



Air Quality Assessment of Tesco Store Development at Hadleigh, Suffolk

Document Control

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1 Introduction

- 1.1 Air Quality Consultants Ltd has been commissioned by Martin Robeson Planning Practice, acting on behalf of Tesco Plc, to carry out an air quality assessment of the proposed supermarket development at Hadleigh, Suffolk. The assessment is to support the planning application for a Class A1 food store and associated landscaping, service yard, car parking and access on the Brett works and adjoining land.
- 1.2 The proposed development site lies on Bridge Street close to the town centre, west of the High Street. It is bounded by the Brett River to the west, allotments to the north and commercial/residential buildings to the south and east. The site currently comprises of scrubland and industrial buildings.
- 1.3 The proposed development would consist of a supermarket and car park. It would lead to a small increase in traffic on the local roads, which could potentially have an effect on existing residential properties. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM₁₀).
- 1.4 This report describes existing local air quality conditions (2006), and the predicted air quality in the future assuming that the proposed development goes ahead and under the circumstance that the status quo is maintained. The assessment of traffic-related impacts focuses on 2008, which is the anticipated year of opening.

2 Policy Context and Assessment Criteria

Air Quality Strategy

- 2.1 The Air Quality Strategy (Defra, 2007a) provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify

whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Planning Policy

- 2.2 National policy on air quality and planning is set out in Planning Policy Statement 23 (PPS23) (ODPM, 2004). This contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account, as well as the presence of any AQMAs. PPS23 notes that the findings of local authority air quality reviews and assessments will be important, as they will identify local air pollution problems, which may in turn influence the siting of certain types of development. The need for compliance with any statutory environmental quality standards or objectives, including the air quality objectives prescribed by the Air Quality Regulations 2000 and Amending Regulations 2002, will also be a factor in determining whether air quality is a material consideration.
- 2.3 Further emphasis is given to the importance of air quality objectives and AQMAs in the Appendices to PPS23. The impact of a development on air quality is likely to be particularly important:
- where the development is proposed inside, or adjacent to an AQMA;
 - where the development could in itself result in the designation of an AQMA; and
 - where to grant planning permission would conflict with, or render unworkable, elements of a LA's air quality action plan.
- 2.4 PPS23 states clearly that not all planning applications for developments inside or adjacent to AQMAs should be refused, even if the development would result in a deterioration of local air quality.

Assessment Criteria

Health Criteria

- 2.5 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The

'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The objectives for use by local authorities are prescribed within the Air Quality Regulations, 2000 (Stationery Office, 2000) and the Air Quality (England) (Amendment) Regulations 2002, (Stationery Office, 2002). The relevant objectives for this assessment are provided in Table 1.

Table 1: Relevant Air Quality Objectives

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour mean	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year
	Annual mean	40 $\mu\text{g}/\text{m}^3$
Fine Particles (PM ₁₀) ^a	24-hour mean	50 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year
	Annual mean	40 $\mu\text{g}/\text{m}^3$

^a Measured by the gravimetric method.

- 2.6 The objectives for nitrogen dioxide and PM₁₀ were to have been achieved by 2005 and 2004 respectively, and will continue to apply in all future years thereafter. The Air Quality Strategy Addendum (Defra, 2003a) proposed a set of more stringent provisional objectives for PM₁₀ to be achieved by 2010. However, the 2007 Air Quality Strategy (Defra, 2007a) replaces these provisional PM₁₀ objectives with an exposure-reduction approach for PM_{2.5}. The exposure-reduction objective will be a 15% reduction in average urban background concentrations across the UK between 2010 and 2020. It will be supplemented with a 'backstop' annual mean objective for PM_{2.5} of 25 $\mu\text{g}/\text{m}^3$ to be achieved by 2020, which is designed to deliver a minimum level of protection to all areas. Examination of UK monitoring data shows it is highly unlikely that the PM_{2.5} backstop objective will be exceeded if the 24-hour PM₁₀ objective is attained. These PM_{2.5} objectives have not been included in Regulations, and they are not considered further in this assessment.
- 2.7 Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu\text{g}/\text{m}^3$ (Laxen and Marnier, 2003). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.
- 2.8 The European Union has also set limit values for both nitrogen dioxide and PM₁₀. Achievement of these values is a national obligation rather than a local one. The limit values for nitrogen dioxide

are the same levels as the UK objectives, and are to be achieved by 2010 (Stationery Office, 2007). The limit values for PM₁₀ are also the same level as the UK statutory objectives, and were to be achieved by 2005. The objectives are the same as, or more stringent than, the limit values, thus it is appropriate to focus the assessment on the objectives

Significance Criteria

2.9 There is no official guidance in the UK on how to define the magnitude of air quality impacts nor their significance. Criteria have therefore been developed by Air Quality Consultants to define 'impact magnitude' and 'overall impact significance'. The definition of impact magnitude is solely related to the degree of change in pollutant concentrations. Impact significance takes account of the impact magnitude and of the absolute concentrations and how they relate to the air quality objectives or relevant standards. These criteria have been adopted by the Irish National Roads Authority in its 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (NRA, 2006). They are also set out as an example in the National Society for Clean Air guidance document 'Planning Control: Planning for Air Quality' (NSCA, 2006). The criteria describing the magnitude of change due to the scheme are set out in Table 2, while Table 3 sets out the significance criteria, which relate the magnitude of change to the air quality objectives.

Table 2: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO ₂ / PM ₁₀	Days PM ₁₀ >50 mg/m ³
Very large	Increase/decrease > 25%	Increase/decrease > 25 days
Large	Increase/decrease 15-25%	Increase/decrease 15-25 days
Medium	Increase/decrease 10-15%	Increase/decrease 10-15 days
Small	Increase/decrease 5-10%	Increase/decrease 5-10 days
Very Small	Increase/decrease 1-5%	Increase/decrease 1-5 days
Extremely Small	Increase/decrease <1%	Increase/decrease <1 days

Table 3: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective	Change in Concentration					
	Extremely Small	Very Small	Small	Medium	Large	Very Large
Decrease with Scheme						
Above Objective with Scheme	slight beneficial	slight beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Above Objective in Do-min, Below with Scheme	slight beneficial	moderate beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Below Objective in Do-min	negligible	slight beneficial	slight beneficial	moderate beneficial	moderate beneficial	substantial beneficial
Well Below Objective in Do-min	negligible	negligible	slight beneficial	slight beneficial	slight beneficial	moderate beneficial
Increase with Scheme						
Above Objective in Do-min	slight adverse	slight adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Objective in Do-min, Above with Scheme	slight adverse	moderate adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Objective with Scheme	negligible	slight adverse	slight adverse	moderate adverse	moderate adverse	substantial adverse
Well Below Objective with Scheme	negligible	negligible	slight adverse	slight adverse	slight adverse	moderate adverse

'Do-min' = future baseline condition in the assessment year

'Below Objective' = 75-100% of the objective level

'Well Below Objective' = < 75% of the objective level.

3 Assessment Approach

Existing Conditions

- 3.1 Existing air quality within the study area has been defined using a number of sources. Industrial and waste management sources that may affect the area have been identified using the Environment Agency's website 'what's in your backyard' (Environment Agency, 2006). Local sources have also been identified through discussion with the Environmental Health Department of Babergh District Council, as well as through examination of the Council's air quality Review and Assessment reports.

- 3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers both the study area and nearby sites, the latter being used to provide context for the assessment. The background concentrations across the study area have been defined using the national pollution maps published by Defra (Defra, 2007b). These cover the whole country on a 1x1 km grid. Future year baseline concentrations have been derived from existing values using the forward projection calculator published by Defra. This is based on national projections of concentration changes over future years.

Road Traffic Impacts

Sensitive Locations

- 3.3 Concentrations of nitrogen dioxide and PM₁₀ have been predicted at a number of worst-case locations both within, and close to, the proposed development. Receptors have been selected to represent these worst-case locations. Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes etc. When selecting these receptors, particular attention has been given to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.
- 3.4 Three existing residential properties have been identified as receptors for the assessment. These locations are described in Table 4.

Table 4: Description of Receptor Locations

Receptor	Type	Description
Existing properties		
Receptor 1	Roadside	Property at the junction of Bridge Street, High Street and Calais Street. (5 m) ^a
Receptor 2	Roadside	Property on High Street, approx 10m south of the Bridge Street junction. (5 m) ^a
Receptor 3	Roadside	Property on Bridge Street, near to proposed access. (5 m) ^a

^a Distances are from building façade to road centre line.

Impact Predictions

- 3.5 Predictions of nitrogen dioxide and PM₁₀ concentrations have been carried out for the current year (2006), and the year of opening (2008). For 2008, predictions have been made assuming both that development does proceed (With Scheme), and does not proceed (Without Scheme).
- 3.6 Predictions have been carried out using the Design Manual for Roads and Bridges (DMRB) model v1.03c, (Highways Agency, 2007). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of heavy duty vehicles (HDVs), the distance of the road from the receptor, and the vehicle speed. It is also necessary to input background pollutant concentrations. These have been derived from the national maps discussed in the section on Existing Conditions.
- 3.7 Modelled road-NO_x concentrations for each receptor are used to calculate the nitrogen dioxide concentration following the method set out by Defra (2003b), taking into account the most recent guidance (Defra, 2007c):
- NO₂ (modelled) = NO₂ (road) + NO₂ (background) where:
- NO₂ (road) = NO_x (road) x (-0.0719*LN(NO_x(total)) + 0.6284)
- 3.8 The Environmental Health Department of Babergh District Council, pointed out that parts of High Street, Hadleigh are 'canyon-like', i.e. that the dispersion of pollutants may be constrained by buildings on either side of the road and therefore concentrations may be higher than those experienced in a more open environment. To account for this issue, the nitrogen dioxide concentrations due to road emissions, calculated using the DMRB, have been multiplied by a factor of 2, as recommended in the Review and Assessment Technical Guidance (Defra 2003b).
- 3.9 AADT flows, and the proportions of HDVs for each scenario have been derived from the traffic assessment carried out by Boreham Consulting Engineers in November 2006. Traffic speeds have been estimated from local speed restrictions and the proximity to a junction. The baseline flows are those measured in 2006, projected forwards to 2008 using National Road Traffic Forecasts (NRTF). The 2006 AM and PM peak flows have been adjusted to AADT flows by Boreham Consulting Engineers. The traffic flow assumptions are summarised in Table 5.

Table 5: Summary of Traffic Data used in the Assessment.

Road Link	Base Year (2006)	2008 (Without Scheme)	2008 (With Scheme)
Bridge Street (east)	5291 ^a (1.3%) ^b	5450 (1.3%)	7602 (1.3%)
High Street	9078 (1.3%)	9350 (1.3%)	8807 (1.3%)
Calais Street	4729 (1.3%)	4870 (1.3%)	3594 (1.3%)
Access Road	1510 (1.3%)	1554 (1.3%)	5437 (1.3%)

^a AADT traffic data derived from measured AM and PM peak flows in November 2006. Based on information provided by Boreham Consulting Engineers Ltd, 2006. Factored growth between 2006 and 2008 based on NRTF forecasts as advised by Boreham Consulting Engineers Ltd.

^b Values in parentheses are proportions of HDVs.

- 3.10 The AM and PM surveys that were carried out by Boreham Consulting Engineers indicated very low HDV flows (about 1.3% of total flow).

4 Site Description and Baseline Conditions

- 4.1 The development site is located to the west of the High Street. Access to the site would be from Bridge Street via a new access road. There are no relevant receptors close to the proposed car-parking area.
- 4.2 Babergh District Council has investigated air quality in its area as part of its local air quality management responsibilities. During both the first round of review and assessment, and the subsequent Updating and Screening stage of the second round, no areas were identified in Hadleigh where the air quality objectives are likely to be exceeded. The Third round of review and assessment also concluded that the air quality objectives would not be exceeded (Babergh District Council 2006).
- 4.3 There are no automatic monitoring stations close to the development site, but Babergh District Council operates an automatic roadside nitrogen dioxide monitor near the A12 at Lattinford. The Council historically operated two nitrogen dioxide diffusion tube monitoring sites in the area of Hadleigh. These were a roadside site in Benton Street and a background site in Fullers Close. The diffusion tube data provided have been projected from results for 6 months in 2001, and are summarised in Table 6.

Table 6: Summary of Nitrogen Dioxide (NO₂) Monitoring Adjusted to 2006 and 2008

Site No.	Site Type	Location	NO ₂ concentration (µg/m ³)	
			2006	2008
Automatic Monitor			2006	2008
1	Roadside	Lattinford Hill	24.7	23.1 ^a
Diffusion Tubes				
2	Roadside	Benton Street	22.5 ^b	21.1 ^b
3	Background	Fullers Close	12.6 ^b	12.0 ^b
Objective			40	

^a Estimated from results from continuous monitoring data for 2006 (Babergh District Council, 2007) using the projection factors supplied by Defra (Defra, 2007^b)

^b Estimated from Babergh District Council's diffusion tube results for 6 months in 2001 (adjusted for bias using factor for Harwell Scientific Services (Defra 2006^a) and estimated for a full year by comparison with Norwich Roadside, Norwich Centre and Cambridge) using the projection factors supplied by Defra (Defra, 2007^b)

4.4 There has been no monitoring of PM₁₀ carried out in Hadleigh or elsewhere in Babergh District Council. The background PM₁₀ concentration for the proposed development site is presented in Table 7.

4.5 In addition to the locally measured nitrogen dioxide concentrations, the estimated background concentrations have been obtained from the national maps (Table 7). The estimated background nitrogen dioxide concentrations are broadly consistent with the 2006 measured background value set out in Table 6.

Table 7: Estimated annual mean background pollutant concentrations in 2006 and 2008 (µg/m³)

Year	NO _x	NO ₂	PM ₁₀
2006	15.0	11.9	19.9
2008	13.8	11.3	19.2
Objectives	-	40	40

4.6 The DMRB model has been used to predict baseline concentrations of nitrogen dioxide and PM₁₀ at each of the receptors identified in Table 4. The results, which cover both existing baseline and future year baseline (without development), are set out in Tables 8 and 9.

Table 8: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)

Location	Existing (2006)	2008
	Annual mean	Annual mean
Receptor 1	22.4	20.7
Receptor 2	19.2	17.8
Receptor 3	17.1	16.0
Objective	40	40

Results modelled using DMRB 1.03c (Highway Agency, 2007)

Table 9: Modelled Baseline Concentrations of PM_{10} ($\mu\text{g}/\text{m}^3$)

Location	Existing (2006)	2008	Existing (2006)	2008
	Annual mean	Annual mean	No.Days $>50\mu\text{g}/\text{m}^3$	No.Days $>50\mu\text{g}/\text{m}^3$
Receptor 1	21.9	20.9	6	5
Receptor 2	21.1	20.2	5	4
Receptor 3	20.8	19.9	4	3
Objective	40	40	35	35

Results modelled using DMRB 1.03c(Highway Agency, 2007)

- 4.7 The predicted annual mean concentrations of both nitrogen dioxide and PM_{10} are well below the objectives at all receptor locations in 2006 and 2008. The numbers of days above $50 \mu\text{g}/\text{m}^3$ are also well below the objective at all receptors.
- 4.8 These results are consistent with the conclusions of Babergh District Council in the outcome of its air quality review and assessment work.

5 Impact Assessment

Road Traffic Impacts

- 5.1 Predicted annual mean concentrations of nitrogen dioxide and PM_{10} and days with $\text{PM}_{10} >50 \mu\text{g}/\text{m}^3$ are set out in Table 10, for both the "Without Scheme" and "With Scheme" scenarios.

Table 10: Predicted Concentrations of Nitrogen Dioxide (NO₂) and PM₁₀ in 2008

Location	2008 "Without Scheme"			2008 "With Scheme"		
	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)		NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)	
	Annual Mean	Annual Mean	No.Days >50µg/m ³	Annual Mean	Annual Mean	No.Days >50µg/m ³
Receptor 1	20.7	20.9	5	20.6	20.9	5
Receptor 2	17.8	20.2	4	17.4	20.2	4
Receptor 3	16.0	19.9	3	19.5	20.6	4
Objectives	40	40	35	40	40	35

- 5.2 Predicted concentrations of both nitrogen dioxide and PM₁₀ remain well below the objectives in 2008, whether the proposed scheme proceeds or not. This is despite slightly higher traffic flows on some of the existing roads in 2008. Concentrations in 2008, with the scheme, also remain below existing (2006) levels at all receptors except receptor 3 (compare with values in Tables 8, 9 and 10). This is due to the expected decline in concentrations arising from the implementation of more stringent emission controls, in particular those for new vehicles. The concentration at receptor 3 remains well below the objective with the scheme in 2008 however the concentration is higher than the existing (2006) level. This receptor is located close to the proposed new access road and will therefore experience a relatively large rise in traffic flow.
- 5.3 The changes in annual mean concentrations and days with PM₁₀ >50 µg/m³ brought about by the scheme are set out in Table 11. The incremental changes in annual mean nitrogen dioxide are extremely small at receptor 1 and very small at receptor 2. This reflects the minor decrease in traffic flow on roads impacting on these receptors. Using the criteria set out in Table 3 these impacts are judged negligible. The change in concentration at receptor 3 is large in magnitude and reflects the introduction of traffic on the new access road. The concentration at receptor 3 is well below the objective level and the impact is judged to be slight adverse. Changes in PM₁₀ concentrations are all very small or extremely small, and reflect the changes to road traffic flows. The scheme makes no difference to the number of days with PM₁₀ >50 µg/m³. Using the criteria set out in Table 3, the impacts on PM₁₀ are therefore judged to be negligible.

Table 11: Percentage Change in Predicted Concentrations Between “With Scheme” and “Without Scheme” Conditions in 2008

Location	NO ₂	PM ₁₀	
	Annual Mean	Annual Mean	No. Days >50µg/m ³
Receptor 1	-0.2%	0.0%	0
Receptor 2	-2.3%	-0.4%	0
Receptor 3	22.4%	3.2%	0

6 Mitigation

Road Traffic Impacts

- 6.1 The assessment has demonstrated that the scheme would not cause any exceedences of the air quality objectives. Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered by the introduction of more stringent emissions standards, largely via European legislation. It is not considered appropriate to propose further mitigation measures for this scheme.

7 Summary and Conclusions

- 7.1 The air quality impacts associated with the proposed Tesco development at Hadleigh have been assessed. Existing conditions within the study area show good air quality, with concentrations well below the air quality objectives.
- 7.2 The impacts assessed are principally those associated with changing road traffic emissions on the local roads resulting from the development. Concentrations have been modelled for 3 worst-case receptors, representing existing properties where impacts are expected to be greatest.
- 7.3 Traffic flows along the roads local are relatively low, and would remain below 10,000 (AADT) in 2008, even with the proposed development. The impact of road traffic emissions has been modelled, using a standard approach, and it is concluded that concentrations of nitrogen dioxide and PM₁₀ would remain well below the objectives in 2008, whether the scheme is developed or not. This is consistent with the outcome of the reviews and assessments prepared by Babergh District

Council, which have concluded that exceedence of the nitrogen dioxide and PM₁₀ objective, are unlikely at any location.

- 7.4 The proposed scheme would cause slight increases in traffic flows on some existing roads and slight decreases on others. Correspondingly these small changes in traffic flow on the existing roads lead to very small to extremely small changes in concentrations of nitrogen dioxide and PM₁₀ and the impacts are judged to be negligible. The traffic flow on the new access road is relatively low (less than 5,500). However as this is a new road the impact for the nearest receptor is shown to be large. The predicted concentrations at this receptor remain, however, well below the objective. The impact here is considered to be slight adverse.
- 7.5 It is concluded that road traffic emissions do not provide any constraints to the proposed scheme.

8 References

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Stationery Office (2000) Air Quality Regulations, 2000, Statutory Instrument 928.

Stationery Office (2002) Air Quality Regulations, 2002, Statutory Instrument 3043.

9 Glossary

Standards A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal.

Objectives A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date, taking into account costs, benefits, feasibility and practicality. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides.

Exceedence A period of time where the concentration of a pollutant is greater than the appropriate air quality objective.

AQMA Air Quality Management Area

DMRB Design Manual for Roads and Bridges (Highways Agency 2003)

PM₁₀ Small airborne particles, more specifically particulate matter less than 10 micrometers in aerodynamic diameter.

NO₂ Nitrogen dioxide.

mg/m³ Microgrammes per cubic metre.