse case scenario assumptions have been made by Suffolk Coastal District Council as to what percentage of this future traffic will use this section of the A1152, these can also be seen from Figures D-4 and D-5 earlier in this Appendix.
- It is assumed that **25%** of the **Sutton Hoo** traffic and **50%** of the **St Audry's** traffic will use this section of the A1152;

  100% Sutton Hoo (10 AADT) + 50% St Audry's (700 AADT) = **710 vehicles per day**

- Therefore, AADT for this section of A1152 in 2004 and 2005 is;

  AADT in **2004** is: 4,965 + 710 = **5,675** **vehicles per day** ÷ 24 **= 237 vehicles per hour**
  AADT in **2005** is: 5,060 + 710 = **5,770** **vehicles per day** ÷ 24 **= 241 vehicles per hour**

d) Percentage of HGVs in 2004 and 2005;

- Traffic count on this section of the A1152 in July 2000 did not record the percentage of HGVs using this section. Following advice from Suffolk County Council, Highways and Transport Department the percentage of HGVs recorded at a nearby traffic count, undertaken on the A1152 at Eyke in October 2000, was used. The percentage of HGVs recorded was **11.1%**. Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

e) Traffic speed (km/hr) in 2004 and 2005;

- Traffic speed is equal to the National Speed Limit on this section of road, **30 mph (48 km/hr)**. This speed has been used for 2004 and 2005 traffic modelling.

f) Receptor Site(s) = closest building, garden or boundary facade;

- Closest **garden** facade to this section of the A1152 is in Bromeswell. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

Distance to **kerbside**	=	**2m**
Distance to **centre of road**	=	**5.7m**

g) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **16.3 μg/m^3**
  PM_{10} = **22.9 μg/m^3**

Figure D-10

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic

A1152, including the intersection with the B1438 at the Melton crossroads.

LINK 5 - A1152 from the B1084 junction, Bromeswell to the Bentwaters roundabout, Rendlesham.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 7-day, 24-hour traffic count taken during October 2000 on this section of the A1152, see map D-1 earlier in Appendix for location of traffic count.
- Count gave an **AADT** in 2000 of **4060** vehicles on this section of the A1152.

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

  Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

  AADT in **2004** is: 4,060 x 1.093 = **4,438 vehicles per day**
  AADT in **2005** is: 4,060 x 1.114 = **4,523 vehicles per day**

c) Calculated AADT in 2004/2005 (with Sutton Hoo and St. Audrys development traffic added, where necessary);

- Planned development of Sutton Hoo and the St Audrys hospital site has been explained earlier in this Appendix, together with traffic predictions for each development. Worse case scenario assumptions have been made by Suffolk Coastal District Council as to what percentage of this future traffic will use this section of the A1152, these can also be seen from Figures D-4 and D-5 earlier in this Appendix.
- It is assumed that **25%** of the **Sutton Hoo** traffic and **50%** of the **St Audrys** traffic will use this section of the A1152;

  100% Sutton Hoo (10 AADT) + 50% St Audrys (700 AADT) = **710 vehicles per day**

- Therefore, AADT for this section of A1152 in 2004 and 2005 is;

  AADT in **2004** is: 4,438 + 710 = **5,148** **vehicles per day** ÷ 24 **= 215 vehicles per hour**
  AADT in **2005** is: 4,523 + 710 = **5,233** **vehicles per day** ÷ 24 **= 219 vehicles per hour**

d) Percentage of HGVs in 2004 and 2005;

- The average percentage of HGVs recorded during the traffic survey in October 2000 was **11.1%**. Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

e) Traffic speed (km/hr) in 2004 and 2005;

- Traffic speed is equal to the National Speed Limit on this section of road, **30 mph (48 km/hr)**. This speed has been used for 2004 and 2005 traffic modelling.

f) Receptor Site(s) = closest building, garden or boundary facade;

- Closest **garden/building** facade to this section of the A1152 is in Eyke. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

Distance to **kerbside**	=	**1m**
Distance to **centre of road**	=	**4.5m**

g) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **16.3 μg/m^3**
  PM_{10} = **22.9 μg/m^3**

Appendix E

Information collected and assumptions made for continued Second Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using High Road West, Felixstowe.

Figure E-1 **Location map of traffic survey point on High Road West, Felixstowe.**

Figure E-2 **Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model for High Road West, Felixstowe.**

Figure E-3 **Summary table to show traffic survey results (averaged over 7 days) for High Road West, Felixstowe.**

Figure E-4 **Information required for continued Second Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using High Road west, Felixstowe.**

Figure E-1

Location map of traffic survey point on High Road West, Felixstowe

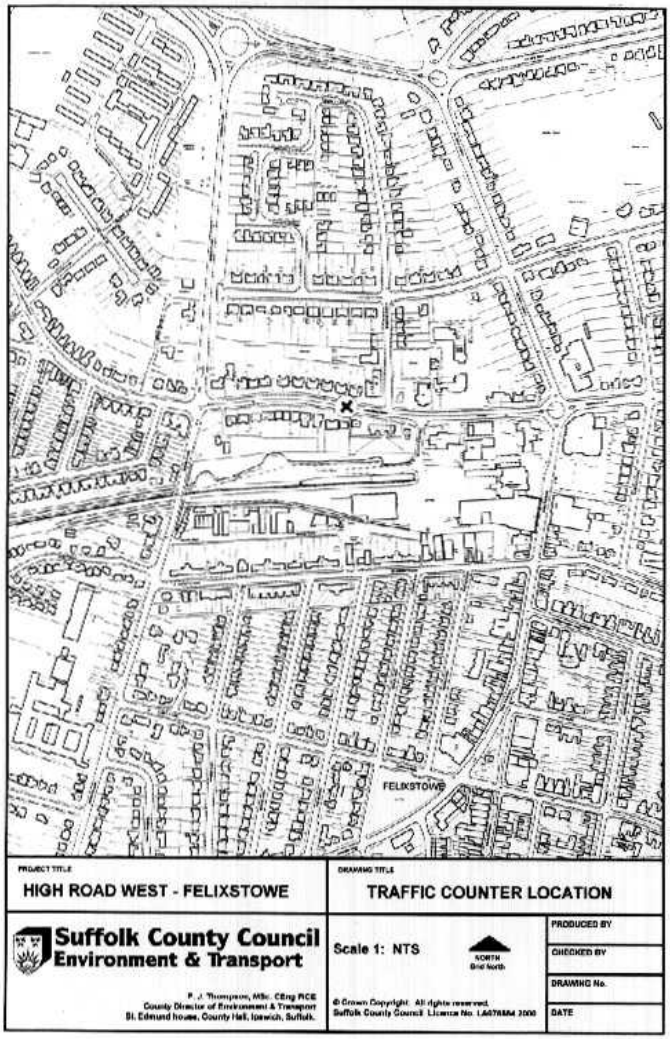


Figure E-2

Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model for High Road West, Felixstowe

Road Link Description	AADT 2000 (from traffic surveys)	AADT 2004 (calculated) *	AADT 2005 (calculated) *	% Heavy Duty Vehicles #	Average Speed In mph (km/hr equivalent) #
High Road West, Felixstowe near to the Police Station (32, High Road West)	10,583	11,568	11,790	3	25 (40)

* Traffic summary figures calculated by Suffolk Coastal District Council in conjunction with Suffolk County Council, Environment and Transport Department.
# For modelling purposes, Suffolk County Council does not predict significant changes in the percentage of Heavy Duty Vehicles or average speeds over the period specified in the table.

Figure E-3

Summary table to show traffic survey results (averaged over 7 days) for High Road West, Felixstowe

Site: HIGH ROAD WEST, FELIXSTOWE

Date: 4.11.2000 to 11.11.2000

Count: 7-day, 24-hour flows

	Eastbound traffic	Westbound traffic	Combined traffic (Eastbound & Westbound)
Number of vehicles recorded over 24 hours (averaged over 7 days)	5,443	5,140	10,583
Percentage of Heavy Goods Vehicles (HGVs)	2.6	2.6	2.6
Mean Speed (mph)	24	25	25

Measurements taken by Suffolk Highways Engineering Consultancy, Ipswich, on behalf of Suffolk Coastal District Council.

For exact location of traffic survey see map in Figure E-1 in this Appendix

Full report can be viewed on request – please contact Denise Bint at Suffolk Coastal District Council, Environmental Services Department on 01394 444350.

Figure E-4

Information required for continued Second Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using High Road West, Felixstowe.

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 7-day, 24-hour traffic count taken during November 2000 on this section of High Road West, Felixstowe, see map E-1 earlier in Appendix for location.

- Count gave an **AADT** in 2000 of **10,583** vehicles on this section of High Road West.

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

  Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

  AADT in **2004** is: 10,583 x 1.093 = **11,568 vehicles per day**
  AADT in **2005** is: 10,583 x 1.114 = **11,790 vehicles per day**

c) Percentage of HGVs in 2004 and 2005;

- The average percentage of HGVs recorded during the traffic survey in November 2000 was **2.6%**. Suffolk County Council agree that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

d) Traffic speed (km/hr) in 2004 and 2005;

- Traffic speed was recorded during the traffic survey in November 2000 and was 24mph (39km/hr) eastbound and 25mph (40km/hr) westbound. It was decided that the speed of 25mph (40km/hr) would be used. This speed has been used for 2004 and 2005 traffic modelling.

e) Receptor Site(s) = closest building, garden or boundary facade;

- Closest **garden** facade to this section of High Road West was chosen as the receptor location. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

  Distance to **kerbside** = **3m**
  Distance to **centre of road** = **8m**

f) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **20.8 $\mu g/m^3$**
  PM_{10} = **23.2 $\mu g/m^3$**

Appendix F

Information collected and assumptions made for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.

Figure F-1 **Location map of traffic survey point on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.**

Figure F-2 **Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model and the BREEZE roads computer model for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.**

Figure F-3 **Summary diagram of 1-day, 12-hour traffic survey results undertaken on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.**

Figure F-4 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.**
Receptor on actual junction.

Figure F-5 **Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.**
Receptor at current diffusion tube site in The Thoroughfare

Figure F-1

Location map of traffic survey point on the Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge

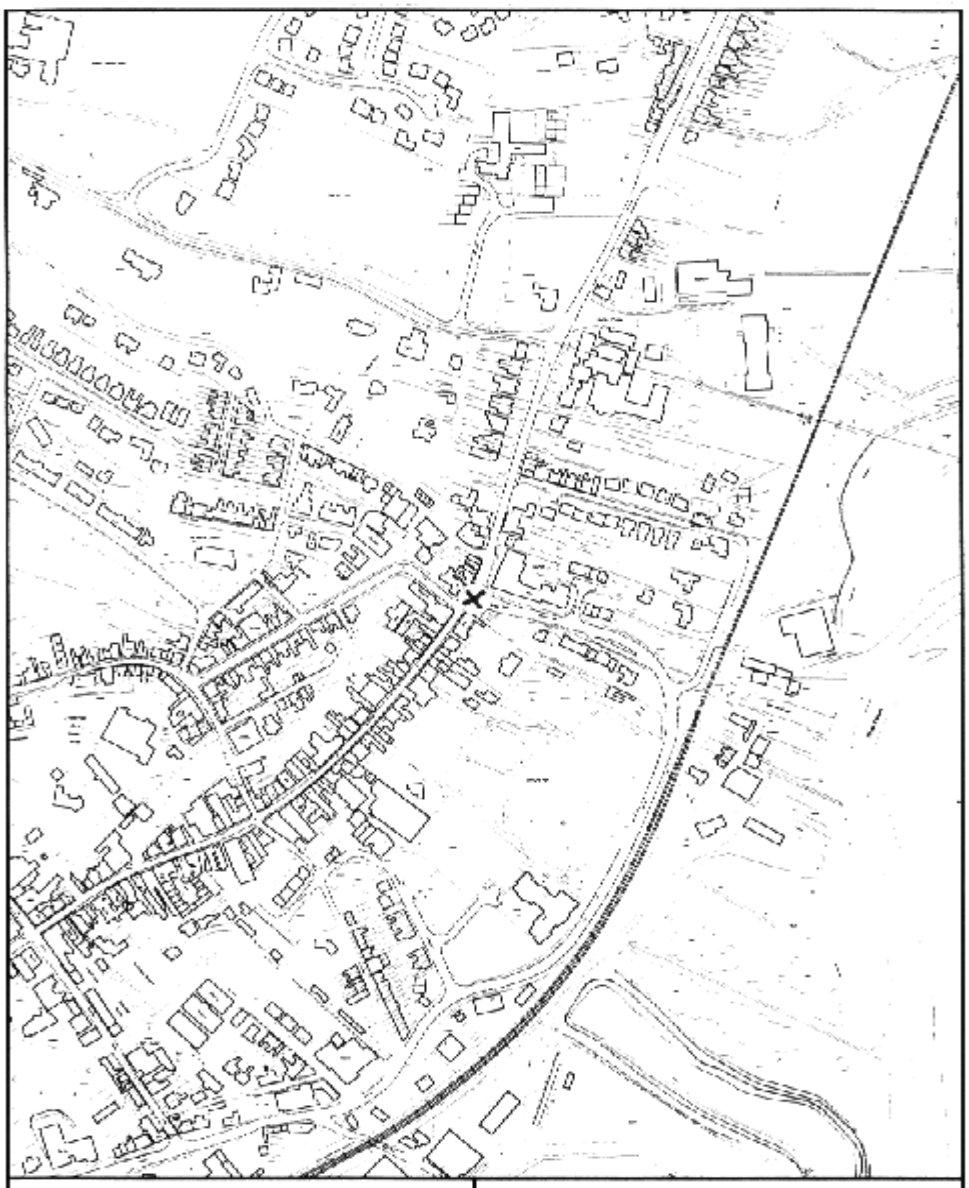


Figure F-2

Summary of traffic data used to run the Design Manual for Roads and Bridges (DMRB) computer model and the BREEZE roads computer model for the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.

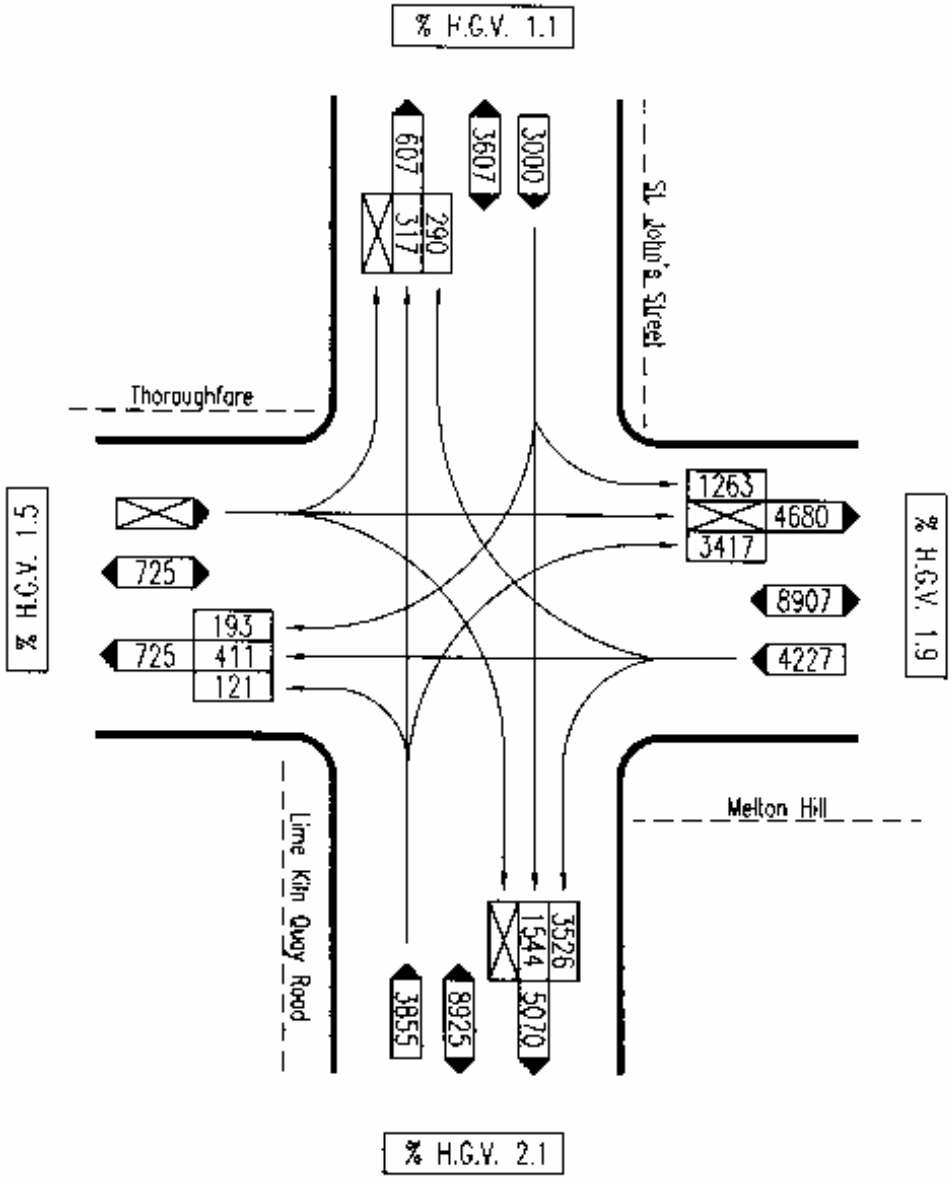
Road Link Description	AADT 2000 (from traffic surveys)	AADT 2004 (calculated) *	AADT 2005 (calculated) *	% Heavy Duty Vehicles #	Average Speed In mph (km/hr equivalent) #
Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge Receptor on **actual junction**	B1438 = 10,442 St. John's Street = 1,558	B1438 = 11,413 St. John's Street = 1,703	B1438 = 11,632 St. John's Street = 1,736	5	15 (24) and 10 (16)
Lime Kiln Quay Road / The Thoroughfare / St. John's Street junction, Woodbridge Receptor at current diffusion tube site, The Thoroughfare.	10,442	11,413	11,632	5	15 (24) and 10 (16)

For detail of all calculations see Figures F-4 and F-5 in this Appendix.

* Traffic summary figures calculated by Suffolk Coastal District Council in conjunction with Suffolk County Council, Environment and Transport Department.
# For modelling purposes, Suffolk County Council does not predict significant changes in the percentage of Heavy Duty Vehicles or average speeds over the period specified in the table.

Figure F-3

Summary diagram of 1-day, 12-hour traffic survey results undertaken on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, Woodbridge.



SUFFOLK HIGHWAYS ENGINEERING CONSULTANCY

TITLE

Location Melton Hill / Thoroughfare Woodbridge

Hour 07:00 to 19:00 C.P.Ref. 1

Date Tuesday 14th Nov 2000 Vehicle Type(s) All

P J Thompson MSc CEng FICE, County Director of Environment & Transport

Figure F-4

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction,

Receptor on actual junction

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 1-day, 12-hour traffic count taken during November 2000 on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, see traffic count summary earlier in Figure F-3. See map in Figure F-1 earlier in Appendix for location.
  - For modelling traffic using a junction DMRB requires that the legs of the junction are divided into two roads. Traffic flow data is input for each of these roads and DMRB then calculates emission levels using both sets of data. The main route for traffic using the Lime Kiln Quay Road junction is on the B1438 and so this was chosen as the main road regarding the junction. The second road, for DMRB purposes, was the combination of St. John's Street and the one way leg of The Thoroughfare, this will be referred to as St. John's Street. Care must be taken not to count any of the traffic twice.
  - Advice was sought from the DETR modelling helpline. It was advised that the largest traffic count on the B1438 was used for input into the DMRB model, this was **8,925** vehicles **over 12 hours**, see Figure F-3 for details.
  - In order to calculate a traffic flow figure for the second road (consisting of St. John's Street and the one way leg of The Thoroughfare) all traffic not already accounted for using these roads was added together. Details can be seen in Figure F-3, calculation is as follows;

    193 + 121 + 411 + 317 + 290 = **1,332 vehicles over 12 hours**

  - Suffolk County Council provided us with the means to factor up the 12-hour data to a **24-hour count** using data from a 5-day, 24-hour automatic count. This was undertaken at the same time as the Lime Kiln Quay Road junction count on another section of the Lime Kiln Quay Road. The factoring up figure is **1.17**.

    Therefore **AADT** in **2000** is:

    B1438: 8,925 x 1.17 = **10,442 vehicles per day**
    St. John's Street: 1,332 x 1.17 = **1,558 vehicles per day**

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

AADT in **2004** is:	**B1438:**	10,442 x 1.093	= **11,413 vehicles per day**
	St. John's Street:	1,558 x 1.093	**= 1,703 vehicles per day**
AADT in **2005** is:	**B1438:**	10,442 x 1.114	= **11,632 vehicles per day**
	St. John's Street:	1,558 x 1.114	**= 1,736 vehicles per day**

c) Percentage of HGVs in 2004 and 2005;

- The traffic count on the Lime Kiln Quay junction in November 2000 recorded a maximum of 2.1% HGVs. In the opinion of Suffolk County Council, Highways and Transport Department this figure was too low. A percentage HGV figure was calculated instead from the 5-day, 24-hour automatic count undertaken farther along Lime Kiln Quay Road. This was **5%.** Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

d) Traffic speed (km/hr) in 2004 and 2005;

- The Lime Kiln Quay Road junction is characterised by traffic often standing queueing at the traffic lights. Traffic which travels through the junction without being stopped by the traffic lights is reduced on average to **15 mph (24 km/hr)** due to the sharp bend. However, the majority of the traffic is stopped at the traffic lights, especially at rush hour, which would reduce the average speed through the junction to which has been estimated at **10 mph (15km/hr)**. The DMRB model was, therefore, run for both traffic speeds.

e) Receptor Site(s) = closest building, garden or boundary facade;

- The closest **building** facade to the **centre of the Lime Kiln Quay Road junction** was chosen as the receptor location. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

Distance to **kerbside**	=	**4.2m**
Distance to **centre of junction**	=	**12.8m**

f) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **18.7 μg/m^3**
  PM_{10} = **23.0 μg/m^3**

Figure F-5

Information required for continued Second Stage and Third Stage computer modelling of Nitrogen Dioxide and Particulate Matter levels from road traffic using the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction,

Receptor at current diffusion tube site in The Thoroughfare

a) Annual Average Daily Traffic flow (AADT) at last traffic count;

- AADT calculated from 1-day, 12-hour traffic count taken during November 2000 on the Lime Kiln Quay Road/The Thoroughfare/St. John's Street junction, see traffic count summary earlier in Figure F-3. See map in Figure F-1 earlier in Appendix for location.
  - Advice was sought from the DETR modelling helpline as this receptor is not directly on the junction itself, but is slightly farther along The Thoroughfare near Sun Lane. The helpline advised that the largest traffic count on the B1438 should be used for input into the DMRB model, this was **8,925** vehicles **over 12 hours**, see Figure F-3 for details.
  - Suffolk County Council provided us with the means to factor up the 12-hour data to a **24-hour count** using data from a 5-day, 24-hour automatic count. This was undertaken at the same time as the Lime Kiln Quay Road junction count on another section of the Lime Kiln Quay Road. The factoring up figure is **1.17**.

    Therefore **AADT** in **2000** is: 8,925 x 1.17 = **10,442 vehicles per day**

b) Calculated AADT in 2004/2005 (with general traffic growth added);

- To calculate forward the 2000 AADT flow to **2004** and **2005** general traffic growth needs to be added. These predictions were obtained from Suffolk County Council, Environment and Transport Department by using the Trip End Modelling Programme (TEMPRO) which produces traffic growth factors for this area of the country. TEMPRO produces factors for both low and high percentage traffic growth. Taking a precautionary approach we used the high percentage traffic growth figures;

  High percentage increase from 2000 to 2004 (9.3%) = **x 1.093**
  High percentage increase from 2000 to 2005 (11.4%) = **x 1.114**

  Therefore, with general traffic growth (high percentage) added to our AADT in 2000;

  AADT in **2004** is: **B1438:** 10,442 x 1.093 = **11,413 vehicles per day**

  AADT in **2005** is: **B1438:** 10,442 x 1.114 = **11,632 vehicles per day**

c) Percentage of HGVs in 2004 and 2005;

- The traffic count on the Lime Kiln Quay junction in November 2000 recorded a maximum of 2.1% HGVs. In the opinion of Suffolk County Council, Highways and Transport Department this figure was too low. A percentage HGV figure was calculated instead from the 5-day, 24-hour automatic count undertaken farther along Lime Kiln Quay Road. This was **5%.** Suffolk County Council state that this figure is representative for this section of road during 2000 and for the years **2004** and **2005**.

d) Traffic speed (km/hr) in 2004 and 2005;

- The Lime Kiln Quay Road junction is characterised by traffic often standing queueing at the traffic lights. Traffic which travels through the junction without being stopped by the traffic lights is reduced on average to **15 mph (24 km/hr)** due to the sharp bend. However, the majority of the traffic is stopped at the traffic lights, especially at rush hour, which would reduce the average speed through the junction to which has been estimated at **10 mph (15km/hr)**. The DMRB model was, therefore, run for both traffic speeds.

e) Receptor Site(s) = closest building, garden or boundary facade;

- The closest **building** facade to the **diffusion tube site on The Thoroughfare** was chosen as the receptor location. Computer models need distance to both the kerbside and the centre of the road in order to predict pollutant levels, measurements as follows (in metres);

Distance to **kerbside**	=	**1.2m**
Distance to **centre of junction**	=	**5.2m**

f) Background levels of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) for Receptor Site (levels obtained from the National Air Quality Archive);

- **NO_x** = **18.7 μg/m^3**
  PM_{10} = **23.0 μg/m^3**