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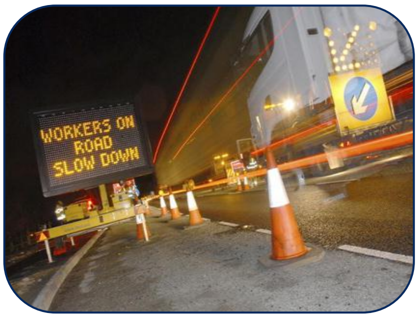


CLIENT PROJECT REPORT CPR1391

Local Air Quality Management Action Plan for the Air Quality Management Area at Ferry Lane, Felixstowe

FINAL

J Price and K Turpin

Prepared for:	Suffolk Coastal District Council, Environmental Health
Project Ref:	11110353

Quality approved:

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8	September 2012	Final Action Plan for submission to Defra including client amendments – final Client Project Report	Jennifer Price	Anna Savage

Executive Summary

This report constitutes the final action plan for the Ferry Lane Air Quality Management Area (AQMA) in Felixstowe, Suffolk. The report was prepared by TRL for Suffolk Coastal District Council in fulfilment of the Council's responsibilities under the Local Air Quality Management (LAQM) system. Suffolk Coastal District Council confirms that it fully endorses all conclusions and recommendations included in this report.

The focus of the action plan is an area to the south west of Felixstowe where an AQMA was declared for annual nitrogen dioxide (NO_2) concentrations at the Dooley Inn public house on Ferry Lane in 2009[1]. A further assessment report was submitted to Defra in 2010. This report confirmed the findings of the 2008 detailed assessment and identified container handling activities in the Port of Felixstowe and heavy duty vehicles (HDVs) on roads external to the port as being the most significant sources of emissions of oxides of nitrogen (NO_X) at the Dooley Inn public house. A draft action plan was submitted to Defra in 2012. The draft plan was accepted and a number of recommendations made. This report constitutes the final action plan, which takes into account comments received from Defra and as part of a wider consultation exercise. The report identifies measures to be adopted as part of the formal action plan and sets out how these measures will be implemented and monitored.

[1] http://www.suffolkcoastal.gov.uk/NR/rdonlyres/E3D38E32-3D86-4030-A4C8-8DB234C7C502/0/AQMADooleyInn.pdf

Contents

1 Introduction

TRL has been commissioned by Suffolk Coastal District Council to produce an action plan for the Air Quality Management Area (AQMA) at Ferry Lane, Felixstowe. This action plan has been developed in compliance with the requirements and recommendations outlined in Defra's Local Air Quality Management Policy[2] and Technical[3] Guidance (2009).

The report is structured as follows:

Section 2: Background – outlines the requirements of the Local Air Quality Management framework and describes the conclusions of Suffolk Coastal District Council's review and assessments completed to date.

Section 3: Source apportionment – reviews the findings of the Ferry Lane AQMA further assessment report to ensure potential action plan measures target the most important emission sources.

Section 4: Population exposure – identifies the number of people exposed to exceedence of the relevant objective value within the existing AQMA.

Section 5: Timescale for compliance – sets out the timeframe over which compliance with the relevant objective value is likely to be achieved without implementation of an air quality action plan.

Section 6: Required emission reduction – quantifies the reduction in emissions required for air quality concentrations within the existing AQMA to be compliant with the relevant objective value.

Section 7: Action plan development – describes measures considered as part of the action plan development. Presents the outcome of discussions between Suffolk Coastal District Council and the Port of Felixstowe and summarises the results of the consultation phase.

Section 8: Final action plan measures – summarises the final action plan measures and presents timescales for implementation and information on how selected measures will be monitored. Quantification of the impacts of potential measures is also discussed.

Section 9: Local Transport Plan – described the links between the Suffolk County Council Local Transport Plan and the Ferry Lane AQMA action plan.

Section 10: Strategic Environmental Assessment – assesses whether the exercise of powers chosen (with regards to selected action plan measures) would trigger a Strategic Environmental Assessment.

[2] http://archive.defra.gov.uk/environment/quality/air/airquality/local/guidance/documents/laqm-policy-guidance-part4.pdf

[3] http://archive.defra.gov.uk/environment/quality/air/airquality/local/guidance/documents/tech-guidance-laqm-tg-09.pdf

2 Background

2.1 Local Air Quality Management Review and Assessment

Local authorities in the United Kingdom have a statutory duty to review the air quality within their areas and assess concentrations of key air pollutants against the standards and objectives set out in the Air Quality (England) Regulations 2000[4] and the Air Quality (England) (Amendment) Regulations 2002[5]. The UK air quality objectives are summarised in Appendix A.

Under Section 83 of the Environment Act 1995, local authorities are required to designate an Air Quality Management Area (AQMA) where air quality objectives are not being achieved or are not likely to be achieved within the relevant time period. Once an AQMA has been declared, Section 84 of the Environment Act 1995 requires the local authority to carry out an assessment and develop an action plan.

2.2 Suffolk Coastal District Council Air Quality Review and Assessment

Suffolk Coastal District Council has completed three rounds of review and assessment and is currently undertaking the fourth round. The findings of the Council's review and assessment reports completed to date are summarised in Appendix B and key findings are outlined below:

- The first round of review and assessment was completed in 2001. No AQMAs were declared as part of the first round.
- The second round of review and assessment was completed in 2005. This round concluded that there was a potential risk of the air quality objectives for nitrogen dioxide (NO_2), particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) and sulphur dioxide (SO_2) being exceeded within the Suffolk Coastal district. Following completion of a detailed assessment, an AQMA was declared for exceedence of the annual mean NO_2 objective concentration at Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge in March 2006.
- The third round of review and assessment consisted of an updating and screening assessment, a detailed assessment and a progress report. The 2006 updating and screening assessment identified a potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 resulting from emissions from activities on and associated with the Port of Felixstowe. Following completion of a detailed assessment for Adastral Close and Ferry Lane, an AQMA was declared in 2009 for exceedence of the annual mean NO_2 objective concentration in the vicinity of the Dooley Inn Public House on Ferry Lane, Felixstowe.
- The fourth round of review and assessment is ongoing and to date has consisted of an updating and screening assessment, progress reports and a further assessment for the Ferry Lane AQMA. The further assessment report confirmed the findings of the 2008

[4] http://www.legislation.gov.uk/uksi/2000/928/contents/made

[5] http://www.legislation.gov.uk/uksi/2002/3043/contents/made

detailed assessment, with exceedence of the NO_2 annual average objective predicted at the Dooley Inn public house. A modelling assessment completed as part of the further assessment concluded that the existing AQMA boundary is appropriate.

2.2.1 Ferry Lane, Felixstowe Air Quality Management Area

The Ferry Lane AQMA was declared in May 2009. The boundary of the AQMA is shown in Figure 1.

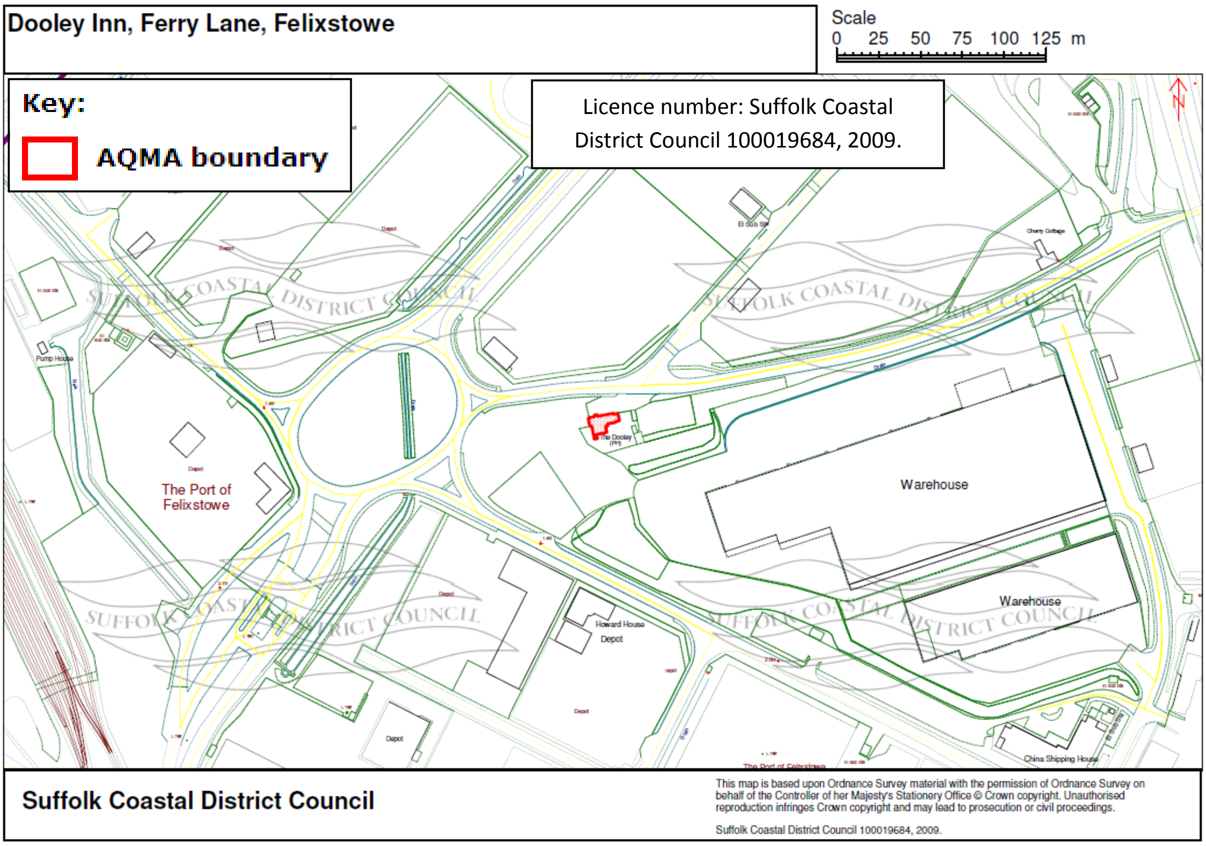

Figure 1: Air Quality Management Area for the Dooley Inn, Ferry Lane, Felixstowe

(Source: The Suffolk Coastal District Council Air Quality Management Area Order No 2, 2009[6])

The further assessment report for the Ferry Lane AQMA was accepted by Defra in August 2010. Following consultation with Defra, Suffolk Coastal District Council was permitted to delay the production of an action plan for the Ferry Lane AQMA due to uncertainty surrounding the future of the Dooley Inn public house, which is the one relevant receptor for which the AQMA was declared. Suffolk Coastal District Council has now confirmed that the Dooley Inn has been sold and remains a public house with a residential flat above it; hence the AQMA will be retained and a draft action plan has been produced. The draft action plan was submitted to Defra in 2012 and was approved. A consultation period was then undertaken (see Section 7.3). This report takes into account comments received from Defra and from other parties during the consultation period and constitutes the final action plan for the Ferry Lane AQMA.

[6] http://www.suffolkcoastal.gov.uk/NR/rdonlyres/E3D38E32-3D86-4030-A4C8-8DB234C7C502/0/AQMADooleyInn.pdf

2.3 Air quality action plans

Local Air Quality Management Policy Guidance[7] (LAQM PG 09) states that an air quality action plan must include:

- Quantification of the source contributions to the predicted exceedences of the relevant objectives (to allow action plan measures to be effectively targeted).
- Evidence that all available options have been considered.
- Description of how the local authority will use its powers and also work in conjunction with other organisations in pursuit of the air quality objectives.
- Clear timescales in which the authority and other organisations and agencies propose to implement the measures within its plan.
- Where possible, quantification of the expected impacts of the proposed measures and an indication as to whether the measures will be sufficient to meet the air quality objectives (where feasible, data on emissions can be included as well as data on concentrations where possible).
- How the local authority intends to monitor and evaluate the effectiveness of the plan.

This action plan has been produced in compliance with the requirements of LAQM PG 09 and includes: a review of the source apportionment exercise completed as part of the further assessment report; identification of the population exposed to exceedence; assessment of the timeframe over which compliance is likely to be achieved; quantification of the required emission reduction; consideration of all possible action plan measures, including a summary of the outcome of consultation with the Port of Felixstowe; timescales over which selected measures may be implemented; quantification of the expected impact of measures (where possible) and description of how the Council intends to monitor the selected measures.

The overall aim of the action plan is to provide a framework for identifying and implementing measures to reduce emissions and mitigate the effects of air pollution. The plan does not aim to constrain development in any way. Instead, the plan can be used by relevant bodies to assist in minimising the negative impacts of development in terms of air quality. LAQM PG 09 states: “Other local authority departments and external bodies should be constructively engaged in agreeing measures to improve air quality and meet the legal requirement to work towards air quality objectives”. It is envisaged that joint working between Suffolk Coastal District Council and the Port of Felixstowe will be necessary in order to achieve compliance with the annual mean NO_2 objective in the existing AQMA.

[7] http://archive.defra.gov.uk/environment/quality/air/airquality/local/guidance/documents/laqm-policy-guidance-part4.pdf

3 Source apportionment

As part of the further assessment for the Ferry Lane AQMA, a source apportionment exercise was conducted to calculate the proportion of total oxides of nitrogen (NO_X) emitted from different sources. The atmospheric dispersion model ADMS-Roads was run separately for different groups of sources to predict their individual contributions to modelled NO_X concentrations at the Dooley Inn receptor. For road vehicles, emissions were calculated for heavy duty vehicles (HDVs) and light duty vehicles (LDVs) separately.

The results of the source apportionment exercise are shown in Table 1. These results relate to a base year of 2008.

Table 1: Percentage contribution to oxides of nitrogen (NO_X) concentration at the Dooley Inn public house

Source	Percentage contribution to NO_X concentrations at the Dooley Inn receptor
External roads (HDV)	28.5%
External roads (LDV)	1.6%
Container handling	36.9%
Shipping	9.4%
Rail	1.1%
Local background	12.9%
Rural background	9.7%

The source apportionment results show that container handling operations (including vehicles on roads within the Port of Felixstowe boundary) are the largest group of sources that contribute to the modelled NO_X concentrations at the Dooley Inn. HDVs travelling on roads outside the port boundary are the next largest contributor. NO_X emissions from rail and LDVs have a minimal impact on concentrations at the Dooley Inn.

These findings have been used to identify appropriate measures targeting a reduction in emissions from port vehicles and HDVs as the most important emission sources for the Ferry Lane AQMA. It should be noted that although emissions from the Port of Felixstowe are the largest contributor, this does not equate to actions being directly targeted at the Port. Actions to reduce emissions should consider all emission sources that can be reasonably targeted.

4 Population exposure

The further assessment report considered the extent of the AQMA boundary and confirmed that it was not necessary for Suffolk Coastal District Council to amend the boundary. In particular, the dispersion modelling domain covered the Port of Felixstowe and relevant receptor locations in nearby Adastral Close. The output from the dispersion modelling completed as part of the further assessment is presented in Figure 2. The Dooley Inn public house was the only relevant receptor where an exceedence of the annual mean NO_2 objective was predicted or measured. Two diffusion tube sites within the Port of Felixstowe boundary recorded exceedences of the NO_2 annual mean objective and the dispersion modelling indicated exceedence across the Port area. These sites and the area within the Port boundary are not, however, relevant for public exposure.

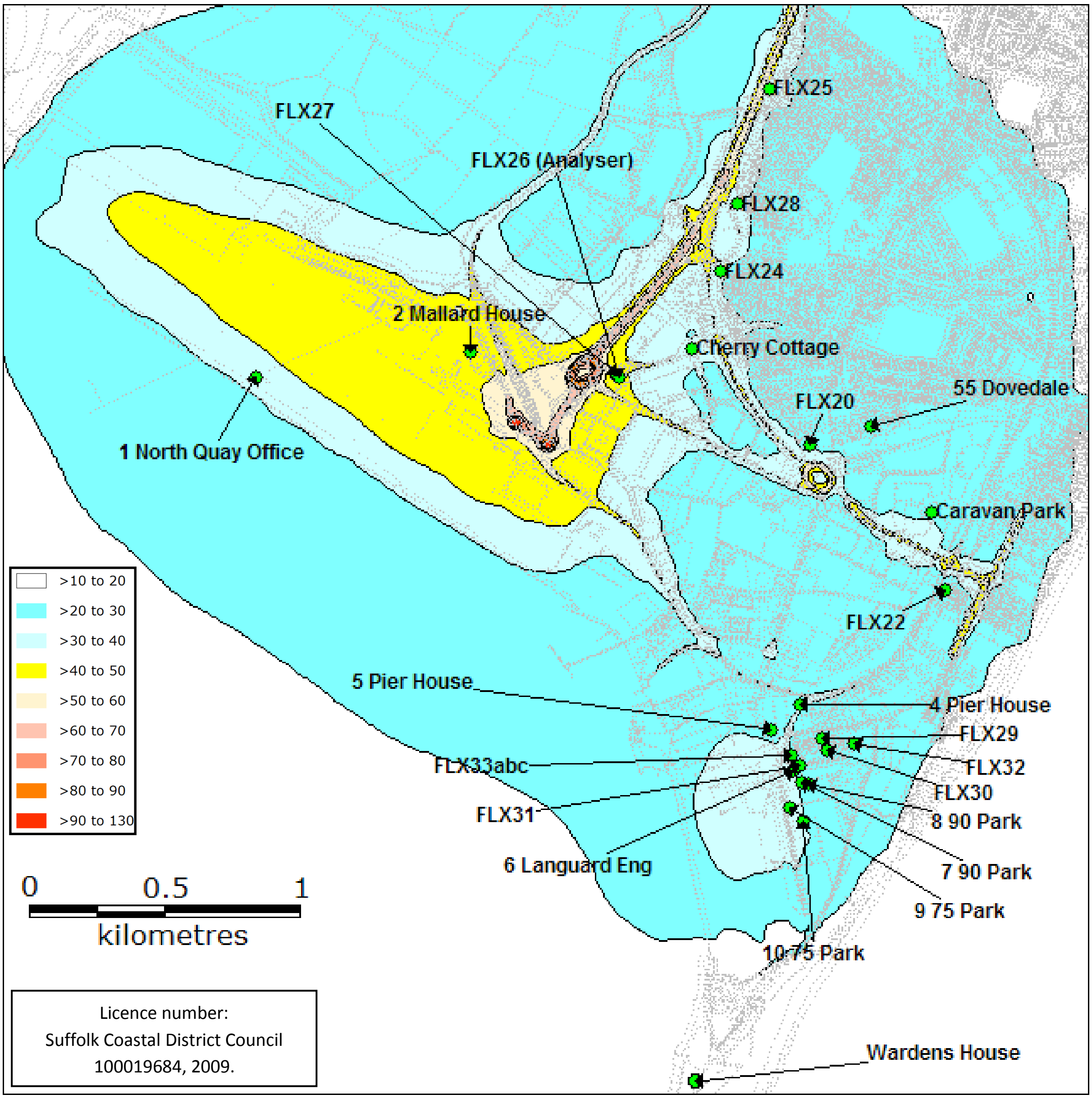

Figure 2: Annual mean NO_2 concentrations across the Further Assessment dispersion modelling domain

Suffolk Coastal District Council was advised that the Dooley Inn public house was sold in July 2010 and would remain a public house with a residential flat above it. The flat was expected to be vacant for approximately six months from July 2010. The current landlord has indicated to the Council that he intends to inhabit the property[8]. Hence, the population exposed to exceedence of the annual mean NO_2 objective concentration is approximately 2 people, assuming an average household occupancy of 2.36 (2001 census data[9]). A planning application has been submitted for a single bedroom annex to be used by public house staff. If this application is successful, relevant exposure within the AQMA will increase.

[8] Personal communication with Suffolk Coastal District Council, June 2011

[9] http://www.statistics.gov.uk/census2001/profiles/commentaries/housing.asp

5 Timescale for compliance

LAQM TG 09 outlines a procedure for projecting measured roadside NO_2 concentrations to future years. Year adjustment factors have been published in an amendment to Box 2.1 of LAQM TG 09[10]. These factors can be applied to monitoring data to estimate when concentrations are likely to be compliant with the objective value without any action plan measures being implemented (*i.e.* due to general fleet replacement and subsequent emissions reductions expected to occur over time). This approach does not, however, take into account any local factors and results represent an indication of the likely trend in concentrations only. It is acknowledged that local authorities should continue to implement action plan measures even when compliance is predicted within the lifetime of the plan.

Continuous monitoring of nitrogen dioxide concentrations at the Dooley Inn public house began in 2007. The analyser was removed when the public house was vacated on 25th March 2010 and was re-installed in July 2010 following confirmation that the pub had been sold and would remain as a residential property. Due to a fault with the analyser, some data between August and October 2010 was discounted. The fault was rectified on 12th October 2010.

Due to the low data capture rate achieved at the Dooley Inn continuous monitoring site in 2010, it was considered more appropriate to project the annual mean NO_2 concentration recorded by the triplicate diffusion tube sites (FLX26) which are co-located with the analyser. These tubes achieved 100% data capture in 2010 (see Appendix D). The average annual mean NO_2 concentration recorded by the three tubes at site FLX26 has been projected in line with the procedure recommended in LAQM TG 09.

Results presented in Table 2 demonstrate that the annual mean NO_2 concentration at the Dooley Inn public house is likely to be compliant with the objective value by 2012. It is, however, acknowledged that the projected results should be treated with caution due to the disparity between measured concentrations and the projected decline in concentrations associated with emissions forecasts. Concentrations have not been declining as rapidly as predicted and NO_2 concentrations at urban roadside and background site have largely remained stable over the past 6-8 years (information published on Defra's frequently asked questions website[11]).

Table 2: Projected annual mean NO_2 concentration at the Dooley Inn public house

Site ID	Grid reference		Background NO_2 ($\mu g/m^3$) 2010	Measured bias adjusted annual mean NO_2 ($\mu g/m^3$) 2010	Projected annual mean NO_2 ($\mu g/m^3$)				
	X	Y			2011	2012	2013	2014	2015
FLX26	627959	234246	18.6	**42.5**	**40.0**	37.6	35.1	32.6	30.2

[10] http://laqm.defra.gov.uk/documents/Is_the_example_in_Box_2.1_TG09_correct.pdf

[11] http://laqm.defra.gov.uk/documents/Measured-nitrogen-oxides-(NOx)-and-or-nitrogen-dioxide-(NO2)-concentrations-do-not-appear-to-be-declining-in-line-with-national-forecastsv1.pdf

6 Required emission reduction

To inform the development of action plan measures, the emission reduction required to achieve compliance with the annual mean NO_2 objective (based on the 2010 concentration) has been estimated at the Dooley Inn public house (the only relevant receptor within the Ferry Lane AQMA).

The use of Defra's NO_X/NO_2 calculator[12] tool was considered. However, it is designed for use where pollution sources can reasonably be described as road or background sources. Table 1 shows a significant contribution to NO_X from container handling and shipping, which are unlikely to have a similar proportion of NO_X and NO_2 emissions as road sources.

Continuous monitoring data for Dooley Inn for 2009 were used to identify the NO_X: NO_2 relationship. Measured annual mean NO_X and NO_2 in 2009 were 109 µg/m^3 and 44 µg/m^3 respectively. Continuous monitoring data capture at the site in 2010 was less than 50 percent and was therefore not considered.

Assuming a similar relationship between annual mean NO_X and NO_2 in 2010 would give an annual mean NO_X concentration of 105 µg/m^3 for the measured annual mean NO_2 concentration of 42.5 µg/m^3 and a NO_X concentration of 99 µg/m^3 if the NO_2 objective level of 40 µg/m^3 were to be achieved.

This suggests a NO_X reduction of 6 µg/m^3 (5.7 percent) would be required in order to achieve the objective. However, there are significant uncertainties in the NO_X: NO_2 relationship and this reduction should be considered indicative only. A reduction of 10 µg/m^3 might be more likely to be required if, for instance, NO_2 directly emitted from road vehicles continued to rise and if the NO_X: NO_2 relationship were not linear in the 40-44 µg/m^3 range.

[12] http://laqm.defra.gov.uk/documents/no2tonox8_ja-forweb_jan2010.xls

7 Action plan development

7.1 Identification of potential action plan measures

The source apportionment exercise carried out as part of the further assessment concluded that container handling activities within the Port of Felixstowe boundary and HDVs on roads external to the port make the greatest contribution to NO_X concentrations at the Dooley Inn receptor. Action plan measures should therefore aim to reduce emissions from these sources.

Whilst the scope for the local authority to influence container handling operations within the Port boundary is limited, Suffolk Coastal District Council has engaged in discussions with the Port of Felixstowe to gauge the feasibility of a number of potential action plan measures. To inform the discussion, TRL carried out research into air quality improvement and emissions-reduction measures which have been implemented at other ports. The findings of the literature review are presented in full in Appendix C.

Table 4 summarises measures which have been considered for implementation both external to the Port and within the Port boundary. Measures which were taken forward to the consultation phase are identified.

Table 4 includes cost, benefit and combined cost-benefit ratings for each action plan measure. The cost and benefit ratings have been assigned in accordance with criteria outlined in Table 3. The combined cost/benefit rating is the product of the two individual scores. The higher the combined score, the more attractive the proposed measure is considered to be.

Table 3: Cost/Benefit ratings

Cost			**Benefit**	
Amount	Description	Rating	Description	Rating
None	Neutral	4	Neutral	0
Up to £20,000	Low	3	Low	1
£20,000-200,000	Medium	2	Medium	2
Greater than £200,000	High	1	High	3

Measures which have been considered for implementation, including those solely within the Port boundary, have been rated in terms of costs and benefits. The rating system is not intended to account for the full economic and environmental impacts of all options; rather it provides a baseline for discussion.

Table 4: Potential action plan measures

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
1	**Traffic management**							
a	Develop a freight holding area on the outskirts of Felixstowe.	Suffolk Coastal District Council and the Port of Felixstowe.	1	2	2	Would allow the transfer of containers to be better managed, leading to more efficient practices and reduced fuel consumption.	No space available for such an area (the Port has been attempting to find a location to hold trucks in the vicinity of the Port for more than 5 years). The option would cost in excess of £10 million.	Not to be taken forward – superseded by the vehicle booking system (VBS) (option 7c).
b	Develop a freight expressway on the A14 and Trinity Avenue (in conjunction with option 1a)	Suffolk Coastal District Council, the Port of Felixstowe and the Highways Agency	2	2	4	Use of gantry controls according to network demand or at specified times of day or night would ease congestion and smooth flow.	Implementation is outside of the local authority's control and the Port of Felixstowe control.	Not to be taken forward – superseded by the VBS (option 7c).
c	Implement a one-way system allowing freight vehicles to access the Port via the A14 and Dock Gate Road (Dock Gate 1) with Walton Avenue one-way westbound to access Dock Gate 2.	Suffolk Coastal District Council, the Port of Felixstowe and the Highways Agency	2	2	4	This would reduce the Annual Average Daily Traffic (AADT) flow on the roundabout directly adjacent to the Dooley Inn.	Existing road infrastructure would make this option difficult to introduce and there is a risk of causing increased congestion elsewhere. There are currently access restrictions at Walton Avenue. The option is likely to worsen the current traffic situation.	Not to be taken forward – not considered feasible and may lead to increased emissions elsewhere.
d	Implement further speed restrictions (in addition to national limits) on the A14.	Highways Agency	3	2	6	Would reduce average speeds in order to manage traffic throughput more effectively leading to potential reductions in emissions and fuel consumption.	There are existing speed restrictions in place on Trinity Avenue (40 mph) and Walton Avenue (30 mph). Further changes are not deemed likely to affect air quality.	Not to be taken forward – not deemed likely to affect air quality in the AQMA.
e	Implement a speed control programme for all container shipping.	Port of Felixstowe & Harwich Haven Authority	-	-	-	The emission reduction would depend on the speed limit introduced and the difference between this and the existing	Safety concerns mean this is not considered feasible. Ships enter the Port at the speed that allows safe	Not to be taken forwards – not considered feasible.

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
						speed limit.	passage.	
2	**Environmental Zones**							
a	Develop a Low Emission Strategy targeting heavy duty vehicles on the A14.	Highways Agency	2	1	2	Emissions reduction would depend on the criteria applied.	Likely to require camera enforcement. Most of the vehicles using the Port are thought to be Euro V compliant at present; therefore the effect of this measure is likely to be limited. Potential for negative effect in terms of competition – therefore not considered feasible.	Not likely to be taken forward. If this option were to be taken forward further information is required to determine if this measure may result in a reduction in emissions – the Council will consider carrying out automatic number plate recognition (ANPR) surveys to gather information on the type and age of vehicles within and surrounding the AQMA.
b	Implement a minimum Euro V emission standard (for PM and NO_X) for heavy duty vehicles (non-Port owned) transferring containers to and from the Port by 2013 *OR* Eliminate pre-Euro V diesel vehicles (non-Port owned) from accessing the Port within 5 years.	Port of Felixstowe (it is likely that this measure would require national policy intervention)	3	1	3	Potential to decrease emissions – size of reduction depends on existing fleet composition. This type of traffic activity may at present be undertaken by older, less efficient vehicles.	Considers all HDVs accessing the Port and requires operators to upgrade to cleaner vehicles. Considered difficult to implement due to increased pressure on operators to upgrade their fleet. Could, however, be used to improve the local 'shunting' fleet. Would require monitoring (*e.g.* regular manual audits). It is possible that a voluntary code of practice between operators and the Port could be achieved. There is also another issue concerning the restraint of trade regulations.	Not likely to be taken forward. If this option was to be taken forwards, information would be required to determine if this measure may result in a reduction in emissions. The Council will consider carrying out automatic number plate recognition (ANPR) surveys to gather information on the type and age of vehicles within and surrounding the AQMA.

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
c	Consider a polluter-pays policy for road freight and shipping, possibly including entry tariffs.	Port of Felixstowe	-	-	-	Emissions reduction would depend on the criteria applied.	This option would make the Port less competitive if it was only implemented in Felixstowe. Would therefore only be feasible to implement as part of a national policy. Could be linked into a five year strategy as part of a Freight Quality Partnership.	Could be considered for implementation in the long term.
3	**Behaviour**							
a	Carry out an air quality awareness campaign targeting local businesses using major roads in the area *e.g.* the A14.	Suffolk Coastal District Council	1	1	2	Potential to encourage more benign travel options and efficient driving behaviour at all times irrespective of poor air quality events.	Could be supported by eco-driving training, Freight Quality Partnerships and/or smart ignition cards.	Take forward – considered feasible.
b	Implement an Environmental Management System (EMS) to include educating Port employees and tenants about best practice, such as eco-driving programmes, efficient handling training, or best practices for construction.	Port of Felixstowe	2	3	6	Eco-driving programmes can reduce all emissions.	The Port currently trains employees on environmental issues in their induction.	Take forward – considered feasible.
c	Utilise variable message signs (VMS) on the A14 (Highways Agency is responsible for this road).	Suffolk Coastal District Council/Highways Agency	3	1	3	Likely to be negligible but would raise awareness of the causes of air pollution.	Messages would be designed to inform drivers of emissions impact from road vehicles.	Not to be taken forwards. A possibility in the future providing administrative barriers were overcome with the

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
								Highways Agency.
4	**Policy**							
a	Engage National / EU / international governments to develop policies which influence port activities to improve air quality.	Suffolk Coastal District Council	4	2	8 (assuming a national strategy is implemented and adopted by all UK ports)	Potential to influence activities at other ports in the UK – potential for significant reduction in emissions.	Port of Felixstowe agreed; acknowledged that all ports should consider adopting a strategy to overcome competition issues.	Take forward – considered feasible.
b	Develop a Port action plan which considers the net effect of emissions from processes over a longer term (five year) timescale.	Port of Felixstowe	3	2	6	Potential for the Port to further improve environmental status.	To be investigated further. The Port is currently looking at similar measures and is developing a five year carbon reduction plan (due for implementation by end of 2011).	Take forward – considered feasible.
c	Identify Section 106 planning gain opportunities to balance any future air quality impact caused by local development.	Suffolk Coastal District Council	4	1	4	Potential to mitigate any increase in emissions through various measures. These might involve providing sustainable transport options. It could also include installing long term air quality monitoring stations.	Planning obligations aim to balance the extra pressure from development, with improvements to the surrounding area, in order that a development makes a positive contribution to the local area.	Take forward – considered feasible.
5	**Modal switch**							
a	Use rail to transport a higher proportion of containers to/from the Port.	Port of Felixstowe	2	1	2	The potential to reduce emissions on roads external to the Port is debatable without further evidence.	Whilst newer trains have lower emissions and may be able to start from cold (without idling) there will be an increase in emissions from HGVs loading containers to the trains both on the Port and between external holding yards. It is likely that the	Not likely to be taken forward. Port of Felixstowe can and is increasing infrastructure and facilities to allow modal shift, other factors including governmental policies and customer demand are the

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
							effects on the AQMA owing to this option will be negligible. However, given a national incentive to encourage an uptake in modal shift to rail at all ports, there would be potential for exposure reduction at a regional level.	ultimate drivers of modal shift
6	**Alternative power and cleaner fleet**							
a	Evaluate and implement efficient power technologies (e.g. hybrid-electric) for cargo handling equipment (rubber tyre gantry (RTG) cranes) and internal movement vehicles (IMVs) in the Port.	Port of Felixstowe	1	2	2	Would reduce demand for fuel oil. The Port has recently purchased eco-RTGs, which have a 40% reduction in fuel use.	The Port has purchased 22 eco-RTGs – these have smaller engines which allow them to run at maximum efficiency, leading to reductions in emissions.	The Port has invested in a number of environmental projects recently and will continue to do so, where practicable. This will be taken forward as part of a package of 'green' measures currently being considered by the Port*
b	Retro-fitting fuel saving controls to existing RTG cranes in the Port.	Port of Felixstowe	2	2	4	Reduction in fuel use of approximately 25% compared to original RTGs.	The Port is currently retro-fitting systems that have been on trial for 18 months. The current programme is for retro-fit of 20 RTGs (25% of the fleet) to be complete within 2011.	The Port is currently implementing this action.
c	Investigate feasibility to convert IMVs in the Port from diesel fuel to liquefied natural gas (LNG).	Port of Felixstowe	2	1	2	Possible reductions in NO_X, PM_{10} and CO_2. Difficult to quantity.	The Port is investigating this – there are issues with net emission savings owing to the practicalities of storing LNG to be considered further.	Take forward – considered feasible.
d	Adopt NO_X abatement technologies on IMVs in the Port.	Port of Felixstowe	2	1	2	Possible reductions in NO_X. Could be quantified by assuming that these vehicles would meet more stringent NO_X emissions	The Port plans to purchase 35 new IMVs during 2011 as part of ongoing replacement plan. The intention is to fit these	The Port plans to implement this action, subject to overcoming all technical issues.

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
						standards. The estimation process would introduce many errors.	with selective catalytic reduction using Adblue.	
e	Introduce shore power (cold ironing/alternative marine power) as an alternative option to generating power on board ships.	Port of Felixstowe	1	2	2	Would lead to fairly significant reductions in local emissions if power from the shore negates the use of onboard diesel generators.	Insufficient power on the grid to implement this measure and concerns regarding the practicalities of implementation (each ship has a different 'socket' - a large number of adaptors would be needed to allow every ship to do this). Requires international standardisation.	Not to be taken forward – not considered feasible.
7	**Operational controls**							
a	Install idling control equipment to Port vehicles to shut-off engines when equipment is not moving	Port of Felixstowe	3	1	3	The potential NO_X/PM_{10} emissions savings that can be gained from a switch-off engine campaign owing are subject to debate due to the potential increase in emissions resulting from turning the engine on again. These effects are thought to increase in cold weather as engines need to be at an optimum temperature for effective emissions control. However, these effects can be analysed further given the fuel savings accrued as a result of the initiative.	The Port implements a 15-minute window currently; therefore the emissions benefit of this measure is not likely to significantly improve air quality. The Port is planning to implement a scheme showing fuel usage of each shift manager – one way to reduce fuel usage is to switch off engines. This will take the form of an incentive/disincentive scheme.	Not to be taken forward – no additional emissions reduction considered likely above that which has already been achieved.
b	Develop best practice to stop ships entering the Port using residual fuel oils.	Port of Felixstowe	3	1	3	Will depend on any agreement on the use and or application of fuels. The current legislation on fuels used by ships accessing ports involves reducing SO_X emissions.	It is considered more appropriate to implement this through international law rather than at a local level. The Port cannot enforce its own restriction. The current North Sea limit is 1.5% sulphur in fuel oil. The Port	The Port does not have the power to implement its own restrictions. Would be considered as part of an international strategy for implementation in the longer term.

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
							currently asks ships to comply with existing regulations and notifies shipping companies of new regulations before they come into force.	
c	Use of a vehicle booking system (VBS) to manage access to the Port.	Port of Felixstowe	-	-	-	Increased efficiency of container handling. Queues previously seen on Dock Gate 2 Roundabout seem to be reduced. In addition peak traffic flows are tending to reduce slightly and instead shifting to less busy periods.	The Port has implemented this system in the last 2 years. All vehicles now have to book a time slot in which they can arrive (time slots are 1 hour periods, with 30 minutes leeway at the start and end of that hour). If booked, vehicles can arrive any time between midnight and 7am to encourage more deliveries during this time period.	The Port has implemented this system and all vehicles now have to book a time slot in which they can arrive. If a vehicle arrives out of its allotted time slot, it is not allowed on to the Port and is required to re-book. This is strictly enforced.
8	**Other options**							
a	A state of the art review of air pollution mitigation options being considered in UK, European and non-European ports.	Suffolk Coastal District Council	3	2	6	The review will establish the emission-reduction potential of options under consideration as well as new options.	It is considered likely that air pollution mitigation measures are being implemented across all ports. Circumstances will vary depending on the characteristics of the port and its hinterland. This work would be complementary to Appendix C. A key element of the review will establish the role of government to support national-based initiatives to overcome competitive barriers.	Take forward – considered relevant to all Ports.
b	Vehicle number plate surveys.	Suffolk Coastal District Council	3	3	9	The survey will assist the Council in gaining a clear understanding of the nature of the vehicle fleet, in particular the age and type of	An evidence-based option to increase the knowledge base. These studies can help to provide a more in depth	Take forward – further information regarding vehicle movements in the vicinity of the Dooley

Option		Authority taking action forward	Cost rating	Benefit rating	Cost/Benefit rating	Emission reducing effects	Comment	Outcome
						heavy goods vehicles at specific locations. This allows tailored options to be developed to target the more polluting vehicle types operating in the vicinity of the Dooley Inn.	understanding of emissions profiles and can help explain peaks in air quality monitoring data, for example.	Inn is required to inform the action plan development.
c	Developing a Supplementary Planning Document (SPD) – Air Quality.	Suffolk Coastal District Council	3	1	3	Establishes a formal planning control mechanism to appraise the potential air quality impacts of proposed development, especially within or near to existing AQMAs.	The SPD – Air quality is currently being developed and will include air pollution as a consideration in the planning process. Its role is to provide advice to practitioners and developers on what may or may not be acceptable given current air quality issues.	Take forward – currently being developed by the Council.

* The package of green measures being considered by the Port of Felixstowe includes replacing internal movement vehicles with vehicles that have more stringent emissions control standards, retrofitting exhaust abatement devices, fitting LED lighting to RTGs to minimise fuel consumption, fuel switching options, and flywheel technologies for RTGs to reduce the consumption of conventional fuels.

7.2 Supporting work

Discussions between Suffolk Coastal District Council and the Port of Felixstowe highlighted some areas where further information was required to inform the air quality action plan. In particular, it was considered necessary to obtain further information on the age and type of vehicle entering and exiting the Port, and to understand the nature of HDV shunting activity in close proximity to the Dooley Inn.

Uncertainty regarding HDV shunting activity near to the Dooley Inn arose from analysis of monitoring data. The Port of Felixstowe advised that fuel usage and throughput at the Port declined during 2009. NO_2 diffusion tubes within the Port boundary recorded a corresponding reduction in annual average concentrations during 2009. Diffusion tubes in the vicinity of the Dooley Inn, however, did not record a reduction in concentrations. As a result, discussions focused on whether there may be a local source of emissions affecting concentrations in the AQMA.

To increase the evidence base, Suffolk Coastal District Council therefore commissioned TRL to undertake an automatic number plate recognition (ANPR) camera survey to investigate vehicle movements and age and type of vehicle in close proximity to the Dooley Inn. A detailed summary of the approach and findings of this survey is included in Appendix E. An outline is provided below.

Automatic number plate recognition (ANPR) camera survey

The survey was undertaken over a 24-hour period commencing on Wednesday 13th July 2011. Cameras were located adjacent to the Dooley Inn on Ferry Lane and Hodgkinson Road. The aim was to capture all vehicle movements to and from nearby goods yards. Traffic activity data and fleet composition information obtained from the ANPR camera survey were compared with data used in the 2010 further assessment. The ANPR camera survey was used to identify the emissions standard for each vehicle and the resulting information was input to the Emission Factor Toolkit[13] (version 4.2.2) to determine whether shunting operations constitute a significant source of emissions that has not previously been identified. Key findings from the survey are summarised below:

- The ANPR camera survey identified disproportionate emissions from articulated heavy goods vehicles (HGVs), adding further evidence to support the findings of the source apportionment exercise (completed as part of the 2010 further assessment): approximately 86% of road NO_X emissions were found to be generated by articulated HGVs, whereas this vehicle type constitutes approximately 25% of local traffic.

- The ANPR camera survey identified some peaks in goods vehicle movements with movements occurring during the early hours of the morning and ceasing at approximately 6pm. With reference to the air quality objectives, however, these peaks in activity have relevance for the hourly mean NO_2 objective only: the annual mean objective is unaffected.

[13] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html

- Comparison of traffic activity data and emissions/air quality results shows that the ANPR camera survey has identified differences in the coarse vehicle composition (*i.e.* the breakdown by vehicle type: cars/buses/heavy duty (articulated or rigid)/light duty) compared with that assumed in the Further Assessment modelling approach, primarily due to the higher proportion of articulated HGVs identified by the cameras.

- Concentrations modelled using the detailed fleet breakdown by Euro emission standard identified from the ANPR survey do not differ substantially from those modelled using the detailed fleet breakdown assumed previously. It is concluded that the estimates of Euro emission standards based on information included in the National Atmospheric Emissions Inventory (NAEI) are adequate for the study area. Overall, the activity from the goods yard does not appear to be affecting air quality concentrations at the Dooley Inn to any greater extent than previously thought.

- The ANPR survey does not take into account cold-starting or emissions from idling vehicles. These activities may have an impact on the annual mean NO_2 concentration at the Dooley Inn. Further work may therefore focus on understanding cold-starting and idling emissions within local haulage depots if deemed necessary.

7.3 Consultation phase

7.3.1 Measures taken forward for consultation

Responsibility for implementation of air quality mitigation options cannot always be assigned in proportion to source contributions due to financial, political and practical considerations. The Port of Felixstowe is actively engaged in reducing the environmental impact of the Port and has a number of schemes in place. Mitigation options can range considerably given that the Port is a major trip attractor for road, rail and shipping modes. However, given the competitive nature of Port operations, mitigation options can be limited and costly to implement. Therefore, a balance between costs and benefits and consideration of the overall impact on business operations is required.

Cooperation between Suffolk Coastal District Council and the Port of Felixstowe is critical to allow for successful mitigation of air quality in and near to the Port. The Council has responsibility for implementing measures outside of the Port boundary. The Council should monitor the situation, gather evidence and develop practical options which complement measures being undertaken by the Port and do not hinder operations. It is considered most appropriate for the Ferry Lane AQMA action plan to consist of a package of joint measures which are agreed by all stakeholders.

Discussions between Suffolk Coastal District Council and the Port of Felixstowe identified the following measures for possible implementation that were taken forward to the consultation phase:

Suffolk Coastal District Council

- A state-of-the-art literature review of air pollution mitigation options being considered in UK, European and non-European ports.

- Automatic number plate recognition (ANPR) camera surveys to record information on movements and types of heavy goods vehicle near to the Dooley Inn.
- Development of a Supplementary Planning Document (SPD) – Air Quality.
- Identify Section 106 planning gain opportunities to balance any future air quality impact caused by local development.
- Implementation of an air quality awareness campaign targeting local businesses using major roads in the area (such as the A14).

Suffolk Coastal District Council/ Port of Felixstowe

- Engagement with government and other UK ports to develop national policies to improve air quality at ports.

Port of Felixstowe

- Implementation of an Environmental Management System (EMS), including additional training for Port employees.
- Development of a Port action plan to incorporate and complement the existing programme of 'green' projects.
- Implementation of alternative power technologies, in addition to existing eco rubber tyre gantry (RTG) cranes.
- Retro-fitting of original RTG cranes.
- Examining the potential to convert internal movement vehicles (IMVs) from diesel fuel to liquefied natural gas (LNG).
- Examining the potential for retro-fitting NO_X abatement technologies to vehicles and plant.
- Ongoing use of the vehicle booking system (VBS) to manage deliveries.

7.3.2 Consultation responses

The draft action plan report was submitted to Defra for approval and the report was accepted with a number of recommendations for elements to include in the final action plan. The draft report was also made available to members of the public and stakeholders via the Suffolk Coastal District Council website, the Suffolk Chamber of Commerce website and via hard copy at the Council offices in Woodbridge and Felixstowe. The Felixstowe Port Users Association was provided with a PDF of the document to disseminate amongst their membership. Seven responses were received, six of which were positive and in support of the action plan. The one negative response commented that information was difficult to understand for the lay person. Comments received were taken into account during the production of the final action plan. No new or alternative measures were identified as part of the consultation phase. The Council continues to liaise with the Port of Felixstowe regarding the action plan.

8 Action Plan measures

8.1 Final action plan measures

As described above, the consultation phase did not identify any new or amended measures. The list of measures included in the final action plan is therefore the same as the list of selected measures shown above (note the numbering has been updated and does not relate to the numbering in Table 4). Final action plan measures are summarised in Table 5. Information on planned timescales for implementation and relevant indicators are provided.

Table 5: Final action plan measures

Option		Responsible authority	Cost rating	Benefit rating	Cost/Benefit rating	Potential emission reduction	Timescale for implementation	Comment	Indicator
1	**Behaviour**								
a	Carry out an air quality awareness campaign targeting local businesses using major roads in the area *e.g.* the A14.	Suffolk Coastal District Council	1	1	2	Potential to encourage more benign travel options and efficient driving behaviour at all times irrespective of poor air quality events.	Medium term (1-5 years)	Could be supported by eco-driving training, Freight Quality Partnerships and/or smart ignition cards.	Measured concentrations at the Dooley Inn public house.
b	Implement an Environmental Management System (EMS) to include educating Port employees and tenants about best practice, such as eco-driving programmes, efficient handling training, or best practices for construction.	Port of Felixstowe	2	3	6	Eco-driving programmes can reduce all emissions.	Ongoing	The Port currently trains employees on environmental issues in their induction. They have delivered training on the EMS and individual responsibilities to approximately 200 employees over the last year (2011/12).	No direct indicator.
2	**Policy**								
a	Engage National / EU / international governments to	Suffolk Coastal District Council	4	2	8 (assuming a national strategy is	Potential to influence activities at other ports in the UK – potential for	Medium term (1-5 years)	Port of Felixstowe agreed; acknowledged that all ports should	No direct indicator.

Option		Responsible authority	Cost rating	Benefit rating	Cost/Benefit rating	Potential emission reduction	Timescale for implementation	Comment	Indicator
	develop policies which influence port activities to improve air quality.				implemented and adopted by all UK ports)	significant reduction in emissions.		consider adopting a strategy to overcome competition issues.	
b	Develop a Port action plan which considers the net effect of emissions from processes over a longer term (five year) timescale.	Port of Felixstowe	3	2	6	Potential for the Port to further improve environmental status.	2011	The Port's five year carbon reduction plan is now in version 2 and to date, the estimate is that outputs of the plan are responsible for an annual reduction of approximately 4000 tonnes CO_2.	Emissions monitoring at the Port (including CO_2 emissions).
c	Identify Section 106 planning gain opportunities to balance any future air quality impact caused by local development.	Suffolk Coastal District Council	4	1	4	Potential to mitigate any increase in emissions through various measures. These might involve providing sustainable transport options. It could also include installing long term air quality monitoring stations.	Ongoing	Planning obligations aim to balance the extra pressure from development, with improvements to the surrounding area, in order that a development makes a positive contribution to the local area.	Uptake/implementation of Section 106 agreements.
3	**Alternative power and cleaner fleet**								
a	Evaluate and implement efficient power technologies (e.g. hybrid-electric) for cargo handling equipment (rubber tyre gantry (RTG) cranes) and internal movement vehicles (IMVs) in the Port.	Port of Felixstowe	1	2	2	Would reduce demand for fuel oil. The Port has recently purchased eco-RTGs, which have a 40% reduction in fuel use.	The Port has invested in a number of environmental projects recently and will continue to do so, where practicable. This will be taken forward as part of a package of 'green' measures currently being	The Port has purchased 22 eco-RTGs – these have smaller engines which allow them to run at maximum efficiency, leading to reductions in emissions.	Power use at the Port.

Option		Responsible authority	Cost rating	Benefit rating	Cost/Benefit rating	Potential emission reduction	Timescale for implementation	Comment	Indicator
							considered by the Port*		
b	Retro-fitting fuel saving controls to existing RTG cranes in the Port.	Port of Felixstowe	2	2	4	Reduction in fuel use of approximately 25% compared to original RTGs.	2011	The Port has carried out retro-fit of 22 RTGs (greater than 25% of the fleet).	Fuel use at the Port.
c	Investigate feasibility to convert IMVs in the Port from diesel fuel to liquefied natural gas (LNG).	Port of Felixstowe	2	1	2	Possible reductions in NO_X, PM_{10} and CO_2. Difficult to quantity.	Ongoing	The Port is investigating this – there are issues with net emission savings owing to the practicalities of storing LNG to be considered further.	No direct indicator.
d	Adopt NO_X abatement technologies on IMVs in the Port.	Port of Felixstowe	2	1	2	Possible reductions in NO_X. Could be quantified by assuming that these vehicles would meet more stringent NO_X emissions standards. The estimation process would introduce many errors.	2011 (ongoing replacement plan)	The Port planned to purchase 35 new IMVs during 2011 as part of ongoing replacement plan. The intention is to fit these with selective catalytic reduction using Adblue. This is not currently being used en masse but is used in a few pieces of new equipment.	Air quality monitoring using diffusion tubes within the Port boundary.
4	**Operational controls**								
a	Use of a vehicle booking system (VBS) to manage access to the Port.	Port of Felixstowe	-	-	-	Increased efficiency of container handling. Queues previously seen on Dock Gate 2 Roundabout seem to be reduced. In addition peak traffic flows are tending to reduce slightly and instead shifting to less busy periods.	The Port has implemented this system and all vehicles now have to book a time slot in which they can arrive. If a vehicle arrives out of its allotted time slot, it is not allowed on to the Port and is	If booked, vehicles can arrive any time between midnight and 7am to encourage more deliveries during this time period. This and other traffic management systems have changed traffic flows in and around the Port, significantly	Traffic flows (HGVs).

Option		Responsible authority	Cost rating	Benefit rating	Cost/Benefit rating	Potential emission reduction	Timescale for implementation	Comment	Indicator
							required to re-book. This is strictly enforced.	reducing peak HGV flows.	
5	**Other options**								
a	A state of the art review of air pollution mitigation options being considered in UK, European and non-European ports.	Suffolk Coastal District Council	3	2	6	The review will establish the emission-reduction potential of options under consideration as well as new options.	Medium term (1-5 years)	It is considered likely that air pollution mitigation measures are being implemented across all ports. Circumstances will vary depending on the characteristics of the port and its hinterland. This work would be complementary to Appendix C. A key element of the review will establish the role of government to support national-based initiatives to overcome competitive barriers.	No direct indicator.
b	Vehicle number plate surveys.	Suffolk Coastal District Council	3	3	9	The survey will assist the Council in gaining a clear understanding of the nature of the vehicle fleet, in particular the age and type of heavy goods vehicles at specific locations. This allows tailored options to be developed to target the more polluting vehicle types operating in the vicinity of the Dooley Inn.	ANPR survey undertaken in 2011 and results summarised in this report.	An evidence-based option to increase the knowledge base. These studies can help to provide a more in depth understanding of emissions profiles and can help explain peaks in air quality monitoring data, for example.	No direct indicator. Can assist in quantifying the impact from articulated HGVs over time if repeated.
c	Developing a Supplementary	Suffolk Coastal District Council	3	1	3	Establishes a formal planning control	Draft SPD completed and	The SPD – Air quality is currently being	No direct indicator.

Option		Responsible authority	Cost rating	Benefit rating	Cost/Benefit rating	Potential emission reduction	Timescale for implementation	Comment	Indicator
	Planning Document (SPD) – Air Quality.					mechanism to appraise the potential air quality impacts of proposed development, especially within or near to existing AQMAs.	awaiting formal adoption in 2012.	developed and will include air pollution as a consideration in the planning process. Its role is to provide advice to practitioners and developers on what may or may not be acceptable given current air quality issues.	

8.2 Timescale for implementation of final action plan measures

LAQM PG 09 states that an action plan must include: "clear timescales in which the authority and other organisations and agencies propose to implement the measures within its plan". Suffolk Coastal District Council has considered the following timescales:

- Short term: <12 months
- Medium term: 1-5 years
- Long term: +5 years

Each selected measure has been allocated a timescale over which Suffolk Coastal District Council intends to implement the measure. Timescales are shown in Table 5 and discussed below. Where progress has been made since development of the draft action plan, this is also discussed below (text in italics).

Short term

- Automatic number plate recognition (ANPR) camera surveys to record information on movements and types of heavy goods vehicle near to the Dooley Inn. *This has been completed. The survey enabled the Council to better understand goods vehicle activity adjacent to the Dooley Inn. Findings are summarised in Section 7.2.*
- Development of a Supplementary Planning Document (SPD) – Air Quality. *The SPD has been prepared and has been submitted to Members for formal acceptance*.

Medium term

- A state-of-the-art literature review of air pollution mitigation options being considered in UK, European and non-European ports. *The Council has requested outline costs for this review*.
- Implementation of an air quality awareness campaign targeting local businesses using major roads in the area (such as the A14). *The draft action plan consultation has increased awareness of air quality issues in the area amongst businesses and members of the public*.
- Engagement with government and other UK ports to develop national policies to improve air quality at ports.

Ongoing

- Identify Section 106 planning gain opportunities to balance any future air quality impact caused by local development.

Timescales and progress for measures for which the Port of Felixstowe are responsible are outlined below. As above, some of the measures have been fully implemented since submission of the draft action plan and progress with these measures is discussed below.

- Implementation of an Environmental Management System (EMS), including additional training for Port employees. *The Port has delivered training on the EMS and individual responsibilities to around 200 employees over the last year. In addition, they have a TUC-sponsored green workplaces workshop scheduled for September 2012 which will aim to educate and support some 'green champions' within the workforce.*

- Development of a Port action plan to incorporate and complement the existing programme of ‘green’ projects. *The 5-year carbon reduction plan is currently in version 2 and to date, the Port has estimated that outputs of the plan are responsible for an annual reduction of approximately 4000 tonnes of CO_2. The reduction in overall emissions which has enabled the Port to achieve this reduction is also expected to have benefited air quality.*
- Implementation of alternative power technologies, in addition to existing eco rubber tyre gantry (RTG) cranes. *The Port are currently testing and evaluating different types of energy recovery systems. They are also exploring fuel cell and other hydrogen technologies for some cargo handling equipment. The projects will be carefully examined and tested before wide scale implementation is considered. The Port are also considering use of electric RTG cranes in future.*
- Retro-fitting of original RTG cranes. *The Port now has 22 cranes retro-fitted (to date), which equates to just over 25% of the original cranes now fitted with fuel saving controls.*
- Examining the potential to convert internal movement vehicles (IMVs) from diesel fuel to liquefied natural gas (LNG). *This remains a consideration along with other alternatives, although there are no tangible outcomes from this to date. Some of the fuel supply and infrastructure issues associated with alternative fuels are outside of the Port’s control.*
- Examining the potential for retro-fitting NO_X abatement technologies to vehicles and plant. *This is not currently being considered en masse but is used in a few pieces of new equipment. The Port continues to explore the use of such technologies with the assistance of the equipment and engine manufacturers.*
- Ongoing use of the vehicle booking system (VBS) to manage deliveries. *The VBS is fully operational and this and other traffic management systems applied in periods of restricted working on the terminal have changed traffic flows in and around the Port, significantly reducing peak flows of HGVs.*

8.3 Monitoring of the impacts of final action plan measures

Suffolk Coastal District Council has installed a number of additional diffusion tube monitoring sites in the vicinity of the Dooley Inn public house. This has enabled the Council to gather more information to assess the local situation *i.e.* to identify any unusual activity and/or local sources of emissions. It should be noted that the majority of the additional diffusion tube sites are not relevant for public exposure. Results collected at the additional sites will also allow the Council to better assess long-term trends in concentrations in the area.

The following diffusion tube sites were installed in 2011:

- FLX32 (triplicate) – industrial/roadside site on the guttering to the rear of the Dooley Inn public house.
- FLX33 (single) – roadside site on Dock Gate 2 roundabout.
- FLX34 (single) – industrial/roadside site on Ferry Lane, midway between the roundabout and the Dooley Inn public house.

- FLX35 (single) – industrial/roadside site on the Dooley Inn signpost at the front of the building.
- FLX36 (single) – industrial/roadside site on the Hodgkinson Road street sign.
- FLX37 (single) – industrial/roadside site on the lamp-post on corner of Ferry Lane/Hodgkinson Road.
- FLX38 (single) – industrial/roadside site on the lamp-post on Ferry Lane, past Hodgkinson Road.

Results from these diffusion tube sites and other monitoring sites operated by the Council are shown in Table 6. These results have been bias adjusted using a factor of 0.84 (obtained from the national bias adjustment spreadsheet). The results at sites in the vicinity of the Dooley Inn were also plotted on a map (see Figure 3) to assist in identifying the spatial extent of exceedence.

Table 6: Non-automatic monitoring results (diffusion tube sites) in 2011

Site ID	Site type	2011 data capture (%)	2011 Annual mean NO_2 (µg/m^3)	2011 Bias adjusted* annual mean NO_2 (µg/m^3)
FLX12	Roadside	100	39.0	32.8
FLX14	Industrial	100	30.2	25.3
FLX17	Roadside	100	33.2	27.9
FLX20	Industrial/roadside	100	30.7	25.8
FLX21	Urban background	100	30.3	25.4
FLX22	Industrial	100	30.3	25.4
FLX23	Roadside	100	34.3	28.8
FLX24	Roadside	100	36.6	30.7
FLX26	Industrial/roadside	100	**47.2**	39.7
FLX27	Industrial/roadside	92	**42.7**	35.9
FLX29	Industrial	92	29.1	24.5
FLX31	Industrial	100	32.5	27.3
FLX32	Industrial/roadside	100	**43.8**	36.8
FLX33	Roadside	100	**78.2**	**65.7**
FLX34	Industrial/roadside	100	**60.2**	**50.6**
FLX35	Industrial/roadside	100	**56.9**	**47.8**
FLX36	Industrial/roadside	100	**48.2**	**40.5**
FLX37	Industrial/roadside	100	**56.7**	**47.6**

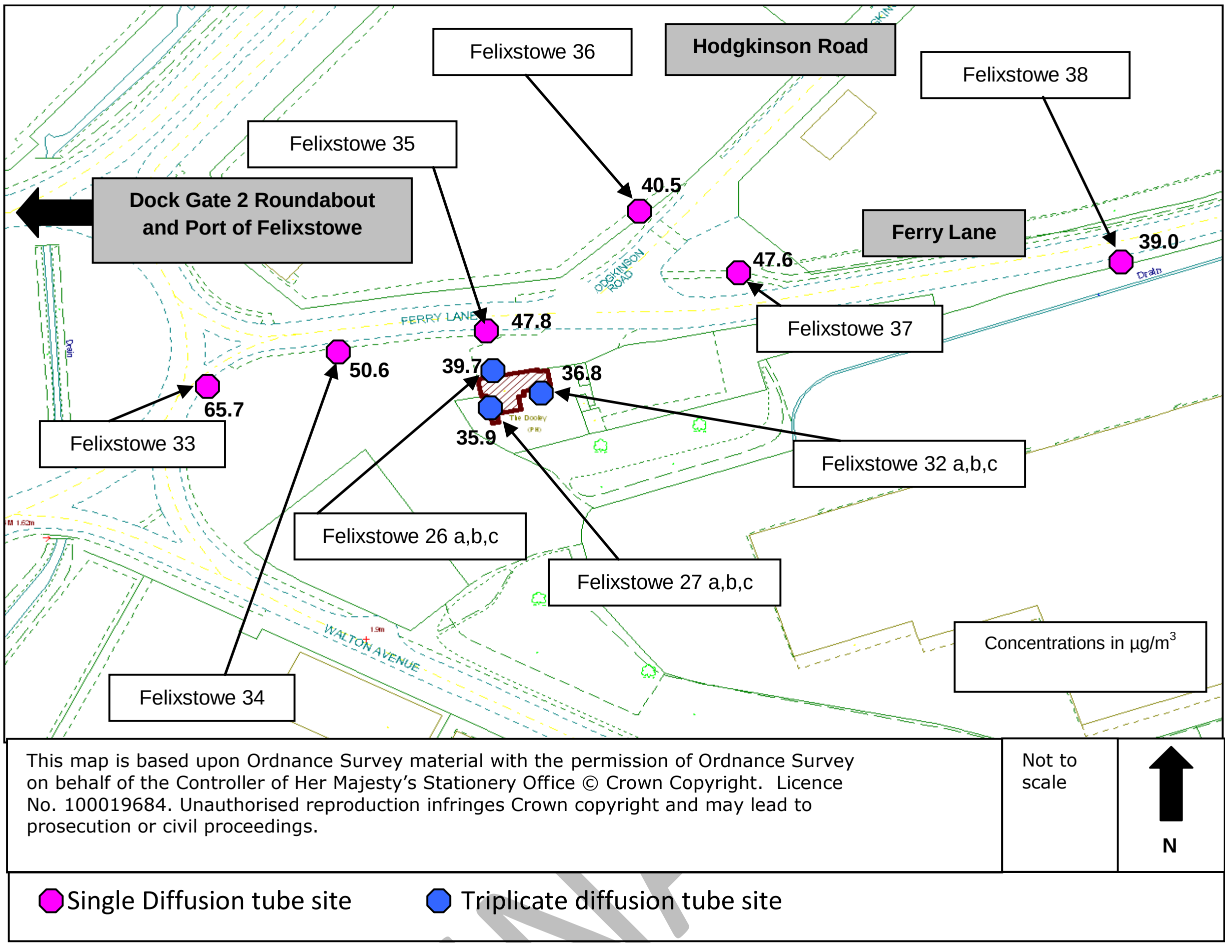

Figure 3: Locations and annual mean NO_2 concentrations in the vicinity of the Dooley Inn public house, 2011

Results obtained in 2011 show compliance with the NO_2 objectives at the diffusion tube sites which represent relevant exposure at the Dooley Inn public house (FLX26, FLX27 and FLX32). Exceedence of the annual mean NO_2 objective has been measured at a number of the additional sites in the area. As stated, however, the majority of these sites are not relevant for public exposure and the air quality objectives do not apply. Exceedence was detected at site FLX35, which is located on the signpost at the front of the Dooley Inn public house (on the roadside at the entrance to the car park). Site FLX26 is located on the Dooley Inn façade (this site was co-located with the automatic analyser which ceased operation in 2010) and this location recorded compliance with the annual mean NO_2 objective in 2011. This implies that the fall-off in NO_2 concentration from Site FLX35 was sufficient such that the annual mean concentration at the receptor was compliant with the annual mean NO_2 objective. It is not deemed necessary to carry out a fall-off with distance calculation to estimate the concentration at the nearest receptor to site FLX35 given that site FLX26 represents relevant exposure at the façade.

Figure 3 shows that measured annual mean NO_2 concentrations are highest at roadside/industrial sites to the west of the Dooley Inn, indicating that vehicle numbers are higher and specifically, there are more heavy goods vehicles which are travelling between the docks and the depots on Hodgkinson Road. Concentrations at roadside sites to the east of the Dooley Inn are lower than sites located to the west and site FLX38 recorded compliance with the annual mean NO_2 objective in 2011. The results show that concentrations measured at the Dooley Inn building were compliant with the annual mean NO_2 objective in 2011.

The results from this extended diffusion tube survey will be assessed in future years to determine whether concentrations are compliant with the annual mean NO_2 objective in the long term. Several years of data or evidence of a significant change to a key emissions source will be required before the Council can consider revoking the Ferry Lane AQMA. Given the localised nature of the air quality issue (the Dooley Inn public house is an isolated receptor), the Council considers diffusion tube monitoring to be the most appropriate means of monitoring the effectiveness of action plan measures at this stage.

8.4 Quantification of the impacts of final action plan measures

Measures taken forward to the consultation phase were assessed to determine the potential for quantification of expected impacts resulting from these measures. Overall, it was not deemed feasible to assess the potential impact of any of the measures through detailed dispersion modelling. The ANPR camera survey has attempted to quantify the impact of heavy goods vehicle (HGV) shunting activities (see Appendix E) to determine whether the Council should pursue specific mitigation options. This assessment showed that vehicle movements near to the Dooley Inn have been adequately captured in previous assessments.

As previously discussed, the Port of Felixstowe advised that fuel usage and throughput at the Port declined during 2009. NO_2 diffusion tubes within the Port boundary recorded a corresponding reduction in annual average concentrations in the same year, whereas tubes at the Dooley Inn did not. The ANPR camera survey undertaken in 2011 indicated that shunting activity in the vicinity of the Dooley Inn does not appear to be an unaccounted for source of emissions, as previously deemed possible. It is, however, possible that shunting activities declined between 2009 and 2011. Measured concentrations during 2011 at the tubes which represent relevant exposure at the Dooley Inn showed compliance with the objective and indicated a decrease compared with 2010 and 2009 annual mean concentrations. It is therefore possible that there has been a reduction in NO_X emissions from key sources in 2011 compared with previous years. Further monitoring data are required before this can be confirmed and a long term trend can be identified.

Since submission of the draft action plan, progress has been made with a number of action plan measures, including production of a Supplementary Planning Document (SPD) which is awaiting formal adoption. The Council continues to liaise regularly with the Port of Felixstowe on air quality issues and to determine progress with action plan measures. Whilst it is not possible to directly quantify the impacts of these measures, the Council intends to continue diffusion tube monitoring in the area surrounding the Dooley Inn as a means of assessing progress towards long term compliance with the annual mean NO_2 objective in the Ferry Lane AQMA.

9 Local Transport Plan

Local Air Quality Management Policy Guidance (LAQM PG 09) states: “Where a local authority (outside London) designates an AQMA due to emissions from local transport, local authorities should consider integrating the action plan with the Local Transport Plan”. Source apportionment completed for the Ferry Lane AQMA demonstrated that emissions from HDVs on roads external to the Port constitute a significant proportion of NO_X emissions. Road transport is therefore a key consideration in the Ferry Lane AQMA action plan.

Options included in this action plan have not been fully incorporated in Suffolk County Council’s Local Transport Plan (LTP3)[14]. However, the LTP3 document (page 23) acknowledges the need to address the challenge of “managing large scale movements of lorries associated with the Port and the adjacent Air Quality Management Area”. The Air Quality Management Areas in Woodbridge and Felixstowe are identified as key transport issues for Suffolk Coastal District Council on page 24 of the LTP3. This demonstrates that the road transport elements of the Ferry Lane AQMA action plan will be in line with relevant actions included in the LTP3. In addition, communication between Suffolk Coastal District Council and Suffolk County Council[15] has confirmed that the Ferry Lane AQMA action plan is supported by the LTP process.

[14] http://www.suffolk.gov.uk/NR/rdonlyres/0B7E9BDE-B2C6-4C4B-BAF3-01AA698D1FD8/0/20110706SuffolkLocalPlanPart1lr.pdf

[15] Personal communication between Suffolk Coastal District Council and Suffolk County Council, July 2010

10 Strategic Environmental Assessment

Local Air Quality Management Policy Guidance (LAQM PG 09) states: "For stand-alone action plans, local authorities will need to determine on a case-by-case basis whether the Strategic Environmental Assessment Directive (2001/42/EC)… applies to their action plan". LAQM PG 09 provides the following criteria as a guide:

- Does the local authority intend to include conditions within the action plan which will influence a Development Plan or other consent framework in ways which are likely to have significant environmental effects (for example, will the action plan require or preclude certain projects at certain locations)? If so, a Strategic Environmental Assessment will be required.
- Does the action plan only set out specific air quality measures such as traffic management schemes, parking controls, and there is no intention of including conditions to influence planning or development consents? If so, there is probably no need for a Strategic Environmental Assessment.
- Is the action plan integrated into another plan or programme (for example, a Local Transport Plan, or Local Implementation Plan in London) which already requires a Strategic Environmental Assessment? If so, the Strategic Environmental Assessment Directive applies to that plan or programme.

The above criteria have been considered in relation to the Ferry Lane AQMA. Suffolk Coastal District Council has confirmed that it does not intend to include conditions within the action plan which will influence a development plan or consent framework in ways which will have significant environmental effects. The action plan only includes measures specific to air quality. In discussion with the Port of Felixstowe, Suffolk Coastal District Council has considered the impact of potential measures on Port development. Measures which were deemed likely to have negative effects on development were not taken forward. Suffolk Coastal District Council therefore concludes that a Strategic Environmental Assessment is not required.

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Appendix A UK Air Quality Standards and Objectives

A.1 UK Air Quality Standards and Objectives

Pollutant	Objective	Compliance date
NO_2	Hourly mean concentration should not exceed 200 µg/m^3 more than 18 times a year. Annual mean concentration should not exceed 40 µg/m^3.	31 December 2005
Particulate matter, expressed as PM_{10}	24-hour mean concentration should not exceed 50 µg/m^3 more than 35 times a year. Annual mean concentration should not exceed 40 µg/m^3.	31 December 2004 31 December 2005
Benzene	Running annual mean concentration should not exceed 16.25 µg/m^3.	31 December 2003
	England & Wales: Annual mean concentration should not exceed 5 µg/m^3.	31 December 2010
1,3-butadiene	Running annual mean concentration should not exceed 2.25 µg/m^3.	31 December 2003
CO	Maximum daily running 8-hour mean concentration should not exceed 10 mg/m^3.	31 December 2003
PAHs	Annual mean concentration of B(a)P should not exceed 0.25 ng/m^3	31 December 2010
Lead (Pb)	Annual mean concentration should not exceed 0.5 µg/m/^{3}. Annual mean concentration should not exceed 0.25 µg/m^3.	31 December 2004 31 December 2008
SO_2	Hourly mean of 350 µg/m^3 not to be exceeded more than 24 times a year. 24-hour mean of 125 µg/m^3 not to be exceeded more than 3 times a year. 15-min mean of 266 µg/m^3 not to be exceeded more than 35 times a year.	31 December 2004 31 December 2004 31 December 2005

Appendix B Suffolk Coastal District Council Review and Assessment

B.1 Main findings from the first round of air quality review and assessment

Report and reference	Main outcomes
Report on the first stage review and assessment of air quality in Suffolk Coastal (SCDC, 1999)	Negligible risk of exceedence of the air quality objectives for benzene and 1,3-butadiene and no further action needs to be taken. The risk of exceedence of the air quality objectives for lead, carbon monoxide (CO), NO_2, PM_{10} and SO_2 is such that a second stage review and assessment will need to be undertaken to determine the risk more precisely.
Report on the second stage review and assessment of air quality in the Suffolk Coastal District (SCDC, 2000)	Negligible risk of exceedence of the air quality objectives for lead and CO and further review and assessment is not necessary at this time. Significant risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at relevant locations and further review and assessment is necessary.
Report on the third stage review and assessment of air quality in the Suffolk Coastal District (SCDC, 2001)	Negligible risk of exceedence of the air quality objectives and further assessment not necessary at this time for: NO_2 from traffic using the A14 trunk road and traffic using High Road West, Felixstowe. PM_{10} from: traffic using the A1152 (specifically the crossroads of the A1152 and B1438 at Melton); traffic using High Road West, Felixstowe; traffic using the Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge; and the combined emission 'footprint' of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry and Foxhall Landfill Site. Insufficient information to date and therefore further review and assessment required for: SO_2 and PM_{10} emissions from shipping at the Port of Felixstowe. PM_{10} emissions from the combined emission 'footprint' of Roadworks (1952) Limited and Sinks Pit Quarry. Risk of NO_2 air quality objectives being exceeded and further review and assessment required for: Emissions from traffic using the A1152 (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.
Air quality review and assessment stage 3 (AEA Technology, 2001)	Unlikely risk of exceedence of the air quality objectives for NO_2 at the Melton and Woodbridge road junctions and an AQMA is not required.

B.2 Main findings from the second round of air quality review and assessment

Report and reference	Main outcomes
Report on the updating and screening assessment of air quality in the Suffolk Coastal District (SCDC, 2003)	Unlikely risk of exceedence of the air quality objectives for CO, benzene and 1,3-butadiene. No further assessment necessary. Potential risk of exceedence of the air quality objectives for lead, NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary.
Report on the detailed assessment and continued updating and screening assessment of air quality in the Suffolk Coastal District (SCDC, 2004)	Unlikely risk of exceedence of the air quality objectives for lead and no further assessment is necessary. Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary for: Emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road/The Thoroughfare St John's Street junction, Woodbridge. Emissions of NO_2, PM_{10} and SO_2 from activities on and associated with the Port of Felixstowe, incorporating assessment of emissions generated by the Bathside Bay and FSR planning applications if they are granted permission.
Progress report: Air Quality in the Suffolk Coastal District (SCDC, 2005)	Outlines the findings of detailed modelling undertaken as part of the FSR planning application: No risk of exceedence of the air quality objective for PM_{10} at receptors from emissions resulting from activities on and associated with the Port of Felixstowe. No further review and assessment necessary. Exceedence of the air quality objective for annual average NO_2 in 2005 at receptor locations situated in The Downs (close to the Port of Felixstowe Road) and Spriteshall Lane (close to Dock Spur roundabout). *NO_2 diffusion tube monitoring undertaken in 2004 does not correspond with the above modelling results. Seven new diffusion tube sites established at the start of 2005 to obtain further information for receptor locations close to the Port of Felixstowe and along the A14.* Exceedence of the air quality objective for annual average NO_2 predicted for the end of 2005 at the Dooley Inn, Ferry Lane. Two new NO_2 diffusion tube sites established on the building. At the end of 2005, SCDC to determine if declaration of an AQMA is necessary for receptor locations near to the Port of Felixstowe and/or along the A14 based on 12 months of monitoring information from the new NO_2 diffusion tube sites in Felixstowe and the Trimleys. The findings to be reported in the next updating and screening assessment.
Detailed assessment of the Woodbridge road junction (AEA Technology, 2005)	**Declaration of an AQMA for the annual average objective for NO_2 is required for Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.**

B.3 Main findings from the third round of air quality review and assessment

Report and reference	Main outcomes
Report on the updating and screening assessment of air quality in the Suffolk Coastal District (SCDC, 2006)	Unlikely risk of exceedence of the air quality objectives for CO, benzene, 1,3-butadiene and lead and no further assessment is necessary. Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations resulting from emissions from activities on and associated with the Port of Felixstowe. A detailed assessment is required to investigate these emissions.
Air quality review and assessment: detailed assessment for Adastral Close and Ferry Lane, Felixstowe (SCDC, 2008a)	AQMA declaration for SO_2 not required. AQMA declaration for PM_{10} not required. Exceedence of the annual average objective for NO_2 at the Dooley Inn, Ferry Lane, Felixstowe (modelling indicated that this the only relevant receptor location at which the objective was not met). Risk of exceedence of the annual average objective for NO_2 at fifteen properties at the west end of Adastral Close in 2010 and beyond following the FSR. Source apportionment studies indicated that container handling operations by rubber tyred gantry (RTG) crane and internal movement vehicles (IMVs) will potentially make the greatest contribution to oxides of nitrogen (NO_X) concentrations in 2010 both at Adastral Close and the Dooley Inn, Ferry Lane. **Declaration of an AQMA for the annual average objective for NO_2 is required for the Dooley Inn, Ferry Lane, Felixstowe.**
Progress report: air quality in the Suffolk Coastal District (SCDC, 2008b)	Work on production of the draft action plan for the Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge is continuing. Public consultation will be undertaken following Defra's approval of the completed draft action plan. Public consultation on the findings of the 2008 detailed assessment (SCDC, 2008a) is to be undertaken following approval of the report by Defra.

Appendix C Review of air quality measures implemented in ports

C.1 Container ports in the USA (Energy Futures Inc. report)

A report published by Energy Futures Inc. (Cannon, 2008) examines the air pollution control measures that are currently in place at major container ports in the USA. The aim of the report is to identify specific environmental problems at each port, the development status of pollution control strategies and the opportunities for alternative fuels and advanced technologies to play a role in reducing air pollution. The report states that the most promising new pollution control strategies are: (i) providing dockside electricity for ships at berth and (ii) powering cargo handling equipment and drayage trucks (heavy duty diesel trucks) such as to alleviate pollution and reduce demand for oil.

Measures which have been implemented to improve air quality at ports in the USA are summarised below. Information is taken from the Energy Futures Inc. report authored by Cannon (2008).

C.1.1 Alternative fuels

Programmes to deploy fleets of natural gas powered cargo handling vehicles, including replacing diesel fuel with liquefied natural gas (LNG), have been implemented at Los Angeles, Long Beach and Oakland ports (*i.e.* the three largest container ports in California) (Cannon, 2008). Los Angeles and Long Beach ports have implemented a *Clean Air Action Plan*[16] (see section C.2), which includes replacing approximately 5,300 on-road diesel trucks at the two ports with LNG trucks by 2011.

The advantages of using natural gas to power the vehicle fleet compared to using diesel fuel include: lower tailpipe emissions, lower greenhouse gas emissions and greater supply (Cannon, 2008). In addition, on-port cargo handling equipment operates within a confined region that can be relatively easily served by an onsite fuelling station (Cannon, 2008). The Energy Futures Inc. report states that emissions of PM decline by 70%, NO_X by 72% and SO_2 emissions are almost eliminated when bunker fuel is replaced by natural gas.

The Port Authority of New York and New Jersey has introduced a programme to switch cargo handling equipment vehicles from conventional diesel fuels to ultra low sulphur diesel fuel and to install idling control equipment on yard tractors to shut off engines when the equipment is not moving (Cannon, 2008). Emissions from cargo handling equipment were found to reduce by 48% per container as a result of this programme (Cannon, 2008).

Two ports in Washington State (Tacoma and Seattle) have adopted the use of biodiesel blends in their vehicle fleets (Cannon, 2008). The Port of Seattle uses biodiesel in its fleet of administrative and maintenance vehicles which operate on the docks and the Port of Tacoma uses biodiesel for its cargo handling equipment, including rubber tyre gantry (RTG) cranes, yard tractors and top picks (Cannon, 2008). Cannon (2008) states that emissions of NO_X are known to increase with the use of biodiesel, whereas emissions of PM, which is the pollutant of greatest concern in the area incorporating Tacoma and Seattle Ports, are known to decrease.

[16] http://www.cleanairactionplan.org

C.1.2 Hybrid technology

A project to develop hybrid electric powered cargo handling equipment began at Long Beach Port, California in 2006. In 2008, hybrid electric yard tractor and rubber tyre gantry projects were launched by the Port Authority of New York and New Jersey. These Ports report a 40% reduction in emissions resulting from hybrid technology (The Port Authority of New York and New Jersey, 2008). Hybrid electric rubber tyre gantry cranes are also being tested by the Port of Seattle. The advantages of hybrid vehicles include reduced fuel consumption, reduced emissions and reduced operating costs (Cannon, 2008).

C.1.3 Cleaner fleet

The Port of Tacoma in Washington State was awarded a grant to retrofit carriers with diesel oxidation catalysts to reduce PM emissions from engines. This project was found to reduce SO_2 emissions by 1 ton per year and PM by 0.94 tons per year (Cannon, 2008).

The two San Pedro Ports (Los Angeles and Long Beach) have reduced emissions from container terminals by 24% for NO_X and more than 50% for diesel PM compared to 2002 through the accelerated replacement and retrofitting of 600 vehicles in their cargo handling equipment fleets with diesel oxidation catalysts (Cannon, 2008).

The three main California Ports (Los Angeles, Long Beach and Oakland) require the use of cleaner diesel fuels while ships are in harbour. The Energy Futures Inc. report implies that this is a short term solution to help reduce emissions but states that continuing to operate diesel powered equipment does not help diversify fuel supply away from oil (Cannon, 2008).

C.1.4 Shore power systems

Shore power (also called cold ironing or alternative marine power) is an alternative option to generating power onboard ships (onboard power is normally generated by the auxiliary engines) (Cannon, 2008). Shore power systems use electric power substations to connect berths to the main power grid or portable dockside generators that use natural gas as the fuel and are independent of the grid. In the USA, Oakland Port has introduced cold ironing technology at a container terminal where electricity is produced on the dock using a portable natural gas fired generator (Cannon, 2008).

C.1.5 Environmental Management System (EMS)

Several ports along the East and Gulf coasts of the USA have established environmental management systems (EMS) to guide voluntary pollution initiatives (Cannon, 2008). One measure that has been implemented by the Port Authority of New York and New Jersey under its EMS is 'Voluntary Tenant Environmental Awareness Training', which educates Port employees about environmental best management practices, green terminal design and construction practices (Cannon, 2008).

C.1.6 Speed reduction

Implementation of a speed limit of 12 knots between Los Angeles and Long Beach Ports and within a 24 mile offshore boundary has been estimated to result in a 40% reduction in NO_X emissions compared to ships travelling at 24 knots or more (Cannon, 2008). Speed reduction programmes can be implemented for safety reasons: Houston and Savannah Ports have implemented speed reduction programmes due to the narrow channels which container ships are required to traverse on their way to the berths (Cannon, 2008).

C.2 Container ports in the USA: San Pedro Bay Ports Clean Air Action Plan

The San Pedro Bay Ports of Los Angeles and Long Beach, California, have developed a strategy in conjunction with the US EPA, the California Air Resources Board and the South Coast Air Quality Management District group to improve the air quality situations at the two Ports (The Ports of Long Beach and Los Angeles, 2006). The Ports have established air quality standards at 3 levels: the San Pedro Bay level (relates to public health risk and state/federal standards), Project Specific level (relates to California Environmental Quality Act standards) and Source Specific Performance level (relates to standards which will be met through lease requirements, tariffs, incentives and market-based mechanisms) (The Ports of Long Beach and Los Angeles, 2006).

Measures included in the *Clean Air Action Plan*[17] are expected to eliminate more than 47% of diesel PM emissions from port-related sources and reduce NO_X and SO_2 emissions by more than 45% and by 52% respectively (The Ports of Long Beach and Los Angeles, 2006). Some of the pollution reduction strategies included in the plan are outlined below:

- Eliminate ‘dirty’ diesel trucks from San Pedro Bay cargo terminals within 5 years.
- Collaborate with the state and local agencies to finance programmes to replace trucks with a new generation of clean or retrofitted vehicles.
- Equip all major container cargo and cruise ship terminals at the Ports with shore-side electricity within 5-10 years so that vessels can shut down diesel-powered engines while at berth.
- Require ships to reduce speeds when entering or leaving the harbour region, use low-sulphur fuels and employ other emission reduction measures and technologies.

C.3 Container ports in Europe: Rotterdam Port Vision 2020

The Port of Rotterdam, Netherlands, adopted the *Port Vision 2020*[18] plan in 2004. This plan endorses a number of strategies to reduce air pollution from Port operations, despite a projected 250% growth in container traffic (Cannon, 2008). The ‘clean’ Port planned for 2020 includes improved air quality achieved by discouraging non-essential road transport and encouraging clean forms of transport (Port of Rotterdam, 2004).

C.4 Container ports in Europe: Port of Göteborg shore-connected energy supply

The Port of Göteborg, Sweden, was the first port in the world to provide high voltage shore-side electricity for cargo vessels when it implemented this at its Ro/Ro terminal in 2000

[17] http://www.cleanairactionplan.org
[18] http://www.portofrotterdam.com/mmfiles/SummaryPortVision2020_UK_tcm26-9530.pdf

(Port of Göteborg, 2007). The environmental benefits of this mechanism are reported to depend on factors such as the length of time the vessel spends in the Port, which fuel is used and the power of the engines (Port of Göteborg, 2007). The Port of Göteborg has reported that a Ro/Ro vessel at the Port would, on average, emit 25 tonnes of CO_2, 520 kg of NO_X and 22 kg of particles if not provided with shore-side electricity (Port of Göteborg, 2007). If the entire Ro/Ro terminal was provided with shore-side electricity facilities (and assuming all vessels used these facilities), it is estimated that this would result in reductions of approximately 31,000 tonnes of CO_2, 510 tonnes of NO_X and 12 tonnes of PM annually (Port of Göteborg, 2007).

The actual environmental benefit of using shore-side electricity must take into account how the electricity is produced and compare it with emissions from the fuel which would otherwise be used by ships in port (Port of Göteborg, 2007). The Port of Göteborg reports that studies have indicated that using shore-side electricity has a lower environmental impact than using auxiliary engines and to ensure that shore-side electricity facilities are as environmentally sound as possible, the Port utilises two local wind turbines (Port of Göteborg, 2007).

Appendix D Monitoring data (2010)

D.1 Nitrogen dioxide diffusion tube data (2010)

Site ID	Site type	2010 data capture (%)	Short-term adjustment factor	Annual mean NO_2 ($\mu g/m^3$)	Bias adjusted* annual mean NO_2 ($\mu g/m^3$)
Suffolk Coastal District Council diffusion tubes (Felixstowe)					
FLX12	Roadside	83	1.08	36.9	31.4
FLX14	Industrial	100	NA	31.4	26.7
FLX17	Roadside	100	NA	30.4	25.8
FLX20	Industrial/roadside	100	NA	28.0	23.8
FLX21	Urban background	100	NA	28.6	24.3
FLX22	Industrial	100	NA	29.3	24.9
FLX23	Roadside	100	NA	36.7	31.2
FLX24	Roadside	92	NA	36.2	30.8
FLX26	Industrial/roadside	100	NA	**50.0**	**42.5**
FLX27	Industrial/roadside	83	0.96	38.8	33.0
FLX29	Industrial	100	NA	31.6	26.9
FLX31	Industrial	100	NA	35.0	29.8
Port of Felixstowe diffusion tubes					
75 Park	Port	100	NA	34.8	33.0
Central Eng car park	Port	100	NA	**51.2**	**48.6**
Mallard House	Port	91	NA	**52.4**	**49.8**
LT7410	Port	100	NA	31.2	29.7
LT7403	Port	100	NA	34.1	32.4
LT7402	Port	91	NA	**40.2**	38.2
LT7404	Port	100	NA	35.1	33.4
LT7120	Port	100	NA	35.3	33.6
LT7113	Port	100	NA	36.9	35.1

* Bias adjustment factor of 0.85 applied to Suffolk Coastal District Council diffusion tube data recorded in 2010 and factor of 0.95 applied to Port of Felixstowe diffusion tube data recorded in 2010

Appendix E Automatic number plate recognition (ANPR) camera survey

E.1 Objective

An Automatic Number Plate Recognition (ANPR) camera survey was undertaken to gain a greater understanding of the number and types of vehicles travelling in the vicinity of the Dooley Inn public house. The aim of the survey was to identify the age and emission standard of each vehicle. This allowed the fleet composition assumed in the 2010 further assessment (derived from the National Atmospheric Emissions Inventory (NAEI)) to be refined in order to understand whether shunting activity (not previously captured in the 2010 modelling assessment) is likely to be contributing significantly to NO_2 concentrations in the Ferry Lane AQMA. If this was deemed to be the case, the Council would pursue mitigation options specifically targeting shunting operations.

E.2 Method

The ANPR camera survey was undertaken on a 'neutral' weekday in 2011 (Wednesday 13th July) over a 24-hour period. Cameras were located adjacent to the Dooley Inn public house on Ferry Lane and Hodgkinson Road. Vehicles were initially classified over 15-minute intervals according to the following vehicle types:

- Car
- Light goods vehicles (LGVs)
- Other goods vehicles 1 (OGV1) – rigid HGVs with twin rear wheels or three axles
- OGV2 - rigid and or articulated goods vehicles with four or more axles
- Public service vehicles (PSV) – buses
- Motorcycles (MC)
- Pedal cycles (PC).

Number plate details were compared with information stored in the DVLA database. This enabled emission standards of vehicles to be determined based on their taxation class and date first registered. These details were formatted and input to the Emission Factor Toolkit (EFT)[19] (version 4.2.2).

Traffic data (flow and composition) for Ferry Lane (adjacent to the Dooley Inn) are shown in Table 7. Data collected via the 2011 ANPR camera survey and data used in the 2010 further assessment (with 2008 as the assessment year) are shown. The 2010 further assessment assumed the default composition for the national fleet for 2008 (the assessment year).

[19] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html

Table 7: Summary of traffic activity (ANPR and further assessment)

	Data source			
	ANPR (2011)		SCDC (2008)	
Combined two way Traffic Flow (AADT)	4091		3697	
Two way percentage composition				
Petrol car	73.0	51.8	72.0	73.8
Diesel car		31.5		15.1
Petrol LGV		0.0		1.1
Diesel LGV		8.0		10.0
Motorcycles		9.4		0.0
Total		**100.0**		**100.0**
Rigid HGV	27.0	8.9	28.0	50.7
Articulated HGV		91.1		14.3
Buses and coaches		0.0		35.0
Total		**100.0**		**100.0**

Table 7 shows that the main difference between the two sources of data (ANPR survey and further assessment approach) is the vehicle composition: the composition determined from the ANPR survey shows a much higher proportion of articulated HGVs than assumed in the further assessment (and there were no buses/coaches observed on Ferry Lane during the ANPR survey). The AADT differs between each method and this could indicate traffic growth between 2008 and 2011 (the ANPR survey derived flow is 11% higher than the flow used in the 2010 further assessment, with 2008 as the assessment year).

The vehicle class breakdown (by Euro emission standard) is shown in Table 8. The breakdown measured during the ANPR survey is shown and compared with the breakdown taken from the National Atmospheric Emissions Inventory (NAEI) for roads outside London in 2011.

Table 8: Heavy goods vehicle class proportions (2011)

Vehicle category	Assumed: NAEI (Vehicle Class Proportion for Outside London) 2011	Actual 2011
Rigid HGV Pre-Euro 1OK	0.00	0.00
Rigid HGV Euro 1OK	0.00	0.00
Rigid HGV Euro 2OK	0.15	0.00
Rigid HGV Euro 3OK	0.39	0.50
Rigid HGV Euro 4OK	0.19	0.25
Rigid HGV Euro 5OK	0.27	0.25
Rigid HGV Euro 6OK	0.00	0.00
Artic HGV Pre-Euro 1OK	0.00	0.00
Artic HGV Euro 1OK	0.00	0.02
Artic HGV Euro 2OK	0.08	0.01
Artic HGV Euro 3OK	0.41	0.29
Artic HGV Euro 4OK	0.23	0.39
Artic HGV Euro 5OK	0.28	0.29
Artic HGV Euro 6OK	0.00	0.00

The ADMS-Roads model was used to model the air quality concentrations derived using (i) the ANPR camera fleet breakdown and (ii) the NAEI fleet breakdown. The model applied NO_X and PM emission rates derived from the EFT (discussed above). Meteorological data collected at Wattisham in 2008 were applied. The output (road NO_X) was converted to NO_2 using Defra's NO_X to NO_2 calculator[20]. No other emissions sources were considered and background concentrations were not included given that the aim was to determine the relative difference in air quality concentrations using the two different fleet breakdowns (absolute concentrations were not of interest).

E.3 Results

Vehicle classifications

The full classification results are shown in Figure 4, Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9. The results show that westbound traffic flows are higher than eastbound flows on Ferry Lane. Heavy goods vehicles (HGVs) are shown to frequently turn on to Hodgkinson Road and those travelling eastbound originate predominantly from Hodgkinson Road. The general traffic profile suggests that HGVs leave Hodgkinson Road during the early morning periods (from approximately 3am) and return to Hodgkinson Road from midday to 6pm.

[20] http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html

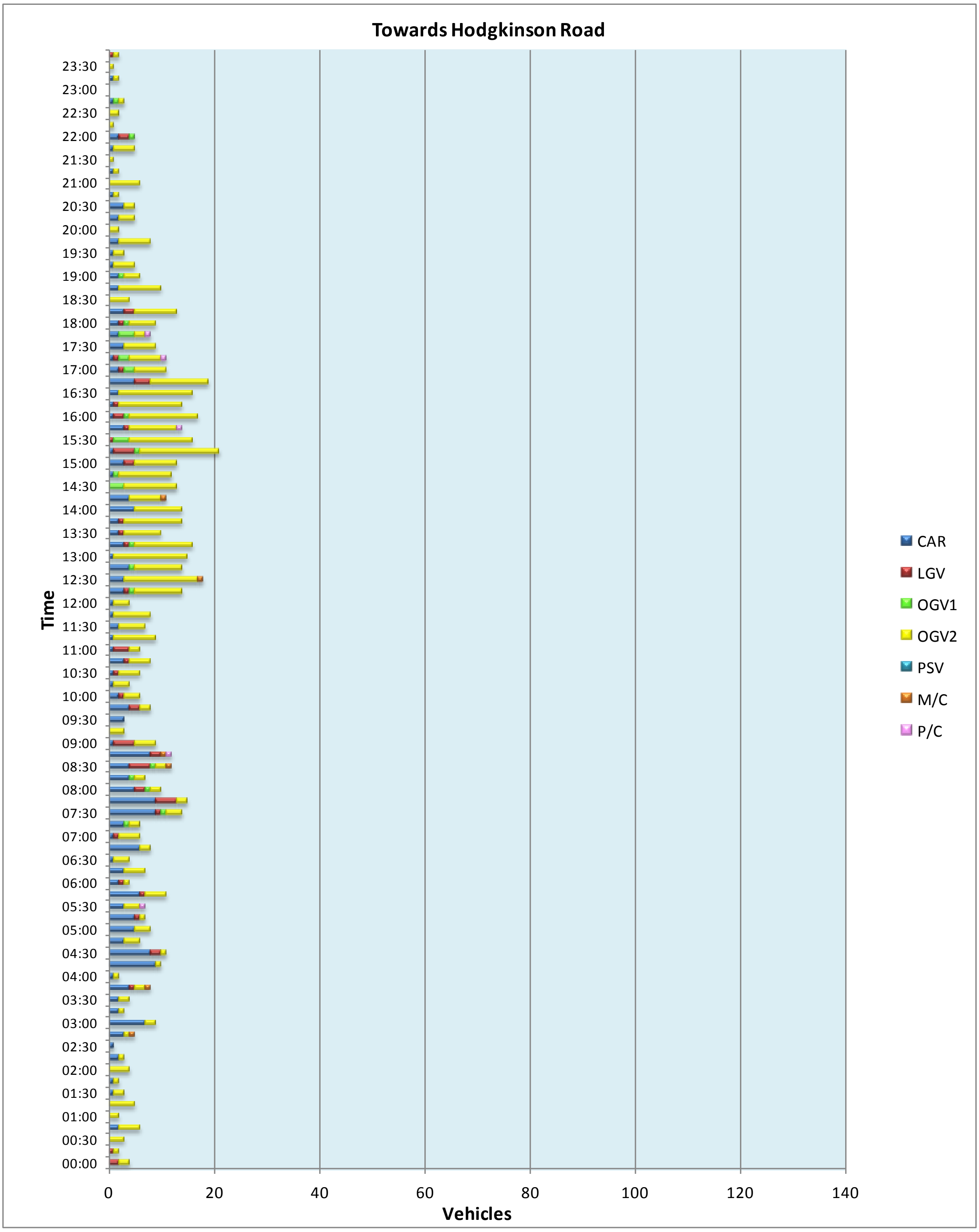

Figure 4: Vehicle classification (towards Hodgkinson Road)

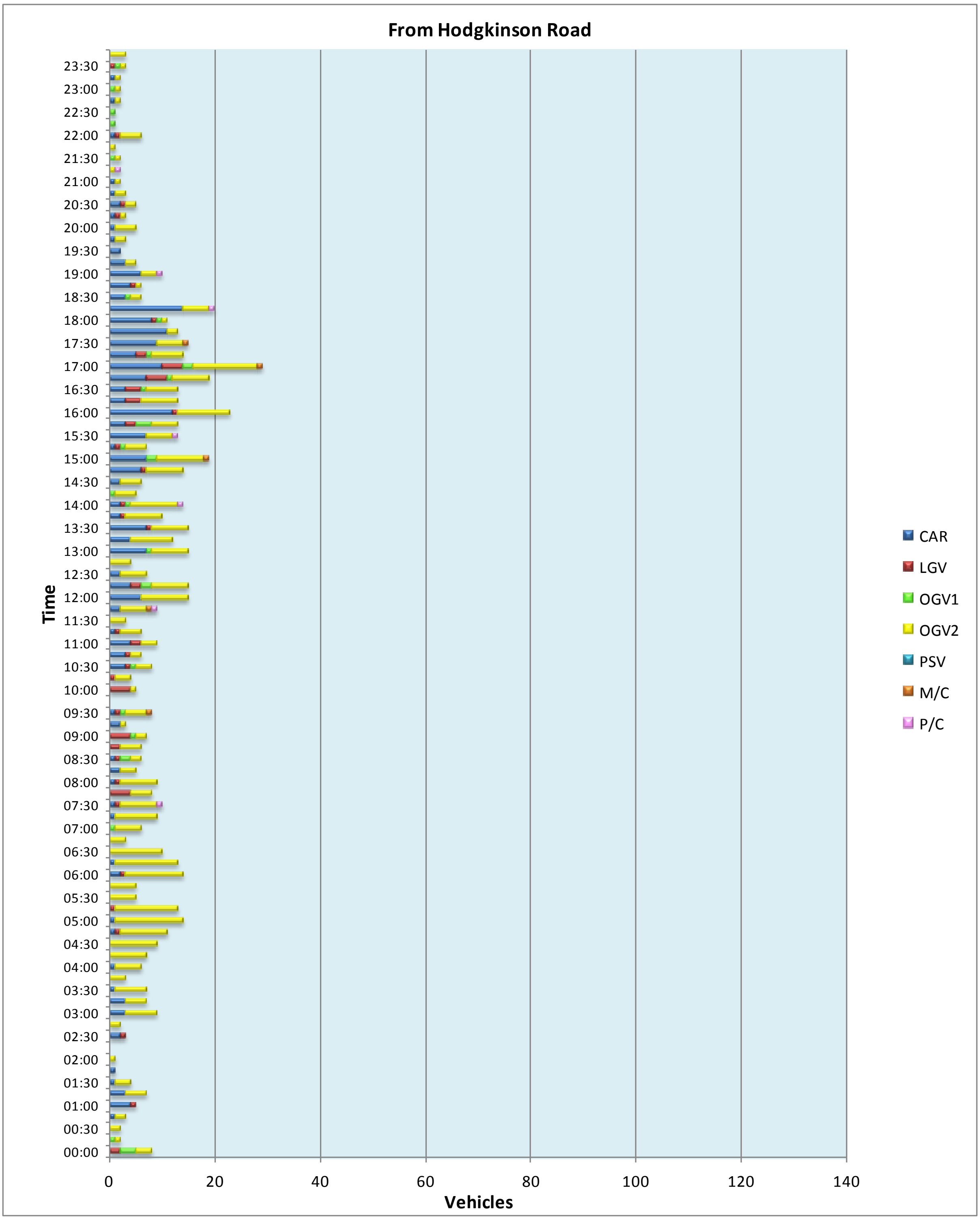

Figure 5: Vehicle classification (from Hodgkinson Road)

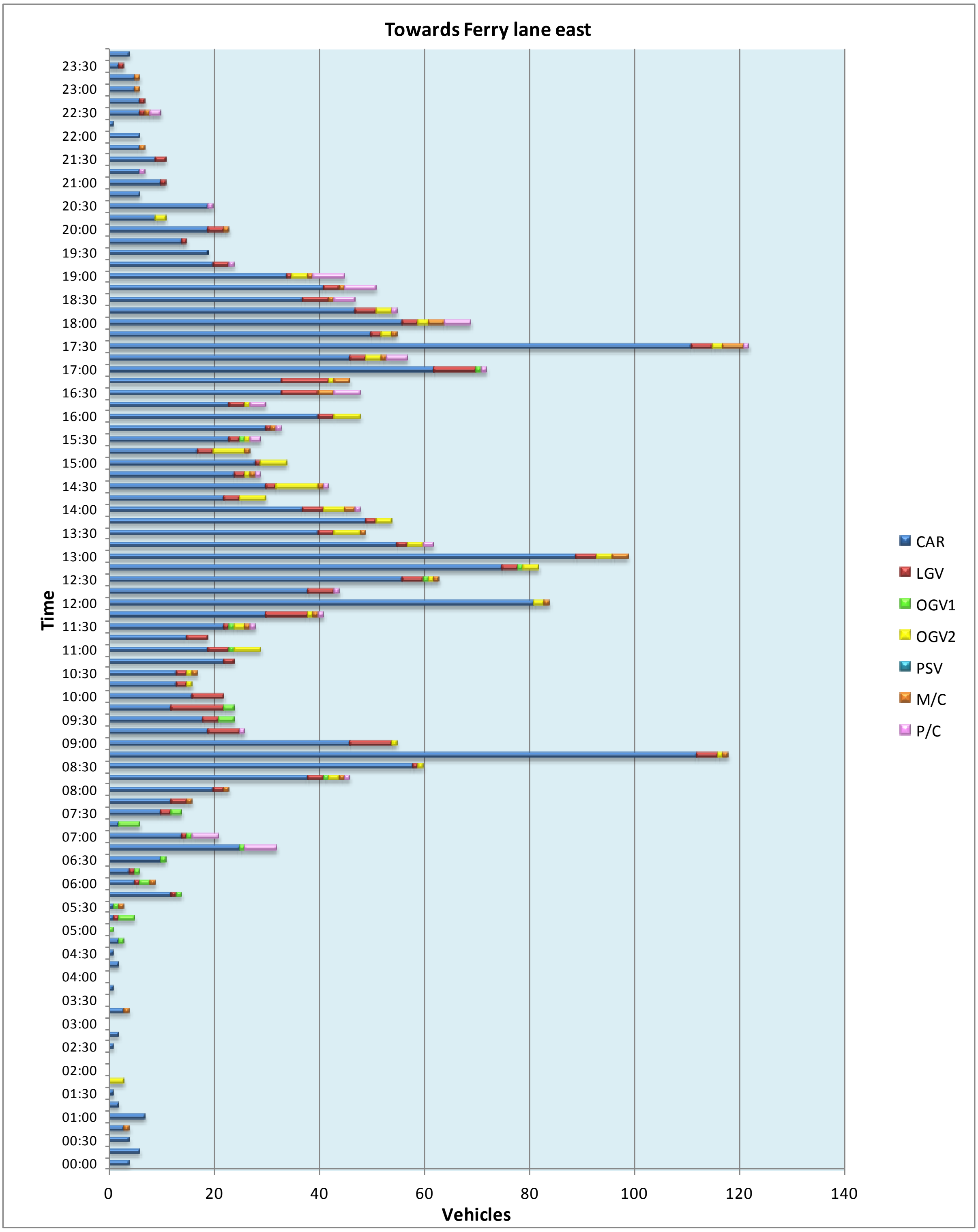

Figure 6: Vehicle classification (towards Ferry Lane East)

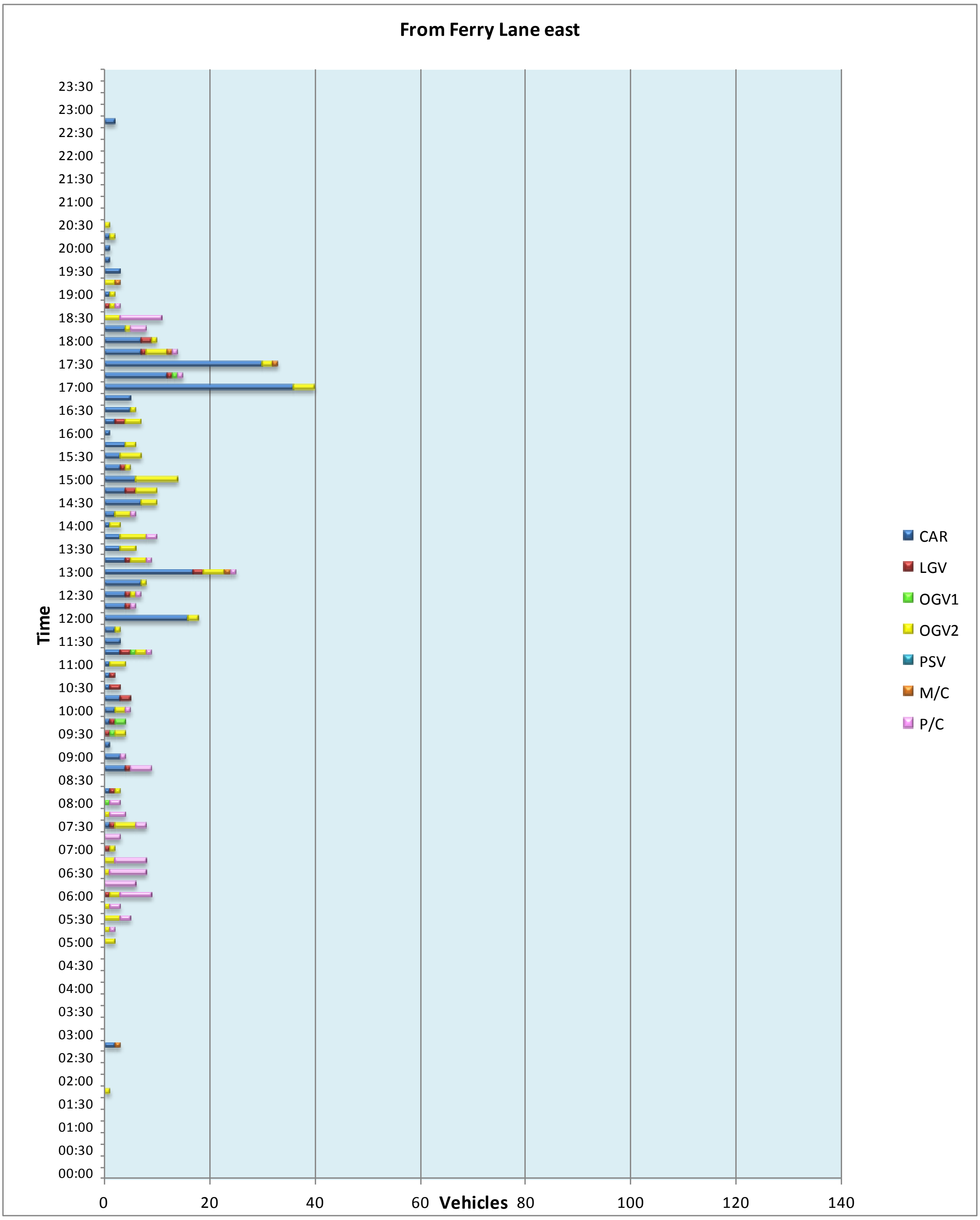

Figure 7: Vehicle classification (from Ferry Lane East)

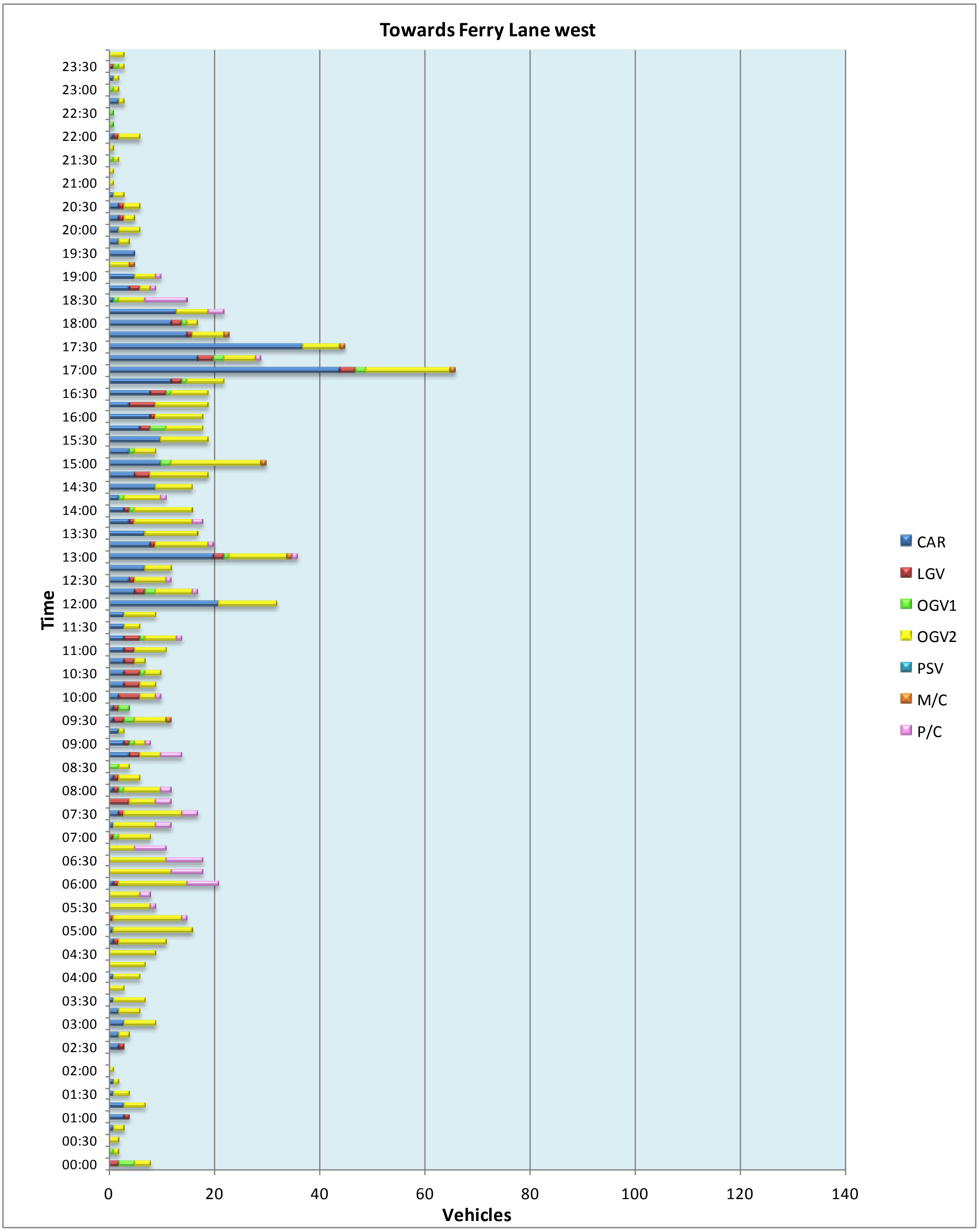

Figure 8: Vehicle classification (towards Ferry Lane West)

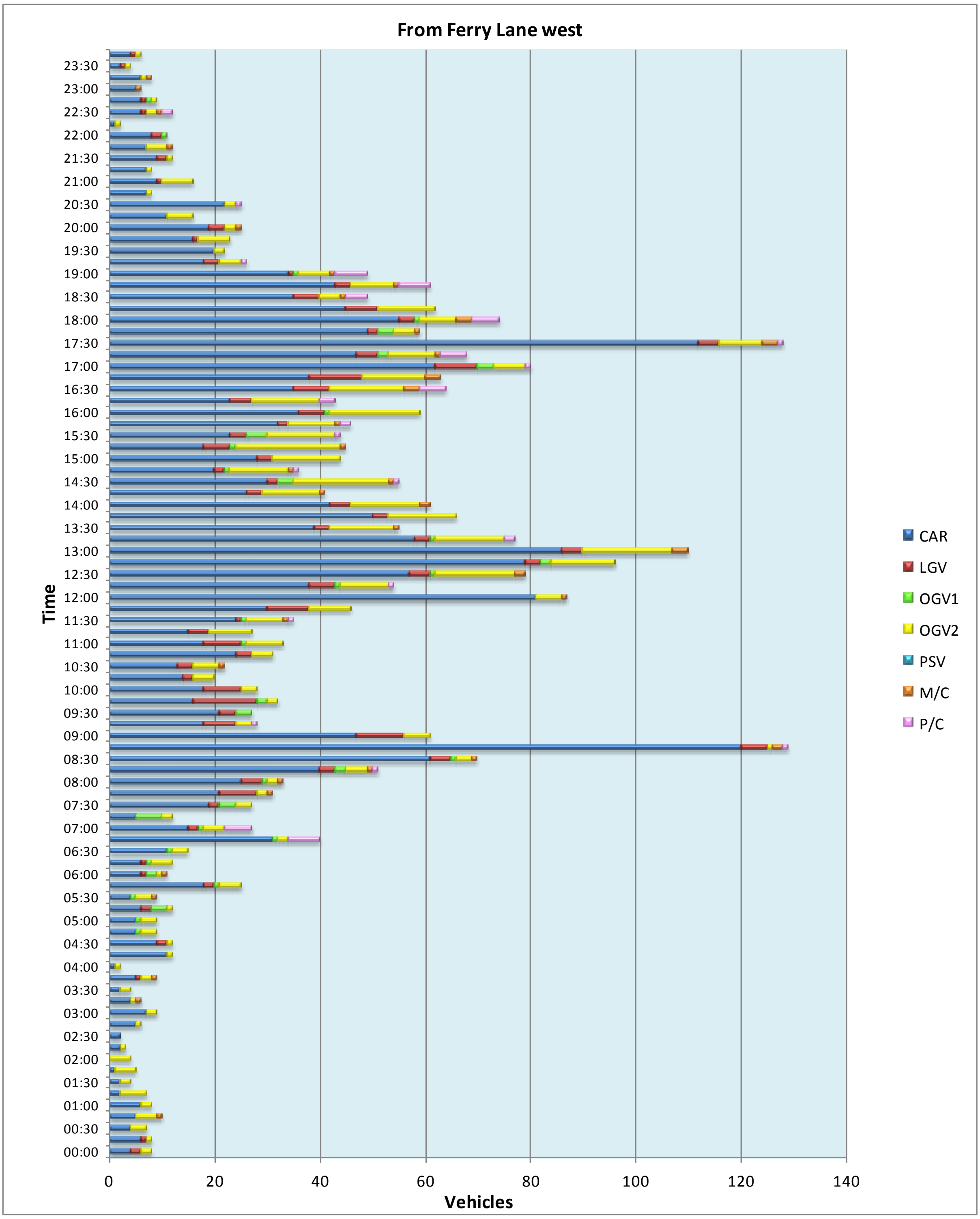

Figure 9: Vehicle classification (from Ferry Lane West)

<u>Emissions</u>

Assumed (NAEI-derived) and actual (ANPR-derived) emission rates (g/km) are shown in Table 9 (and Table 10 shows percentage contributions). The assessment has used the traffic activity data (flow and fleet composition) recorded by the ANPR cameras to estimate emissions using (i) the ANPR Euro standard breakdown (actual) and (ii) the NAEI Euro standard breakdown (assumed); hence differences in emissions are attributable only to differences in Euro emission standards, not differences in coarse composition (*i.e.* the breakdown by vehicle type: cars/buses/heavy duty (articulated or rigid)/light duty) or total vehicle flow. Emission rates are shown to be similar using both Euro standard breakdowns – the breakdown recorded via the ANPR survey results in slightly higher NO_X emissions (0.5% higher) than the breakdown taken from the NAEI. The highest emission rates originate from articulated heavy goods vehicles using both breakdowns, as expected given that 27% of vehicles were found to be HGVs and of this 27%, 91% were articulated HGVs.

Table 9: Actual (ANPR-derived) and assumed (NAEI-derived) emission rates (NO_X and PM)

Source	Pollutant	Emission Rates (g/km/s)	Emission rates (g/km)						
			Total	Petrol Cars	Diesel Cars	Diesel LGV	Rigid HGV	Artic HGV	Motor cycles
		Assumed							
Ferry Lane	NO_x	0.081	6965.4	161.7	304.9	110.6	325.0	6030.0	33.2
	PM_{10}	0.003	294.2	34.8	35.1	15.4	12.6	189.3	7.0
		Actual							
	NO_x	0.081	6996.9	183.0	298.9	101.2	339.0	6039.3	35.5
	PM_{10}	0.003	292.2	34.8	37.9	14.7	13.1	184.4	7.4
		Change							
	NO_x	0.0	31.5	21.3	-5.9	-9.4	14.0	9.3	2.3
	PM_{10}	0.0	-1.9	0.0	2.8	-0.7	0.5	-5.0	0.4

Table 10: Actual (ANPR-derived) and assumed (NAEI-derived) emission rates (NO_X and PM)

Source	Pollutant	Petrol Cars	Diesel Cars	Diesel LGV	Rigid HGV	Artic HGV	Motorcycles
Ferry Lane		**Assumed (%)**					
	NO_x	2.3	4.4	1.6	4.7	86.6	0.5
	PM_{10}	11.8	11.9	5.2	4.3	64.4	2.4
		Actual (%)					
	NO_x	2.6	4.3	1.4	4.8	86.3	0.5
	PM_{10}	11.9	13.0	5.0	4.5	63.1	2.5

Air quality

Annual mean road NO_X concentrations were modelled using ADMS-Roads at three receptor locations: two at roadside and one at the Dooley Inn public house – results are shown in Table 11. Results show that incorporating knowledge of the detailed Euro standard breakdown (measured via the ANPR survey) does not significantly affect the modelled road NO_X concentrations and derived road NO_2 concentrations. As such, it can be concluded that shunting activities are not likely to be contributing to air quality concentrations at the Dooley Inn to any greater extent than previously assumed: the differences in emission standards between the assumed fleet and the actual fleet are shown to be negligible in terms of air quality.

Table 11: Actual (ANPR-derived) and assumed (NAEI-derived) annual mean road NO_X and NO_2 concentrations

Location	Distance from roadside (metres)	Annual mean				
		Road NO_x (µg/m^3)		Road NO_2 (µg/m^3)		Road NO_2 (µg/m^3)
		Assumed	Actual	Assumed	Actual	Change
Dooley Inn	105	0.3	0.3	0.3	0.3	0.00
Roadside North	3.5	7.0	7.0	3.8	3.8	0.01
Roadside South	3.5	7.6	7.7	4.1	4.2	0.02

E.4 Conclusion

The ANPR survey was undertaken to examine goods vehicle activity in more detail than has previously been possible to determine if shunting activity is likely to be contributing significantly to air quality concentrations at the Dooley Inn public house. The results are summarised below:

- 15-minute vehicle classifications showed that goods vehicles tend to operate from the early hours of the morning (3am) and finish at approximately 6pm. Particular peaks in activity are of relevance to the hourly mean NO_2 objective but the annual mean will be unaffected.
- The ANPR survey identified disproportionate emissions from articulated heavy goods vehicles (HGVs), adding further evidence to support the findings of the source apportionment exercise (completed as part of the 2010 further assessment): approximately 86% of road NO_X emissions were found to be generated by articulated HGVS, whereas this vehicle type constitutes approximately 25% of local traffic.
- Comparison of traffic activity data and emissions/air quality results shows that the ANPR camera survey has identified differences in the coarse vehicle composition (*i.e.* the breakdown by vehicle type: cars/buses/heavy duty (articulated or rigid)/light duty) compared with that assumed in the Further Assessment modelling approach, primarily due to the higher proportion of articulated HGVs identified by the cameras.
- Concentrations modelled using the detailed fleet breakdown by Euro emission standard identified from the ANPR survey do not differ substantially from those modelled using the detailed fleet breakdown assumed previously. It is concluded that the estimates of Euro emission standards based on information included in the

National Atmospheric Emissions Inventory (NAEI) are adequate for the study area. Overall, the activity from the goods yard does not appear to be affecting air quality concentrations at the Dooley Inn to any greater extent than previously thought.

Limitations

- The ANPR survey took place on Ferry Lane – it is not known whether traffic statistics collected here can be assumed for other locations in Felixstowe.
- The ANPR survey does not enable cold-starting or emissions from idling vehicles to be taken into account. These activities may impact the annual mean NO_2 concentration at the Dooley Inn. Further work may therefore focus on understanding cold-starting and idling emissions within local haulage depots if deemed necessary.