Public Document Pack

Scrutiny Inquiry Panel - Air Quality

Thursday, 20th November, 2014
at 4.30 pm

PLEASE NOTE TIME OF MEETING

Committee Room 1 - Civic Centre

This meeting is open to the public

Members

Councillor Hammond (Chair)
Councillor Coombs
Councillor Galton
Councillor McEwing (Vice-Chair)
Councillor O'Neill
Councillor Parnell
Councillor Thorpe

Contacts
Senior Democratic Support Officer
Natalie Noke
Tel: 023 8083 3950
Email: natalie.noke@southampton.gov.uk

Community Development Officer
Louise Fagan
Tel: 023 8083 2644
Email: louise.fagan@southamtpon.gov.uk

PUBLIC INFORMATION

Role of this Scrutiny Panel

The Overview and Scrutiny Management Committee have instructed Scrutiny Panel to undertake an inquiry into Air Quality in Southampton

Southampton City Council's Priorities

- Jobs for local people
- Prevention and early intervention
- Protecting vulnerable people
- Affordable housing
- Services for all
- City pride
- A sustainable Council

Public Representations

At the discretion of the Chair, members of the public may address the meeting about any report on the agenda for the meeting in which they have a relevant interest.

Smoking policy – the Council operates a no-smoking policy in all civic buildings.

Mobile Telephones:- Please switch your mobile telephones to silent whilst in the meeting

Use of Social Media:- If, in the Chair's opinion, a person filming or recording a meeting or taking photographs is interrupting proceedings or causing a disturbance, under the Council's Standing Orders the person can be ordered to stop their activity, or to leave the meeting

Fire Procedure – in the event of a fire or other emergency a continuous alarm will sound and you will be advised by Council officers what action to take.

Access – access is available for the disabled. Please contact the Democratic Support Officer who will help to make any necessary arrangements.

Dates of Meetings: Municipal Year

2014	2015
31 July	22 January
18 September	
23 October	
20 November	
18 December	

CONDUCT OF MEETING

TERMS OF REFERENCE FOR THE INQUIRY

Purpose:
To develop understanding of the issue of air quality in Southampton and to identify what additional steps can be taken, if necessary, to improve it.

Objectives:

a. To increase understanding of air quality issues within Southampton
b. To examine the causes and impacts of air pollution
c. To understand the actions being taken to reduce air pollution in Southampton
d. Learning from best practice, to identify ways of improving air quality in the City now and for future generations

BUSINESS TO BE DISCUSSED
Only those items listed on the attached agenda may be considered at this meeting.

RULES OF PROCEDURE
The meeting is governed by the Council Procedure Rules and the Overview and Scrutiny Procedure Rules as set out in Part 4 of the Constitution.

QUORUM
The minimum number of appointed Members required to be in attendance to hold the meeting is 3.

DISCLOSURE OF INTERESTS

Members are required to disclose, in accordance with the Members' Code of Conduct, ***both*** the existence ***and*** nature of any "Disclosable Pecuniary Interest" or "Other Interest" they may have in relation to matters for consideration on this Agenda.

DISCLOSABLE PECUNIARY INTERESTS

A Member must regard himself or herself as having a Disclosable Pecuniary Interest in any matter that they or their spouse, partner, a person they are living with as husband or wife, or a person with whom they are living as if they were a civil partner in relation to:

(i) Any employment, office, trade, profession or vocation carried on for profit or gain.

(ii) Sponsorship:

Any payment or provision of any other financial benefit (other than from Southampton City Council) made or provided within the relevant period in respect of any expense incurred by you in carrying out duties as a member, or towards your election expenses. This includes any payment or financial benefit from a trade union within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992.

(iii) Any contract which is made between you / your spouse etc (or a body in which the you / your spouse etc has a beneficial interest) and Southampton City Council under which goods or services are to be provided or works are to be executed, and which has not been fully discharged.

(iv) Any beneficial interest in land which is within the area of Southampton.

(v) Any license (held alone or jointly with others) to occupy land in the area of Southampton for a month or longer.

(vi) Any tenancy where (to your knowledge) the landlord is Southampton City Council and the tenant is a body in which you / your spouse etc has a beneficial interests.

(vii) Any beneficial interest in securities of a body where that body (to your knowledge) has a place of business or land in the area of Southampton, and either:

a) the total nominal value for the securities exceeds £25,000 or one hundredth of the total issued share capital of that body, or
b) if the share capital of that body is of more than one class, the total nominal value of the shares of any one class in which you / your spouse etc has a beneficial interest that exceeds one hundredth of the total issued share capital of that class.

Other Interests

A Member must regard himself or herself as having an 'Other Interest' in any membership of, or occupation of a position of general control or management in:

Any body to which they have been appointed or nominated by Southampton City Council

Any public authority or body exercising functions of a public nature

Any body directed to charitable purposes

Any body whose principal purpose includes the influence of public opinion or policy

Principles of Decision Making

All decisions of the Council will be made in accordance with the following principles:-

- proportionality (i.e. the action must be proportionate to the desired outcome);
- due consultation and the taking of professional advice from officers;
- respect for human rights;
- a presumption in favour of openness, accountability and transparency;
- setting out what options have been considered;
- setting out reasons for the decision; and
- clarity of aims and desired outcomes.

In exercising discretion, the decision maker must:

- understand the law that regulates the decision making power and gives effect to it. The decision-maker must direct itself properly in law;
- take into account all relevant matters (those matters which the law requires the authority as a matter of legal obligation to take into account);
- leave out of account irrelevant considerations;
- act for a proper purpose, exercising its powers for the public good;
- not reach a decision which no authority acting reasonably could reach, (also known as the "rationality" or "taking leave of your senses" principle);
- comply with the rule that local government finance is to be conducted on an annual basis. Save to the extent authorised by Parliament, 'live now, pay later' and forward funding are unlawful; and
- act with procedural propriety in accordance with the rules of fairness.

AGENDA

Agendas and papers are now available via the City Council's website

1 **APOLOGIES AND CHANGES IN PANEL MEMBERSHIP (IF ANY)**

To note any changes in membership of the Panel made in accordance with Council Procedure Rule 4.3.

2 **DECLARATION OF PARTY POLITICAL WHIP**

Members are invited to declare the application of any party political whip on any matter on the agenda and being scrutinised at this meeting.

3 **DECLARATIONS OF SCRUTINY INTEREST**

Members are invited to declare any prior participation in any decision taken by a Committee, Sub-Committee, or Panel of the Council on the agenda and being scrutinised at this meeting.

4 **STATEMENT FROM THE CHAIR**

5 **MINUTES OF THE PREVIOUS MEETING (INCLUDING MATTERS ARISING)** (Pages 1 - 4)

To approve and sign as a correct record the Minutes of the meetings held on 20th November, 2014 and to deal with any matters arising, attached.

6 **AIR QUALITY - SOUTHAMPTON CITY COUNCIL** (Pages 5 - 130)

Report of the Assistant Chief Executive looking at how effectively the Council is working collectively to address air quality issues in Southampton, attached.

Wednesday, 12 November 2014 HEAD OF LEGAL AND DEMOCRATIC SERVICES

This page is intentionally left blank

SCRUTINY INQUIRY PANEL - AIR QUALITY

MINUTES OF THE MEETING HELD ON 23 OCTOBER 2014

Present: Councillors Hammond (Chair), Coombs, Galton, Lloyd and Parnell

Apologies: Councillors McEwing (Vice-Chair) and O'Neill

10. **APOLOGIES AND CHANGES IN PANEL MEMBERSHIP (IF ANY)**

It was noted that following receipt of the temporary resignation of Councillor Thorpe from the Panel, the Head of Legal and Democratic Services, acting under delegated powers, had appointed Councillor Lloyd to replace him for the purpose of this meeting.

11. **MINUTES OF THE PREVIOUS MEETING (INCLUDING MATTERS ARISING)**

RESOLVED that the minutes of the meeting held on 18th September, 2014 be approved and signed as a correct record, subject to the following amendment:

Page 8, Minute 9, Bullet Point 7 – "the data showed a 61% increase"

12. **ASSOCIATED BRITISH PORTS, DP WORLD SOUTHAMPTON AND THE SUSTAINABLE DISTRIBUTION CENTRE**

The Panel considered the report of the Assistant Chief Executive relating to the impact that the operations at the Port of Southampton had on air quality.

A joint written statement was provided by Associated British Ports and D P World Southampton (DPWS) in the appendices to the report, together with the report from Meachers Global Logistics on a Sustainable Distribution Centre.

Aart Hille Ris Lambers from DPWS gave more details on the statement provided:-

- October was always a very busy month as deliveries were needed for the Christmas period.
- Peak hours within the port were not the same as the usual commuter peak traffic hours. The peak port hours were 13.00 to 16.00 hours.
- Bookings were restricted to 125 per hour in order for the vehicles within the docks to be serviced in an appropriate time.
- 36% of the containers were now carried by rail, reducing the number of lorry movements by 80,000 per year. This compared to 28% in 2007.
- There had been a large investment in the rail link. Including the gauge height of the tunnel to allow high cube containers to use the rail links; the Freightliner terminal had new cranes; and prioritising rail containers discharging from vessels as there was no flexibility on the train movements in the same way that there was with lorries.
- Energy reduction was currently measuring 22%.
- They were looking into the possibility of trials for compressed gas powered straddle carriers.
- Had previously trialled hybrid straddle carriers however they had not deliver.
- There had been major developments ship side with the opening of Terminal 5 which now meant new larger ships could berth. The newer ships were more energy/ fuel efficient.

- In January 2015 there was an agreement being introduced for ships to burn cleaner fuel. Marine gas oil was more expensive but less polluting.

The following responses were received to questions raised:-

- In principle DPWS would be supportive of a bid for the City to achieve Ultra-Low Emission City (ULEC) Status. And also involvement in community projects. There would need to be work with the community and viable for the business.
- The intension was to increase the use of the rail facilities, but this would be customer driven. There was pollution associated with rail however the impact was less than that caused by the road journeys. Currently it tended to be the shorter distances that the journey would be by road. Customers with deliveries further than Birmingham would look to use rail freight.
- London deliveries were not often rail freight. In order to go into London the vehicles have to be compliant with the rules of the Low Emissions Zone, so they would generally be newer and more environmentally friendly. This has had a knock on effect and Southampton is having cleaner vehicles visiting the City.
- Ship to shore power was still an area that was limited due to there being no industry standard on what equipment would be used. Therefore it was not viable to invest in quay side equipment that may not be suitable.
- Consideration of the increasing the slots available for vehicles could possibly be considered. They currently do not go over the current 125 slots per hour. Hours of operation had been increased recently over the weekend period however the take up had not been sufficient to continue. This would have been partly due to the current shortage of drivers and the rules regarding their driving hours.
- With regards to queuing lorries at Dock Gate 20, the Vehicle Booking System (VBS) meant that vehicles do not arrive at the docks unless they have a slot, therefore there should not be any queues. If drivers arrived earlier than their booking they were able to contact the VBS helpdesk to amend the time of the booking to ensure vehicles were not queuing. Parking areas within the docks was an issue and therefore it was important to ensure all vehicles were only arriving if they had a current VBS slot.
- There was a need for a local lorry parking facilities, particularly at night, in order for the lorries to have a place to go if they did not have a current VBS slot. Other ports had such facilities and they worked very well. They were privately operated and provided facilities for the drivers as well as parking.
- Idling of vehicles was not an issue. Whilst moving around areas there would be a small amount of idling, however when vehicles were waiting engines were switched off. It would not be economical for the engines to be idling.
- In principle DPWS would be supportive of a no idling policy as long as it did not affect the drivers getting to their destination or parking up.
- There was no need to have enforcement measures for drivers arriving without a VBS slot, as this did not occur. If companies were not registered to use the system then they were unable to collect containers.
- Companies were encouraged to use the off peak slots with the current charging structure. Peak time slots were more expensive. Some off peak slots were free.
- DPWS would be prepared to consider looking at supporting a monitoring station within the dock, dependant on cost.
- DPWS would be able to provide details of companies that were already using Liquid Nitrogen Gas (LNG) as an alternative fuel.

Congratulations were given to DPWS for being awarded Global Port Operator of the Year 2014.

13. **BUS COMPANIES : FIRST HAMPSHIRE AND GO SOUTH COAST**

The Panel considered the report of the Assistant Chief Executive relating to evidence from two major bus companies operating in Southampton and the actions being taken or that were planned to address air quality in Southampton.

Andrew Wickham from Go South Coast, operators of the BlueStar and Uni-Link buses in Southampton and Marc Reddy from First Bus Southampton both gave presentations, which included details of their current fleet and the measures that were in place to improve the emissions even further.

Both stated the importance of encouraging bus travel and that this could only be done by working in partnership with local authorities and also retailers.

The following responses were received to questions raised:-

- Hybrid buses were not particularly economical and that in most cases where only operational with support. There were issues with regards to range; and recharging for fully electric vehicles. Battery technology for these types of vehicle needed to be developed.
- Both operators would be supportive in principle of a no idling zone however there would need to be consideration of when buses were collecting/ dropping passengers and whether at these times it would be economical for the engine to stop. Stop/start technology was not at the same level for bus engines as it was for modern cars. Though buses do have idling limiters installed.
- Both operators would also be supportive of ULEC status, however they would need to evaluate what the impact would be.
- The best buses with regards to lowest emission levels were not specifically allocated to the routes with the worst air quality, however in reality these routes did often have these vehicles as they were often the busiest and the newest buses were allocated. Hybrid vehicles were often used on the western approach.
- The new technology for the Euro VI engines has taken longer to develop for the bus engines. It was thought that they may be available in 2015.
- Details for Southampton fleets were:
    - First Bus – 40% Euro V, 35% Euro IV and 25% Euro III
    - Go South Coast – 32% Euro V, 6% Euro IV and 62% Euro III
- If the increase in bus travel generated additional profit it would allow investment in the fleets.
- It was noted that the buses used for football match days were not part of the services provided by either First or Go South Coast. These were private organised by the Club. And although the emissions from these vehicles appeared to be poor they were only used for a very limited period and therefore did not have a large impact on the overall air quality.
- The introduction of the telematics systems initially caused some concern amongst the drivers, however they now see it as a tool to improve. It has created a healthy competition amongst staff.
- There was a preference to keep buses on the road rather than pulling into laybys when collecting and dropping off. This also created traffic calming.

- Both operators confirmed that priority bus lanes were the best option. Not only did this improve the journey time for the current users, it was a good way to encourage new users.
- Go South Coast indicated that there were plans to replace their Euro III buses. They invested year on year. The older part of the fleet was used less and were often only used for the college/school runs.
- It was reported that evening services had remained unchanged, however there had been some reduction in the night time service.
- Information was given about multi tickets and also that it was possible to purchase family tickets.
- It was agreed that advertising to reach non bus users was an issue but the operators were looking at using many different options as possible.
- Concerns were raised relating to queues of empty buses causing traffic delays along Shirley High Street. This caused cars to be stationary and creating more pollution. The suggestion of smaller buses during non-peak times was probably not a viable option as it would mean that operators would need to have two fleets. It was also important to remember that although the buses may be less than at capacity at this part of the route this did not mean that there were not higher numbers of passenger as other points, particularly with the cross city routes.
- Contactless payment systems may be something that could be introduced in the future however with different fare levels this would be very complicated with regards to the technology.
- Both bus companies indicated it would be helpful if the Council restricted certain types of land use. For example ‘pop-up’ car parks that appeared whilst waiting for land to be developed were not welcomed as they undermined the Council and the bus companies.

DECISION-MAKER:		SCRUTINY PANEL – AIR QUALITY		
SUBJECT:		AIR QUALITY- SOUTHAMPTON CITY COUNCIL		
DATE OF DECISION:		20 NOVEMBER 2014		
REPORT OF:		ASSISTANT CHIEF EXECUTIVE		
CONTACT DETAILS				
AUTHOR:	**Name:**	**Louise Fagan**	**Tel:**	**023 8083 2644**
	E-mail:	**Louise.fagan@southampton.gov.uk**		
Director	**Name:**	**Suki Sitaram**	**Tel:**	**023 8083 2060**
	E-mail:	**Suki.sitaram@southampton.gov.uk**		

STATEMENT OF CONFIDENTIALITY
None

BRIEF SUMMARY

For the fourth meeting of the Air Quality Inquiry Southampton City Council officers within Environmental Health, Planning, Sustainability and Transport have been invited to provide evidence to the Panel. The focus of the meeting will be to consider how effectively the Council is working collectively to address air quality issues in Southampton.

In addition, Philip Marshall, Principle Transport Planner – Solent Transport will be in attendance and has provided the Panel with written evidence, attached as appendix 3. Written evidence from Licensing has also been submitted, and has been appended to this report (Appendix 5).

RECOMMENDATION:

(i) The Panel is recommended to consider the comments made by council officers from Environmental Health, Planning, Sustainability and Transport and use the information provided, including the written submission provided by Licensing as evidence in the review.

(ii) The Panel is recommended to consider the detail within Dr Beth Conlan's (Ricardo- AEA) presentation (Appendix 6) and the Western Approach AQMA air quality assessment (Appendix 7).

REASON FOR REPORT RECOMMENDATIONS

1. To enable the Panel to compile a file of evidence in order to formulate findings and recommendations at the end of the review process.

ALTERNATIVE OPTIONS CONSIDERED AND REJECTED

2. None.

DETAIL (Including consultation carried out)

3. From 2006-2026 Southampton has a target of building 16,300 new homes, an average of 815 homes per year. This target will shortly be rolled forward to 2036. With this in mind it is clear that Planning has a role in addressing air quality issues in Southampton. Southampton City Council's Planning Policy Group Leader, Graham Tuck has been invited and has provided the Panel with a written submission, attached as appendix 1.

4. Southampton City Council officers from Transport have also been invited. Officers will provide the Panel with an overview of initiatives that are being taken now, or are planned, to improve local air quality.

5. The Council's Waste, Fleet and Sustainability Manager, Colin Rowland will be in attendance. His written submission appended to this report (Appendix 2) outlines the role of the Councils Fleet Services and gives an overview of the actions that are being taken by Fleet Services to address air quality issues in Southampton.

6. Solent Transport is the new name for the Transport for South Hampshire and Isle of Wight (TfSHIoW) Partnership. Solent Transport works closely with a range of key stakeholders, which include the Partnership for Urban South Hampshire (PUSH), the Solent Local Enterprise Partnership, Department for Transport, Highways Agency and Network Rail to develop transport policies and investment programmes. Solent Transport's Principle Transport Planner, Philip Marshall has been invited and has provided the Panel with an overview of Solent Transport which includes policy background and planned interventions to address air quality issues (Appendix 3).

7. Steve Guppy, Team Leader, Scientific Services within the Regulatory Services Division will also be in attendance. He has been the link officer during the inquiry and provided the background information on Air Quality in Southampton submitted as evidence at the first inquiry meeting. For ease of reference this report has been attached (Appendix 4).

8. Southampton City Councils Licensing Manager, Phil Bates has provided the Panel with written evidence. His submission is attached as Appendix 5.

9. The Panel are also requested to consider the content of the presentation which was due to be delivered by independent Air Quality expert, Dr Beth Conlan (AEA-Ricardo) at the initial inquiry meeting (Appendix 6). Beth was unfortunately unable to attend and has been invited to the fifth meeting where she has been asked to comment on the inquiry's emerging recommendations.

10. In addition, at the first meeting of the Air Quality inquiry Councillor Rayment requested that the Panel provide a steer with regards to whether a Low Emission Zone (LEZ) should be introduced in Southampton for the Western

Approach. This follows the publication of the independent study by Ricardo-AEA (attached as Appendix 7).

11. Findings found that traditional LEZ models used to promote the introduction of low emission technology through penalties and enforcement cameras (as operating in Greater London) could bring compliance dates forward by a few years but would require significant capital investment. Over a ten year period costs would still outweigh benefits by approximately £2M and further economic impacts would be difficult to predict.

12. The guests invited to present information at the meeting will take questions from the Panel relating to the evidence provided. Copies of any presentations will be made available to the Panel.

RESOURCE IMPLICATIONS

Capital/Revenue

13. N/A

Property/Other

14. N/A.

LEGAL IMPLICATIONS

Statutory power to undertake proposals in the report:

15. The duty to undertake overview and scrutiny is set out in Part 1A Section 9 of the Local Government Act 2000.

Other Legal Implications:

16. None

POLICY FRAMEWORK IMPLICATIONS

17. None

KEY DECISION? No

WARDS/COMMUNITIES AFFECTED:	None directly as a result of this report

SUPPORTING DOCUMENTATION

Appendices

1.	Submission to Air Quality Scrutiny Panel: Planning Policy
2.	Submission to Air Quality Scrutiny Panel: Fleet Services (Sustainability)
3.	Solent Transport – Air Quality
4.	Air Quality in Southampton – Background information
5.	Submission to Air Quality Panel: Licensing

6.	Air Quality in Southampton – Ricardo AEA
7.	Western Approach AQMA air quality assessment– a baseline study to support the Low Emission Zone feasibility assessment and development of mitigation measures

Documents In Members' Rooms

1.	None

Equality Impact Assessment

Do the implications/subject of the report require an Equality Impact Assessment (EIA) to be carried out.	No

Other Background Documents

Equality Impact Assessment and Other Background documents available for inspection at:

Title of Background Paper(s)		Relevant Paragraph of the Access to Information Procedure Rules / Schedule 12A allowing document to be Exempt/Confidential (if applicable)
1.	None	

Southampton City Council - Planning department

Submission to Air Quality Scrutiny Panel: Planning Policy

Introduction - Future development in Southampton

1. From 2006 – 2026, Southampton has a target of building 16,300 new homes, an average of 815 homes per year. This target will shortly be rolled forward to 2036. In addition to these new homes, Southampton has targets for around 110,000 sqm of new office floorspace and 90,000 sqm of new comparison retail floorspace to deliver by 2026.

2. The development plan sets out the approach to development and identifies sites that may come forward to accommodate the targets. It also includes detailed development management policies for new developments, standards to be met and principles to be followed. The new local plan will balance the need for growth with new homes and jobs and the need for high quality development that addresses issues such as air quality.

3. Recent development in Southampton has involved the redevelopment of vacant commercial premises and sites. These have included the former Vosper Thornycroft and Ordnance Survey sites which between them will deliver over 2,000 new homes as well as other retail and commercial floorspace. The challenge for the new Local Plan is to identify sites to deliver the amount of development needed. In addition to finding individual sites, the council will be considering the potential for intensification to deliver development in the city centre, Itchen Riverside, district centres and along main bus routes.

Planning policy on air quality

4. Planning Policy has started work on a citywide new Local Plan which provides the opportunity to update the general policy on air quality as well as set development targets. The current planning policy on air quality is shown in Appendix 1. The policy is split between two plans, the Local Plan (2006) and Core Strategy. The main policy is SDP 15 in the Local Plan (2006). In accordance with this policy, permission will be refused where the proposal either contributes significantly to, or would be materially affected by, poor air quality. The supporting text to SDP 15 includes reference to 'any Air Quality Management Areas and Action Plans declared by the city council' as these were not in place when the policy was adopted. The Core Strategy policy is a wider policy covering climate change which includes reference to the council implementing measures identified in the Climate Change and Air Quality Strategy (2004) and subsequent revisions to the strategy.

5. Since the adoption of SDP 15, the Government has published national guidance in the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG). This provides the framework for Southampton's policies and must be taken into account in preparing plans and determining planning applications. The NPPF states that:

> Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan (paragraph 124).

6. The Planning Practice Guidance (PPG) includes a section on air quality. This states that ‘local plans can affect air quality in a number of ways, including through what development is proposed and where, and the encouragement given to sustainable transport’ (Ref. ID 32-002-20140306). In providing guidance on mitigating an impact on air quality, the PPG states that ‘planning conditions and obligations can be used to secure mitigation where the relevant tests are met’. It provides the following examples of mitigation:

- the design and layout of development to increase separation distances from sources of air pollution;
- using green infrastructure, in particular trees, to absorb dust and other pollutants;
- means of ventilation;
- promoting infrastructure to promote modes of transport with low impact on air quality;
- controlling dust and emissions from construction, operation and demolition; and
- contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.

<u>Planning applications and air quality</u>

7. Air quality is a material planning consideration and Development Management will assess air quality as part of the determination of a planning application. When an application is received in an Air Quality Management Area, this will be identified as a constraint and the case officer will contact Environmental Health to discuss the proposal. It is a requirement that an air quality report is submitted with applications for development in Air Quality Management Areas.

8. Conditions will be imposed on planning permission to ensure that the measures required and identified in the air quality report such as mechanical ventilation are actioned. Examples of section 106 agreements connected to air quality in Southampton include monitoring facilities in the Centenary Quay redevelopment and contributions secured for a feasibility study in the Mayflower Halls redevelopment.

<u>Charges to offset air quality impacts</u>

9. In accordance with national guidance, planning policies should be based on evidence and be deliverable. Planning policy officers have recently met with Environmental Health officers to discuss issues to be addressed in the new Local Plan and will develop the new policy collaboratively. The work on the Low Emission Strategy will provide important evidence to justify Southampton’s policy. It should therefore include evidence of good practice elsewhere and measures that can be delivered in the city.

10. The proposal to use contributions to offset the cost of poor air quality is in accordance with national policy and is supported. This should be in place if all possible measures that can be used to mitigate poor air quality on site have been considered and the impact remains. This includes the design and layout of the development and the use of green infrastructure to increase the distance away from sources of poor air quality and to provide a buffer, subject to good design. Other measures such as installing wiring for electric vehicle charging points should also be implemented.

11. The council has in place a Community Infrastructure Levy (CIL). This is a standard charge on residential and retail development. It is used to fund off-site local and sub-regional infrastructure to support development as set out in the CIL regulations 123 list. This includes green open spaces and strategic transport infrastructure e.g. pedestrian, cycling and public transport improvements. Any off-site air quality measures involving infrastructure on the CIL 123 list will be financed through CIL.

12. Site specific infrastructure necessary to overcome obstacles to granting planning permission is funded through section 106 agreements. Affordable housing is also funded through section 106 agreements. On site mitigation measures such as air quality monitoring (as required at Centenary Quay) and the control of the construction and operation of the development will be financed through section 106 agreements.

13. National guidance sets out tests for section 106 planning obligations which any proposed charge would need to meet. In addition to demonstrating why the charge is necessary and how it relates to new developments, the council needs to show that the charges are 'fairly and reasonably related in scale and kind to the development'. The Low Emission Strategy should clearly demonstrate how the charges proposed relate to the Community Infrastructure Levy, section 106 contributions and other charges on new development currently collected by the council. In accordance with national policy, the cumulative cost of these charges should not cause development to be unviable. This may affect the level or priorities for section 106 contributions. (The CIL has already been set at a level considered viable). The strategy should also clearly show how the contributions will be used to improve air quality.

<u>Other measures</u>

14. As work is at an early stage in producing a new local plan, there is the opportunity to consider other measures on air quality and how air quality may affect the overall approach to development. These include fundamental issues of where new development will be promoted, e.g. in locations which will encourage public transport use or away from areas of poor air quality. Planning Policy recognises that in some instances there may be a tension and need for balance between these two approaches. Key transport improvements may include measures to encourage public transport, walking and cycling; and parking policies. There is also scope to consider whether there is the potential for more detailed measures such as the use of conditions on planning permissions which could, for example, require developments to produce an emission strategy and where possible promote cleaner delivery vehicles.

15. There is a lengthy statutory process to go through involving the production of evidence, draft plans, public consultation and a public examination on the plan before this will become council policy. The new Local Plan is expected to be adopted in 2018.

<u>Conclusion</u>

16. Planning policy has a role in addressing air quality issues. There are two ways in which planning can help:

1. Reduction of emissions – planning policies can guide patterns of development and encourage public transport use in order to reduce the need to travel by the private car
2. Mitigation of emissions – requiring on-site measures such as landscaping and ventilation or alternatively funding measures off site through the Community Infrastructure Levy

Appendix 1 Local Planning Policy on air quality

Current adopted air quality policy:

Local Plan Review policy SDP 15 Air Quality

> ‘Planning permission will be refused:
> (i) where the effect of the proposal would contribute significantly to the exceedance of the National Air Quality Strategy Standards; or
> (ii) where the proposal would be materially affected by existing and continuous poor air quality.
>
> Large potentially polluting developments will be required to assess their air quality impact by detailed air dispersion modelling and appropriate monitoring.’

Core Strategy policy CS 20 Tackling and Adapting to Climate Change (selected text)

> ‘Southampton City Council will continue to implement the measures identified in the Council’s Climate Change and Air Quality Strategy (2004) and any subsequent revisions to the strategy’

Text in emerging plans:

Draft City Centre Action Plan text (in the section titled ‘A greener centre’):

> **Air Quality**
>
> ‘Air quality is a significant issue in Southampton. There are currently four Air Quality Management Areas (AQMAs) in the city centre: Town Quay (including Platform Road, Terminus Terrace and Canute Road); Bevois Valley (including Charlotte Place); New Road (part; south of Southampton Solent University) and Commercial Road (part).
>
> The Council has an Air Quality Action Plan in place. It is currently reviewing its approach which will affect development across the city and an updated policy on air quality will be developed for the next citywide local plan. The supporting text to the local plan saved policy SDP 15 states that developments should take account of AQMAs and the measures in Air Quality Action Plans. This will continue to be applied.
>
> The approach to air quality is in accordance with paragraph 124 in the National Planning Policy Framework (NPPF). This states that policies should take into account the presence of AQMAs and cumulative impacts on air quality and that planning decisions should ensure that any new development in AQMAs is consistent with the local Air Quality Action Plan’.

This page is intentionally left blank

Appendix 2

Southampton City Council **November 2014**

Air Quality Inquiry - Fleet Management Services (FMS)

The Fleet Management Services team are aiming to make efficiencies across fleet services specifically to achieve cost efficiencies, reduce emissions and provide a standard approach to its fleet operations through:

- Investigating cost saving proposals to address the ongoing need to reduce costs and seek cost effective fleet transport that meets the requirements of service users across the Council.
- Continuing to investigate alternative vehicles e.g. electric, hybrid or liquid gas fuels to reduce emissions and support the improvement in air quality in Southampton.
- Investigating and implementing technologies to reduce fleet vehicles, reduce mileage and fuel e.g. route optimisation, fuel options etc.
- Investigating partnership arrangements with other authorities and organisations to create joint efficiencies.
- Improving the vehicle procurement and vehicle disposal strategy.
- Maximising the use of the Council's fleet facilities and other supporting resources.
- Improving safety and compliance through better trained drivers and higher driving standards of the fleet, which in turn reduce vehicle emissions, through more careful driving, and reduce the number of accidents.
- Improving communications to customers of Fleet Management Services.
- Streamlining processes and policies across all service areas with fleet vehicles.

To date, the following measures have been implemented which should have a positive impact on air quality:

- A DVLA licence checking service implemented where drivers no longer have to drive to City Depot for licence checking which saves on fuel and emissions.
- Electric bin hoists (for standard bins) on refuse collection vehicles for vehicles purchased since 2013 which reduces fuel consumption, emissions and noise pollution.
- From 2014 all large vehicles including refuse vehicles have the latest EURO 6 engines which are more fuel efficient and compliant with the latest emission controls.
- New vehicle request form implemented so the minimum specification is provided for the requirement and to reduce unnecessary 'extras' which may have a cost / environmental impact.

Other initiatives being developed include:

- Testing electric/hybrid vehicle demonstrators with a view to exploring the wider use of electric vehicles.
- Investigating the use of vehicle tracking for all vehicles / driver monitoring equipment for all large vehicles to reduce the number of fleet vehicles on the road thus reducing fuel consumption and vehicle emissions.
- New Light Goods Vehicles (LGVs) and refuse vehicles have driver monitoring equipment fitted (although not yet switched on). If operated this equipment can be used to support the reduction of heavy acceleration and emissions and more careful driving as well as protect drivers in the event of accident claims.

In response to the specific questions posed for the enquiry, responses are as follows:

1. **What measures is SCC Fleet taking to reduce its emissions and their impact on local air quality?**

All Council vehicles have lowest emission engines available and/or are considered suitable for their intended use whilst taking into account cost effectiveness. The newest vehicles in the fleet are fitted with Diesel particulate filters and the majority have the most efficient engines. Above all, new refuse vehicles have the latest Euro 6 diesel engines.

2. **What consideration is currently given to vehicle emissions and local air quality when identifying SCC fleet needs?**

Fleet Management Services will specify the fuel saving technologies that have minimal emission levels on all new vehicles at the point of procurement. In addition to point 1 above, service areas are also required to put forward a business case for any new vehicle required, with a sign off at Head of Service level in all cases, to ensure that these vehicles match the service requirement but also have the lowest cost / environmental impact.

3. **Are there low emission vehicles available to consider for SCC's fleet?**

Fleet Management Services continually monitors the viability of using more environmentally friendly alternatives such as electric, or hybrid vehicles or making use of low emission fuels such as Liquid Petroleum Gas (LPG) or Liquid Natural Gas (LNG). All Council fleet vehicles have the lowest possible emissions wherever this is practicable and cost effective. Electric vehicles have been tested and the Council has one electric van at present which is intended to be used as a staff pool vehicle.

4. **What is preventing SCC from commissioning such vehicles?**

Electric vehicles are not available or suitable for all types of usage and at the moment, the required infrastructure is not in place to support the large scale deployment of electric vehicles, e.g. charge points, charging duration and range requirements for the distances vehicles travel on a daily basis. Also, the current SCC policy is that the majority of drivers take their vehicles home and commence their work from home. This current policy would require installation of charge points in staff homes. A review of this policy is currently being undertaken which could lead to more electric vehicles being recommended for purchase and use as part of the fleet. Charging electric vehicles is also problematic at the Council depots due to the time taken to charge batteries and the lack of sufficient space for vehicles during the charging period.

There are currently no large vehicles such as refuse collection vehicles or large vans on the market in the UK. Although larger vehicles in the Council's fleet could make use of LNG or LPG, the recently acquired Euro 6 engines compete favourably with these vehicles on cost, efficiency, and emissions. The cost of the LNG and LPG infrastructure also needs to be considered when looking at a vehicle solution. The wider availability of natural gas as a vehicle fuel and a corresponding reduction in infrastructure costs and availability may be facilitated through a greater take up by other organisations in the city.

5. **The proposed Low Emission Strategy will explore the opportunity to assign a damage cost (in terms of public health) to emissions. This could be applied to procurement procedures to promote the uptake of low emission vehicles. Would you support this and why?**

This change would be supported in principle. However, as per point 4 above there are currently no zero emission type vehicles suitable to carry out a majority of the Council's functions in a cost effective and efficient manner. The introduction of such a damage cost could result in significant unjustified additional costs to the Council if zero emission vehicles are not available for use at that time. These type of vehicles will be constantly re-evaluated and trialled to determine future suitability. Zero emission large vehicles are still in an early development stage. When this technology becomes more viable there would be no reason why more vehicles of this type cannot be utilised. It should be noted though that currently electric vehicles cost much more to purchase than conventional alternatives. As with liquid gas fuels account needs to be taken for supporting recharging infrastructure costs. Future technology and infrastructure changes and economies of scale for vehicle purchasing should support the change in the procurement policy to zero emission vehicles. Implementation of electric engines can sometimes have other adverse effect, e.g. how much a truck could carry (extra weight) before becoming overloaded due to battery space, meaning that additional journeys would be required negating the air quality/emissions saved through electric vehicles.

6. **What else could SCC do to improve its fleet emissions and what could be done to help you achieve this?**

The Council is constantly monitoring and assessing manufacturer's advances in cleaner engine technology in terms of their use for the tasks required of the council fleet. To improve its fleet emissions SCC would also:

- Seek funding grants for implementation of the infrastructure required for implementation of electric vehicles, or LPG/LNG vehicles.
- Reduce the overall fleet size through route optimisation and changes to working practices and patterns of working.
- Research LPG/LNG or hybrid vehicles to replace standard fleet vehicles where considered appropriate and cost effective.
- Work with fleet partners in the city to reduce infrastructure and low emission vehicle purchase and running costs.

The Fleet Management Service recognises the importance of reducing emissions and improving air quality in the city and that further measures need to be taken to support the Council in achieving this to reduce its ranking as one of the highest polluted cities in the UK.

This page is intentionally left blank

SOLENT TRANSPORT – AIR QUALITY

Overview of Solent Transport
Solent Transport (formerly known as Transport for South Hampshire Isle of Wight) is a partnership of the four transport authorities (Hampshire, Portsmouth, Southampton and Isle of Wight). The Isle of Wight is the most recent member, joining in 2012.

Solent Transport was established to look holistically at transport issues across the Solent area as a whole, recognising that transport issues cross traditional local authority boundaries. Solent Transport works closely with a range of key stakeholders, including amongst others the Partnership for Urban South Hampshire (PUSH), the Solent Local Enterprise Partnership, Department for Transport, Highways Agency and Network Rail to develop transport policies and investment programmes. Solent Transport has developed the Sub Regional Transport Model (SRTM), a comprehensive transport and land use evidence base, which has the capability to assess the air quality impacts of transport interventions.

Solent Transport Policy Background
A joint Local Transport Plan 20 year South Hampshire Strategy was developed between the three mainland Solent Transport members in 2011. This identified Challenges, Outcomes and finally 14 policies, which aim to contribute to the Outcomes.

Policy E of the Joint Strategy is ***To deliver improvements in air quality***. The policy states that:

The TfSH authorities will work with key partners, environment al health professionals and transport operators to mitigate the impacts of traffic on air quality. The principal causes of poor air quality will be addressed by implementing a strategic area-wide approach within each urban centre to minimise the cumulative effect of road transport emissions. This can be achieved through measures promoting modal shift towards public transport modes, walking and cycling, reducing single occupancy car journeys. Tackling congestion at hotspots can also improve air quality.

Some specific delivery options noted, include:

- Air Quality Management Areas;
- Promotion of cleaner, greener vehicle technologies;
- Car share schemes; and
- Support for car clubs and similar schemes.

Subsequent work to develop the Transport Delivery Plan (TDP) has developed a Study Approach, which identifies Objectives, which are used to define specific solutions to unlock Barriers. This work was undertaken in consultation with a range of stakeholders. One of the five identified Objectives states:

Reduce emissions (particularly carbon) from the transport sector by reducing highway vehicle kilometres.

The TDP summarises the SRTM's analysis of emission trends over the period to 2036. This concludes that:

- Nitrous Oxide (NOx) and particulate (PM10) levels reduce substantially over this period, primarily due to improved vehicle technology;
- In contrast, whilst showing an initial decline due to improved technology, increased travel demand leads to hydrocarbon (HC) and carbon monoxide (CO) levels substantially exceeding 2010 levels in 2036.

Solent Transport Interventions to Address Air Quality Issues
Solent Transport has recently secured funding towards two projects, which will contribute towards improved air quality.

In 2012, Solent Transport secured £17.8m of Government funding towards the overall £31m investment in the ***Better Connected South Hampshire*** Local Sustainable Transport Fund project. This was supplemented by funding secured directly by the Solent Transport authorities.

The project includes a comprehensive range of interventions to encourage more sustainable travel patterns, particularly through increasing the proportion of journeys made by public transport, walking and cycling. The project is focussed on nine key corridors across the South Hampshire area, most of which focus on journeys to / from Southampton. These corridors include all the AQMAs in South Hampshire. The appraisal of the project shows that it would reduce NOx, PM10, HC and CO emissions in 2026 by around 1% compared to the reference case (i.e. without the implementation of the project). The reduction in emissions is primarily due to modal shift towards public transport, walking and cycling.

In March 2012, Solent Transport secured £4.5m from Government towards the ***Better Bus Area Fund*** project, which has made bus travel in South Hampshire more attractive. This includes investment to provide on board wifi, bus refurbishment, next stop audio visual equipment and installation of LED lighting. The project is contributing towards reducing emissions of pollutants that contribute towards poor air quality, by a combination of increasing the proportion of journeys made by bus and through the improved fuel efficiency offered by the installation of LED lighting.

Future Work
The four Solent Transport authorities are currently considering opportunities provided by the DfT's Cycling Delivery Plan to enter a Partnership with Government to increase levels of walking and cycling across the Solent. Modal shift towards these modes would improve air quality.

Summary
Solent Transport has established policies on a cross Solent basis, which support air quality improvements. Solent Transport led on securing funding for the *Better Connected South Hampshire* LSTF and BBAF projects, which are contributing towards reduced emissions.

SUBJECT: Air Quality in Southampton – Background information

DATE: 31st July 2014

RECIPIENT: Scrutiny Panel

1. The Local Air Quality Management Regime (LAQM)

1.1. Local Authorities have a duty to fulfil the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act 1995. The LAQM process requires all local authorities to regularly review and assess air quality in their areas, and to determine whether or not air quality objectives are likely to be achieved (see Appendix 1). Where exceedances are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

1.2. Local Authorities have to work towards achieving the air quality objectives in a cost effective way. They are not, under legislation, charged with meeting them. They have a vital role to play but ultimately compliance with the values lies with Government.

1.3. The LAQM process involves a three year cycle of screening, review and assessment. This includes a desk based exercise identifying emission sources and recognised issues. Where potential issues are identified, monitoring may be used to determine actual levels and can be combined with modelling to determine the extent of the problem.

1.4. Regulatory Services is responsible for delivering the LAQM regime on behalf of Southampton City Council. They are currently completing the fifth round of the review and assessment process. The assessment activities over the last 11 years have included maintaining a NOx diffusion tube network (at 60+ locations across the city at any one time) and real time monitoring (at eight separate locations) for nitrogen dioxide, particulates, sulphur dioxide and ozone.

1.5. Over 200 local authorities have declared AQMAs in the UK. Southampton currently has ten AQMAs declared, each one as a result of the annual mean for nitrogen dioxide (NO_2) exceeding the limit value of 40 µg/m^3 (see Appendix 2). In all cases emissions from road transport are the main contributor of the exceedance and the AQMA's capture some of the city's busiest roads and junctions where residential dwellings are within close proximity.

1.6. An Air Quality Action Plan for Southampton was first introduced in 2007. The plan focuses on measures associated with road transport and has been integrated with the Local Transport Plan and the Local Sustainable Transport Fund. The AQAP has been successful in reducing NO_2 concentrations across the city (see Appendix 5) but levels still remain above the EU objective within the recognised AQMAs.

1.7. Over the past decade diesel vehicles have grown from 18% of new cars sold in 2001 to reach 50% of the market in 2012 as successive government schemes have incentivised drivers to buy diesel cars, principally to tackle CO2 emissions. Diesel vehicles are responsible for significantly higher levels of NO2 emissions compared to petrol vehicles. It is generally recognised that if the proportion of petrol and diesel vehicles remained at 2001 levels the limit value for NO_2 would have been achieved in many of the current AQMA's.

2. EU Air Quality Directive 2008/50/EC

2.1. UK policy is driven by the European Air Quality Directive which requires Member states to meet limit values for key air pollutants which are known to cause human health effects. Air quality is reported to the European Commission in terms of 43 zones and urban agglomerations. This is handled by DEFRA on behalf of the government and LA reporting of air quality under LAQM feeds into this.

2.2. In February 2014 the European Commission started infraction proceedings against the UK for breaching nitrogen dioxide (NO2) limit values in 16 of its 43 zones. The Southampton agglomeration is one of these recognized zones and the council has received written notification from DEFRA informing them of the infraction process and the potential financial risks this presents. The letter reminds the responsible authorities of the discretionary power in Part 2 of the Localism Act under which the government could require them to pay all or part of an infraction fine if they have not taken reasonable actions to achieve the air quality objectives.

2.3. The letter indicates that the legal process could take several years to complete and that the Commission has stated that regardless of this it would like to "to achieve full compliance with existing air quality standards by 2020 at the latest.

3. Southampton Air Quality levels in Context

3.1. Nitrogen dioxide levels in Southampton are comparable to similar cities. Within the AQMA's levels range from 40 ug/m3 to 51 ug/m3 annual average. Levels have been steady with some evidence of a decline in recent years (see Appendix 3). Date collated by European Environment Agency (EEA) from Member States reports the highest UK levels at Marylebone Road in London at 98 ug/m^3 which was behind individual sites in Italy and Germany.

3.2. In March 2014 the World Health Organisation published an update of its Ambient Air Pollution in Cities Database. From this it was reported in the press that Southampton ranked amongst the most polluted cities in the UK and PM10 levels exceeded the WHO guideline of 20 µg/m^3 annual average. The WHO guideline level is aspirational. The EU limit value is set at 40 µg/m^3 annual average and Appendix 4 illustrates that levels in Southampton fall below this statutory level and well below the European average of 49 µg/m^3 and world average of 71 µg/m3. The WHO report used data from a limited number of monitoring sites in varied locations. The Brintons Road station (quoted for Southampton) is 8 metres from one the city's busiest road junctions and it is accepted that because of its location this station will experience particulate levels that are elevated above the typical urban background levels that most of the city experiences.

4. Air Quality Monitoring in the City

4.1. Regulatory Services have monitored air quality at key locations across the city in order to fulfil its LAQM duties. Monitoring has been subject to constant change in order to ensure resources are focused effectively. In recent years monitoring has consisted of:

- A network of approximately 60 diffusion tubes. These tend to be adjacent busy roads and are subject to regular adjustments in response to changing circumstances in the city.
- Two continuous monitoring stations measuring nitrogen dioxide and particulates at Redbridge and Bitterne. Ozone and sulphur dioxide had been measured at these locations until there was sufficient evidence to demonstrate that levels were not exceeding any thresholds.
- A continuous monitoring station at Onslow Road measuring nitrogen dioxide only.

4.2. A further continuous monitoring station measuring nitrogen dioxide is located at Victoria Road, Woolston to monitor the air quality impact of the Centenary Quay development. This is funded by the developer and operates as a condition of the Centenary Quay planning approval.

4.3. In addition, SCC has access to data from two other continuous air quality monitoring stations within the City. As a condition of the permit issued by the Environment Agency, Marchwood Power currently operates a station at Millbrook Road/Waterhouse Lane measuring nitrogen dioxide. Brintons Road, St Marys is the location of a station operated by the Department of Environment, Food and Rural Affairs (DEFRA) as part of their national network. Nitrogen dioxide, sulphur dioxide, particulates, benzene and ozone are all measured at this location.

4.4. SCC's monitoring network has been subject to continuous review and change since its introduction. Where monitoring has achieved its objective it is appropriate that resources are reprioritised, especially towards action planning. The monitoring station at Bitterne has recorded acceptable pollutant levels for 4 years and was closed in early 2014. The Redbridge station has been providing a consistent picture for several years. It has confirmed that the nitrogen dioxide average mean is the only pollutant of concern in this part of the city. In recent years the station has been unreliable and data capture has been poor. The nearby air quality management area on Redbridge/Millbrook Road is well catered for by a network of diffusion tubes. Therefore, the ongoing operation of this station was not considered to be necessary and it was closed in January 2014.

4.5. DEFRA is reviewing its national monitoring network and is looking for opportunities to expand this where there are opportunities to affiliate with stations operated by local authorities. Regulatory Services has had discussions with DEFRA's representatives and has promoted options that could enhance existing arrangements within the City without further burden on the council.

5. Air Quality Action Planning

5.1. To date the Action Plan has focused on transport related projects that will improve the efficiency of the road network and reduce congestion or reduce the burden on the existing road network by promoting a shift to more sustainable forms of transport. Details are included in Appendix 5.

5.2. In 2013 AEA Ricardo were commissioned by Regulatory Services to undertake a study of the city's Western approach, which includes the largest of the AQMA's declared. The study was financed by a grant from DEFRA and was to identify interventions which might be effective in achieving the limit value for NO_2.

5.3. A draft report of the study findings has been published and the final version is due to be published in August 2014. The draft reports that modelling has demonstrated that emissions from road transport are the most significant contributor but emissions from the port are far more significant than previously understood.

5.4. The introduction of newer, cleaner engine technology within the national fleet (i.e. the introduction of Euro 6 light vehicles and Euro VI heavy vehicles) in line with national expectations could reduce nitrogen dioxide levels below the statutory limit values by 2019. However, this is dependent upon the technology delivering its full potential and it is untested so far in real world conditions. The analysis suggests that if only a proportion of the benefit were achieved in practice, this would have to approach 75% of the theoretical maximum to deliver compliance.

5.5. Traditional LEZ models used to promote the introduction of low emission technology through penalties and enforcement cameras (as operating in Greater London) could bring compliance dates forward by a few years but would require significant capital investment. Over a ten year period costs would still outweigh benefits by approximately £2M and further economic impacts would be difficult to predict. Again, success will be dependent upon the technology delivering the benefits predicted.

5.6. The draft report promotes a city wide Low Emission Strategy (LES) as an effective means of promoting low emission technologies and improving air quality. A series of meetings and workshops with internal and external stakeholders were conducted as part of the study and the output has been used to outline a City-wide LES. Further funding has been obtained from DEFRA to develop the proposal.

5.7. It is proposed to deliver the project through a cross-departmental Project Team sponsored by Regulatory Services over a 24 month period. A Project Plan and some key policies are to be presented for adoption within the next 3-6 months.

5.8. The LES would sit within the AQAP and deliver the following objectives:

- Develop a City-wide emission reduction strategies for passenger cars, freight (including sustainable delivery & port activities), buses and taxis. Projects and policies will be identified that will look to promote and incentivise the uptake of cleaner, low emission technologies. Examples include:
    - identifying opportunities to support and incentivise the uptake of electric vehicles with a charging infrastructure and subsidised (cost neutral) parking for visitors and residents.
    - developing mechanisms to use the ports freight booking system to incentivise the use of lower emission vehicles in the city.
    - exploring alternative fuel infrastructures for commercial vehicles including liquid natural gas
- Develop and further introduce innovative retrofit technologies to our bus fleet. Like the flywheel technology being piloted through the Clean Bus Technology Fund.
- Look at opportunities to make cleaner vehicles more attractive to taxi operators. For example by exploring a voluntary “low emission” badge scheme.
- Develop a mitigation approach to air quality and land-use planning policies to support the uptake of low emission vehicles and infrastructure. This would look to develop a method for assigning a community damage cost (in terms of emissions) associated with new developments and use this to promote good practice and fund mitigation.
- Develop & implement policies capable of using public sector procurement to reduce transport emissions. This would look to develop a method for calculating and acknowledging the damage costs associated with traditional combustion engines.

- Establish effective messaging on air quality and health promotion by establishing partnerships between Public Health and Regulatory Services.
- Build on existing private sector partnerships to achieve shared emission reduction goals. For examples, the port is open to reducing emissions from its harbour side operations by replacing diesel with cleaner fuels. SCC may be able to provide some influence if it is considered in conjunction with a wider strategy to bring a clean fuel infrastructure to the city.
- Provide a platform for inward investment for air quality mitigation

6. Air Quality and Planning

6.1. Regulatory Services works closely with its colleagues in Planning and due consideration is given to the air quality impacts of every planning application. Developers are expected to demonstrate that their proposals will not have a detrimental impact on local air quality. If the development is considered likely to increase emissions significantly permissions maybe refused or conditions applied to mitigate the effects on public health. For example, residential developments placed within existing AQMA's may need to ventilate the occupied areas using clean air sourced from an unaffected facade. National guidance on planning and air quality is weak with regard to promoting improvements. To address this, local policies and guidance is to be considered as part of the LES project plan.

7. Air Quality and Public Health

7.1. Moderate air pollution levels are unlikely to have any serious short term effects on individuals in good health. However, elevated levels and/or long term exposure to air pollution can present symptoms and conditions affecting human health. This mainly affects the respiratory and inflammatory systems. People with lung or heart conditions are likely to be more susceptible to the effects of air pollution. Particulates and nitrogen dioxide are regarded as the pollutants responsible for the most significant impact on public health in the UK.

7.2. The Committee on the Medical Effects of Air Pollutants (COMEAP) estimated that long term exposure to air pollution had an effect equivalent to 29,000 deaths a year in the UK in 2008.

7.3. In April 2014 Public Health England published the report Estimating Local Mortality Burdens associated with Particulate Air Pollution. Modelling suggests that 6.3% of mortality in the Southampton area is attributable to long-term exposure particulate air pollution.

7.4. SCC Regulatory Services and Public Health suspect that these figures are not a direct reflection of poor air quality in the city. Standards of respiratory health within the city (as a consequence of occupational exposure and smoking) are likely to have left a significant proportions of the population more vulnerable to the effects of reduced air quality.

7.5. SCC Public Health acknowledges the importance of the health issues presented by air quality in the city.

7.6. The Air Alert service has been delivered as part of the AQAP. Although it does not deliver improvements to actual air quality it assists vulnerable groups manage any detrimental health effects. A 2011 survey indicated that 90% of users would recommend the service. Southampton is only one of a handful of authorities to provide this free service which is funded until 2016 by DEFRA.

8. Looking Forward

8.1. DEFRA is currently reviewing the future delivery of LAQM duties and it is widely anticipated that this will reduce the burden on local authorities to report review and assessment activities. The options being considered include proposals that could significantly reduce the expectation for council's to maintain air quality monitoring networks and focus their resources on action planning to ensure improvements are achieved.

8.2. The government has recently announced it will be investing £500M from 2015-2020 in to ultra low emission technologies. £50 million will be available for local areas to invest in cleaner taxis and buses. Cities will be encouraged to bid for Ultra Low Emission Status and the 2-4 successful cities will have access to a further £35M to showcase best practice.

8.3. Grants of up to £500k have recently been made available through the Clean Vehicle Technology Fund. Transport Policy, working with local bus operators and Regulatory Services have already submitted a bid for the maximum amount. A similar bid was submitted to last year's Clean Bus Technology Fund and was successful in securing funds to support a £1M project to improve emissions from the cities commercial bus fleet.

Further Information Available From:	**Name:**	Stephen Guppy
	Tel:	023 8091 7525
	E-mail:	steve.guppy@southmpton.gov.uk

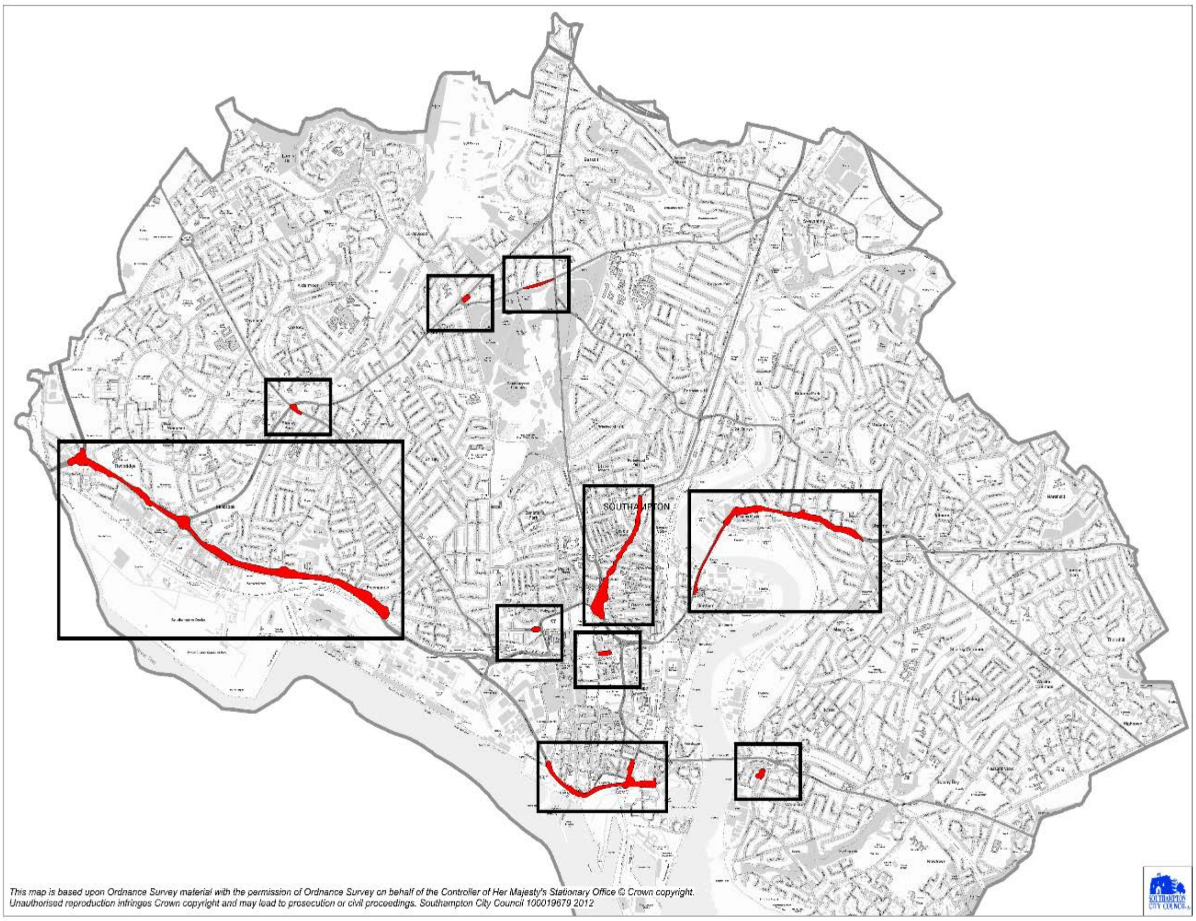
Appendix 1

Air Quality Objectives included in Regulations for the purpose of LAQM in England

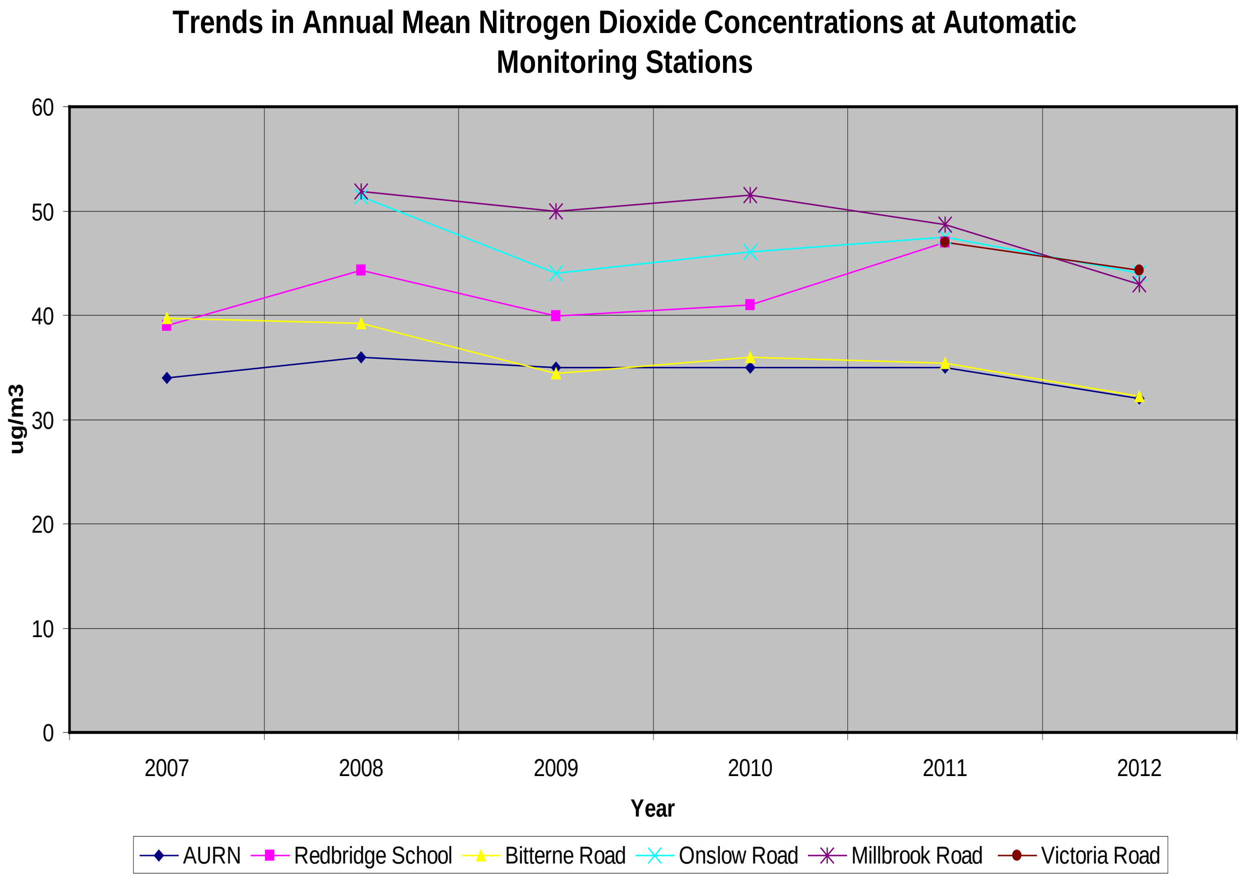
Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	5.00 µg/m^3	Annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Appendix 2

Map of Southampton's Air Quality Management Areas



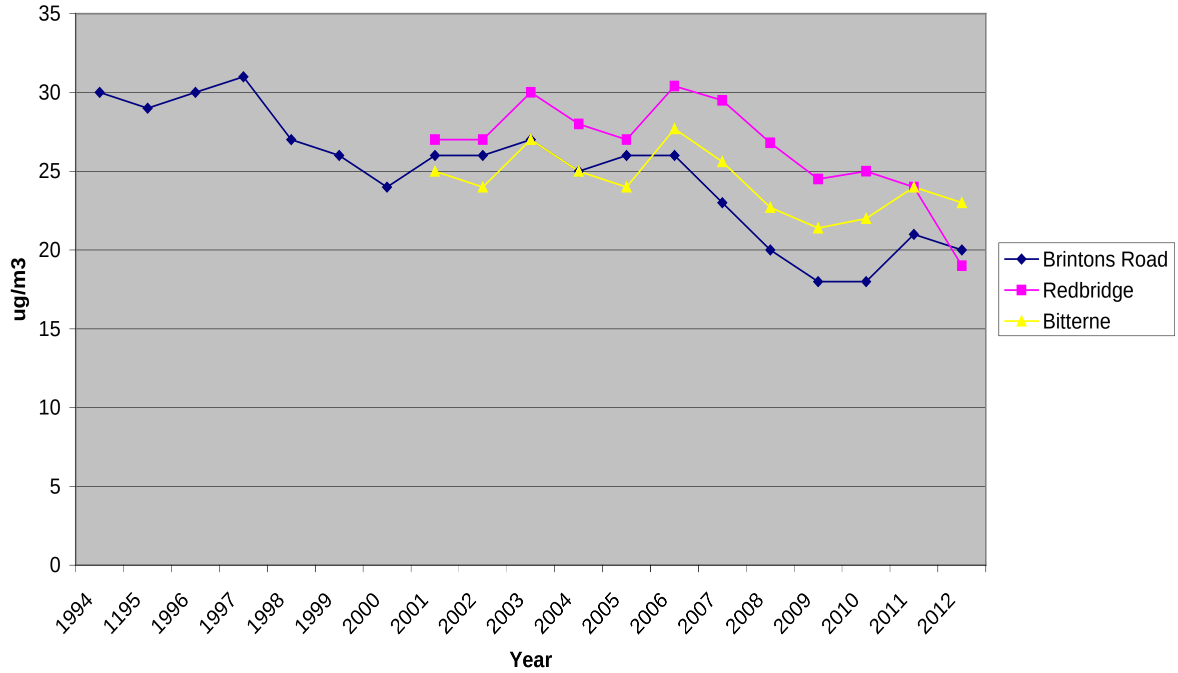
Appendix 3



Trends in Annual Mean Nitrogen Dioxide Concentrations at Automatic Monitoring Stations
ug/m3
60
50
40
30
20
10
0
2007
2008
2009
2010
2011
2012
Year
AURN
Redbridge School
Bitterne Road
Onslow Road
Millbrook Road
Victoria Road

Appendix 4

Figure Particulate Dust (PM_{10}) 1994-2012



Appendix 5

Air Quality Action Plan – 2013 Progress Report.

Progress update

COUNCIL'S OWN ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
1.1	School travel plans	Survey of travel needs; encouraging alternatives to car travel; route improvements (walking/cycling); cycle storage provision; walking buses	Green	David Deane	100% of all schools in Southampton have travel plans in place
1.2	Assist staff in cycling to work in between meetings	A number of measures including: road safety assessments, expanding on number of secure cycle storage locations, a salary sacrifice scheme for bike lease to staff and providing pool bikes.	Green	Dale Bostock	Road safety assessments are now undertaken, the number of secure cycle storage locations have been expanded throughout the city, a salary sacrifice scheme for bike lease to staff has been put in place and pool bikes are now provided to staff
1.3	Journey Planning Service	Enables staff to have their journeys to/from work or business travel planned to increase financial efficiency and promote sustainable travel.	Amber	David Deane	30.9% of the working population are now covered by a Travel Plan.
1.4	Corporate Courier Transport Service	A council wide review of the movement of goods vehicles to re-engineer routes to create efficiencies.	Green	Annemarie Hooper	This has been completed and has resulted in 2 x WTE reducing from full time to term-time only and enabled a reduction in one fleet vehicle.
1.5	Continuous Improvement Objectives	A series of projects arising from a review of efficiency savings in fleet vehicle use conducted by Peopletoo consultancy	Green	Annemarie Hooper	Fleet Management Services have made a number of efficiency savings over the last few years, including reviewing the fleet vehicles they lease / purchase.
1.6	Improve emissions from the Council's vehicle fleet	A review of existing fleet to investigate the use of bio-fuel and the retro fitting of abatement technology.	Amber	Annemarie Hooper	This has been investigated but at the moment, new technologies for a greener fleet are expensive to maintain.
1.7	Public awareness and information provision	General awareness initiatives to encourage behavioural changes that could lead to reduced car use, more efficient car use, and greater acceptance of alternatives and air quality management measures.	Green	Dale Bostock and Simon Hartill	SCC runs the 'Southampton Cycle Challenge' communications campaign to encourage a greater take-up of cycling across the city as an alternative to private car use. Additionally the council runs the air alert project. Air Alert provides Southampton residents who have an existing respiratory condition with advance warning of poor air quality to enable them to adjust their behaviour to minimise the risk of exposure to elevated levels of pollution.

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
2.1	City-wide travel marketing and communications	Travel awareness, branding, marketing campaigns, advertising, events and publicity in various locations	Green	Adrian Webb	A city-wide campaign was run between January and March 2013. It achieved a 37% awareness of the MyJourney brand based upon 2700 survey responses. The campaign

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
		(including creating a new website). This will involve the commissioning of a new social marketing campaign to be used as the main branding and advertising. A range of strategic, low-cost advertising sites such as on school railings will be used to promote sustainable travel.			has since been commended for a national award. 25 MyJourney roadshow events were staged, a website has been launched offering a multi-modal journey planning tool and live bus and train travel information. A Skyride was run in the city in July 2013 with over 10,000 cyclists in attendance.
2.2	Business Travel Planning	Retail Travel Plans for Major Shopping Destinations including West Quay to encourage more shoppers to travel by public transport and reduce reliance on the car. Items such as cycle parking, shower facilities, electric vehicle charging points at workplaces, PT information points and establishing a framework for collective delivery and evaluation of the travel plan will be taken forward.	Green	Adrian Webb	SCC has been, and is continuing to, work with major retailers and businesses in the city including: Skandia, Mayflower Theatre, the National Oceanography Centre, Town Quay, IKEA, Lloyds Register, Station Quarter, Solent University, the University of Southampton and the General and Royal South Hants Hospitals. Organisations in the Station Quarter including the Maritime and Coastguard Agency have also been engaged. A travel plan for West Quay is in progress. A customer travel survey and a staff travel survey were conducted in August and October 2013 respectively with results of the studies to determine the measures included in the travel action plan being finalised in December 2013. Additional achievements include: 1. A car share scheme has been launched at the General Hospital and 60 additional cycle parking bays installed. 2. An annual travel and transport conference has also been staged. 3. The Royal South Hants Hospital now has a travel plan in place and several walking and cycling events have been held. 4. Solent University has implemented a parking management scheme and updated its cycle facilities. 5. The University of Southampton has installed additional cycle parking provide road safety training and a regular bike doctor for cyclists. 6. Bike week was held in June 2013 for the city. 7. A travel planner's forum has been set up with at least 20 businesses in attendance at each meeting. 8. A travel planning newsletter is also sent out on a monthly basis.
2.3	Freight consolidation and efficiency	The project will investigate, evidence and implement a series of measures to introduce 'Green fleet' management. This will eventually	Green	Simon Fry	The viability study for the development of a Sustainable Freight Consolidation Centre has been produced. An OJEU process has been undertaken identifying a private distribution company who

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
		encompass **a driver behaviour change programme** aimed at encouraging more economic driving techniques, emissions modelling tools to identify particular locations where freight is delayed, reducing householder wasted mileage through picking up failed home deliveries, shared service activities in urban centres and smart bins to reduce unnecessary waste collection, **managed loading bay booking** in urban centres. A trial of the smart-freight concept, the use of **smart tagging** to enhance customer visibility of freight transport and a **fleet vehicle partnership** looking at joint procurement and specification, sharing vehicles and depots to deliver efficiencies for members and lower emissions from vehicles purchased by members. These elements will be delivered through the development of a Sustainable Freight Distribution Centre.			have since been appointed to develop and operate the centre. The site has also been identified in Nursling and will be commissioned in December 2013. A number of major organisations have signed up to make use of the centre including: 1. Southampton City Council 2. University Hospital 3. University of Southampton 4. Solent University 5. New Forest District Council 6. Hampshire County Council 7. Eastleigh Borough Council 8. Hampshire Constabulary 9. West Quay A number of other private businesses have expressed an interest in utilising the facility.
2.4	Public Transport Travel Planning	Preparation of new rail station travel plans. Work with local rail users, transition towns, rail operators and ATOC to develop station travel plans at the following key locations including Southampton Central, Eastleigh and other local stations.	Green	Adrian Webb	A consultant has been appointed to develop a travel plan for the Southampton Central Station. The travel plan is scheduled to be completed in January 2014 with up to £180k of funding identified to be invested in measures to promote more sustainable modes of transport in the area. An overarching plan for all stations in the city is also in progress. Real time information is now available at the station providing travellers with up-to-date info on buses and trains.
2.5	Smart ticketing and media	Delivery of a sub-regional multi-modal interoperable transport smartcard. The ticket will provide the link between operators and modes to give the best possible products to transport users making public transport seamless, easier to use and cheaper as well as promoting the growth of the sector.	Green	Thomas King	A Hampshire-wide Smartcard will be launched in July 2014. The back office system has been procured and the equipment is in the process of being fitted to buses and ferries.
2.6	Brompton Bike Hire scheme	Expansion of the Brompton bike hire scheme i.e. PlusBike establishing a series of hire points in conjunction with South West Trains in addition to a Leeds-style	Green	Adrian Webb	Installed in March 2013 and launched in April 2013. The scheme has 60 members signed up to use the bikes with 10% of bikes used every day of the year. Corporate members include the University Hospital, the University of Southampton, Solent University,

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
		cycle hub at Southampton Central Station.			Skandia, CooperVision, Ordance Survey and the Mayflower Theatre.
2.7	Legible Bus Network	Legible bus networks. Improving road-side publicity for services along key networks. The city has high levels of bus use and is seeking to double bus use over the next 20 years.	Green	Richard Cooke	A new format for bus timetables has been rolled out on bus stops along Above Bar Street as a pilot. Two additional phases of the project will see the new timetables installed at 181 bus stops in December 2013 and another 180 bus stops between February and March 2014.
2.8	School Travel Planning	Support for the implementation of measures in existing School Travel Plans and ModeShift	Green	David Deane	27 schools have signed up to the STARS school travel plan programme (a national accreditation scheme). Through this programme over 1000 bikes have been fixed, 192 Bike-it events have been staged, and 25,000 positive cycling and scooting experiences have been delivered. By July 2013 14 schools had achieved bronze status under the scheme which is the highest rate of any local authority area in the UK. The scheme has seen 18,000 pupils walk to school at least once a week and an 8% increase in cycling to school rates for those schools participating in 'Bike-it'. A pilot project was staged in Sholing where a road was closed off to simulate what it would be like without traffic. A bus pass for 16 to 19 year olds has also been launched which has trebled participation in bus use. An additional travel training programme was developed with a number of schools for children with special educational needs and is running until March 2014. The scheme has so far seen 40 children shift from local authority supported journeys to other modes of travel resulting in a £31k saving within 9 months. The scheme is referenced as best practice by the DfT in their annual school travel review.
2.9	Active Travel programme	Active travel programme to encourage more active life styles through walking and cycling. A community and workplace engagement programme led by Sustrans in partnership with the city council.	Green	Sustrans	Sustrans staff now sit with the council's transport planning team. In 2012/2013 the active travel programme achieved the following: 1. Engagement with 12 community groups (target of 6) 2. Engagement with 5 SureStart Centres (target of 5) 3. 3 Health Walk Groups maintained 4. 1 Health Walk Group established 5. 34 Roadshow events staged 6. 63 Cycle training and Bike Doctor events held 7. 214 participants engaged in walking activities (target of 80) 8. 1000+ participants engaged in cycling activities (target of 80) 9. 845 participants provided info on walking and cycling (target of 800)

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
					10. 22 Active Travel Champions recruited and trained (target of 10)
2.10	Traffic Control Predictions Development to improve air quality.	Working with Southampton University Transport Design Group to predict flows of traffic emanating from signals data to predict patterns ad influence travel advice. This will include disseminating the information via mobile media and amending signal plans to improve air quality	Amber	Adrian Webb	The city council is sponsoring an EngD student to take the project forward.
2.11	Promotion of home deliveries campaign	A campaign to be run in conjunction with retailers to encourage higher take-up of home deliveries allowing more people to travel to shops without the car.	Amber	Adrian Webb	To be progressed in 2014.
2.12	Development and promotion of a bus times smartphone app	SCC is working with academic partners to develop bespoke mobile phone apps to provide a step-change in public transport smart ticketing and information.	Amber	Adrian Webb	An online journey planner has been developed and implemented as part of the MyJourney website and marketing campaign. Access to this tool and information on bus times will be developed into a smartphone app in 2014.
2.13	Cycle Training	Joint Commissioning and contract management of bikeability cycle training across the South Hampshire sub-region to establish a standard offer for cycle training to help ensure the self funded centre of excellence for sustainable travel.	Green	Adrian Webb	Up to March 2013 the following was delivered: 1. Over 166 individuals have received bike maintenance training 2. Over 133 adults have received cycle training 3. Another 130 adults are on the waiting list to receive training 4. 667 children have undertaken 'bikeability' training 5. The target of 2000 children will be exceeded by March 2014
2.14	City Car Club	Develop a sub-regional car club scheme. The operator will supply vehicles to be used for marketing and installation of up to 200 bays. Clear options for extensive supply of electric vehicles within the fleet will be included.	Amber	Adrian Webb	A campaign will be run in February 2014 to drive up membership of the existing City Car Club. As part of this promotion Eco-driver training will be made available to residents and businesses.
2.15	Real time information provision	SCC will deliver public transport with real time information through display screens at our key transport hubs, core bus corridors and highly visible locations and through mobile phones by utilising current and future proof media. RTPI screens to be installed at 13 x locations including Hedge Superstores, Gosport Ferry terminal, Southampton cruise ship terminals, Bus Corridor	Green	Paul Walker	Real time information systems have been fitted along all core bus routes in the city.

SOUTHAMPTON SUSTAINABLE TRAVEL CITY					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
		RTPI on key routes and multi-modal real time information at interchanges.			
2.16	Access to work scheme	Free travel advice and bus passes to be provided to unemployed individuals in the city in order to aid their route back into employment.	Green	Adrian Webb	A scheme has been delivered in partnership with the Jobcentre plus to remove the transport barriers that may prevent unemployed people from accessing work. The scheme was targeted at 18 to 24 year olds with free Solent Travelcards provided to participants in the scheme along with free travel planning advice. 811 individuals were assisted throughout the scheme. Results suggest that of those participating in the scheme 44% were subsequently able to find a job compared to 10% of those who didn't participate.
2.17	Bus priority measures	Investment in measures on high frequency city corridors that reduce journey times for buses and design out delays including bus lanes, bus gates, changes to traffic signals and "virtual" priority measures.	Green	Simon Bell	Bus priority programme in progress with 42 junction improvements identified to be delivered.
2.18	Improving Journey Time Reliability	Targeted interventions to deliver journey time savings of 9.5 seconds per bus per junction. This will deliver an economic benefit, improve punctuality and journey times, whilst reducing emissions. The savings in peak vehicle requirement bought about by these improvements will be reinvested by operators within the bus network. This includes bus priority measures at 15 x locations.	Amber	Paul Walker	To be progressed

LTP3 ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
4.1	Cycle Lane/Routes Provision.	Work with Sustrans, Organisations & Stakeholders to contribute to the design and delivery of a city wide strategic cycle route.	Green	Dale Bostock	Phase 1 of the eastern cycle route to be completed by March 2014. University cycle corridor targeted for development with funding bids submitted. A 10 year cycle strategy has been produced.
4.2	Bus stop improvements	The installation of new bus shelters across the city to improve the waiting environment for passengers. This will be followed by the implementation of a legible bus network which will make it easier for passengers to find the correct bus stop and interpret timetable information.	Green	Simon Bell	Installation of new bus shelters has now commenced with phase completed in 2012/13. The legible bus network is currently in the design phase and will be implemented over the course of next the two years with completion in March 2015.
4.3	Platform road and Dock Gate 4 removal of gyratory	Major alterations to the highway network in order to enable two lanes of traffic in each direction between Town Quay and Dock Gate four, and the removal of the existing gyratory system arrangement.	Green	Phil Marshall	Scheme underway. Further information to be provided in next update.
4.4	Parking measures	Car Park Guidance System (CPGS) technology has recently been augmented by the arrival of reliable parking bay management systems. A red or green light above each bay indicates if the bay is free or not, and display boards at the top of each ramp indicate the number of free spaces on each floor.	Amber	Frank Baxter	To be progressed.
4.5	Civic Centre Place design and implementation	The Civic Centre Place scheme aims to remove through traffic from Civic Centre Road / New Road and divert this onto the Inner Ring Road via Havelock Road, Cumberland Place, Brunswick Place and Charlotte Place.	Amber	Phil Marshall	Further information to be provided in next update.
4.6	Oxford Street	Create a shared surface scheme, creating more space for the bars and restaurants to spill out into and activating the street.	Green	Phil Marshall	Scheme underway. Further information to be provided in next update.
4.7	Old Town public realm	Low cost improvements to the public realm will be implemented in the short term. These include works outside the recently renovated Tudor Merchant's House and the extension of the existing 20mph zone through the recently completed QE2 Mile enhancements in Holyrood to link with the existing scheme in French Street.	Amber	Phil Marshall	Scheme underway. Further information to be provided in next update.
4.8	North of central station improvements	Consolidation of surface level car parking into a new multi-storey car park to create land for	Amber	Phil Marshall	To be progressed.

LTP3 ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
		redevelopment and to create a high quality public realm and public transport interchange.			
4.9	Legible cities	Delivery of the on street way finding maps and signing in the city centre.	Green	Richard Alderson	Phase 4 due to be completed in March 2014 which will see the city centre network completed.
4.10	District Centres - Bitterne	Bitterne District Centre is a high priority for investment to improve accessibility and enhance the public realm.	Amber	Richard Alderson	To be progressed.

PLANNING POLICY ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
4.1	Local planning policies (citywide)	Implementation of existing Local Plan policy and work towards strengthening policy in new Local Development Framework. This should include ensuring that the cumulative adverse effect of smaller developments on local air quality is avoided.	Green	Graham Tuck	There is a requirement in the Core Strategy transport policy (CS18) to 'Require new developments to consider impact on air quality, particularly in Air Quality Management Areas (AQMAs) through the promotion of access by sustainable modes of travel'. The Core Strategy sets out the general principles and the CCAP and Southampton Development Plan will show how this affects individual sites.
4.2	Targeted planning guidance to address air quality impacts of development	Ongoing involvement with Planning Policy and Development Control to avoid the canyon effect (created by tall buildings on both sides of a road) and cumulative air quality effects of development through the planning process.	Green	Graham Tuck	There is regular and ongoing close working between Planning Policy and Development Control. Both the Masterplan and CCAP set out a strategic approach to tall buildings.

OTHER ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
5.1	Low Emission Zone (LEZ)	Potential for reducing emissions from HGVs by working with freight partnerships to establish minimum emissions standards for HGVs operating in Southampton.	Green	Simon Hartill	Low Emissions Strategy to be developed and adopted outlining appropriate measures to be implemented along the Western Approach to the city.
5.2	Bus Quality Partnership	Emissions from buses can be reduced by modernising the bus fleet.	Green	Paul Walker	Partnership established. Further information to be included in next update.
5.3	Taxi Quality Partnership	Steps to modernise the taxi fleet and reduce taxi emissions.	Amber	Paul Walker	To be progressed.
5.4	Introduce fixed penalty for idling vehicles (including buses and taxis)	Use legal powers to enforce fines for idling vehicles and prevent unnecessary emissions.	Red	Paul Walker	This has not been invoked.
5.5	Changes to traffic light phasing	Use the road traffic management system to change traffic light phasing to hold back traffic queues in areas without residential receptors.	Amber	Martin Wylie	Further information to be provided in next update.
5.6	Port Masterplan actions	Working with ABP to address port related transport issues and emissions from shipping could involve a range of measures, including; creating new access routes, providing alternative fuel supplies, introducing freight quality partnerships, and developing lorry staging areas.	Amber	Sue Simmonite	Further information to be provided in next update.
5.7	Legible city signage	Legible city methodology to be adopted to improve signage within the city to encourage cycling and walking at key points in the city.	Green	Richard Pemberton	Signage has been fully installed throughout the city centre.

OTHER ACTIONS					
Ref	Action	Additional Information	Status (RAG)	Responsible Owner	Progress
5.8	Integrate Air Quality Impact Assessment into all major transport projects	Include costs for air quality modelling and impact assessment in the design stage of major transportation projects to ensure that their impacts are understood.	Green	Frank Baxter	This is part of the planning and transport assessment and is done on a site by site basis
5.9	Research the health impacts of air pollution	Work closely with the Health Authority and University of Southampton to research the health impact of air pollution on vulnerable groups.	Green	Simon Hartill	The monitoring and evaluation procedures as part of the Air Alert project are specifically designed to research the health affects of air pollution. This project has now commenced
5.10	Use of adaptive traffic control systems	The study is intended to investigate the feasibility of reducing or relocating traffic queues in AQMA areas. It is a 3- year-long project. Whilst they won't necessarily reduce air pollution they will relocate the source to an area without receptors, therefore reducing the health impact.	Green	Martin Wylie	The first phase of project, which involves data collection and analysis, is approaching its conclusion
5.11	Air Alert	The Air Alert project aims to provide Southampton residents who have an existing respiratory condition with advance warning of poor air quality and enable them to adjust their behaviour to minimise the risk of exposure to elevated levels of pollution. The project will initially identify community clusters in 3 of Southampton's Air Quality Management Areas (AQMAs) – Redbridge Road, Bitterne Road and Bevois Valley. The project has now commenced and the process of registering users is taking place.	Green	Simon Hartill	201 air alert subscribers enrolled, 96 air alerts issued since June 2010. Very high customer satisfaction results from survey of subscribers undertaken in 2011. "90% of subscribers would recommend the service."
5.12	Keep the City Moving Group	A project board for congestion issues that will coordinate, communicate and plan in relation to keeping the city moving.	Green	Frank Baxter	The group provide a focus for and coordination of anti-congestion actions achieving financial savings from significant reduction in fuel consumption. The group has met several times and has developed an action plan
5.13	Flywheel technology	Buses in Southampton to be upgraded with pollution-reducing flywheel technology on transport routes with poor air quality.	Green	Paul Walker	Southampton was one of eleven local authorities to have been awarded funds from the Department for Transport's Clean Bus Technology Fund to enable the flywheel technology to be fitted to buses in the city. The funding will be made available for bus operators in the 2013-2014 financial year with installation by bus operators to be completed by 31st March 2014. It is possible that UK and EU companies could also adopt this technology and there is potential for a 'Centre of Excellence' to be created within the Southampton area for installation of flywheel technology on buses.

Appendix 5

SUBJECT: Submission to Air Quality Panel: Licensing

DATE: 20 November 2014

RECIPIENT: Air Quality Scrutiny Panel

Does Licensing and its processes take into account air quality?

The only area where Licensing has a link with air quality are taxis and private hire vehicles. The authority has set conditions to restrict the age of the vehicles that can be licensed. Until last year this was seven years for a normal vehicle and ten years for wheel chair accessible vehicles. However last year the trade asked for the life of vehicles to be extended by two years, their reason was at a time of austerity the trade needed that extra breathing space. There was a concern that older vehicles are likely to be less environmentally friendly and this was raised. The Licensing Committee agreed to the extension requested which means presently the Council will licence vehicles until they are nine years old for saloon type vehicles or 12 years for wheelchair accessible vehicles; so presently this is the only consideration with a link to air quality.

Would Licensing be supportive of a City-wide Low Emission Strategy?

In principle the Council's Licensing Manager would be happy to support a City-wide Low Emission strategy. Although it must be noted that such a strategy will need the support of the Licensing Committee. The taxi trade will argue it is difficult enough now to make a living and it would be expected that any changes in policy that has a negative cost implication to them will be resisted vigorously.

In Southampton there is a small increase in the number of hybrid vehicles being licensed and some sections of the trade recognise the financial benefits of these vehicles. However hybrid vehicles are expensive to purchase therefore smaller traders or one person interest vehicles will struggle to fund such purchases. A factor that influences the decisions of type of vehicle to use is the docks trade. To work the Port of Southampton effectively the vehicle needs to be able to cope with large amounts of luggage. The Toyota Prius is the vehicle of choice in the hybrid range but Toyota has not released the estate version in this country and have no plans to in the future. The normal saloon has inadequate boot space to operate in the docks and those that have bought a Prius have decided not work in the docks. The vast majority of the hackney trade rely on docks work to make a living and it is a significant portion of the private hire trade's work as well.

The Council could work towards an emission based policy for vehicles instead of an age based one, however there are difficulties in checking the compliance. Diesel engines are the main issue. This is said because a basic diesel engine is no different now to one of twenty years ago. What assists the engine to be more efficient or cleaner has changed, but unfortunately these 'add ons' go wrong from time to time and are expensive to replace. For example, Diesel Particulate Filter (DPF) only works when the engine is hot and requires a vehicle to go on a long journey regularly to operate, if it does not, it would need replacing costing at least £1,000.

In Southampton, the average journey for a taxi is three miles and in consequence the DPFs fail after a short time. The trade has found a work around by bypassing the DPF, however it would take a mechanic four hours to determine if the DPF has been bypassed making any compliance check costly, inefficient and unlikely to be proportionate or justified. The trade will also compare what is happening to other forms of transport, especially but not restricted to buses to ensure they are treated on equal terms.

One option might be to include in the policy Euro standard 5 or 6 engines. To prevent driving a number of the trade out of business any change in policy will need to be introduced over a number of years, at least three years, to allow effective financial planning by the trade.

Finally, licensing fees can only be used to cover the administration costs of processing and servicing the licence. The fees cannot be used to subsidise other such projects.

Further Information Available From:	**Name:**	Phil Bates – Licensing Manager, SCC
	Tel:	80834351
	E-mail:	Phil.bates@southampton.gov.uk

RICARDO-AEA

APPENDIX 6

Page 43

Ricardo-AEA

Air Quality in Southampton

Dr Beth Conlan

31st July 2014

Agenda Item 6
Appendix 6

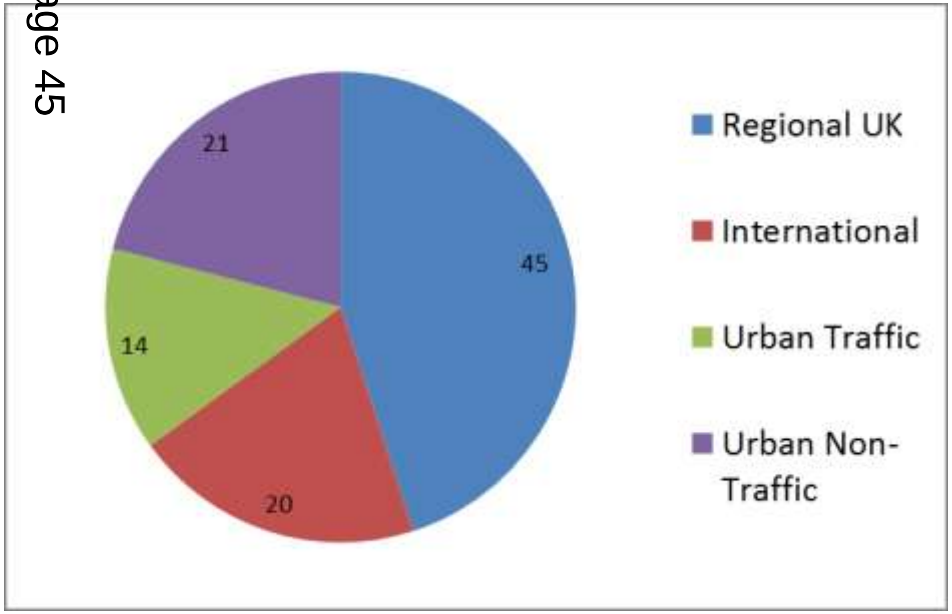
Presentation will cover:

- The Council Paper
- Comparison of AQ in Southampton with elsewhere
- Exemplar Local Authorities
- Short term focus

The Council Air Quality Paper

RICARDO-AEA

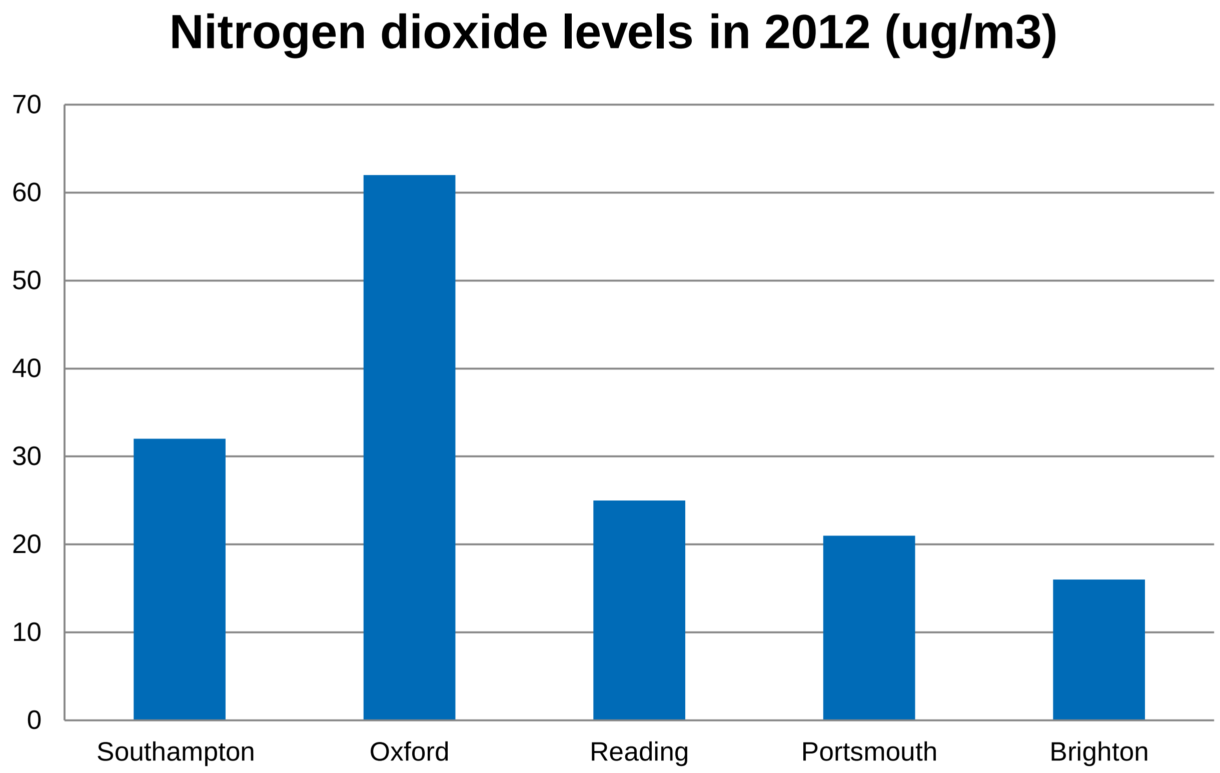
- Sets out the issues and challenges accurately
- Public health impact is clear and is not just related to NO_2 but also is from fine particulates (soot) $PM_{2.5}$
- In Southampton in 2010 6.2% is the attributable fraction of mortality due to $PM_{2.5}$
- This is equivalent to 110 deaths in age 25+ and 1280 associated life years lost
- This is similar to Portsmouth, but higher than the South East average



Percentage contributions to modelled annual mean ambient $PM_{2.5}$ concentrations at urban background air quality monitoring locations. (Urban non-traffic emissions include: industrial, commercial and domestic emissions. "Regional UK" refers to national emissions in non-urban areas).

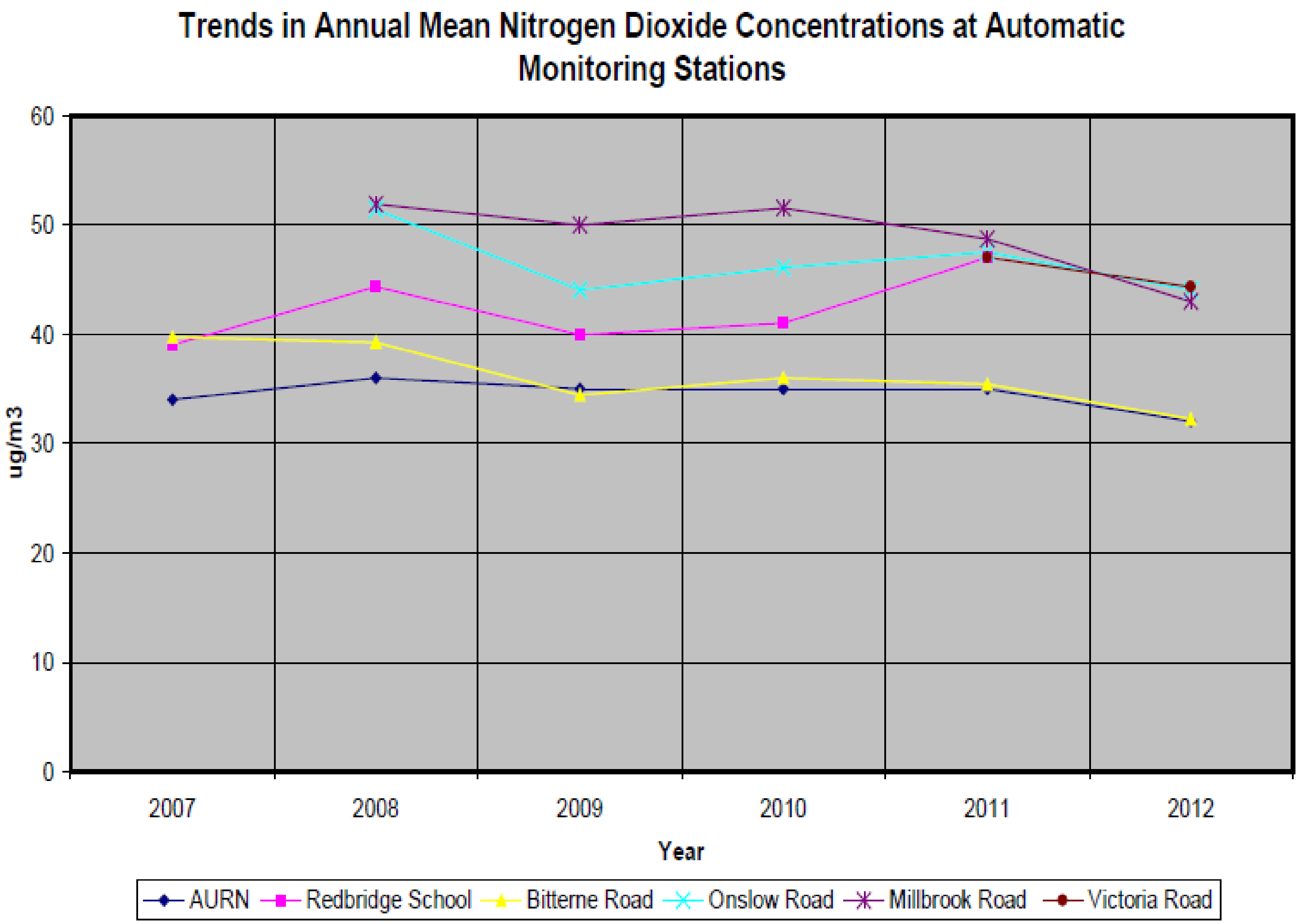
Comparison of pollution levels

- Pollution levels vary significantly across a city
- Caution when comparing individual sites to represent a whole city
- Generally Southampton pollution levels are similar to other cities in the South



Compliance gaps

RICARDO-AEA



Page 47

Implementing measures

RICARDO-AEA

Air quality action plan measures

- mostly been implemented

LEZ feasibility study

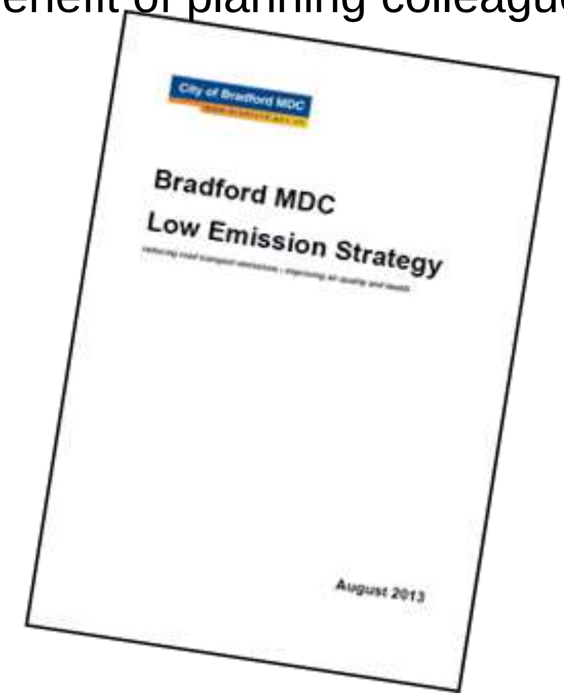
- Not economically attractive
- Achieve compliance by 2019 without

Exemplar Local Authorities

- The Oxford LEZ Traffic Regulation Condition consists of two elements:
- a requirement to switch off the bus engine if waiting for more than 1 minute from March 2013;
- a Euro V standard engine or retrofit equivalent for all emissions from January 2014.
- Southampton - Clean Bus Technology Fund but no emission standard within the Bus Quality Partnership
- 

Exemplar Local Authorities

- Bradford Council introduce air quality into local planning policy to:
- design with a focus on providing cost effective low emission infrastructure and other measures such as travel planning.
- tackle the issue of cumulative impact
- give clarity and consistency to the process to the benefit of planning colleagues and developers



Sources to be assessed in LAQM include….

RICARDO-AEA

- In Millbrook, about 50% of the total NO_2 comes from the port activities
- Ships hotelling is the largest source
- Priority is to engage on this issue with the Port Authority

Next Steps

RICARDO-AEA

- Commence the development of a Low Emission Strategy
- Focus on Port Activities
- Consider other emission sources e.g. buses and diesel cars
- Timeframes

Page 52

RICARDO-AEA

Dr Beth Conlan
Ricardo-AEA Ltd
The Gemini Building
Fermi Avenue
Harwell, Didcot,
OX11 0QR

T: +44 (0)1235 753480
E: Beth.conlan@ricardo-aea.com
W: www.ricardo-aea.com

This page is intentionally left blank

Western Approach AQMA air quality assessment, Southampton

Baseline study to support LEZ feasibility assessment & Development of Mitigation Measures

Report for Southampton City Council

Ricardo-AEA/R/ED58152
Issue Number 4
Date 24/07/2014

Customer:

Southampton City Council

Customer reference:

Click here to enter text.

Confidentiality, copyright & reproduction:

Ricardo-AEA reference:

Ref: ED58152- Issue Number 4

Contact:

Dr Beth Conlan
Ricardo-AEA Ltd
Gemini Building, Harwell, Didcot, OX11 0QR
t: 01235 753480
e: beth.conlan@ricardo-aea.com

Ricardo-AEA is certificated to ISO9001 and ISO14001

Author:

Dr Scott Hamilton, John Abbott (Ricardo-AEA), and Andrew Whittles (LES Ltd)

Approved By:

Beth Conlan

Date:

24 July 2014

Signed:

Beth Conlan

Executive summary

Southampton City Council has a responsibility under Part IV of the Environment Act 1995 to monitor and identify sources of air pollution within its area. In particular, the Council considers where people are living and where air quality standards are not being met. Where these standards are not being met the local authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan to tackle the pollution identified in these areas. According to the EC Directive on Air Quality (2008/50/EC) It is mandatory for the UK government to comply with the annual average limit value for nitrogen dioxide (NO_2) by 2010. Local Authorities have a role to play in achieving such air quality standards and must work `in pursuit' of the standard. Where Member States exceed the air quality limit values, the European Commission may commence infringement proceedings and impose a fine. The Localism Act (2011) enables such fines to be cascaded to local authorities.

The Council declared an AQMA to cover the Western Approach because measured concentrations of nitrogen dioxide exceeded the air quality limit value of 40 µg m^{-3} as an annual mean. The designated area runs from Redbridge Road to the west through Millbrook Road and Mountbatten Way through to the Paynes Road slip at the eastern edge of the boundary. The boundaries incorporate a wider area than simply where concentrations exceeded the limit so that a holistic approach to tackle air quality issues can be taken.

Concentrations in Southampton can be compared with other similar cities by examining monitoring data from the national monitoring network, which include sites that are representative of the wider city rather than pollution hotspots. In 2012 annual average concentrations of NO_2 in Southampton were 32 µg m^{-3}, whereas concentrations in Oxford were 62 µg m^{-3}; Reading 25 µg m^{-3}; Portsmouth 21 µg m^{-3};and Brighton 16 µg m^{-3}.

The Council has worked to improve air quality since 2008 when its Air Quality Action Plan was adopted. This Action Plan set out 45 measures which the Council has been implementing to improve air quality. Recent examples of measures being implemented include the real time bus priority system and the "My Journey" programme to assist passengers to plan their journey which both aim to improve the uptake of public transport and change travel behaviour over the long term.To address the poor air quality along the Western Approach the Council undertook a feasibility study for the implementation of a Low Emission Zone. This involved characterising the baseline air quality situation so that any interventions could be implemented as part of a wider scheme that is not specific to the Western Approach. This part of Southampton has a large effect from the port operations, but also from road traffic.

The results of the assessment suggest that the spatial variation in contributions from the road, rail and port sectors are significant. The west of the AQMA is primarily affected by road sources, of which the car and HGV fleets are significant contributors. In the centre of the AQMA around Millbrook Road the port is a large NOx contributor, indeed it is as large a source of NOx as road traffic at some locations. To the east of the AQMA road sources are again the most important source group, with cars and buses being the largest two contributors within the fleet.

Management of NOx along the Western Approach would therefore sensibly target road vehicles and congestion around the M271 junction. There is a significant flow of HGVs serving the port accessing from that junction so their contribution is quite large on the western side of the AQMA. Further east management of port emissions would seem sensible as this source is as significant as local roads around Millbrook Road. Indeed, the Port Authority is examining ways to reduce emissions and is currently considering options to reduce emissions from their Straddle Carriers. However, the most significant source of emissions from the Port are from ships hotelling and to most effectively improve air quality this source of emission needs to be tackled. To the east of the modelled area areas of high concentration are more associated with congestion at junctions so perhaps traffic management options could be explored along Millbrook Road into Mountbatten Way. Options to reduce emissions in the Western Approach and across Southampton are considered within this study including the feasibility of implementing a Low Emissions Zone (LEZ).

The Do Minimum scenario (with no further local interventions and not taking account of traffic growth) indicates that the national air quality objective is likely to be met around 2019 based on national fleet improvements. To bring this compliance date forward the following LEZ scenarios were considered:

- All HGV to be Euro V compliant
- All HGV to be Euro VI compliant

In addition to these LEZ scenarios, consideration was given to the emissions reduction from the introduction of Euro VI/6 into the vehicle fleet. As previous Euro standards have not delivered in the real world as was expected from test bed emissions monitoring, it was deemed prudent to assess the following improvements from Euro VI/6

- Euro Standard achieving 25% of the predicted benefit
- Euro Standard achieving 50% of the predicted benefit
- Euro Standard achieving 75% of the predicted benefit

An economic analysis of the LEZ options for the Western Approach indicated that in all scenarios monetary costs outweighed the predicted benefits, which included the health benefits. An LEZ based on the Euro V standard brought compliance forward by one year but the costs outweighed the benefits by £200,000 (2014 NPV) across a 10 year scheme. An LEZ based on Euro VI standard would be more effective bringing forward compliance to the year of implementation, which for this initial assessment was deemed to be 2014. However the costs of the scheme outweighed the benefits by £1.9m, and implementing a scheme swiftly would not be practicable. Also, if Euro VI achieved 50% of the predicted benefit the year of compliance is estimated at 2017, with costs outweighing the benefits by £2m.

It should be noted that the abatement costs outlined in this study would not necessarily fall to Southampton City Council- no distinction is made in government guidance as to where costs of abatement should be apportioned. As the abatement scenarios we have looked at would mainly involve private vehicles, it is likely that most of the cost burden would be felt by vehicle owners faced either with replacing their vehicles or paying to enter a LEZ. That said, there would be an implementation cost (e.g. cost of road traffic cameras) and enforcement cost to the Council of any LEZ scheme, and some financial gain from penalty notices. We have made no attempt to ascertain where these costs/gains would ultimately fall as this would necessarily involve detailed LEZ planning with well understood infrastructure requirements which is not available at this time. Should the Council wish to pursue this as a measure to improve air quality, detailed LEZ planning would form part of a further study. This would involve detailed traffic modelling to ascertain the best locations for entry into the LEZ, the impact of traffic displacement on surrounding areas of the proposed LEZ and how economic development would be impacted within the City. Importantly, it would need to focus on the preparation of a detailed cost model and apportion where those costs would fall.

In the meantime, the Council is undertaking to develop a Low Emission Strategy which would cover the whole city and use existing policy levers where possible to reduce emissions.

Table of contents

1 Introduction 1
1.1 Background 1

2 Air quality at the Western Approach 5
2.1 NO_2 Monitoring data 5
2.2 Road source dispersion modelling 6
2.3 Air dispersion modelling of other transport sources 12
2.4 NO_2 concentrations from all sources 20
2.5 Emission reduction scenario 29

3 Economic assessment 33
3.2 Emissions data 36

4 Compliance implications of LEZ options 38
4.1 Introduction 38
4.2 Projections of nitrogen dioxide concentrations 38
4.3 Required emission reductions from Do Minimum scenario 39

5 Unit abatement costs 41
5.1 Choice of unit abatement costs 41
5.2 Cost of emissions reductions 42
5.3 Significance of the impact on compliance 44
5.4 Conclusions of the economic assessment of LEZ 45

6 Road Transport & Port Emissions Mitigation Measures 46
6.1 Consideration of Emission Reductions 46
6.2 Mitigation & Low Emission Strategy (LES) Development (2014-2016) 46

7 Conclusions 50

Appendices

Appendix 1: Wind rose for Southampton Airport

Appendix 2: Sample of emissions factor toolkit input

Appendix 3: Sample of emissions factor toolkit output

Appendix 4: Potential Low Emission Strategy Measures for Western Approach, Southampton

Appendix 5: Southampton City Council – Fleet Model and Whole Life Costs

Appendix 6: Compressed Natural Gas (CNG) Pipelines (Medium Pressure) in Port Area

1 Introduction

1.1 Background

Southampton City Council has participated in the local authority air quality review and assessment process since 1998 as required by the Environment Act 1995. The Council has currently declared 11 Air Quality Management Areas (AQMAs) for nitrogen dioxide (NO_2):

- • AQMA 1 - Bevois Valley Road
- • AQMA 2 - Bitterne Road West
- • AQMA 3 - Winchester Road
- • AQMA 4 - Town Quay
- • AQMA 5 - Millbrook Rd & Redbridge Rd
- • AQMA 6 - Romsey Road
- • AQMA 7 - (has now been merged with AQMA 5)
- • AQMA 8 - Commercial Road
- • AQMA 9 - Burgess Road
- • AQMA 10 - New Road
- • AQMA 11 - Victoria Road

1.1.1 Air Quality and Health

The effect that poor air quality has on human health is widely reported and the mechanisms that affect mortality and morbidity are becoming clearer. Elevated concentrations of NO_2 are known to cause constriction of the bronchioles, sensitivity to allergens and trigger asthma, however, it is still unclear about the effect that NO_2 has on morbidity[1].

While Southampton City Council has not declared AQMAs for PM_{10} exceedences, our understanding of the effect that fine particulates ($PM_{2.5}$) have on health is increasing. There is strong correlation between fine particulate concentrations and cardiovascular and respiratory diseases, such as strokes and heart disease[2]. Defra has stated that the evidence suggests that there is no "safe" limit for exposure to $PM_{2.5}$, and that this type of man-made pollution cuts the average life expectancy of people living in the UK by seven to eight months[3]. Public Health England have published data showing that 6.3% of deaths in Southampton are attributable to $PM_{2.5}$ exposure – the national average being 5.6%[4]. The Department of Occupational and Environmental Medicine at the University of Southampton believe that further study is needed to establish that there are important health risks from levels of exposure below current exposure limits. They state that “this is because the differences in risk that are observed may have been a long-term effect of exposures in the past when levels of pollution were higher."[5]

In 2012, the World Health Organisation (WHO/IARC) designated diesel exhaust fumes as carcinogenic[6], increasing the risk of both lung and bladder cancer.

[1] http://www.comeap.org.uk/air/pollutants/106-health-effects-of-nitrogen-dioxide
[2] http://www.comeap.org.uk/air/pollutants/97-health-effects-of-particles
[3] Air Pollution: Action in a Changing Climate, Defra, 2010
[4] http://www.phoutcomes.info/public-health-outcomes-framework#gid/1000043/pat/6/ati/101/page/3/par/E12000008/are/E06000045
[5] http://www.bbc.co.uk/news/health-25827304
[6] http://www.bmj.com/content/344/bmj.e4174

1.1.2 Western Approach AQMA

This study is concerned with AQMA 5 which runs from Redbridge Road to the west through Millbrook Road and Mountbatten Way through to the junction with West Quay Road at the eastern edge of the boundary. A map showing the AQMA boundary is shown in Figures 1.1a to c. The stretch of road under consideration here is commonly named the "Western Approach" which is mainly formed by the A33 dual carriageway.

Figure 1.1a Location of Western Approach AQMA, Southampton

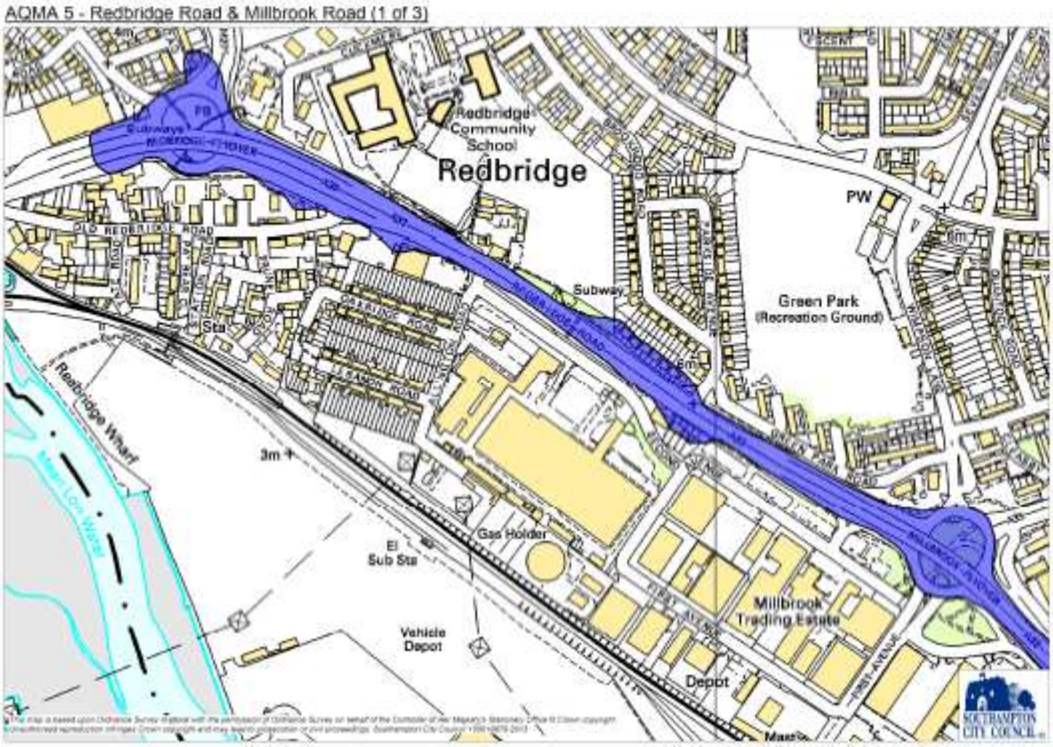


Figure 1.1b Location of Western Approach AQMA, Southampton

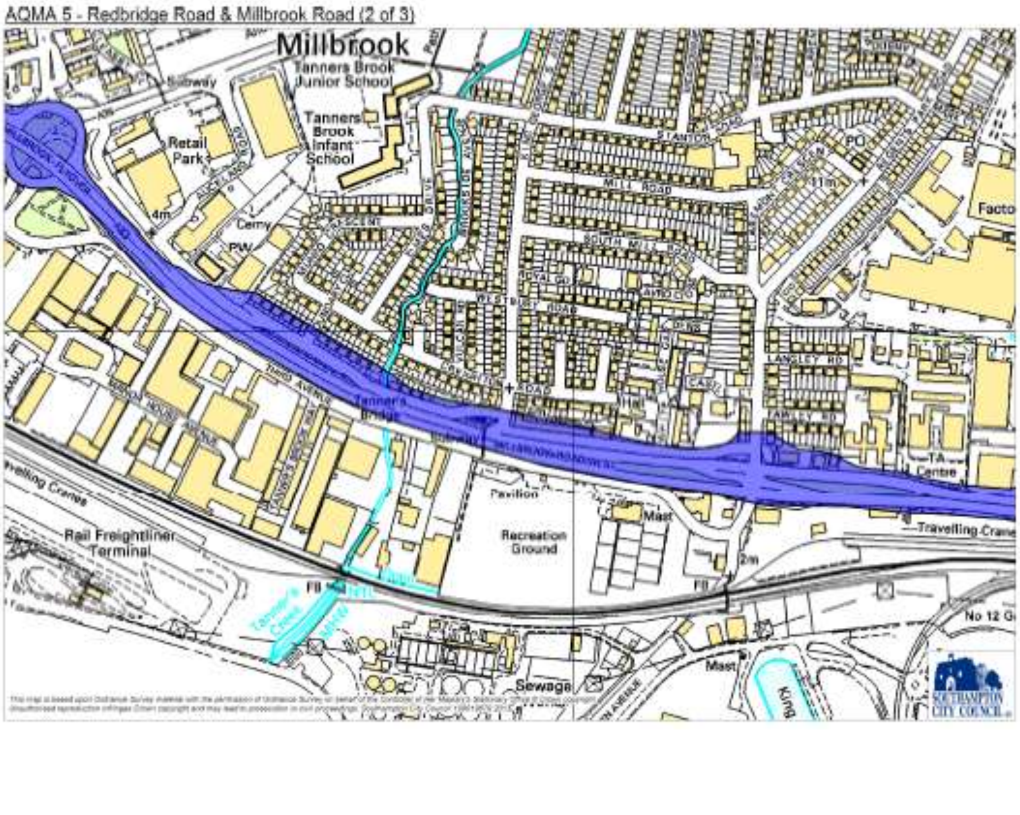
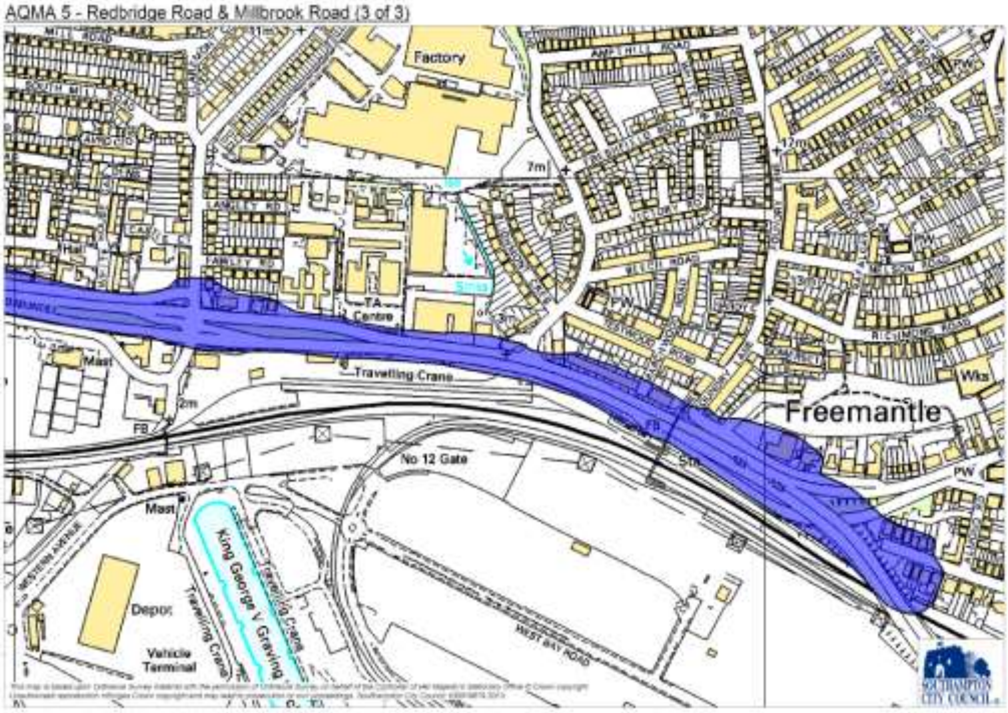


Figure 1.1c Location of Western Approach AQMA, Southampton



1.1.3 Southampton City Council Air Quality Action Plan

Southampton adopted its Air Quality Action Plan[7] in 2008 and this was updated in 2009. Recently, the Council has been selected[8] as having the potential to benefit from a Low Emission Zone based on all buses and HGVs meeting Euro IV standards for both NOx and PM_{10} on locally controlled roads. The air quality action plan describes a series of actions to improve air quality within the AQMAs and across the whole city. The AQMAs were declared based on measured concentrations exceeding the national objective for nitrogen dioxide (NO_2), principally due to emissions from road transport.

Progress on the implementation of the plan is described in progress reports (most recently the 2011 air quality action plan progress report[9]). Recognising the contribution of road traffic emissions, the air quality action plan has been integrated into the Local Transport Plan[10] (LTP3) which includes several policies which can aid air quality management. The status of each measure is reported as red/amber /green with a high, medium and low impact in air quality for each measure. The 2011 air quality action plan progress report reported that some outcomes show a broader picture of progress towards cleaner air. However, despite efforts to implement measures in the action plan since 2008, trends in NO_2 data, for both Redbridge School and Millbrook Road (and indeed other monitoring locations in Southampton) have been fairly stable. This is a trend which is commonplace throughout the UK and research has demonstrated it is related to the failure of the Euro vehicle standards to deliver the expected emission reductions in real world driving conditions.

There is however some evidence of a downward trend in some of the NO_2 measurements along the Western Approach from 2007 to 2011 but there are still measured exceedances of the annual mean objective locally. Many urban authorities in the UK have long standing

---

[7] https://www.southampton.gov.uk/Images/Air%20QUality%20Action%20Plan%202009_tcm46-258022.pdf

[8] http://uk-air.defra.gov.uk/library/no2ten/documents/110609_Technical_report_FINAL.pdf

[9] Available here: http://www.southampton.gov.uk/Images/progress%20report%202011%20Nov%202011%20for%202010%20data%20(2)_tcm46-314418.pdf

[10] Available here : https://www.southampton.gov.uk/s-environment/transportplanning/localtransportplan3/

exceedances of the annual mean NO_2 objective so the results of SCCs monitoring are in line with a trend which is commonplace throughout the UK.

In 2013/14, Southampton CC secured £60,000 of Defra Air Quality Grant funding to develop a Low Emission Strategy (LES) for the City. The LES, to be developed over a 2 year period from 2014 to 2016, will review the policies and measures within the Local Transport Plan[4] (LTP3) and build on this study to develop an appropriate strategy to reduce road transport and port emissions. This is discussed further in Section 4.

1.1.4 This study

This air quality study is focussed specifically on the potential for a Low Emission Zone that might address the NO_2 exceedances that have been measured along the Western Approach in 2011. The first step in this process was to robustly characterise the baseline air quality situation in the city. . This part of Southampton has a large effect from the port operations, but also from road traffic. Therefore a key outcome of this study is to apportion those sources before testing any potential abatement scenarios.

We have undertaken this analysis based primarily on dispersion modelling of NOx emissions from roads, local railways, and the Port of Southampton. In general terms the approach taken was to first characterise the NOx emissions from each source group. Emissions were then modelled NOx dispersion separately in two dispersion models (ADMS and ADMS Roads) and apply an appropriate background NOx background to determine 2011 based NO_2 concentrations across the model domain.

LEZ scenarios were also tested as part of this work along the Western Approach As HGVs were estimated to significantly add to the total NOx pollution levels the following scenarios were considered:

- All HGV to be Euro V compliant
- All HGV to be Euro VI compliant

In addition to these LEZ scenarios, consideration was given to the emissions reduction from the introduction of Euro VI/6 into the vehicle fleet. As previous Euro standards have not delivered in the real world as was expected from test bed emissions monitoring, it was deemed prudent to assess the following improvements from Euro VI/6

- Euro Standard achieving 25% of the predicted benefit
- Euro Standard achieving 50% of the predicted benefit
- Euro Standard achieving 75% of the predicted benefit

.

The consideration of an LEZ was supplemented by other measures which may also help to reduce emissions in the Western Approach and throughout the City.. These mitigating measures and progress towards their implementation are discussed in Section 3, and could be included within the development of a Low Emission Strategy for Southampton.

Mitigation measures considered by Southampton CC can be found in Appendix 4.

2 Air quality at the Western Approach

2.1 NO_2 Monitoring data

Southampton City Council measures nitrogen dioxide concentrations at a network of diffusion tube sites throughout Southampton. Nitrogen dioxide is also measured by continuous automatic monitor at five locations of which two are within the modelling domain for this study.

Figure 2.1 shows the locations of diffusion tube and automatic monitors in or close to the AQMA. The limit value for nitrogen dioxide set in the EC Air Quality Directive and Regulations in England and Wales is 40 µg m^{-3}. Table 2.1 shows the concentrations measured at these locations for 2008-2011.

The NO_2 annual mean concentration exceeded the limit value in 2011 at several of the measurement sites in the area of the AQMA, highlighted in bold in Table 2.1. The highest concentrations in 2011 were measured at the M271 diffusion tube site and the Redbridge School and Millbrook automatic sites.

Figure 2.1: Location of monitoring sites in the Redbridge Road/Millbrook Road AQMA

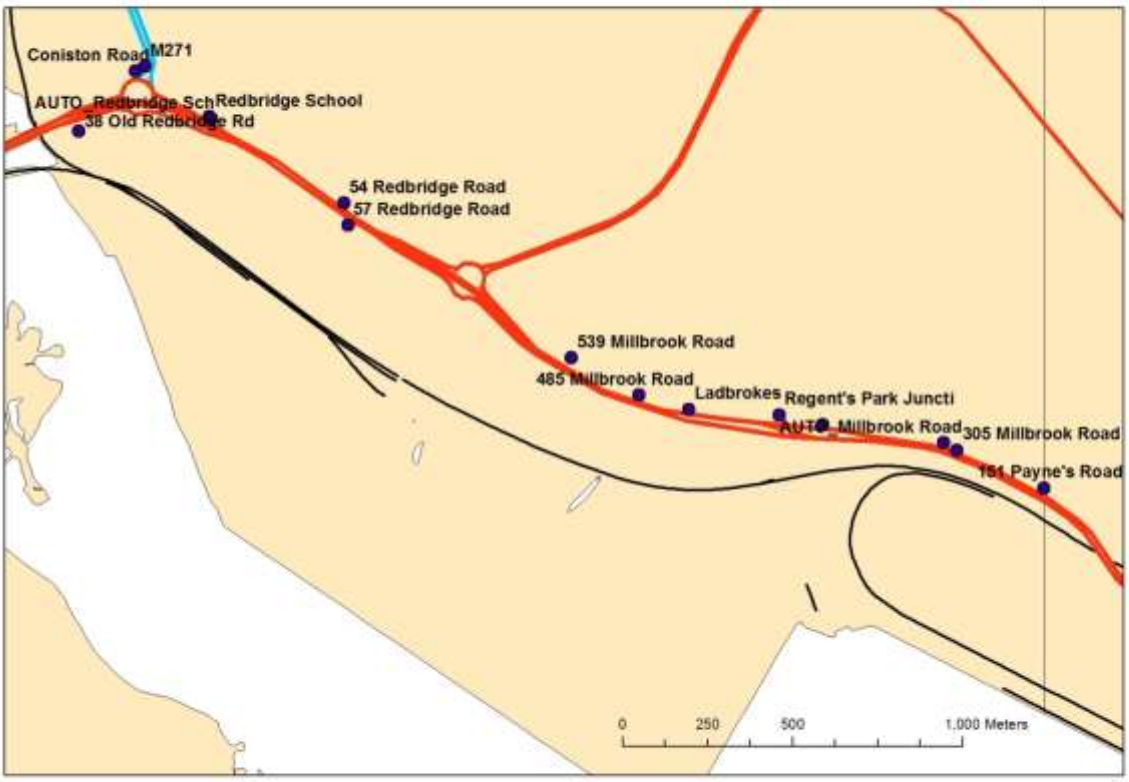


Table 2.1: Summary of the results of NO_2 diffusion tube monitoring in the AQMA

Location	Data Capture, 2011	Annual mean concentration, µg m^{-3}

		2008	2009	2010	2011
M271	75%	**59.1**	**51.0**	**-**	**54.1**
Coniston Road	66%	35.5	34.4	-	37.7
38 Old Redbridge Rd	33%	35.7	36.3	37.3	33.6
Redbridge School	100%	**46.9**	**45.8**	**41.6**	**42.1**
AUTO_Redbridge School	86%	**44.3**	**39.9**	**41.0**	**47.5**
54 Redbridge Road	83%	-	**41.3**	**42.8**	39.8
57 Redbridge Road	100%	-	**41.5**	**42.7**	39.8
539 Millbrook Road	91%	**40.1**	35.4	32.1	32.9
485 Millbrook Road	100%	38.4	37.4	32.0	33.3
Ladbrokes	91%	**46.1**	**43.2**	**40.6**	39.8
Regent's Park Junction	83%	**45.5**	**41.7**	38.3	42.0
367A Millbrook Road	91%	**46.1**	**48.7**	**41.6**	**45.1**
AUTO_Millbrook Road	99%	**51.9**	**50.0**	**51.5**	**48.7**
305 Millbrook Road	100%	**41.7**	**43.0**	**42.3**	39.7
151 Payne's Road	100%	-	33.8	33.5	33.0

NO_2 concentrations at the monitoring sites will be affected to varying degrees by contributions from local traffic and the port. It is thought that the sites around Millbrook Road are affected to a larger degree by NOx emissions from the port. Sites further east and west are expected to be mainly affected by road traffic emissions due to the increased distance from the most NOx intensive port activities (see Section 3). Apportioning the contribution from the sources at the different locations will allow effective targeting of interventions in any Low Emission Strategy that may follow for the city.

The 2011 NO_2 results have been used to verify the outputs of the air dispersion modelling study which is described below.

2.2 Road source dispersion modelling

We have conducted an air dispersion modelling analysis of NO_2 concentrations around the Western Approach. The results of this work can be used to understand the air pollution climate in the area given the relative contributions of the local road network and the Port of Southampton. Our approach follows the methodological recommendations of LAQM.TG(09).

Annual mean concentrations of NO_2 from roadways during 2011 have been modelled within the study area using the atmospheric dispersion model ADMS Roads (version 3.1).

The model was verified by comparing the modelled predictions of road NO_x with local monitoring results. The available roadside measurements within the study area were used to verify the annual mean road NOx model predictions.

Following initial comparison of the modelled concentrations with the available monitoring data, refinements were made to the model input to achieve the best possible agreement with the local measurements.

A surface roughness of 1.5 m was used in the modelling to represent a large urban area in the model domain. A limit for the Monin-Obukhov length of 30 m was applied.

The source-oriented grid option was used in ADMS-Roads; this option provides finer resolution of predicted pollutant concentrations along the roadside, with a wider grid spaced at approximately 20 metres being used to represent concentrations further away from the road across the wider study area. The predicted concentrations were interpolated to derive values between the grid points using the Spatial Analyst tool in the GIS software ArcMap 10. This allows contours showing the predicted spatial variation of pollutant concentrations to be produced and added to the digital base mapping.

A time varying emissions file based on an analysis of diurnality in the traffic data was used in the model to account for daily variations in traffic flow. This was derived from the 24hr traffic counts provided by SCC for Redbridge Road and Millbrook Road.

The model domain is shown in Figure 2.2 below; roads modelled are shown in blue. All roads included in the model were treated as two way flows. The Redbridge and Millbrook flyovers were modelled at heights representative of the difference between them and the closest roadside receptors.

2.2.1 Validation of ADMS-Roads

Validation of the model is the process by which the model outputs are tested against monitoring results at a range of locations and the model is judged to be suitable for use in specific applications; this is usually conducted by the model developer.

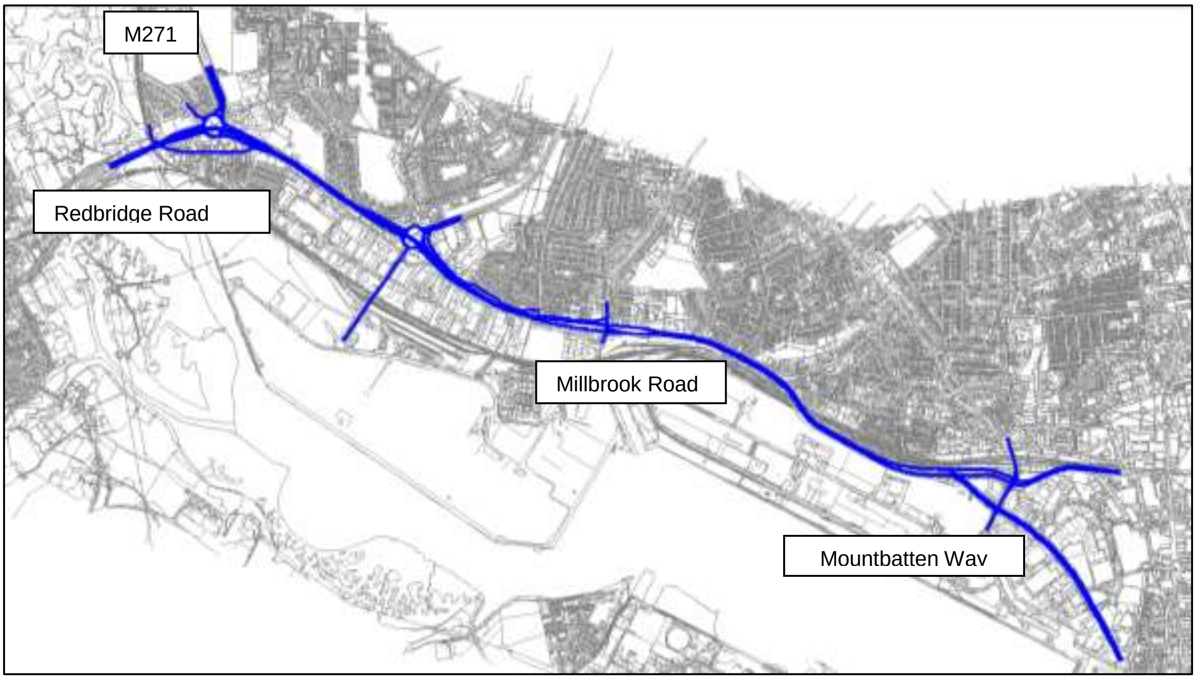
CERC have carried out extensive validation of ADMS applications by comparing modelled results with standard field, laboratory and numerical data sets, participating in EU workshops on short range dispersion models, comparing data between UK M4 and M25 motorway field monitoring data, carrying out inter-comparison studies alongside other modelling solutions such as DMRB and CALINE4, and carrying out comparison studies with monitoring data collected in cities throughout the UK using the extensive number of studies carried out on behalf of local authorities and Defra.

2.2.2 Mapping

Ordnance Survey based GIS data of the model domain and a road centreline GIS dataset were used in the assessment. This enabled accurate road widths and the distance of the housing to the kerb to be determined in ArcMap.

Southampton City Council provided OS Mastermap data to support the assessment.

Figure 2.2: Model domain and roads included (in blue) in emissions and ADMS Roads dispersion calculations



2.2.3 Road traffic data

Real time traffic count data collected by Southampton City Council and Hampshire County Council in 2011 were used for the assessment to characterise traffic flows and fleet splits in the area; this included annual counts with 1-hr resolution for the roads being modelled.

Speed data was supplied by the Economy, Transport and Environment Department at Hampshire County Council from their Strat-e-gis dataset. The Strat-e-gis data provides high temporal resolution speed data that represents the speed on a link by link basis across the day. The use of this data removes the need for assumption as to how traffic speed is affected near junctions and other obstacles. Each link has an average speed for the time interval specified- in this instance 7 to 9am, 9am to 4pm, 4 to 6pm, and 10pm to 6am. Each link also has the number of GPS observations from which the average for the year is derived; this allows weighting of the daily average speed by the number of observations. In practice the weighted average speed is normally around the same as the measured speed for the 9am to 4pm interval.

An example of how the Strat-e-gis data was processed is provided in Table 2.2 below- this example is from the Redbridge Road area to the west of the model domain where the traffic is reasonably free flowing.

All vehicle fleets except buses were assumed to be the same as those defined in the EfT which uses fleet splits for England provided by the DfT. The bus fleet was defined in more detail as information was provided by local operators.

Table 2.2: Excerpt of Strat-e-gis data for Redbridge Road

Road	Speed (kph) 7am to 9am	No. of Obs	Speed (kph) 9am to 4pm	No. of Obs	Speed (kph) 4pm to 6pm	No. of Obs	Speed (kph) 10pm to 6am	No. of Obs	Speed (kph) Total Obs	Weighted Speed (kph)
Redbridge Causeway from A36 Junction_1	46.73	2877	61.98	7901	61.8	2685	75.78	718	14181	60
Redbridge Causeway from A36 Junction_2	51.90	2907	59.86	7923	59.37	2698	71.63	721	14249	59
Redbridge Causeway from A36 Junction_3	64.73	1311	70.81	4220	73.53	1614	74.28	443	7588	71
Redbridge Causeway from A36 Junction_4	59.19	1313	68.65	4233	71.87	1615	69.87	442	7603	68
Redbridge Causeway from A36 Junction_5	59.89	1310	69.63	4227	74.08	1617	74.41	441	7595	69
No. of Obs= number of GPS observations										

The Strat-e-gis data was also very useful for delineating areas of the road network that are congested with resulting low average speeds. In general speeds near junctions were much lower as would be expected, with some junctions having weighted average speeds in the order of 10 to 15 kph.

All roads were split into 50m links within the ADMS Roads model yielding over 300 individual road sources in the model domain. Each was assigned a bespoke AADT flow, speed and fleet composition.

It should be noted that traffic patterns in urban locations are complex and it is not possible to fully represent these in atmospheric dispersion models. By attempting to describe these complex traffic patterns using quite simple metrics a degree of uncertainty is introduced into the modelling.

Road traffic in the Western Approach area has a diurnal variation in flow which is, as would be expected for a dual carriageway serving a major city, quite tidal in nature. During the morning most traffic is flowing East to access the city, with the opposite being true in the afternoon.

The weekend diurnal profile is less associated with commuting and appears to be more associated with shopping and leisure based trips, so the peak period is later in the day. There is still something of a tidal effect at the weekend as before but it is less pronounced. Figures 2.3 and 2.4 show the diurnal traffic profile derived for the A33 West and Eastbound, and by weekday and weekend (the same phenomena is observed at both the Redbridge Road and Millbrook Road ends of the A33). All other roads in the domain were modelled using a combined diurnal profile.

Figure 2.3: Diurnal traffic profile- Redbridge Road Eastbound (1=total daily traffic flow)

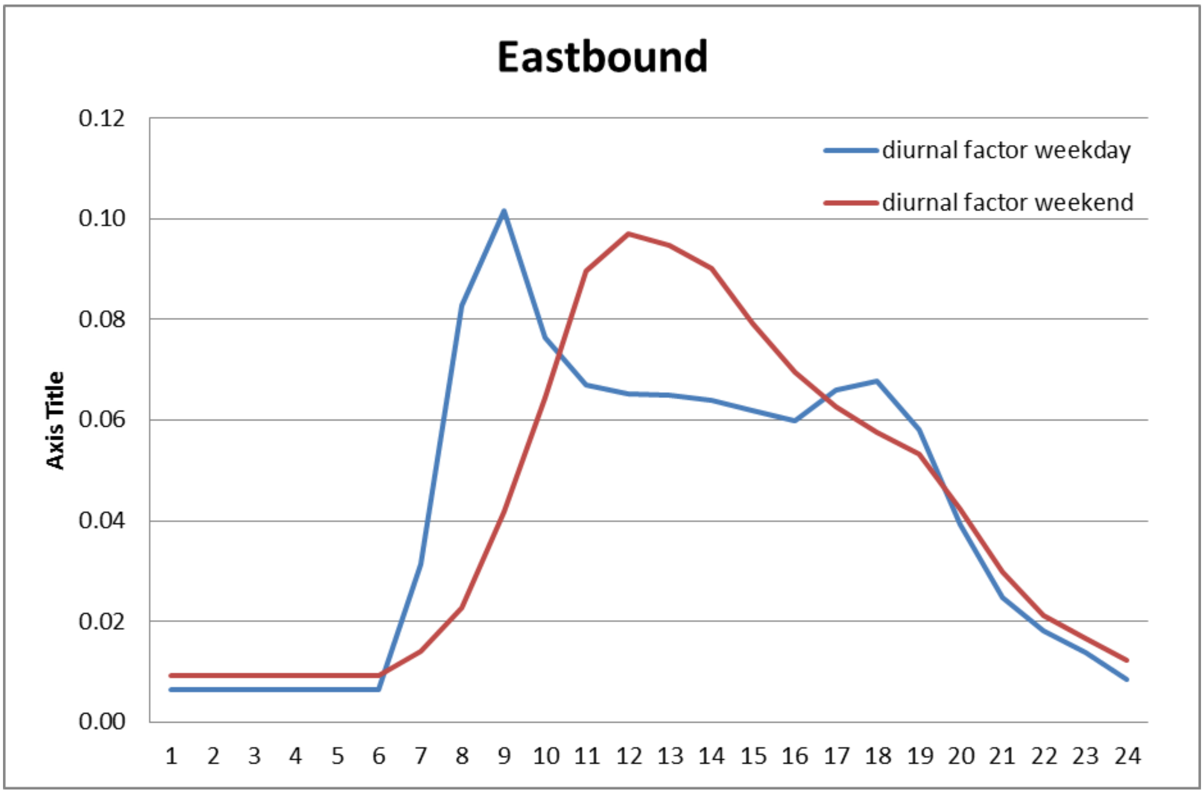
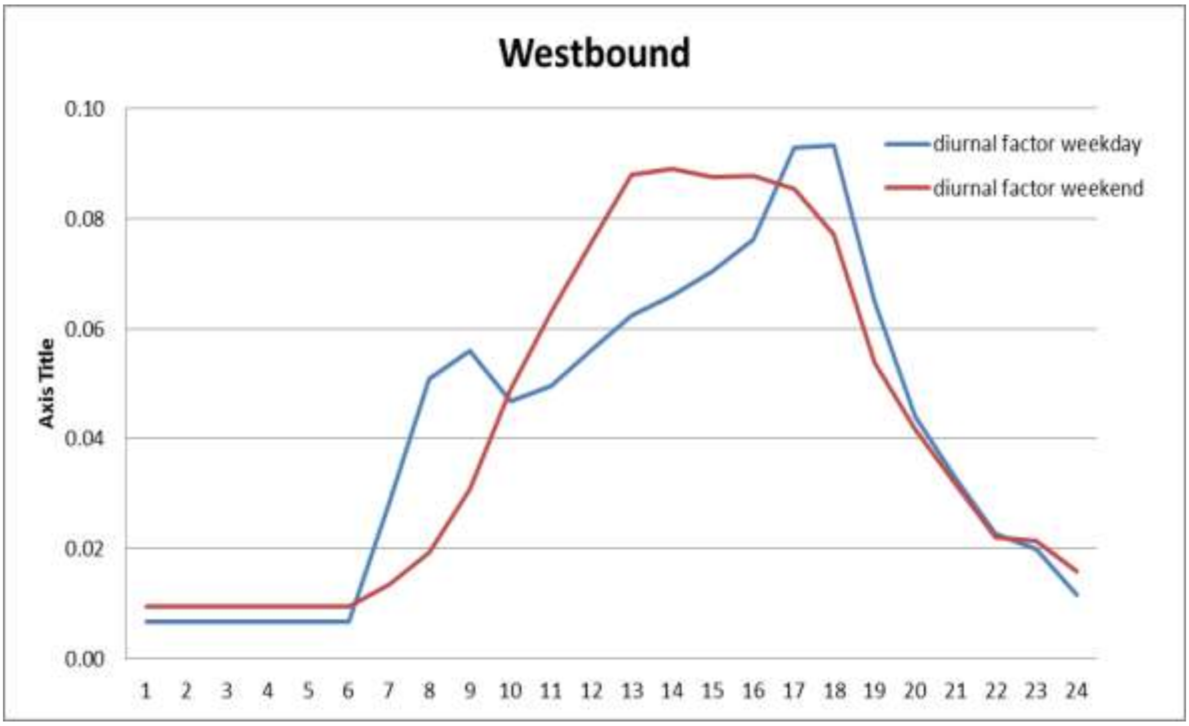


Figure 2.4: Diurnal traffic profile- Redbridge Road Westbound (1=total daily traffic flow)



2.2.4 Road traffic emissions factors

The most recent version of the Emissions Factors Toolkit[11] (EFT V5.2c Jan 2013) release) was used in this assessment to calculate pollutant emissions factors for each road link modelled. The calculated emission factors were then imported in to the ADMS-Roads model.

[11] http://laqm1.defra.gov.uk/documents/tools/EFT_Version_4_2.zip

Parameters such as traffic volume, speed and fleet composition are entered into the EfT, and an emissions factor in grams of NOx/kilometre/second is generated for input into the dispersion model. In the latest version of the EfT, NOx emissions factors previously based on DFT/TRL functions have been replaced by factors from COPERT 4 v8.1. These emissions factors were published in May 2011 through the European Environment Agency and are widely used for the purpose of calculating emissions from road traffic in Europe.

The latest version of the EFT also includes addition of road abrasion emission factors for particulate matter; and changes to composition of the vehicle fleet in terms of the proportion of vehicle km travelled by each Euro standard, technology mix, vehicle size and vehicle category.

Vehicle emission projections are based largely on the assumption that emissions from the fleet will reduce as newer vehicles are introduced. Any inaccuracy in the emissions factors contained in the EFT will be unavoidably carried forward into this modelling assessment.

All Strat-e-gis data was used in the EfT as received and following the weighting procedure described.

The EFT has also been used for this study to test the implementation of an idealised set of scenarios based around uptake of Euro 6 and Euro VI vehicles in Southampton.

Example EfT inputs and outputs are provided in Appendices 2 and 3.

2.2.5 Meteorological data

Hourly sequential meteorological data (wind speed, direction etc.) for 2011 from the Southampton Airport site was obtained from a third party supplier and used for the modelling assessment. The meteorological measurement site has good data quality for the period of interest though cloud cover data had to be taken from another site some 80km away (Gatwick Airport). Cloud cover is relatively regional so the conditions measured at Gatwick will be representative of those in Southampton for that parameter.

2.2.6 Background concentrations

Background NOx concentrations for a dispersion modelling study can be accessed from either local monitoring data conducted at a background site or from the Defra background maps[12]. The Defra background maps are the outputs of a national scale dispersion model provided at a 1km x 1km resolution and are therefore subject to a degree of uncertainty.

We consulted with Southampton City Council on the treatment of background and it was agreed that using the mapped background values was appropriate for this assessment. In the context of an area that is affected by both road and other transport sources it is important that these can be screened out of the background concentrations used. The Defra NOx mapping is sectorised so we were able to remove the contributions of the roads and the port from the background so that these could be discretely modelled thereby avoiding double counting.

When the contributions of the local roads and shipping based sources were removed from the background grid squares covering the model domain this resulted in a uniform background NOx concentration of 20.1μg.m^{-3} which was applied in the modelling. The background data derived from the Defra maps is shown in Table 2.3 below. For the purposes of this study, and since these source groups will be modelled explicitly, we have used the “Total minus other + industry + A Roads + Rail” as shown in the table.

Table 2.3: Summary of NOx background values around the Western Approach (μg.m^{-3})

x	y	Total NOx 2001	Total minus "other"	Total minus "other+A roads"	Total minus "other + industry"	Total minus "Other + industry	Total minus "Other + industry +

[12] Defra (2012) http://laqm1.defra.gov.uk/review/tools/background.php (accessed September 2012)

						+ A Roads"	A Roads + Rail"
437500	113500	41.8	32.6	20.1	31.4	18.9	**17.9**
438500	113500	41.3	31.9	22.1	30.6	20.8	**19.9**
439500	113500	47.9	31.4	27.2	27.7	23.4	**22.5**
440500	113500	43.7	30.8	26.8	28.5	24.5	**23.6**
441500	113500	40.8	29.2	25.3	27.0	23.0	**22.0**
438500	112500	37.7	24.4	19.4	22.9	17.9	**15.4**
439500	112500	59.9	28.1	21.4	26.3	19.6	**17.6**
440500	112500	51.6	32.1	24.2	30.0	22.0	**20.8**
441500	112500	52.7	35.1	29.2	32.1	26.3	**24.8**
440500	111500	64.2	25.1	22.4	21.5	18.8	**16.3**
441500	111500	72.7	32.0	26.4	28.7	23.2	**19.8**
Mean		50.4	30.2	24.0	27.9	21.7	**20.1**

2.2.7 Treatment of modelled NOx road contribution

It is necessary to convert the modelled NOx concentrations to NO_2 for comparison with the relevant objectives.

The Defra NOx/NO_2 model[13] was used to calculate NO_2 concentrations from the NOx concentrations predicted by ADMS-Roads. The model requires input of the background NOx, the modelled road contribution and accounts for the proportion of NOx released as primary NO_2. For the Southampton area in 2011 with the “All other UK urban Traffic” option in the model, the NOx/NO_2 model estimates that 22% of road NOx is released as primary NO_2.

2.2.8 Road model verification

The results of the roadway dispersion modelling have been verified by comparing with the available local measurements. As roads are not the only important source of NOx in the modelled area we must also include the contribution from other local sources in the verification exercise. Hence, the verification procedure is described in a later section.

2.3 Air dispersion modelling of other transport sources

Emission sources within the Port of Southampton contribute to pollutant concentrations on the Western Approach road. This section provides details of how the contribution from the port to roadside pollutant concentrations was estimated. It considers the contribution from:

- Manoeuvring and hotelling of container ships in the dredged channel
- Manoeuvring and hotelling of cruise ships in the dredged channel
- Manoeuvring and hotelling of other cargo ships, including vehicle import/export, in the dredged channel
- Straddle carriers used for container handling operations
- Container transfers from/to lorries
- Container lorry emissions in the port area
- Vehicle delivery lorries in port area
- Rail terminals
- Mainline railway

[13] Defra (2012) NOx NO_2 Calculator v3.2 released September 2012; Available at http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html

Figure 2.5 shows the location of these sources of emission.

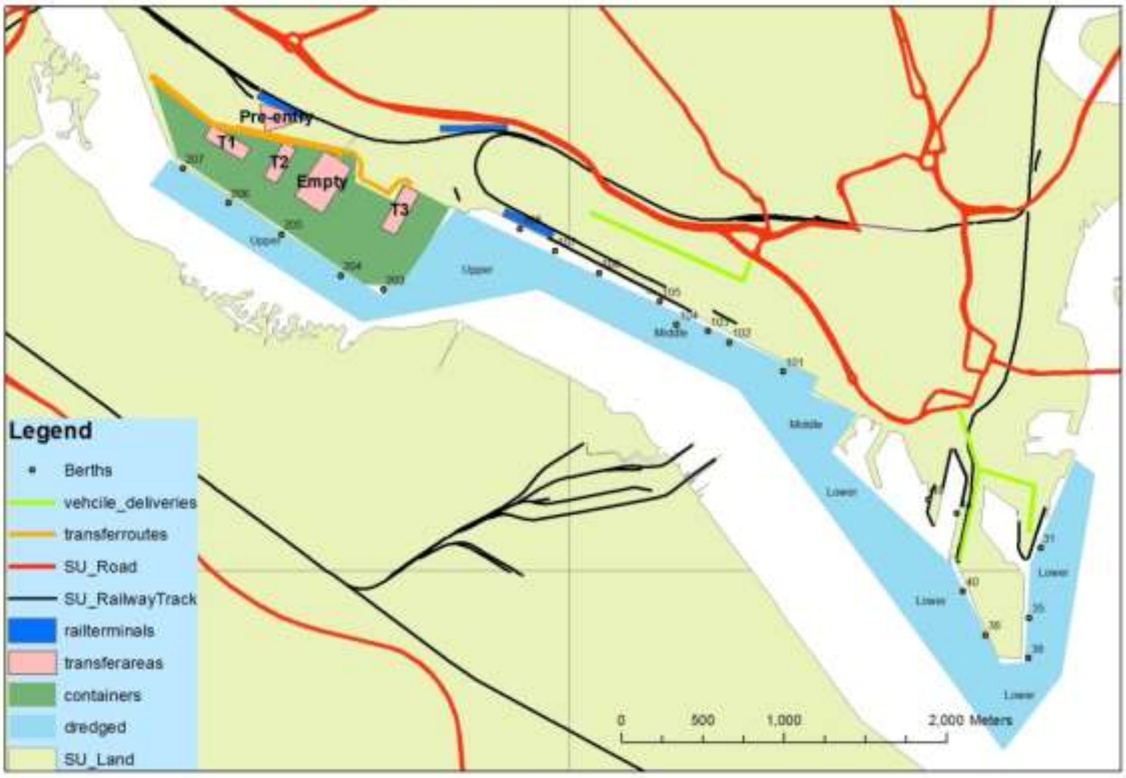
This section describes how the emissions were estimated and how dispersion models were used to predict the concentrations at relevant locations.

Two dispersion models were used for this assessment:

- The ADMS5 dispersion model is widely used to model industrial point, area and volume sources. ADMS 5 is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by the boundary layer depth, and the Monin-Obukhov length. ADMS 5 has an in-built meteorological pre-processor that allows flexible input meteorological data both standard and more specialist.

- LADSUrban The air quality impact from port roads and railways was assessed using our proprietary urban model (LADS Urban). This model provides a tool for calculating atmospheric dispersion using a 10 m x 10 m x 3 m volume-source kernel derived from ADMS5 to represent elements of the specified road links. The volume source depth takes account of the initial mixing caused by the turbulence induced by the vehicles. The LADSUrban tool calculates the emissions for each road link using the emissions factors published by the Department for Transport in 2012. It calculates the annual emissions for each road link taking into account the annual average daily traffic flow, the proportion of vehicles in each vehicle category and the vehicle speed. The emission factors for heavy goods vehicles, buses and coaches for oxides of nitrogen have been updated in line with the COPERT IV emission factors. The tool takes account of the age of the vehicle fleet based on national statistics.

Figure 2.5 Location of Port of Southampton emission sources



2.3.1 Container ships

The emissions from container ships were estimated using the methods described in the EMEP/EEA air pollutant emission inventory guidebook, 2009. The total deadweight tonnage of container ships entering the Port of Southampton in 2011 was 49.9 million DWT (Department for Transport Port Statistics Table 0603). There were 252 ships of less than 20,000 DWT and 525 of more than 20,000 DWT (Department for Transport Port Statistics Table 0601). The smaller ships are feeder ships: the Vega Stockholm (8306 DWT) is typical and has been assumed to be representative. The estimates of the emissions from larger ships assume a representative deadweight tonnage of 91,219 DWT. The gross tonnage of the container ships was estimated as 0.96 times the deadweight tonnage, based on an analysis of a sample of container ships entering the Port of Southampton. The main engine power rating was then estimated using an empirical formula relating the size of the main engines to the gross tonnage, taken from the EEA guidebook.

Table 2.4 lists the assumptions made about the operation of the main and auxiliary engines during manoeuvring and hotelling in port and the emission factors used, based on the recommendations in the EEA guidebook. Table 2.4 also shows the calculated annual emissions from manoeuvring and hotelling the container ships.

The ADMS5 dispersion model was used to predict ground level concentrations. Meteorological conditions were represented by hourly sequential wind speed, wind direction and cloud cover data from Southampton Airport, for 2011.

The manoeuvring emissions were represented in the model as a 45 m deep volume source, covering the upper part of the dredged channel shown in Fig. 2.5.

The hotelling emissions were represented as point sources located at berths 204, 205, 206 and 207, shown in Fig. 2.5. A quarter of the total emission was allocated to each of the berths. Ships less than 20,000 DWT were assumed to discharge through 1 m diameter stacks at a height 30 m above ground level with a discharge velocity of 2 m s^{-1} and a discharge temperature of 180°C. Ships more than 20,000 DWT were assumed to discharge through 3 m stacks at a height of 45 m above ground level.

Table 2.4 Container ship emissions

	< 20000 dwt	>20000 dwt	Total
Number	252	525	
Typical dwt	8306	91061	
Annual dwt	2.09 million	47.8million	49.9 million
Ratio GT/DWT	0.9598	0.9598	
GT	7972	87400.	
Main engines, kW	6032	48663.	
Ratio Auxiliary/main	0.25	0.25	
Auxiliary engines, kW	1508	12166	
Manoeuvring time, hrs	1	1	
Fraction load Main	0.2	0.2	
Fraction time operating	1	1	
Fraction load Auxiliary	0.5	0.5	
Fraction time operating	1	1	
NOx Emission factor main , g/kWH	14	14	
NOx Emission factor aux	14.2	14.2	
Manoeuvring NOx emissions, tonne per year	6.95	116.9	
Average emission rate NOx, g s^{-1}	0.221	3.71	
PM Emission factor main , g/kWH	2.4	2.4	
PM Emission factor aux	0.3	0.3	
Manoeuvring PM emissions, tonne per year s^{-1}	0.786	13.2	
Average emission rate PM, g s^{-1}	0.025	0.419	
Hotelling time, hrs	14	24	
Fraction load main engine	0.2	0.2	
Fraction time operating	0.05	0.05	
Fraction load auxiliary	0.4	0.4	
Fraction time operating	1	1	
NOx Emission factor main , g/kWH	13.1	13.1	
NOx Emission factor aux	13.5	13.5	
NOx Hotelling emissions, tonnes per year	31.5	908.1	
Average NOx emission rate, g s^{-1}	1.00	28.8	
PM Emission factor main , g/kWH	0.3	0.3	
PM Emission factor aux	0.3	0.3	
PM Hotelling emissions, tonnes per year	0.703	20.2	
Average PM emission rate, g s^{-1}	0.022	0.642	

2.3.2 Cruise ships

The emissions from cruise ships were estimated using the methods described in the EMEP/EEA air pollutant emission inventory guidebook, 2009. The cruise ships use five cruise terminals: Ocean Terminal, City Terminal, Mayflower Terminal, QE II Terminal and Southampton 104 Terminal. These correspond to berths 49, 101, 106, 38/39 and 104 respectively shown in Fig. 2.5. The ships using each of the terminals were identified from the Port of Southampton Cruise Ship Schedule for 2013. The main engine power for each ship was estimated from its gross tonnage using an empirical formula for passenger ships relating the size of the main engines to the gross tonnage, taken from the EEA guidebook. The emissions for each ship were then calculated assuming the operational duty and emission factors shown in Table 2.5, which are based on the EEA guidance.

The annual emission for each terminal was calculated as the sum of the emissions from ships using each terminal. Table A.2 lists the assumptions made about the operation of the main and auxiliary engines during manoeuvring and hotelling in port and the emission factors used, based on the recommendations in the EEA guidebook. Table 2.5 also shows the calculated annual emissions from manoeuvring and hotelling the cruise ships.

The manoeuvring emissions were represented in the ADMS5 dispersion model as a 45 m deep volume source, covering the part of the dredged channel shown in Fig. 2.5. Emissions from ships using the Mayflower, Southampton104, and City Terminals were allocated to the middle part of the dredged channel shown in Fig. 2.5. Emissions from ships using the QE II and Ocean Terminals were allocated to the lower part of the dredged channel.

The hotelling emissions were represented as point sources located at each of the terminal berths.. Cruise ships were assumed to discharge through 2.8 m diameter stacks at a height 45 m above ground level with a discharge velocity of 2 m s^{-1} and a discharge temperature of 180°C.

Table 2.5 Operating pattern for cruise ships

	Manoeuvring	Hotelling
Time, hrs	1	14
Fraction load maximum continuous rating	0.2	0.2
Fraction time operating	1	0.05
Fraction load auxiliary engine continuous rating	0.5	0.4
Fraction time operating	1	1
Ratio Auxilary/Main	0.16	0.16
NOx Emission factor main engine, g/kWh	14	13.1
NOx Emission factor auxiliary engines	14.2	13.5
PM Emission factor main engine, g/kWh	2.4	0.3
PM Emission factor auxiliary engines	0.3	0.3
Total NOx emission, tonnes per year	82.0	290.1
Total PM emission, tonnes per year	10.5	6.47

2.3.2.1 Vehicle carriers, Ro-Ro and general cargo ships

Vehicle carriers and Ro-Ro ships, for the import and export of vehicles, make up the majority of the other ships using the Port of Southampton. The Port of Southampton web site provided details of expected arrivals for the period 2-6 March 2013. The web site provided details of the deadweight tonnage of each ship and the berth allocated to the ship. It was assumed that this period was representative of the types of ship using the port and the berth allocation. The gross tonnage of each ship was obtained from the marinetraffic.com website. The main engine power for each ship was estimated from its gross tonnage using an empirical formula for Ro-Ro ships relating the size of the main engines to the gross tonnage, taken from the EEA guidebook. The emissions for each ship were then calculated assuming the operational duty and emission factors shown in Table 2.6, which are based on the EEA guidance.

The total deadweight tonnage of general cargo ships using the port in 2011 was 21.9 million DWT (Department for Transport Port Statistics Table 0603). This was a factor of 72.8 times the deadweight tonnage of the ships during the sample period: the emissions were scaled using this factor.

The manoeuvring emissions were represented in the ADMS5 dispersion model as a 45 m deep volume source, covering part of the dredged channel shown in Fig. 2.5. Emissions from ships using berth numbers less than 100 were allocated to the lower part of the dredged channel shown in Fig 2.5. Emissions from ships using berth numbers 101-106 were allocated to the middle part of the dredged channel. Emissions from ships at berth numbers 107 upwards were allocated to the upper part of the dredged channel.

The hotelling emissions were represented as point sources located at each of the berths.. The emissions were assumed to discharge through stacks with heights in the range 25-45 m and diameters in the range 0.5-2 m depending on the size of the ship. A discharge velocity of 2 m s^{-1} and a discharge temperature of 180 ºC were assumed in each case.

Table 2.6: Operating pattern for Vehicle carriers, Ro-Ro and general cargo ships

Parameter	Manoeuvring	Hotelling
Time, hrs	1	15
Fraction load maximum continuous rating	0.2	0.2
Fraction time operating	1	0.05
Fraction load auxiliary engine continuous rating	0.5	0.4
Fraction time operating	1	1
Ratio Auxilary/Main	0.16	0.16
NOx Emission factor main engine, g/kWh	14	13.1
NOx Emission factor auxiliary engines	14.2	13.5
PM Emission factor main engine, g/kWh	2.4	0.3
PM Emission factor auxiliary engines	0.3	0.3
Total NOx emission, tonnes per year	81.6	309.3
Total PM emission, tonnes per year	11.0	7.26

2.3.3 Container handling operations

DP World manages the container handling operations at the Port of Southampton. Fig. 2.5 shows the location of the main area of container handling and storage operations. Electric-powered gantry cranes load the containers on and off the ships. Straddle carriers and other non-road mobile equipment are used to move the containers around the container handling area. The straddle carriers consume approximately 90% of the fuel used at the site. DP World provided details of annual fuel consumption for the non-road mobile equipment and an age breakdown of the straddle carriers. The annual emissions were calculated from the fuel consumption using the EEA/EMEP Emission Inventory guidebook Tier 2 emission factors for non-road diesel engines shown in Table 2.7.

Table 2.7: Non-road emission factors

EC Stage	Date of implementation	NOx emission factor kg/tonne	PM emission factor. Kg/tonne
Pre Stage II	Pre 2002	31.1	0.967
Stage II	January 2002	22.1	1.031
Stage IIIA	January 2006	16.4	0.957

The container handling operations were represented in the ADMS5 dispersion model as a volume source, 6 m deep covering the area shown in Fig. 2.5.

2.3.4 Container transfer areas

All HGVs arriving at the container port are required to use the Vehicle Booking System to pre-book the transfer/pickup of containers. Vehicles park up at a pre-entry park before being directed to one of three transfer areas or to the empty park area, shown in Fig. 2.5. Vehicles initially park up in the transfer areas to wait to be unloaded/loaded. They are then required to reverse into the area of crane operation before loading or unloading. The vehicles then drive away from the crane. Drivers are instructed to turn the engines off whenever possible.

DP World provided details of the number of HGVs travelling to each transfer area. The emissions were calculated assuming that HGVs ran their engines typically for 4 minutes at the Empty Park and Transfer areas and 2 minutes at the pre-entry park. The calculations assume emission rates based on Defra's Emission Factor Toolkit v 5.2 emission factors for the 2011 national fleet of articulated lorries for a speed of 11 kph:

- 166 g veh-h^{-1} NOx
- 3.03 g veh-h^{-1} $PM_{2.5}$
- 20.5 kg veh-h^{-1} CO_2

The container transfer areas were represented in the ADMS5 dispersion model as a volume source, 3 m deep covering the area shown in Fig. 2.5.

2.3.5 Container lorry movements

Container lorries travel from the A35/A33 roundabout along First Avenue to Dock Gate 20 and then into the container terminal. Container lorries travel from the container terminal entrance to the transfer areas along internal roadways within the container terminal (Fig. 2.5). It was assumed that each lorry travelled from and to the container terminal entrance each time it visited one of the transfer areas: this may overestimate the distance travelled by lorries making multiple transfers. Ricardo-AEA's LADSUrban dispersion model was used to predict the contribution to pollutant concentrations from these vehicles assuming a speed of 40 kph. Slower speeds of 10 kph were assumed on the approaches to Dock Gate 20 and the A35/A33 roundabout.

2.3.6 Vehicle import/export

Total vehicle exports through the Port of Southampton in 2011 numbered 362,000: total imports numbered 150,000 (Department for Transport Port Statistics Table 0445). For this assessment, it was conservatively assumed that all vehicles were transported by road, with 6 vehicles per road transporter lorry. It was also assumed that the imports would be carried on the return journeys so that a total of 165 transporters per day come to the port. It was then assumed that the transporters would deliver to the Western and Eastern docks in proportion to the Gross Tonnage of Ro-Ro and Motor Vehicle ships using berths in these docks. The vehicles were allocated to the vehicle delivery road links shown in Fig. 2.5. Ricardo-AEA's LADSUrban dispersion model was used to predict the contribution to pollutant concentrations from these vehicles in 2011 assuming a speed of 40 kph.

2.3.7 Rail terminals

Freightliner operates two rail terminals in the Port of Southampton. The Maritime terminal is the most westerly of the three terminals shown in Fig. 2.5. The Millbrook terminal is the middle one. DB Schenker operates the third terminal -the Herbert Walker terminal. There are 11 services per day during the week at the Maritime terminal, with 4 per day at the weekend. There are also 4 services per weekday at both the Millbrook and Herbert Walker terminals. For this assessment, it has been assumed that each service is associated with 2 hours shunting time at the terminal. The assessment assumes fuel use of 90.9 kg/h for shunting operations and emission factors of 39.9 kg $tonne^{-1}$ for NO_x and 1.0 kg $tonne^{-1}$ $PM_{2.5}$ taken from the EEA Air pollutant Emission Inventory guidebook, 2009.

The rail terminals were represented in the ADMS5 dispersion model as volume sources, 5 m deep covering the areas shown in Fig. 2.5.

2.3.8 Mainline railway

Mainline trains between Southampton and Bournemouth and between Southampton and Salisbury run parallel with the Western Approach road between the port area and the road. Table 2.8 shows the numbers of passenger trains travelling along the line per day.

The trains mostly consist of railcar units. The assessment assumes fuel consumption of 53.6 kg h^{-1}(EEA emissions inventory guidebook) and a speed of 80 kph. It assumes emission factors of 39.9 kg $tonne^{-1}$ for NO_x and 1.0 kg $tonne^{-1}$for $PM_{2.5}$ (EEA emissions inventory guidebook).

The mainline railway links were modelled as curved line sources within Ricardo-AEA's LADSUrban dispersion model.

Table 2.8: Frequency of passenger trains.

Direction	Monday-Friday	Saturday	Sunday	Weekly Total
Bournemouth - Southampton	67	61	40	436
Southampton-Bournemouth	79	77	44	516
Southampton-Salisbury	40	38	30	268
Salisbury-Southampton	40	40	32	272
Total				1492

2.3.9 Modelled contributions to NOx

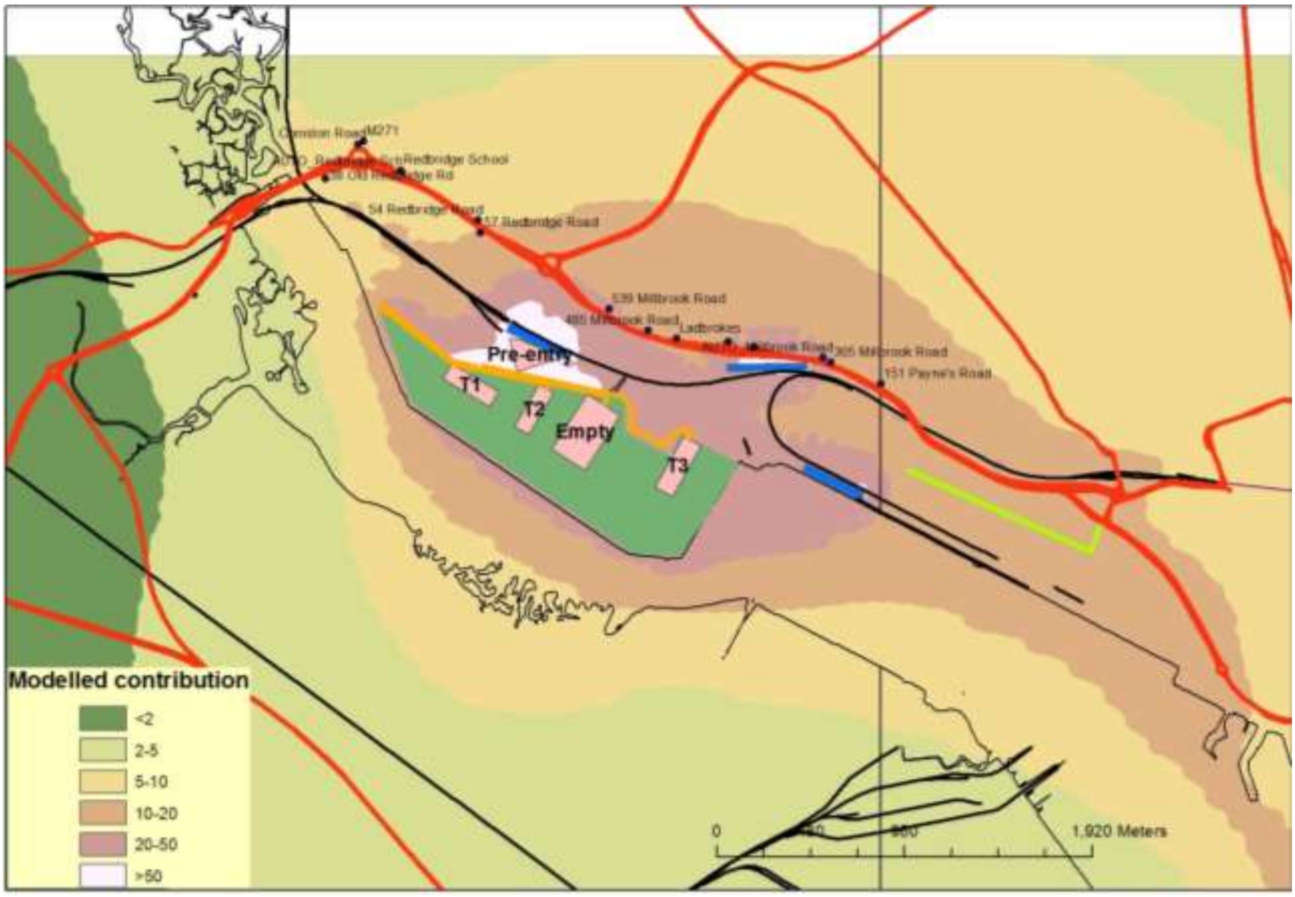
Table 2.9 shows the modelled contribution to oxides of nitrogen concentrations at the locations of diffusion tubes close to the Western Approach Road. This highlights that ships hotelling is the most significant source of emissions at the Port. . Fig. 2.6 shows a map of the modelled contribution to oxides of nitrogen concentrations.

Table 2.9: Modelled contribution to oxides of nitrogen concentrations at NO_2 monitoring sites, µg m^{-3}

Receptor name	Contribution to oxides of nitrogen concentrations, µg m^{-3}									
	Ships hotelling	Ships manoeuvring	Container handling	HGV container transfer	Rail terminals	Container lorries in container terminal	Vehicle delivery lorries	Mainline railways	Container lorries on dock road	total
M271	2.9	0.7	0.7	0.1	0.3	0.1	0.0	0.4	0.1	5.2
Coniston Road	3.0	0.7	0.7	0.1	0.2	0.1	0.0	0.4	0.1	5.2
38 Old Redbridge Rd	3.2	0.7	0.8	0.1	0.2	0.1	0.0	1.1	0.1	6.1
Redbridge School	3.1	0.8	0.9	0.1	0.4	0.1	0.0	0.4	0.1	5.9
AUTO_Redbridge School	3.1	0.8	0.9	0.1	0.4	0.1	0.0	0.4	0.1	6.0
54 Redbridge Road	3.9	1.0	1.5	0.3	0.9	0.4	0.0	0.4	0.3	8.7
57 Redbridge Road	4.1	1.1	1.7	0.3	1.1	0.5	0.0	0.5	0.4	9.6
539 Millbrook Road	7.4	1.9	3.7	0.9	4.2	0.8	0.0	0.5	0.7	20.0
485 Millbrook Road	7.7	2.3	4.1	0.7	2.0	0.8	0.0	0.6	0.3	18.4
Ladbrokes	7.7	2.4	3.9	0.6	1.5	0.6	0.0	0.6	0.2	17.5

Receptor name	Contribution to oxides of nitrogen concentrations, µg m^{-3}									
	Ships hotelling	Ships manoeuvring	Container handling	HGV container transfer	Rail terminals	Container lorries in container terminal	Vehicle delivery lorries	Mainline railways	Container lorries on dock road	total
Regent`s Park Junction	7.3	2.5	3.1	0.4	3.2	0.4	0.0	0.6	0.1	17.6
367A Millbrook Road	7.2	2.6	2.9	0.3	7.1	0.3	0.0	0.9	0.1	21.3
AUTO_Millbrook Road	6.5	2.7	2.1	0.2	5.2	0.2	0.0	1.4	0.1	18.4
151 Payne`s Road	6.2	3.2	1.5	0.1	1.4	0.1	0.0	1.6	0.0	14.2
303 Millbrook Road	6.5	2.8	2.0	0.2	3.6	0.1	0.0	1.7	0.1	16.9

Figure 2.6: Modelled contribution to oxides of nitrogen concentrations



2.4 NO_2 concentrations from all sources

2.4.1 Model verification

In order to check that the model is representing NO_2 concentrations accurately we have carried out a model verification exercise where we have checked the model predictions against the local measurements.

This is done by first back calculating the contribution of local roads to measured NOx concentrations at the measurement sites. This provides a road NOx value with which we can compare our modelled road NOx predictions from ADMS Roads. It is important to perform the back calculation in the context of contributions from other local sources. We assume the modelled concentrations from the port and railway plus the regional background value of 20.1µg.m^{-3} to account for all other sources not modelled discretely in this study are fixed- only the modelled road NOx are adjusted to account for any overall model underprediction between modelled and measured NO_2 results.

In practice there is bound to be some uncertainty in both the background NOx values in the Defra maps and the modelled port contributions. However, it is only possible in practice to verify and tune the model by adjusting the contributions of a single source, in this instance the road traffic around the Western Approach.

The model was verified and adjusted by plotting modelled road NOx against back calculated measured road NOx. We then conducted a regression analysis of the two variables and derived the slope of the line which was used as a scaling factor that was then applied to all road NOx values. Once adjusted the road NOx emissions were added to the background, port and rail concentrations, before deriving the NO_2 concentrations arising from all of these sources.

The model verification exercise yielded an adjustment factor of 1.37 which represents quite good agreement given that the road sources are assumed to carry all of the underestimation in the study. This value was used to scale all modelled road NOx predictions upwards- the regression plot is shown in Figure 2.7 below.

Figure 2.7: Modelled vs measured Road NOx (road only sources, $\mu g.m^{-3}$)

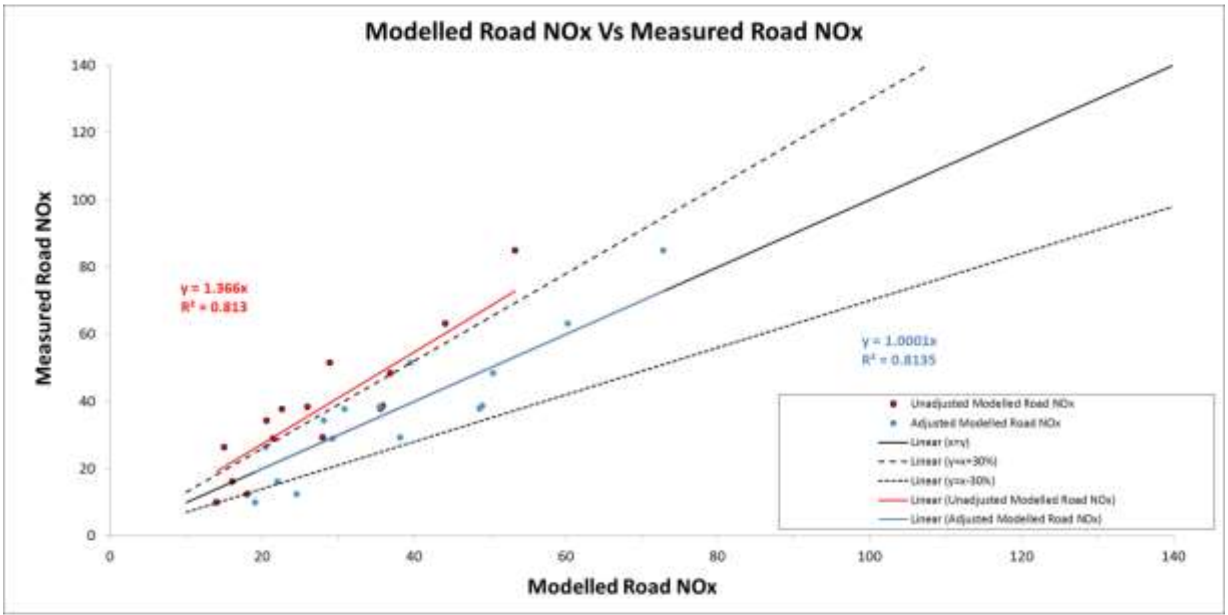


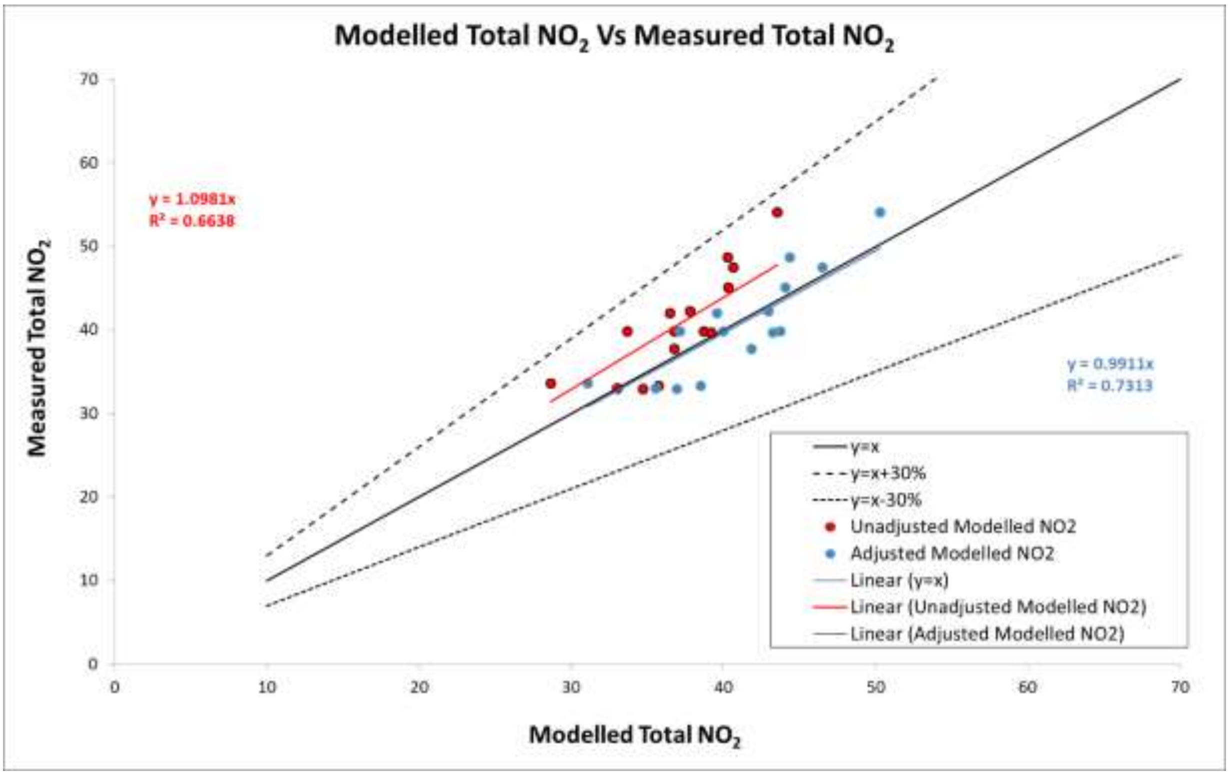
Table 2.10 and Figure 2.8 below shows the model agreement in terms of measured NO_2 vs modelled total NO_2 when all sources are summed in the model. The model underpredicted by around 10% prior to adjustment of the road NOx concentrations. After adjustment the model agrees well with the local measurements and has a Root Mean Square Error value of 3.2$\mu g.m^{-3}$. This is well within the recommended value of 4$\mu g.m^{-3}$ suggested in LAQM.TG(09).

Table 2.10: Measured vs modelled concentrations of NO_2 at SCC monitoring locations (all sources, $\mu g.m^{-3}$)

Location	Measured NO_2	Modelled NO_2
M271	54.1	50.3
Coniston Road	37.7	41.8
38 Old Redbridge Rd	33.6	31.1
Redbridge School	42.2	43.0
AUTO Redbridge School	47.5	46.5
54 Redbridge Road	39.8	43.7
57 Redbridge Road	39.8	37.1

Location	Measured NO_2	Modelled NO_2
539 Millbrook Road	32.9	36.9
485 Millbrook Road	33.3	38.5
Ladbrokes	39.8	40.0
Regent`s Park Junction	42.0	40.0
367A Millbrook Road	45.1	44.1
AUTO Millbrook Road	48.7	44.4
151 Payne`s Road	33.0	35.6
305 Millbrook Road	39.7	43.2
	RMSE= 3.2 µg.m^{-3}	

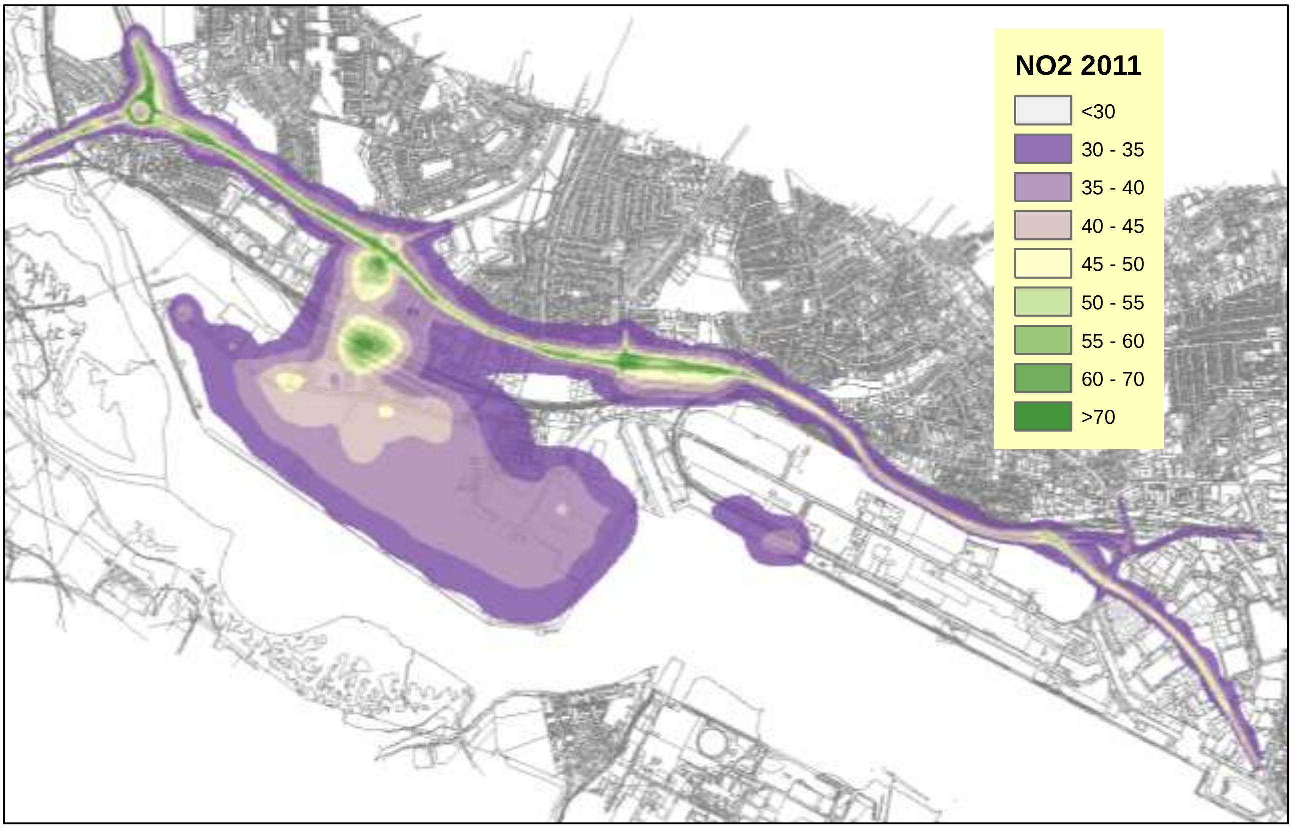
Figure 2.8 Modelled vs measured NO_2 (all sources, µg.m^{-3})



2.4.2 NO_2 dispersion plots

Once good model agreement had been established we plotted the total NO_2 concentration field across the whole model domain, yielding the plot provided in Figure 2.9 below. The plot was derived by summing the NO_2 rasters for each of the sources in the Spatial Analyst tool in ArcMap 10 at a resolution of 5m. The plot shows the influence of the road, rail and port sources included in the model on local NO_2 concentrations. We explore the relative contribution of each of these sources at SCC's measurement sites later in this report.

Figure 2.9 Total modelled NO_2 within the model domain (all sources, µg.m^{-3})



To better outline the annual mean NO_2 concentration profiles along the Western Approach we have prepared contour line plots that show the 40µg.m^{-3} concentration line, along with 37 and 43 µg.m^{-3} to reflect the error in the model (RMSE was 3 µg.m^{-3}). As before the plots show clearly the relative influence of the roadways, railway, and port emissions across the model domain. Figures 2.10 to 2.15 show NO_2 contour lines for the different parts of the modelled area.

Figure 2.10 Close up view of M271/ Redbridge Road Junction- modelled NO_2 contours (all sources, µg.m^{-3})

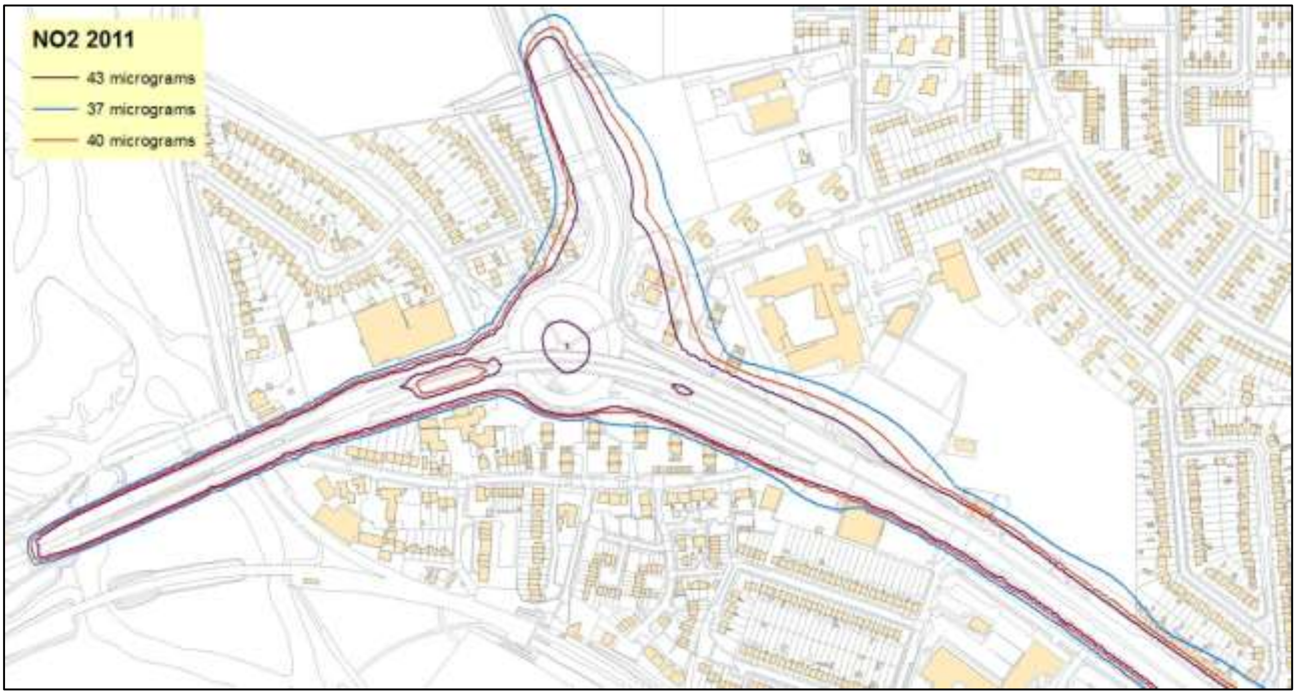


Figure 2.11 Close up view Redbridge Road - modelled NO_2 contours (all sources, µg.m^{-3})

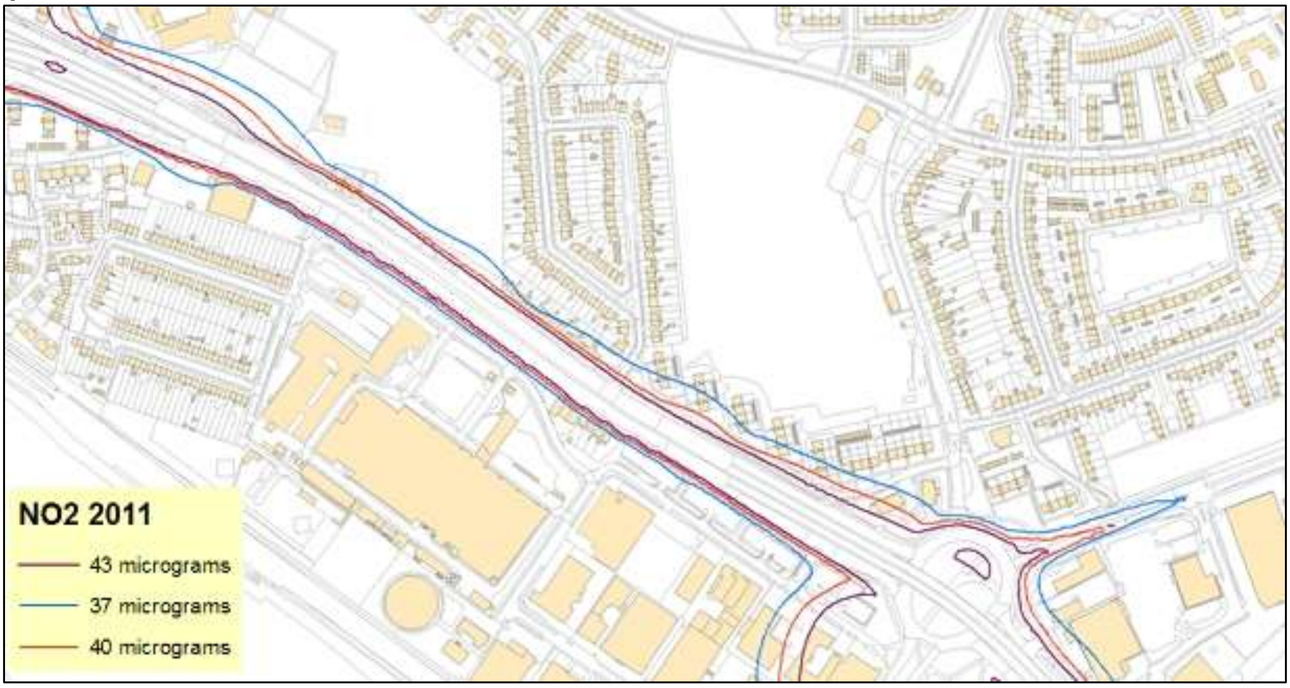


Figure 2.12 Close up view Port area and Millbrook Road- modelled NO_2 contours (all sources, µg.m^{-3})

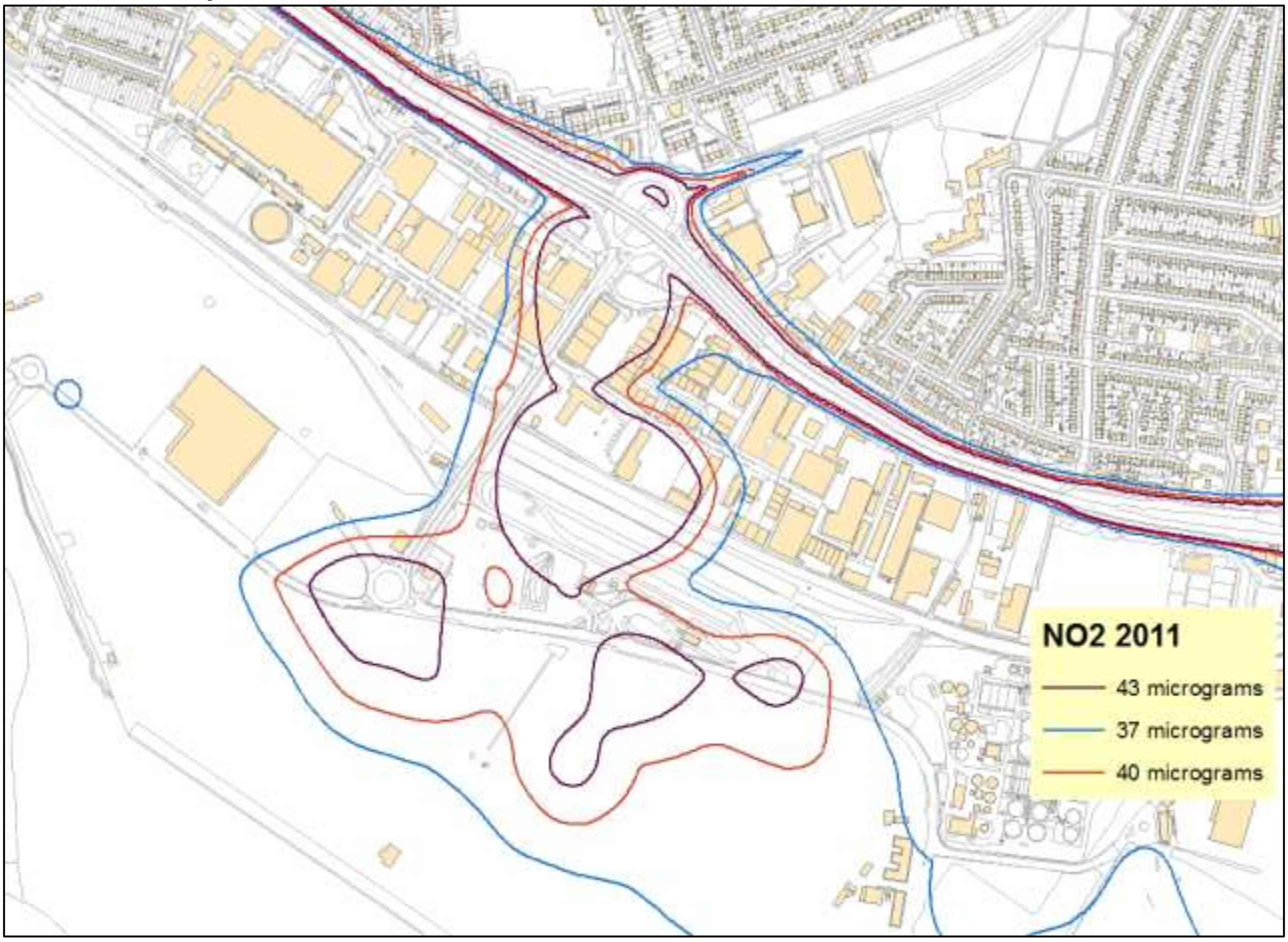


Figure 2.13 Close up view Millbrook Road near Railway- modelled NO_2 contours (all sources, µg.m^{-3})

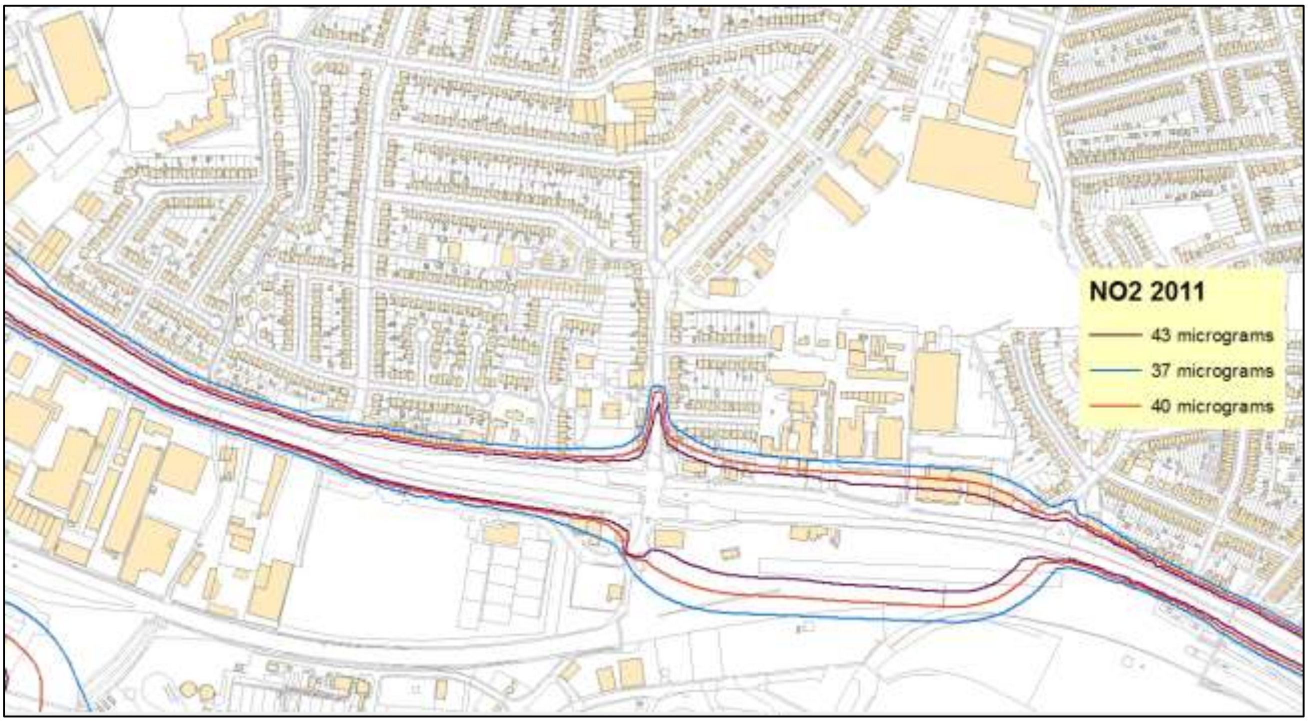
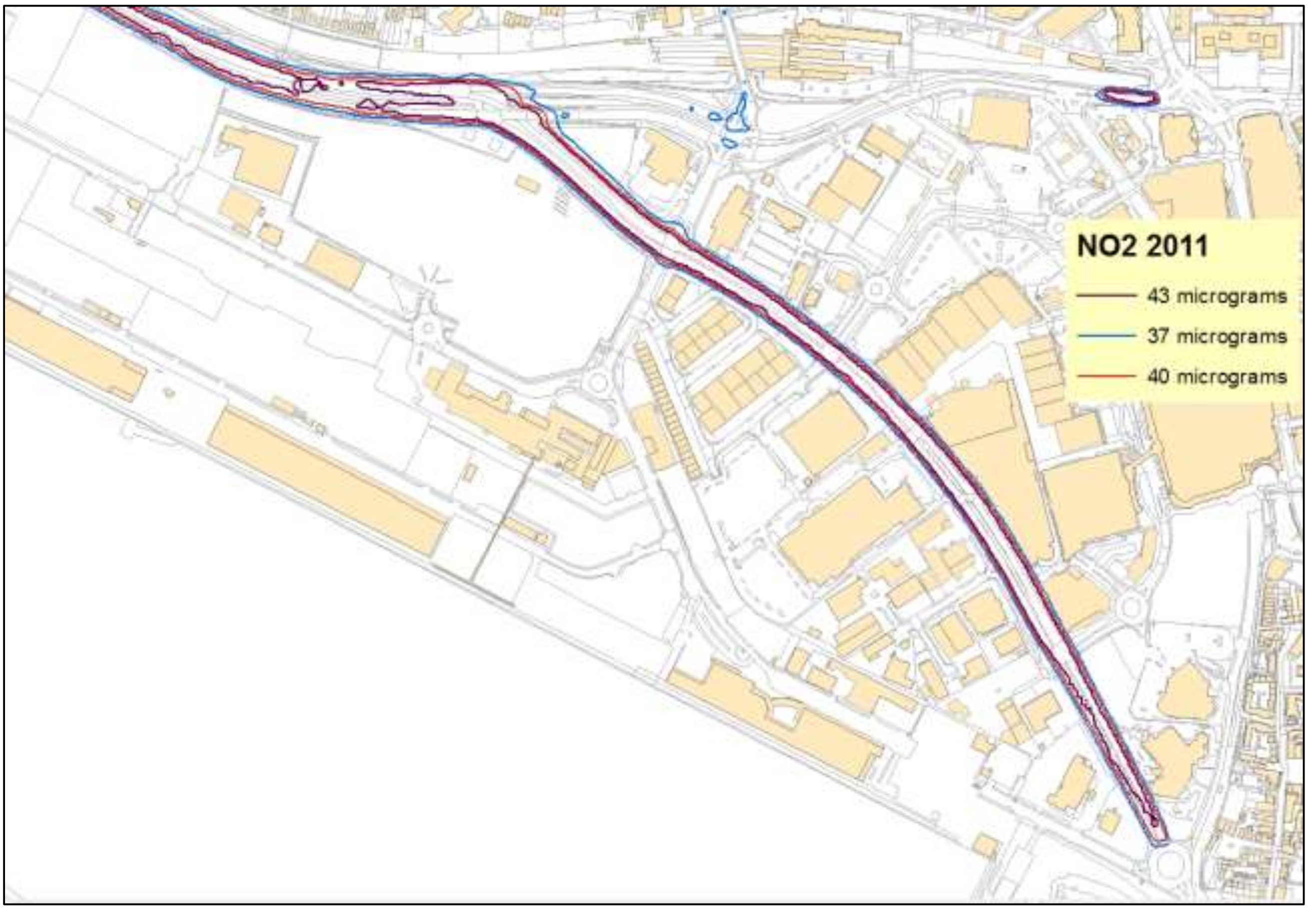


Figure 2.14 Close up view Mountbatten Way- modelled NO_2 contours (all sources, µg.m^{-3})

Figure 2.15 Close up view West Quay Rd- modelled NO_2 contours (all sources, $\mu g.m^{-3}$)



2.4.3 Source apportionment

To better understand the relative contributions from the various source types in the model domain we have carried out a source apportionment of NOx concentrations at each of the monitoring locations used in this assessment. LAQM.TG(09) recommends conducting source apportionment of NOx rather than NO_2.

The results of this in terms of microgram contributions from each location are shown in Table 2.11 below. Percentage contributions at the same locations are provided in Table 2.12. Note that the total NOx in is the product of either 1+2+3, or 1+2+4+5+6+7- this reflects the relative contributions from the different vehicle classes within the road fleet.

Table 2.11: Source apportionment of NOx at SCC monitoring locations ($\mu g.m^{-3}$)

Location	Total Modelled NOx	Mapped Background NOx (1)	Port activities and rail NOx (2)	Road NOx (3)	Car NOx (4)	HGV NOx (5)	Bus NOx (6)	LGV NOx (7)
M271	99.0	20.1	5.2	73.7	19.6	44.8	2.2	7.2
Coniston Road	74.1	20.1	5.2	48.7	14.6	27.1	2.1	4.9
38 Old Redbridge Rd	46.7	20.1	6.1	20.5	8.2	8.1	1.5	2.6
Redbridge School	76.9	20.1	5.9	50.9	17.5	24.5	3.3	5.6
AUTO_Redbridge Sch	86.9	20.1	6.0	60.8	20.7	29.6	3.9	6.6
54 Redbridge Road	78.1	20.1	8.7	49.4	18.0	22.8	3.0	5.6
57 Redbridge Road	60.6	20.1	9.6	30.9	11.2	14.4	1.8	3.5

Location	Total Modelled NOx	Mapped Background NOx (1)	Port activities and rail NOx (2)	Road NOx (3)	Car NOx (4)	HGV NOx (5)	Bus NOx (6)	LGV NOx (7)
539 Millbrook Road	59.1	20.1	20.0	19.1	8.5	6.1	1.5	2.9
485 Millbrook Road	63.0	20.1	18.4	24.5	11.6	6.9	2.0	3.9
Ladbrokes	67.0	20.1	17.5	29.4	13.0	9.2	2.7	4.4
Regent`s Park Junction	65.8	20.1	17.6	28.2	11.0	10.9	2.5	3.8
367A Millbrook Road	76.9	20.1	21.3	35.6	15.8	11.2	3.2	5.4
AUTO_Millbrook Road	78.0	20.1	18.4	39.5	14.2	10.1	10.4	4.8
151 Payne`s Road	56.3	20.1	14.2	22.0	10.7	5.7	1.9	3.6
303 Millbrook Road	75.6	20.1	16.9	38.6	15.7	8.9	8.6	5.4

Table 2.12 Source apportionment of NOx at SCC monitoring locations (% of total modelled NOx)

Location	Background contribution % (1)	Port and rail contribution % (2)	Road contribution % (3)	Cars % (4)	HGV % (5)	Bus % (6)	LGV % (7)
M271	20.3	5.3	74.5	19.8	45.3	2.2	7.2
Coniston Road	27.1	7.1	65.8	19.7	36.6	2.9	6.7
38 Old Redbridge Rd	43.0	13.2	43.8	17.7	17.3	3.2	5.6
Redbridge School	26.1	7.7	66.2	22.8	31.8	4.3	7.2
AUTO_Redbridge Sch	23.1	6.9	70.0	23.9	34.1	4.5	7.6
54 Redbridge Road	25.7	11.1	63.2	23.1	29.2	3.8	7.2
57 Redbridge Road	33.1	15.8	51.0	18.4	23.8	3.0	5.8
539 Millbrook Road	34.0	33.8	32.2	14.4	10.4	2.5	4.9
485 Millbrook Road	31.9	29.3	38.9	18.4	11.0	3.2	6.2
Ladbrokes	30.0	26.1	43.9	19.4	13.8	4.1	6.6
Regent`s Park Juncti	30.5	26.7	42.8	16.7	16.5	3.8	5.8
367A Millbrook Road	26.1	27.7	46.2	20.5	14.5	4.2	7.0
AUTO_Millbrook Road	25.7	23.6	50.6	18.2	12.9	13.3	6.2
151 Payne`s Road	35.6	25.3	39.1	19.0	10.2	3.5	6.5
303 Millbrook correct	26.6	22.4	51.0	20.8	11.8	11.3	7.1

As can be seen, the main source of NOx across the domain is the local road network though there is quite marked spatial variation at different locations along the road. Generally speaking the local roads are the dominant NOx source at the east and west of the model area, with the port being almost as important near the centre of the domain around Millbrook Road. This finding has implications for any abatement measures that may be planned for the area- clearly the port is an important source of NOx and any abatement in this area could deliver tangible benefits to NO_2 concentrations on Millbrook Road.

To further illustrate the spatial variation in the relative source contributions, the pie charts in Figures 2.16 to 2.18 below show the split of NOx sources at the two automatic monitoring stations at Redbridge Road and Millbrook Road, and also at the diffusion tube monitoring location at 539 Millbrook Road. Note that the port contribution also includes the railway. The further illustrate the spatial sensitivity of NOx concentrations to the main local source types, Figure 2.19 shows the contribution of each (road, port+rail, background) overlaid on a GIS plot of the area.

Figure 2.16 Redbridge Road auto site source apportionment (% of modelled NOx)

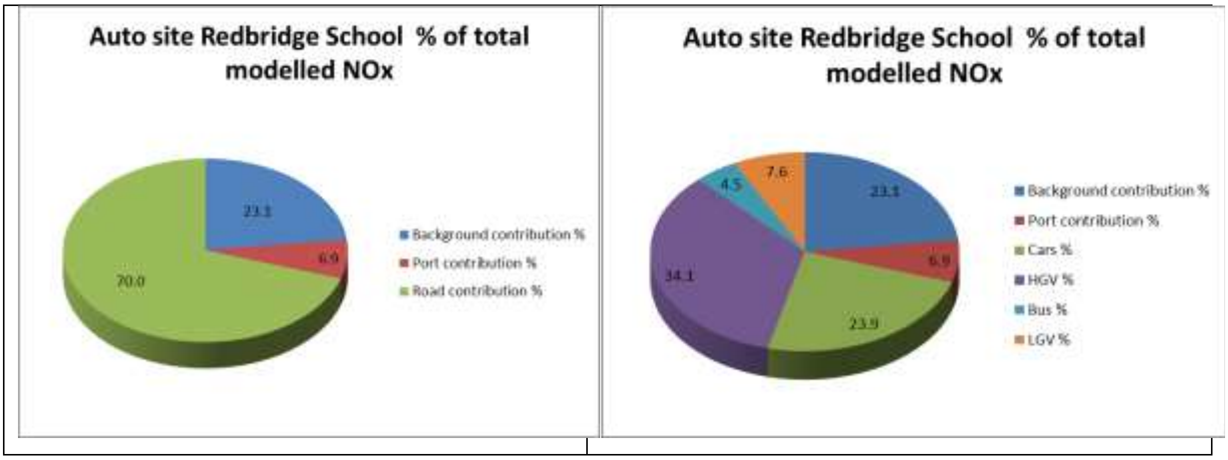


Figure 2.17 Millbrook Road auto site source apportionment (% of modelled NOx)

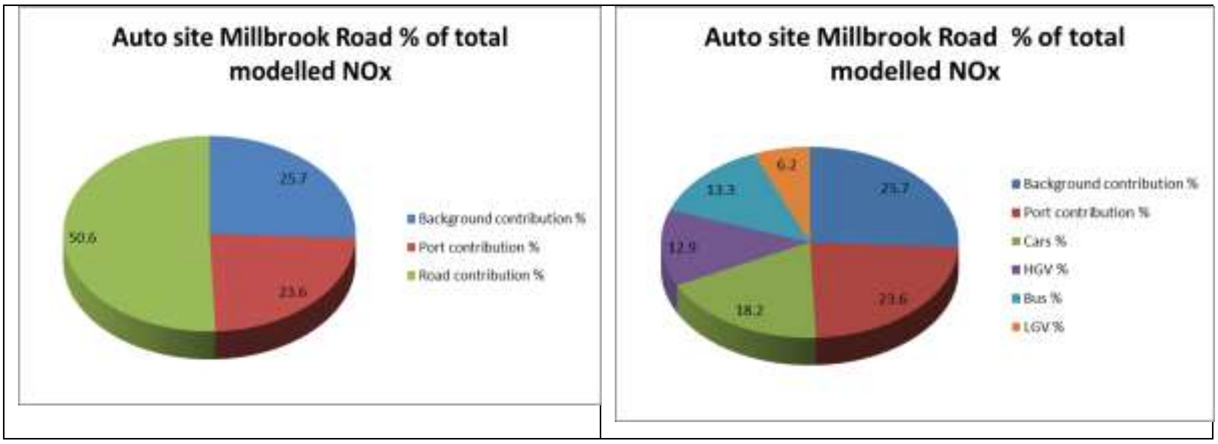


Figure 2.18 589 Millbrook Road diffusion tube site source apportionment (% of modelled NOx)

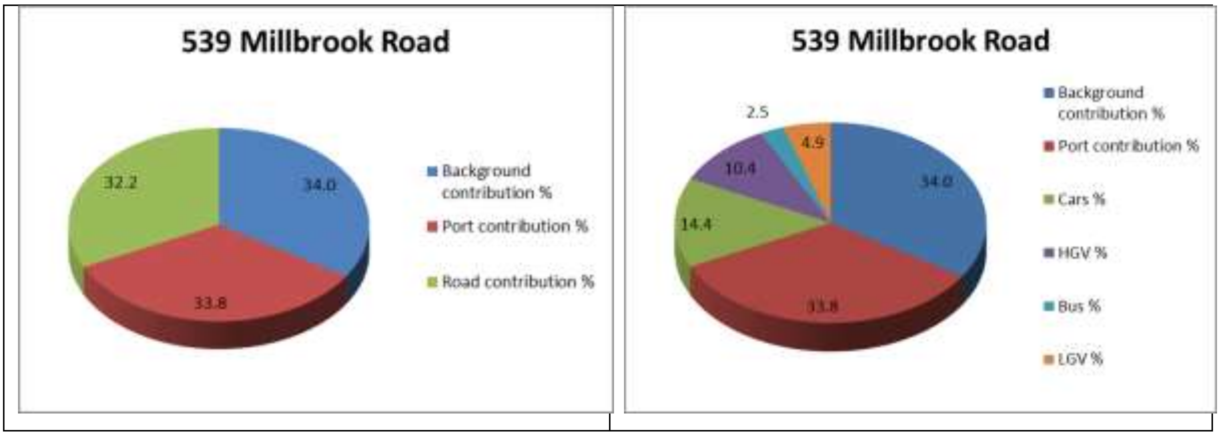
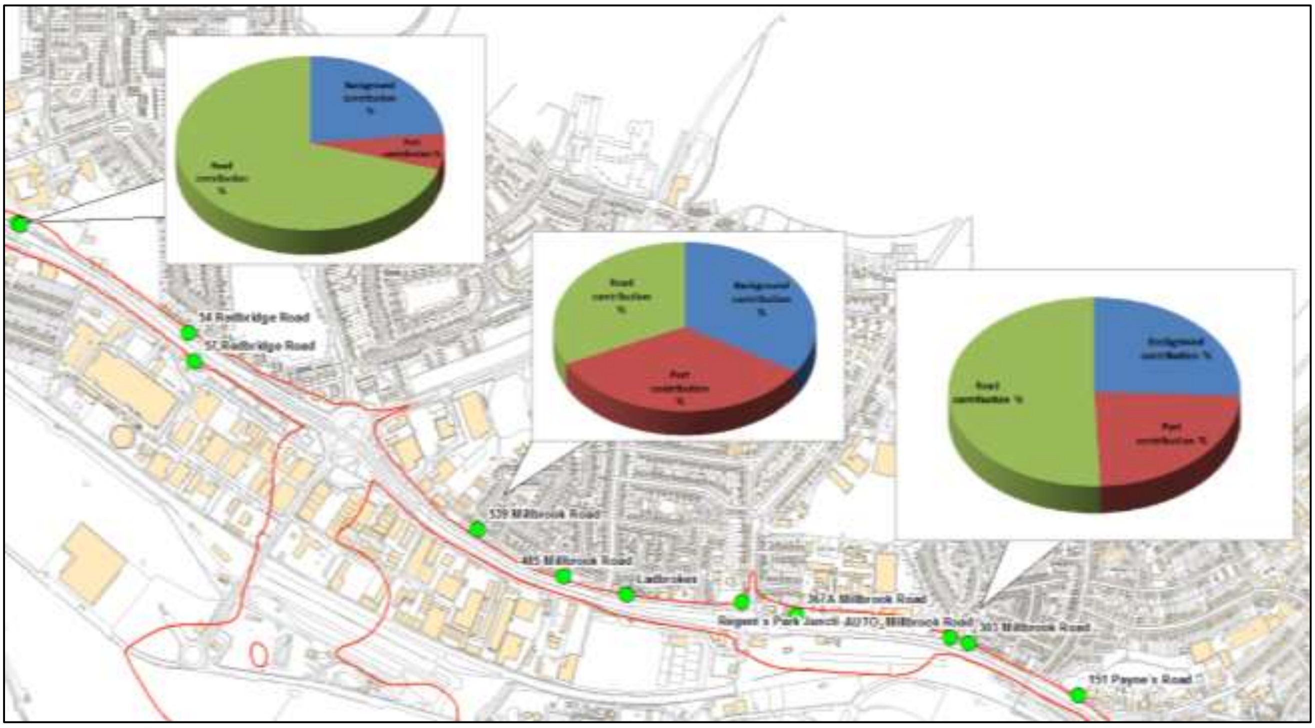


Figure 2.19 Source apportionment at West, Centre and East of Western Approach (% of modelled NOx)



2.5 Emission reduction scenario

It is our understanding that there are no feasible options for a LEZ restricted to the Western Approach area and SCC are now interested in pursuing a wider ranging Low Emissions Strategy (LES) for the whole city. Therefore we have not tested any specific LEZ scenarios as these would normally have been selected by the Council for further investigation before modelling.

However, to aid in the decision making process around the city LES we have tested the effect of uptake of Euro 6 light vehicles and Euro VI heavy vehicles in the Western Approach area based on a 2011 baseline. It is recognised that this is an idealised scenario which is in practice unlikely to occur in the short to medium term. That said this analysis provides a useful look at the future which could aid in the development of the LES as Euro 6/VI vehicles will begin entering the fleet very soon. We have started by assuming E6/EVI will deliver all of the benefits predicted by modelling emissions in the EfT- that is to say that 100% of the reduction in NOx between current fleet conditions and a fully Euro 6/fleet is assumed to be accurate. In practice it may be considered unlikely that Euro 6/VI will deliver all of these benefits and it is more likely that there will be a reduction, but perhaps not 100% of that predicted by the EfT.

To test the effect of the new fleet only delivering a proportion of the predicted benefit we have tested the effect of reducing NOx emissions by 25%, 50% and 75% of the full reduction. In this way we explore the sensitivity of local NO_2 concentrations to fleet improvement but present the results as a range rather than an absolute value. This analysis can also be interpreted as a scenario analysis whereby 25, 50, 75 and 100% of current vehicles are replaced by Euro 6 and Euro VI.

2.5.1 Emissions

The EfT allows the user to specify the Euro split of the fleet which is then used as a parameter in the emissions modelling that follows. In this instance we have simply taken the default UK fleet data that was used in the baseline modelling and applied an “all Euro 6” scenario to the light fleet, and an “all Euro VI” scenario to the heavy fleet.

We have prepared an emissions inventory for all road links in the modelling based on the 2011 fleet (about 17km of road links), and then specified the more modern fleet to test the overall effect on emissions. The results of this analysis are shown in Table 2.13 below.

Table 2.13 Road source emissions inventory, kg/yr NOx

	Total Road NOx	Total LDV NOx	Total HDV NOx
2011 NOx (kg/yr)	74306	39459	34847
2011 NOx Euro6, Euro VI (kg/yr)	14952	11154	3799
% reduction in 2011	80	72	89

As can be seen the reductions in road emissions compared to the baseline are quite large at about 80% of total road NOx emissions. Obviously the effect this would exert on NO_2 concentrations at specified locations will differ according to how important road sources are there (see source apportionment). But generally speaking and as one would expect, large reductions in road NOx are currently predicted with full uptake of Euro 6 and Euro VI vehicles.

Next we looked at the reductions associated with these scenarios on a link by link basis to assess how variable the predicted reduction is across the Western Approach. This will obviously be influenced by the fleet mix on each link but in this instance we have used an average reduction value calculated across all links which is applied at the monitoring locations to scale the modelled NO_2 concentrations. The reductions in NOx emissions associated with full uptake of Euro 6/Euro VI was between 69 to 87% across all modelled links, with a mean value of 79%.

Full uptake of Euro VI by heavy vehicles in Southampton is estimated to result in an average reduction in total road NOx of 36%. Full uptake of Euro 6 by light vehicles is estimated to result in an average road NOx reduction of 43% across the roads along the Western Approach.

2.5.2 Concentrations

We have applied these average NOx reductions (and proportions thereof) to the modelled NO_2 concentrations across the Western Approach using Defra's NOx:NO_2 model used previously. First we assume varying proportions of both heavy and light vehicles adopt Euro VI and Euro 6. Next, we apply the light vehicle specific average NOx reduction leaving the heavy vehicle NOx emissions the same, and then vice versa for Euro VI. The results of the analysis are provided in Tables 2.14 to 2.16.

Table 2.14 NO_2 concentrations assuming 25, 50, 75 and 100% of vehicles Euro 6 and Euro VI, µg.m^{-3}

Location	*NO_2 Baseline (modelled)*	*NO_2 25% Euro 6/ Euro VI*	*NO_2 50% Euro 6/ Euro VI*	*NO_2 75% Euro 6/ Euro VI*	*NO_2 100% Euro 6/ Euro VI*
M271	**50.3**	**45.6**	**40.3**	34.5	28.2
Coniston Road	**41.8**	38.2	34.3	30.2	25.8
38 Old Redbridge Rd	31.1	29.3	27.5	25.6	23.6
Redbridge School	**43.0**	39.4	35.3	31.1	26.5
AUTO_Redbridge Sch	**46.5**	**42.4**	37.8	32.8	27.5
54 Redbridge Road	**43.7**	**40.2**	36.3	32.2	27.8
57 Redbridge Road	37.1	34.6	32.0	29.3	26.5
539 Millbrook Road	36.9	35.3	33.6	32.0	30.2
485 Millbrook Road	38.5	36.4	34.4	32.2	30.0

Location	NO_2 Baseline (modelled)	NO_2 25% Euro 6/ Euro VI	NO_2 50% Euro 6/ Euro VI	NO_2 75% Euro 6/ Euro VI	NO_2 100% Euro 6/ Euro VI
Ladbrokes	40.0	37.7	35.2	32.7	30.0
Regent`s Park Junction	39.6	37.3	35.0	32.5	30.0
367A Millbrook Road	**44.1**	**41.4**	38.5	35.5	32.4
AUTO_Millbrook Road	**44.4**	**41.4**	38.2	34.9	31.5
151 Payne`s Road	35.6	33.7	31.8	29.8	27.8
303 Millbrook Road	**43.2**	**40.4**	37.3	34.1	30.7
Exceedances in **bold**					

The data above indicates that the very large NOx reductions associated with a fleet entirely comprised of Euro 6 and Euro VI vehicles are enough to achieve the NO_2 annual mean objective at all locations along the Western Approach. The analysis also suggests that if only a proportion of the benefit were achieved in practice, then this would have to be in the order of 50% of the theoretical maximum to achieve compliance (except at the M271 location where a small exceedance is still estimated for the 50% case).

Table 2.15 NO_2 concentrations assuming 25, 50, 75 and 100% of vehicles Euro 6, heavy fleet unchanged from 2011 baseline, µg.m^{-3}

Location	NO_2 baseline	NO_2 25% Euro 6	NO_2 50% Euro 6	NO_2 75% Euro 6	NO_2 100% Euro 6
M271	**50.3**	**47.9**	**45.2**	**42.3**	39.3
Coniston Road	**41.8**	39.9	37.8	35.7	33.6
38 Old Redbridge Rd	31.1	30.1	29.1	28.1	27.1
Redbridge School	**43.0**	**41.1**	39.0	36.8	34.6
AUTO_Redbridge Sch	**46.5**	**44.4**	**42.0**	39.5	36.9
54 Redbridge Road	**43.7**	**41.9**	39.9	37.8	35.6
57 Redbridge Road	37.1	35.8	34.4	33.0	31.5
539 Millbrook Road	36.9	36.0	35.1	34.3	33.3
485 Millbrook Road	38.5	37.4	36.3	35.1	34.0
Ladbrokes	40.0	38.8	37.5	36.1	34.8
Regent`s Park Junction	39.6	38.4	37.1	35.8	34.5
367A Millbrook Road	**44.1**	**42.6**	**41.1**	39.6	38.0
AUTO_Millbrook Road	**44.4**	**42.7**	**41.1**	39.4	37.6
151 Payne`s Road	35.6	34.5	33.5	32.5	31.4
303 Millbrook Road	**43.2**	**41.8**	**40.1**	38.5	36.8
Exceedances in **bold**					

The data above indicates that the NOx reductions associated with a light fleet entirely comprised of Euro 6 vehicles are enough to achieve the NO_2 annual mean objective at all locations along the Western Approach. The analysis also suggests that if only a proportion of the benefit were achieved in practice, then this would have to be in the order of 75% of the theoretical maximum to achieve compliance (except at the M271 location where an exceedance is still estimated for the 75% case).

Table 2.16 NO_2 concentrations with 25, 50, 75 and 100% of heavy vehicles Euro VI, light fleet unchanged from 2011 baseline, µg.m^{-3}

Location	*NO_2 baseline*	*NO_2 25% Euro VI*	*NO_2 50% Euro VI*	*NO_2 75% Euro VI*	*NO2 100% Euro VI*
M271	**50.3**	**48.3**	**46.1**	**43.7**	**41.3**
Coniston Road	**41.8**	**40.2**	38.5	36.8	35.0
38 Old Redbridge Rd	31.1	30.3	29.5	28.6	27.8
Redbridge School	**43.0**	**41.4**	39.7	37.9	36.1
AUTO_Redbridge Sch	**46.5**	**44.8**	**42.8**	**40.7**	38.6
54 Redbridge Road	**43.7**	**42.2**	**40.5**	38.8	37.0
57 Redbridge Road	37.1	36.0	34.8	33.7	32.5
539 Millbrook Road	36.9	36.2	35.4	34.7	33.9
485 Millbrook Road	38.5	37.6	36.6	35.7	34.7
Ladbrokes	40.0	39.0	37.9	36.8	35.7
Regent`s Park Junction	39.6	38.6	37.5	36.5	35.4
367A Millbrook Road	**44.1**	**42.9**	**41.6**	**40.3**	39.0
AUTO_Millbrook Road	**44.4**	**43.0**	**41.6**	**40.2**	38.8
151 Payne`s Road	35.6	34.7	33.8	33.0	32.1
303 Millbrook Road	**43.2**	**42.0**	**40.7**	39.3	37.9
Exceedances in **bold**					

The data above indicates that the NOx reductions associated with a heavy fleet entirely comprised of Euro VI vehicles are enough to achieve the NO_2 annual mean objective at all locations along the Western Approach except at the M271 location. The analysis also suggests that if only a proportion of the benefit were achieved in practice, then this would have to be in the order of 75% of the theoretical maximum to approach compliance at most locations (except at the M271 location where a reasonably large exceedance is still estimated for the 75% case).

As would be expected, the results of this analysis suggest that Euro 6 and Euro VI uptake should result in reduced NO_2 concentrations compared with the 2011 baseline. The scenario which assumes both sectors will adopt the modern Euro standards is estimated to deliver achievement of the NO_2 annual mean objective at all locations along the Western Approach at around 50% uptake (on a 2011 baseline). On the other hand if the light and heavy sectors are treated separately, much larger uptake rates are required (about 75% of light vehicles would need to be Euro 6, and >75% of heavy vehicles would need to be Euro VI to deliver compliance.

Of course it should be borne in mind that LEZ schemes typically do not target private cars, so it is far more practical to consider a scheme which targets only the heavy fleet (trucks and buses). We have taken the LEZ analysis further in the next section and subjected the broad options to economic assessment.

3 Economic assessment

Whilst so far the emissions reduction scenarios modelled for the Western Approach in Southampton are quite broad and are unlikely to happen in the short to medium term, it is useful to perform an economic assessment of the potential air quality changes associated with them nonetheless.

Again we suggest that whilst the analysis will be “blue sky” in nature, it will help gauge the financial effort required to abate NOx from road traffic around the Western Approach. It should be noted that the unit abatement costs we describe would not necessarily fall to Southampton City Council- no distinction is made in government guidance as to where costs of abatement should be apportioned. As the abatement scenarios we have looked at would mainly involve private vehicles, it is likely that most of the cost burden would be felt by vehicle owners faced either with replacing their vehicles or paying to enter a LEZ. That said, there would be an enforcement cost to the Council of any LEZ scheme, and some financial gain from penalty notices. We have made no attempt to ascertain where these costs/gains would ultimately fall as this would necessarily involve detailed LEZ planning with well understood infrastructure requirements which is not available at this time.

However it is possible to estimate the economic implications of a scheme to reduce emissions by following Defra guidance. The UK Government provides the Green Book guidance[14] for assessing proposals that lead to changes in UK air pollution and Defra have published methodological notes to assist air quality practitioners in the process[15].

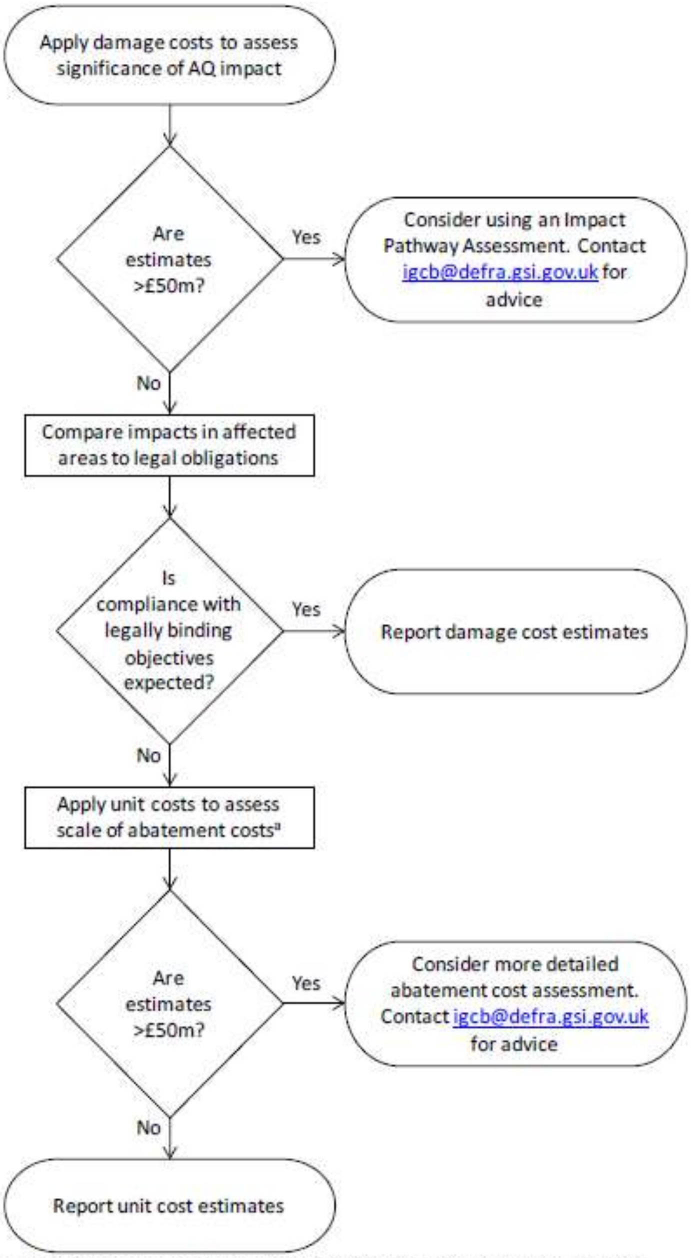
When total air quality impacts are estimated to be less than £50 million (in present value terms) it is recommended that damage costs are used as the basis for appraising a scheme. In addition, when the scheme being assessed is expected to change its compliance status through a scheme it is expected that the cost of abatement is calculated.

Figure 3.1 below shows the HM Treasury staged process that should be followed when performing economic assessment of an air quality scheme.

Figure 3.1- Overview of air quality valuation methodologies (source ref 16)

---

[14] HM Treasury, Valuing impacts on air quality: May 2013 Supplementary Green Book guidance
[15] Defra, Air Quality Damage Cost Guidance, February 2011



[a]Only emissions that occur above the legal obligation should be valued using unit costs. Emissions below this level should be valued using damage costs.

3.1.1 Damage and abatement costs

Damage costs are the cost of the damage from pollution levels to health and the environment (e.g.includes monetisation of mortality and hospital admissions). Abatement costs are the cost of the abatement needed to reduce the pollution levels to below legistiive standards (i.e. to achieve compliance with standards). Defra's Interdepartmental Group on Costs and Benefits (IGCB) provides advice relating to the quantification and valuation of local environmental impacts[16]. The Group has recommended different methodologies for valuing changes in air quality, depending on the circumstances. The Group recommends the abatement cost approach where pollutant concentrations exceed legally binding obligations. Annual mean nitrogen dioxide concentrations exceed the EU limit value of 40 µg m^{-3} at several monitoring sites along the Western Approach and so this approach is appropriate.

[16] Department for Environment, Food and Rural Affairs. Abatement cost guidance for valuing changes in air quality May 2013

The EU has the option to impose fines on the UK if legally binding obligations, such as the air quality limit value for NO_2, are not met and so remedial actions are needed to restore compliance. Consequently measures, such as Low Emission Schemes that reduce the need for further remedial action can limit financial liabilities. The abatement cost approach recognises this, and values any improvements in air quality, where concentrations exceed limit values, as the cost saved by avoiding other compliance activity.

The IGCB developed a four stage methodology for the abatement cost approach:

1. Estimate the likely scale of the impact on emissions by applying damage costs to the change in emissions. The IGCB have developed a Damage Cost Calculator for this purpose.
2. Identify whether there is expected to be any impact on compliance with legally-binding obligations.
3. Estimate the value of the change in air quality using unit abatement costs, which provide an indicative marginal cost per tonne of emission based on the average marginal abatement technology. This provides an easy to use indicative estimate of the abatement impact.
4. Where a measure is likely to have a significant impact on compliance (suggested as a value greater than £50m) then more detailed analysis may be justified.

In this section of the report we apply the damage cost approach for the following scenarios to estimate the damage costs savings associated with each measure.

1) All HGVs and buses using the Western Approach are Euro V or better from 2014 to 2024
2) All HGVs and buses using the Western Approach are Euro VI from 2014 to 2024

These schemes have not been explored in any detail by SCC so this analysis is presented for illustrative purposes only; the intention is to provide a first estimate of potential costs and benefits associated with a LEZ scheme for NOx/NO_2 in the area.

Air pollution has a number of important impacts on human health, as well as on the natural and built environments. The IGCB provides guidance[17] on the assessing the value for the impacts of exposure to air pollution on health – both chronic mortality effects (which consider the loss of life years due to air pollution) and morbidity effects (which consider changes in the number of hospital admissions for respiratory or cardiovascular illness) – in addition to damage to buildings (through building soiling) and impacts on materials. The IGCB has developed a Damage Cost Calculator[18] to calculate the damage costs from proposed policies.

The IGCB Damage Cost Calculator was used to estimate the damage costs saved compared with the baseline for each of the emissions scenarios. The Damage Cost Calculator requires the user to provide the following inputs:

- The first year of your policy which may or may not be the first year where emissions change. This is also important as a different base year has a different level of damage cost associated with it. For this assessment, the base year was assumed to be 2014, so that all damage costs are expressed at 2014 prices.
- The number of years of the policy appraisal. For this assessment the policy was appraised over the period 2014-2024. The dates chosen are relatively arbitrary mainly because the types of vehicle that would be the focus of a LEZ scheme will enter the fleet anyway in the coming years. In practice the LEZ would act as an accelerator to uptake of cleaner, more modern heavy vehicles so the biggest damage cost savings would be reasonably be expected to occur in the first few years of any scheme.
- Data on annual emission changes (in tonnes, by each pollutant)

[17] https://www.gov.uk/air-quality-economic-analysis#damage-costs-approach

[18] uk-air.defra.gov.uk/.../1102150857_110211_igcb-damage-cost-c4192alculator.xls

3.2 Emissions data

The emissions of pollutants from road links in the Air Quality Management Area for 2011 were first calculated for the dispersion modelling study in previous chapters, and then again for 2014 for the economic assessment. The emissions calculations were carried out using Defra's Emission Factor Toolkit[19]. Additional emissions calculations for 2014-2024 were carried out for this study assuming that traffic flows will not change over this period.

The Emission Factor Toolkit calculated the emissions of oxides of nitrogen (as nitrogen dioxide), carbon dioxide and particulate matter PM_{10} for each road link within the specified area. As before, the emission calculation takes account of the annual average daily vehicle flows, average vehicle speeds, traffic composition (petrol cars, diesel cars, light goods vehicles, heavy goods vehicles, buses and coaches) and the emissions abatement (e.g. Euro class) levels within each vehicle category.

Table 3.1 shows the calculated annual emissions of oxides of nitrogen, PM_{10} and carbon dioxide for the modelled area of the Western Approach.

Table 3.1: Calculated emissions for baseline and two LEZ options

Scenario	Year	NO_x, kg y^{-1}	PM_{10}, kg y^{-1}	CO_2, tonnes y^{-1}
Base 2011	2011	74306	5587	23569
Do min	2014	58086	4941	22633
	2015	51703	4762	22294
	2016	45312	4606	21910
	2017	39715	4473	21555
	2018	35115	4359	21239
	2019	31439	4267	20969
	2020	28443	4192	20739
	2021	26041	4133	20546
	2022	24122	4091	20385
	2023	22577	4060	20254
	2024	21371	4038	20151
All heavy vehicles Euro V	2014	55306	4833	22650
	2015	49786	4689	22286
	2016	44003	4557	21905
	2017	38809	4440	21552
	2018	34513	4438	21237
	2019	31045	4254	20968
	2020	28195	4184	20739
	2021	25893	4129	20546
	2022	24019	4087	20385
	2023	22382	4057	20254
	2024	21324	4038	20151
All heavy vehicles Euro VI	2014	38140	4670	22650
	2015	36253	4655	22288
	2016	33711	4460	21905
	2017	31262	4369	21552

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

Scenario	Year	NO_x, kg y^{-1}	PM_{10}, kg y^{-1}	CO_2, tonnes y^{-1}
	2018	29093	4288	21237
	2019	27187	4218	20968
	2020	25495	416	20739
	2021	24031	4113	20546
	2022	22750	4076	20385
	2023	21652	4051	20254
	2024	20741	4034	20151

3.2.1 Damage cost calculations

Table 3.2 shows the damage costs saved calculated for the Euro V and Euro VI options compared with the Do-minimum case for the assessment period 2014-2024.

Separate damage cost savings are shown relating to the changes in emissions of oxides of nitrogen, particulate matter, PM_{10} and carbon dioxide. The table also shows the total damage cost saved for each scenario, the estimated range (based on the high and low estimates of the health impact of particulate emissions) and high and low sensitivity estimates. The estimates for damage costs associated with particulate matter were calculated for the "Urban Big" area category in the Defra guidance.

There is no appreciable reduction in CO_2 emissions on the Western Approach with either measure. In the Euro V case the biggest contribution to damage costs saved is from the reduction in PM_{10}. When Euro VI vehicles are assumed the contributions from reduced NOx and PM_{10} are similar.

Table 3.2: Damage cost saving calculated

Area	Pollutant	Central estimate, £(2014)	Range, £		Sensitivity range, £	
			Lower	Upper	Lower	Upper
All heavy vehicles Euro V	NO_x	9010	7015	10228	1761	20395
	PM_{10}	30194	23618	34278	4003	77798
	CO_2	0	0	0	0	0
	Total	39204	30633	44507	5765	98194
All heavy vehicles Euro VI	NO_x	76532	59444	86678	14926	172832
	PM_{10}	78179	61150	88752	10517	201433
	CO_2	0	0	0	0	0
	Total	154711	120594	175430	25444	374266

4 Compliance implications of LEZ options

4.1 Introduction

In this section we estimate the road NOx emission reductions required to achieve the EU limit values and compare the required reduction with the reduction expected from the Euro V and Euro VI options versus the Do minimum scenario. This analysis feeds into the later analysis of scheme costs and benefits.

4.2 Projections of nitrogen dioxide concentrations

Projections of concentrations at monitoring sites M271, Auto Redbridge and Auto Millbrook were made for years beyond 2014 based on the 2011 measured concentrations using an emissions rollback method based on Defra's NO_x to NO_2 converter. The highest concentrations have been measured and modelled at these sites.

Defra's NO_x to NO_2 converter allows the user to predict annual mean nitrogen dioxide concentrations given:

- Background oxides of nitrogen concentration
- Primary nitrogen dioxide factor for vehicle mix
- Estimates of regional background ozone and oxides of nitrogen concentrations
- Road contribution to oxides of nitrogen concentrations

The converter also provides a tool to estimate the contribution to oxides of nitrogen concentrations from roads from nitrogen dioxide concentrations.

The NO_x to NO_2 converter includes a database of regional background concentrations selectable on the basis of the year and the local authority. Background oxides of nitrogen concentrations were previously determined for 2011 for each diffusion tube site from Defra's background maps. This was combined with the ADMS modelled concentrations for the railway and port described previously.

The primary nitrogen dioxide factor in Southampton was assumed to be similar to that in urban areas throughout the UK and so the default value provided by the NO_x to NO_2 converter for urban areas was used.

The road contribution to oxides of nitrogen concentrations was calculated from the modelled concentrations at the monitoring sites for 2014 for the Do minimum case using the tool provided by the NO_x to NO_2 converter. The road contribution for future years was then calculated by scaling the 2014 road contribution in proportion to the emission rates for the appropriate years for both the Do min and LEZ options.

The NO_x to NO_2 converter was then used to calculate the projected concentrations at each measurement site taking into account the changes in the road contribution to oxides of nitrogen concentrations, and primary nitrogen dioxide factors. Background values have been assumed to remain the same throughout, partly to reflect potential uncertainty in the port activities in future which are an important contributor to background NOx along the Western Approach. This conservative approach can also account for some of the potential growth in HGV traffic as well.

Table 4.1 shows the projected nitrogen dioxide concentrations for the Do Minimum case for the years 2014-2024. The projections indicate that nitrogen dioxide concentrations at the most affected sites in Southampton will fall to the limit value of 40 µg m^{-3} around 2020 for the Do minimum scenario. It should be noted however that this assumption does not include any growth in port activities including HGVs or railways- the reduction in concentrations is derived entirely from reductions in road traffic emissions calculated during the emissions modelling we have undertaken.

Table 4.1: Projected nitrogen dioxide concentrations, µg m^{-3}

Site	2011	2014	2016	2018	2020	2022	2024
M271	54	49	44	39	35	33	31
Auto Redbridge Road	48	43	39	35	32	30	28
Auto Millbrook Road	49	45	42	39	36	35	34

The projected concentrations are estimated to fall below the limit value at all the diffusion tube sites around 2018 to 2020. Of course this prediction relies entirely on engine technologies delivering the predicted emission reductions inherent in the emissions factors.

The site with the slowest reduction in annual mean NO_2 with time is thought to be Millbrook Road, which reflects the port contribution which has not been scaled in this analysis. The automatic site is immediately next to a busy bus stop and is directly across the road from where the train engines idle at the Millbrook Railfreight terminal. The number of trains at the terminal is due to be reduced by half soon[20] so it would be expected that the contribution from rail to drop (its contribution is actually quite small anyway at less than 5 ug.m^3 of NOx at 539 Millbrook Road in 2011), though of course the operators could upscale their activities just as easily in future. Some reductions in the concentration at the Automatic monitor at Millbrook will probably come from updating of the current fleet of buses but it is impossible to predict the trajectory of any improvements with any certainty at present.

However, it should be noted that this analysis does not take account of the traffic growth projections at the Port which are expected to be in the region of 20-30% with time though again, the trajectory for this is unknown at present and could be the focus of additional work in future. Clearly if there was a 30% increase in HGV emissions in and around the port it would have sizeable implications for the emissions reductions predicted here and the compliance issues SCC face at present. HGVs represent over 30% of NOx emissions on the West side of the AQMA so growth of a few tens of percent could be significant.

Also, this analysis assumes that all emissions reductions associated with newer fleets will be delivered in practice so these predictions should be treated with a degree of caution. The Do min may be an underprediction (of annual mean NO_2) and the impact of the scenarios may be similarly overestimated but it is impossible to estimate this with any certainty. Therefore, it is also possible that it will be after 2018 when compliance with the air quality regulations is achieved.

4.3 Required emission reductions from Do Minimum scenario

The reduction in oxides of nitrogen annual emissions from the road network required to achieve compliance at the worst case locations should be calculated so that the costs of abating these emissions can be estimated.

In this instance, based on the projected 2014 concentrations at the three monitoring locations above, a reduction of 24% of road NOx emissions would be sufficient to achieve the limit values in 2014. By 2015 and 2016 a reduction in road NOx emissions of 20 and 16% would be enough to achieve the limit values, and in 2018 no further reductions are required though the two automatic sites only achieve the limit value by less than 2%. Therefore any growth in port or local HGV activity could mean further exceedances past 2018.

[20] Personal communication (email) from Andy Worrall of Freightliner to John Abbott Ricardo-AEA, 22nd March 2013

To estimate the required change in emissions of road NOx we simply take the headline NOx emissions value of 58 tonnes in 2014 (see Table 2.17), and calculate the tonnage of the required percentage reduction to achieve the annual mean NO_2 limit value. In 2014 this analysis suggests that we require about 24% less road NOx which equates to 14 tonnes.

In 2015 we require a reduction in road NOx of around 11 tonnes.

In 2016 we require 16% reduction on a headline figure of 45 tonnes of road NOx, giving a reduction of 7 tonnes.

In 2017 we require a reduction in road NOx of 5% overall which equates to about 4 tonnes.

No further reductions are required in 2018.

Since the locations with the highest annual mean NO_2 cannot be treated in isolation from the rest of the road network, we will use the headline percentage reduction requirements at the worst case locations to estimate the cost of abatement for the whole of the Western Approach.

5 Unit abatement costs

5.1 Choice of unit abatement costs

Defra developed estimates of the unit costs for emission abatement using a marginal abatement cost curve (MACC) to estimate the potential supply of abatement at a national scale. The MACC reflects the abatement potential and cost for a range of different abatement technologies. Wider impacts on society are incorporated, including: impacts on other pollutants; energy and fuel impacts, and health impacts (damage costs). The abatement represented by the national average compliance gap is compared against the MACC to estimate an indicative unit cost of abatement. It is only indicative because both the gap and the abatement potential from different technologies will vary between areas.

The unit cost is provided in terms of the marginal cost of emissions, usually measured in £/tonne. Table 5.1 below shows the menu of abatement costs which have been derived from the NO_x MACC. These are derived from the full package of measures that would mitigate the typical compliance gap, assessed for the year 2015. It is an extract from the complete MACC. The measures shown include those which may represent the marginal technology once all cheaper options have been exhausted.

Defra's guidance recommends that the appraiser should decide which value is most appropriate for a particular case. If there is no clear rationale to use a particular measure the recommended default value is £29,150. The default value has been used in this analysis. Marginal abatement costs are considered to remain constant over time in real terms. Given the relatively short timescales over which the abatement cost technique is expected to be used it was considered unnecessary to investigate how the costs might change through time.

Sensitivity analysis is recommended to reflect the uncertainty in the abatement costs, using both a higher and lower abatement cost technology selected from Table 9. The selection of these technologies is for the judgement of the analyst. If the default value of £29,150 is used then it is suggested that a range of £28,000 - £73,000 is appropriate, derived from the rounded values of the abatement technologies on either side of the default value in Table 5.1.

Table 5.1: Marginal abatement costs of national measures to reduce oxides of nitrogen emissions

Sector	Sub sector	Baseline Technology	Abatement Measure	Marginal Abatement Cost (£/Tonne of NOx) 2015
RT	HGV	Euro II	SCR	5099
RT	HGV	Euro III	SCR	5380
RT	Buses	Euro II	SCR	6251
RT	Buses	Euro I	Hybrid	6500
RT	Buses	Euro I	SCR	6625
RT	Buses	Euro III	SCR	7257
RT	Buses	Euro II	Hybrid	7462
RT	HGV	Euro IV	SCR	8053
RT	Buses	Euro III	Hybrid	9423
RT	Buses	Euro IV	SCR	11889
RT	Buses	Euro I	Electric	14669
RT	Buses	Euro II	Electric	14872
RT	Buses	Euro III	Electric	17352
RT	Articulated HGV	New Euro V	Euro VI	17743
RT	Buses	Euro IV	Hybrid	18391
Commercial	Buildings		Boiler replacement	19332
RT	Buses	New Euro V	Euro VI	24852
RT	Rigid HGV	New Euro V	Euro VI	28374
RT	**Buses**	**Euro IV**	**Electric**	**29150**
RT	Buses	Euro V	Hydrogen	72932
RT	Diesel LGV - class 1	New Euro 5 class I	Euro 6	79323
RT	Diesel LGV	Euro 1	Electric	100665
RT	Diesel LGV	Euro 2	Electric	111619
RT	Petrol cars	Euro 1	Electric	112030
RT	Diesel cars	Euro 1	Electric	135949
RT	Diesel LGV - class 2	New Euro 5 class II	Euro 6	144124
RT	Diesel LGV - class 3	New Euro 5 class III	Euro 6	144124
RT	Diesel cars	Euro 2	Electric	156046
RT	Diesel LGV	Euro 5	Electric	240484
RT	Diesel LGV	Euro 3	Electric	262466
RT	Petrol cars	Euro 2	Electric	280450
RT	Diesel cars	Euro 3	Electric	304593

RT=Road Transport

5.2 Cost of emissions reductions

Defra guidance recommends that abatement costs are used for valuing emissions that exceed legally binding obligations, in this case the EU limit value for nitrogen dioxide. Damage costs should be used to value the part of the change that maintains compliance.

Table 5.2 shows the emissions reductions resulting from the Do Minimum case, as well as the estimated emissions reductions from the Do Minimum case required to achieve the EU Limit value of 40 µg m^{-3}.

Table 5.2: Eligible emissions reductions

	2014	2015	2016	2017	2018
Do minimum (tonnes road NOx/yr)	58	52	45	40	35
Required reduction (tonnes road NOx/yr)	14	11	7	4	0
Abatement cost (£)	408100	320650	204050	116600	0

Therefore we can see that the road NOx reduction in emissions required compared with the Do min starts at 14 tonnes in 2014, and drops to zero in 2018 which reflects the natural fleet improvements which should occur without intervention. Since it is unlikely that a LEZ scenario which targets vehicle technologies would be able to deliver such a precise reduction we prefer to use the total reductions associated with each measure as the basis of the analysis. For example this means the unit abatement costs provided below for the Euro VI (assuming they deliver 100% of expected emissions reductions) are something of an overestimate as the reductions achieved are bigger than those needed for compliance. This could be thought of as a safety factor as the difference between what's required from 2014 to 2018 at least is not very different.

Table 5.3 shows the total benefit of the scheme, calculated as the sum of abatement costs and the damage costs saved. We have used the central value for the unit abatement costs for this analysis. The use of the lower unit cost (£28,000) would not significantly affect the outcome. The use of the higher unit abatement cost (£73,000) would of course have an effect, making the ratio of costs against benefits even more severe.

Table 5.3 Net present value calculations- Euro V scenario

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Do minimum NOx	58086	51703	45312	39715	35115	31439	28443	26041	24122	22577	21371
Do min compliance with limit value?	N	N	N	N	N	Y	Y	Y	Y	Y	Y
Euro V scenario (NOx, t/yr)	55306	49786	44003	38809	34513	31045	28195	25893	24019	22382	21324
NOx saving (t/yr)	3	2	1	1	1	0	0	0	0	0	0
Required saving (NOx, t/yr)	14	11	7	4	0	0	0	0	0	0	0
Compliance with limit value?	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
Abatement cost of full measure	£81,037	£55,881	£38,157	£26,410	£17,548	£11,485	£7,229	£4,314	£3,002	£5,684	£1,370
Total unit abatement cost	£252,118	The total summed unit costs for an LEZ scheme of Euro V in the heavy fleet are greater than the damage costs avoided between 2014 and 2024. Even where the high estimate for damage costs saved is used, the scheme cost outweighs the benefits by >£200k We estimate that compliance is reached around 2019 without the scheme, and in 2018 with the scheme.									
Damage costs avoided (central)	£39,204										
2014 Net present value (central)	-£212,914										
Damage costs avoided (low)	£30,633										
2014 Net present value (low)	-£221,485										
Damage costs avoided (high)	£44,507										
2014 Net present value (high)	-£207,611										

Table 5.4 Net present value calculations- Euro VI scenario, assume 100% benefit

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Do minimum NOx	58086	51703	45312	39715	35115	31439	28443	26041	24122	22577	21371
Do min compliance with limit value?	N	N	N	N	N	Y	Y	Y	Y	Y	Y
Euro VI scenario (NOx, t/yr)	38140	36253	33711	31262	29093	27187	25495	24031	22750	21652	20741
NOx saving (t/yr)	20	15	12	8	6	4	3	2	1	1	1
Required saving (NOx, t/yr)	14	11	7	4	0	0	0	0	0	0	0
Compliance with limit value?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Abatement cost of full measure	£581,426	£450,368	£338,169	£246,405	£175,541	£123,946	£85,934	£58,592	£39,994	£26,964	£18,365
Total unit abatement cost	£2,145,702	The total summed unit costs for an LEZ scheme of Euro VI in the heavy fleet are greater than the damage costs avoided between 2014 and 2024. Even where the high estimate for damage costs saved is used, the scheme cost outweighs the benefits by >£1.9m The scheme does bring forward compliance to 2014 from 2019 but relies on Euro VI delivering 100% of the NOx reduction benefits predicted.									
Damage costs avoided (central)	£154,711										
2014 Net present value (central)	-£1,990,991										
Damage costs avoided (low)	£120,594										
2014 Net present value (low)	-£2,025,108										
Damage costs avoided (high)	£175,430										
2014 Net present value (high)	-£1,970,272										

Table 5.5 Net present value calculations- Euro VI scenario, assume 50% emissions benefit

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Do minimum NOx	58086	51703	45312	39715	35115	31439	28443	26041	24122	22577	21371
Do min compliance with limit value?	N	N	N	N	N	Y	Y	Y	Y	Y	Y
Euro V scenario (NOx, t/yr)	48113	43978	39512	35489	32104	29313	26969	25036	23436	22115	21056
NOx saving (t/yr)	10	8	6	4	3	2	1	1	1	0	0
Required saving (NOx, t/yr)	14	11	7	4	0	0	0	0	0	0	0
Compliance with limit value?	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Abatement cost of full measure	£290,713	£225,184	£169,085	£123,202	£87,771	£61,973	£42,967	£29,296	£19,997	£13,482	£9,182
Total unit abatement cost	£2,145,702	The total summed unit costs for an LEZ scheme of Euro VI in the heavy fleet are greater than the damage costs avoided between 2014 and 2024. Even where the high estimate for damage costs saved is used, the scheme cost outweighs the benefits by >£2m The scheme does bring forward compliance to 2017 from 2019 assuming Euro VI delivers 50% of the NOx reduction benefits predicted. The costs of implementing the measure would reasonably be expected to be the same whether the technology shift delivers all of the predicted emissions reduction or not.									
Damage costs avoided (central)	£77,356										
2014 Net present value (central)	-£2,068,347										
Damage costs avoided (low)	£60,297										
2014 Net present value (low)	-£2,085,405										
Damage costs avoided (high)	£87,715										
2014 Net present value (high)	-£2,057,987										

5.3 Significance of the impact on compliance

The abatement cost guidance for valuing changes in air quality recommends that more detailed analysis is required if the net present value of the air quality impacts valued using unit costs is greater than £50m. The calculated damage costs saved are considerably less than £50 m and so no further detailed analysis is required.

5.4 Conclusions of the economic assessment of LEZ

As can be seen from the analysis presented above, the costs associated with a scheme based around Euro V as a minimum emission standard for heavy vehicles on the Western approach far outweigh the benefits. The scheme has predicted damage costs savings of about £40k, and costs of more than £200k. The date of compliance is virtually unchanged by adopting Euro V at this point in time, and the technology will penetrate the fleet in the next few years anyway so any benefits would be fleeting.

The analysis for the Euro VI case suggests much greater emissions benefits, with a fairly large influence on the date of compliance- essentially if all heavy traffic were Euro VI now compliance with the NO_2 limit value would be expected in 2014. The magnitude of the emissions reductions which could arise from such a scheme are similar to what is needed at the worst case locations along the Western Approach. That said it may not be appropriate to assume that 100% of the NOx reduction benefits that Euro VI is predicted to deliver will occur in practice so this forecasts should be treated with caution. In any case, the economic analysis suggests that (even with full emissions reductions assumed) costs will far outweigh benefits by around £2m across a 10yr scheme. As a sensitivity test, and to further supplement the analysis carried out in a previous section, we have estimated the economic case for a Euro VI LEZ where the technology shift does not deliver the whole emissions reduction benefit. Our analysis suggests that the compliance date could be brought forward by a few years to 2017 from 2019 in the base case. The case for Euro VI only delivering 50% of its expected NOx reductions has an impact on the costs versus benefits but the magnitude of the difference against the 100% NOx benefit scheme is not significant. This is because the large costs greatly outweigh the small benefits so a step change in the damage costs savings is insignificant in the context of scheme costs greater than £2m. The cost of the scheme is greater than the benefits from damage cost savings by £2m as before. We have no reason to expect that costs associated with an engine technology shift that fails to deliver would be any different to the case where we assume they will deliver all that is expected.

We consider that there is no reasonable variation in the analysis that could yield greater damage cost reduction benefits than overall costs.

6 Road Transport & Port Emissions Mitigation Measures

6.1 Consideration of Emission Reductions

The air quality modelling of the Western Approaches shows that emissions of NOx from road transport, and at key locations, those from Port activities, play a significant role in causing exceedences of the NO_2 annual mean objective. The source characterisation of emissions along the Western Approaches varies - while HGV and passengers car emissions are significant towards the Western extremities, Port emissions (including those from the Freightliner Terminal) become predominant at 539 Millbrook Road, then all vehicle types, including buses and LGVs, and Port emissions contribute to exceedences towards the City end of the Western Approaches.

It is relevant to highlight that the study modelling provides an update to the data provided in the Southampton Air Quality Action Plan – A Breathe of Fresh Air (2008). Current modelling uses updated emission factors which show that passenger vehicles, particularly diesel, have a greater contribution to NO_2 levels than was previously identified.

As part of the study, mitigation measures that have the potential to reduce emissions affecting the Western Approaches have been discussed with both Southampton CC Officers and external stakeholders, including Port Operators (DP World, AB Ports), Southampton University, bus operators (Go-Ahead, First Group) and logistics concerns (Meachers Global, Road Haulage Association). The range of low emission measures considered can be seen in Appendix 4.

Several measures were discounted at an early stage. Such measures and associated reasoning included:

Low Emission Zone (Western Approaches), including camera enforcement

- To be effective and proportional, all vehicle types would need to be included within scheme, causing significant vehicle re-routing, particularly at peak times
- Potential to affect viability of Port
- Performance of Euro Standards would make the setting of LEZ criteria problematic
- The cost of enforcement considered excessive
- Alternative measures could achieve emission reductions as effectively as a LEZ with co-ordinated implementation and at significantly less cost

Dedicated HGV Lane from M271 to First Avenue, Dock Gate 20 (access to Container Port)

- Schemes to provide a dedicated HGV lane have been considered previously
- Re-allocation of current road space would cause significant congestion at peak times
- Land constraints prevent road widening to accommodate an extra lane

The following section discusses further mitigation measures considered by both internal and external stakeholders and progress to date with implementation

6.2 Mitigation & Low Emission Strategy (LES) Development (2014-2016)

Based on the findings of the modelling undertaken, Southampton CC have focussed on developing initiatives capable of reducing emissions affecting the Western Approaches and build on these activities through the development of an overarching Low Emission Strategy (LES) for the City that will seek to optimise municipal policies and strengthen partnership working that will target cost-effective, road transport emission reductions across Southampton.

Southampton Council was awarded £60,000 through the Defra Air Quality Grant 2013/14 to develop an LES over the 2014-2016 period. The LES development will involve partnership working and will cover the following areas:

- Review of air quality and emission data for Southampton
- Review of health data and awareness in partnership with Public Health and University of Southampton
- Develop technical guidance to consider air quality through the planning & development control process
- Develop measures to support emission reductions through procurement practices, including Southampton CC Fleet
- Develop a bus emission strategy
- Develop a freight emission strategy
- Develop measures to accelerate the deployment of low emission vehicle infrastructure
- Support measures to increase modal shift and the accelerate the uptake of low/ultra low/clean passenger vehicle technologies and fuels

The LES will build on the following initiatives in development:

6.2.1 Sustainable Distribution Centre

Southampton CC have tendered for a warehousing and logistics provider to run what will be branded as a Sustainable Distribution Centre (SDC) offering freight consolidation and comprehensive warehousing from their premises to Southampton and the surrounding areas. The project is part funded through DfT Local Sustainable Transport Funding (LSTF) and the SDC will streamline deliveries from the South East region and UK into Southampton or one of the other locations. The SDC can reduce congestion by consolidating loads for the 'last mile' of the journey. Evidence from the Bristol Consolidation Centre and others has shown that freight transport traffic into the city centre can be reduced by up to 75% for those participating in the scheme. The optimal site will in the vicinity of the M27 or lower M3 – a western location could help to reduce vehicle numbers on the Western Approach. It is estimated that the SDC could initially reduce 100 vehicle movements into the City on a daily basis.

The aim of the project is to help Southampton and the surrounding areas become more sustainable, both economically and environmentally. In light of the Western Approaches Study, the SDC tender specification refers to the objectives of reducing the carbon footprint and level of NOx emissions in the areas served by the SDC and Improving air quality in the areas that the SDC serves, for example by operating, now or at some point in the future if required by SCC, specific types of low emission vehicle.

The project, due to commence in 2014, will be evaluated for environmental benefits by the University of Southampton

6.2.2 Port Operations

The initial study findings have been discussed with Port Operators (DP World and AB Ports) and the following initiatives are being considered:

Converting Straddle Carriers to Dual Fuel (gas/diesel) – the study highlights the contribution that the emissions from the straddle carriers (container Port) has on ambient NO_2 concentrations and discussions have taken place regarding the potential use of gas (methane) as part of Port operations. DP World has approved a $75,000 feasibility study to look at the feasibility of converting the straddle carriers to run on gas and diesel as a duel fuel. The location of medium pressure gas pipelines in the vicinity of the Port can be seen in the map provided in Appendix 6. The study will assess the emission benefits associated with converting the straddle carriers.

Container Port Vehicle Booking System – all commercial vehicles accessing the Container Port are subject to a pre-booking system. DP World will look at working with clients to raise awareness over vehicle emissions and look at the potential for introducing emission standards as part of the booking system

Low Emission Vehicles – both Port operators will continue to evaluate the potential for using low emission vehicles in the course of Port operations

6.2.3 Southampton CC Fleet Management

Based on 2012/13 data, Southampton CC operate a fleet of 489 municipal vehicles with the main depot based at Central Avenue, off the Millbrook roundabout. As part of the study, the fleet has been divided into 5 vehicle classes (not including specialist vehicles such as street sweepers and mobile libraries) and data analysed to look at energy costs and environmental impacts (including damage costs for CO_2, NO_x & PM) of the fleet compared with alternative vehicle technologies such as diesel electric-hybrid, electric and gas (methane) vehicle technologies. The analysis allowed the comparison of whole life costs (WLC) – a procurement consideration that forms part of the approach required by the Cleaner Road Transport Vehicle Regulations 2011.

The table below shows the basic fleet model:

Vehicle class	Number of vehicles	Average yearly mileage	Average mpg	Total fuel use
Car derived vans, cars and pickups	51	9,235	45.6	47,492
Smaller vans and tippers, 1-2.7t	106	4,193	30.9	66,239
Larger vans, minibuses and tippers, 2.8-3.5t	263	5,014	24.5	247,143
7.5t vans and tippers	12	15,159	19.9	42,114
RCVs (18-26t)	33	7,500	2.9	387,481
Totals	465			790,469

Analysis of the WLC for each of the 5 vehicle classes can be found in Appendix 5.

The assessment showed that alternative vehicle technologies, particularly in the heavier vehicle classes, could be cost-competitive with diesel vehicles, based on WLC, including gas/biomethane technologies. In addition to the emission reduction potential for NOx and particulate matter, gas/biomethane vehicle technologies also offered potential CO_2 savings.

Discussions with Southampton CC Fleet Management indicate interest in pursuing gas/biomethane vehicle technologies, however, the main barrier is the cost of providing refuelling infrastructure. Partnership approaches could be pursued (CF DP World Duel Fuel Feasibility Study). Gasrec, who provide a liquefied methane/biomethane (85/15%) fuel for transport has stated that they are to develop a public access fuelling station in Southampton, which could have potential use for the Southampton CC Fleet.

6.2.4 Bus Operations and Funding

While bus emissions are not significant along most of the Western Approaches, discussions with operators Go-Ahead (Bluestar) and First Group have indicated a willingness to look at emission standards and operational factors as part of the LES development.

DfT Clean Bus Technology Fund (CBTF) – Southampton CC, with assistance from the study team, made a successful application to the DfT Clean Bus Technology Fund 2013/14, securing £632,700 (from a total fund of £5m) to retro-fit 37 Euro III buses with a Williams Gyrodrive (flywheel) system. The funding application referenced the development of the Southampton LES and the benefits that the application would have on air quality in the City. While the Gyrodrive system will principally help reduce CO2 emissions (circa 30% reduction), it will also help reduce emissions of NOx and PM.

Potential emission reductions of 19.6% per bus could be achieved with respect to NOx which could result in overall bus emission reductions of 7.6% in some AQMAs.

Bluestar and Unilink, who have agreed to fit the systems, are also contributing 50% of the costs and suggest that they may retro-fit their entire Southampton bus fleets, creating a centre of excellence in the City

6.2.5 Southampton CC Planning Policy

Southampton is currently experiencing widespread development, with the potential to both increase vehicle numbers and emissions. Discussions have taken place with Southampton CC Planning Officers, with agreement to strengthen provisions for considering air quality through the development of technical guidance.

The National Planning Policy Framework (NPPF) states that air quality is relevant to planning and policies should help pursue the achievement of European Limit Values. While air quality is referenced within the Core Strategy (2010), City Centre Action Plan (2013) and Sustainable Construction SPD, the main focus of environmental consideration centres on climate change and CO_2 reduction, however, policies to promote transport measures, including walking, cycling and the acceleration in uptake of low emission vehicles, form key policies within the planning strategies.

Developing technical guidance to consider air quality and emissions is provided as a commitment within the Air Quality Action Plan – A Breath of Fresh Air (2008) and will be developed as part of the Southampton LES development

7 Conclusions

This assessment has looked at NO_2 concentrations along the Western Approach AQMA in Southampton for a 2011 base year. The study has confirmed that there are still measured and modelled exceedances of the NO_2 annual mean limit value in the AQMA and that the declaration is still required. That said, concentrations do appear to be reducing somewhat on analysis of the NO_2 trend data available to this work.

To enable us to understand the relative contribution to local NOx and NO_2 concentrations, we have used dispersion models to assess road, port and rail sources separately. The results of the assessment suggest that the spatial variation in contributions from each sector is significant. The west of the AQMA is primarily affected by road sources, of which the car and HGV fleets are significant contributors. In the centre of the AQMA around Millbrook Road the port is a large NOx contributor, indeed it is as large a source of NOx as road traffic at some locations. To the east of the AQMA road sources are again the most important source group, with cars and buses being the largest two contributors within the fleet.

Management of NOx along the Western Approach would therefore sensibly target road vehicles and congestion around the M271 junction. There is a significant flow of HGVs serving the port accessing from that junction so their contribution is quite large on the western side of the AQMA. Further east management of port emissions would seem sensible as this source is as significant as local roads around Millbrook Road. To the east of the modelled area areas of high concentration are more associated with congestion at junctions so perhaps traffic management options could be explored along Millbrook Road into Mountbatten Way.

The impact of implementing a LEZ along the Western Approach was estimated for the following scenarios:

- Do Minimum
- All HGV to be Euro V compliant
- All HGV to be Euro VI compliant

In addition to these LEZ scenarios, consideration was given to the emissions reduction from the introduction of Euro VI/6 into the vehicle fleet. As previous Euro standards have not delivered in the real world as was expected from test bed emissions monitoring, it was deemed prudent to assess the following improvements from Euro VI/6

- Euro Standard achieving 25% of the predicted benefit
- Euro Standard achieving 50% of the predicted benefit
- Euro Standard achieving 75% of the predicted benefit

It was concluded that with a Do Minimum scenario, where fleet replenishment was as market rates, the year of compliance of the annual average NO_2 objective is projected to be 2019. If an LEZ was implemented along the Western Approach at a Euro V standard for HGVs then this year of compliance would be brought forward by one year to 2018. However, the economic assessment which includes the monetary value for the improvement in public health through lower pollution levels, concludes that the costs of the scheme would outweigh the benefits by £200,000. Similarly, a Euro VI LEZ for HGVs would bring the compliance date forward to the year of implementation, which for this study was assumed to be 2014. However the costs outweigh the benefits by £1.9m, and the practicalities of implementing a scheme so swiftly would raise difficulties. In addition, should the Euro VI only deliver 50% of its expected emission reduction the compliance year would be 2017, with costs outweighing the benefits by some £2m.

It would appear prudent that Southampton City Council should continue to explore other options for local NOx reductions and not rely solely on future emission standards which may or may not deliver. The large contributions from the port activities also mean that waiting for better Euro standards in the road fleet may not deliver full compliance with the NO_2 limit values at all locations.

As part of the study, progress has been made in engaging with stakeholders and identifying initiatives that will both help reduce emissions along the Western Approaches and across the City. These initiatives will be developed further as part of the Southampton Low Emission Strategy.

Appendices

Appendix 1: Wind rose for Southampton Airport

Appendix 2: Sample of emissions factor toolkit input

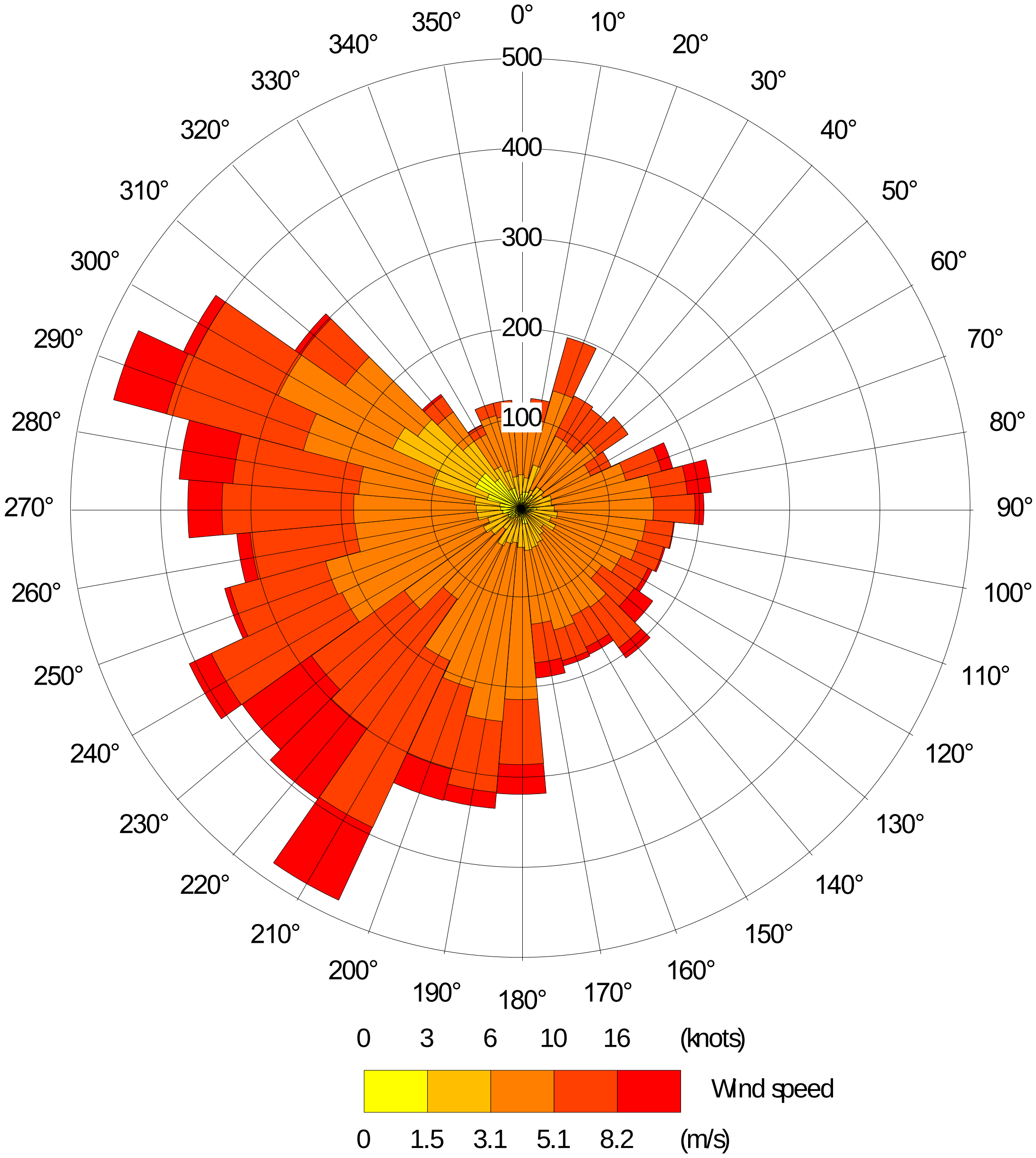
Appendix 3: Sample of emissions factor toolkit output

Appendix 4: Potential Low Emission Strategy Measures for Western Approach, Southampton

Appendix 5: Southampton City Council – Fleet Model and Whole Life Costs

Appendix 6: Compressed Natural Gas (CNG) Pipelines (Medium Pressure) in Port Area

Appendix 1- Wind Rose- Southampton Airport, 2011



Appendix 2- Sample of emission Factor toolkit inputs

Select Pollutants

- ☑ NOx
- ☐ NOx(TRL)
- ☑ PM10
- ☐ Carbon Dioxide
- ☑ PM2.5
- ☐ Hydrocarbons

Select Outputs

- ☑ Air Quality Modelling (g/km/s)
- ☑ Emissions Rates (g/km)
- ☑ Annual Link Emissions

Additional Outputs

- ☑ Breakdown by Vehicle
- ☐ Source Apportionment
- ☑ PM by Source

Advanced Options

- ☑ Euro Compositions
- ☐ Alternative Technologies
- ☐ Output % Contributions from Euro Classes

Click the button to:

Run EFT

Clear Input Data

Please Select from the Following Options:

Area	England (not London)
Year	2011
Traffic Format	Detailed Option 2

Select 'Basic Split' or 'Detailed Option 1 to 3' above

Export Outputs

☑ Save Output to New Workbook

File Name: Eft results with trafficmaster average speeds

SourceID	Road Type	Traffic Flow	% Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	Speed(kph)
a3057_1	Urban (not London)	10882	77.4	0.0	19.7	1.3	0.3	0.1	1.1	22
a3057_2	Urban (not London)	10882	77.4	0.0	19.7	1.3	0.3	0.1	1.1	22
a3057_3	Urban (not London)	5441	77.4	0.0	19.7	1.3	0.3	0.1	1.1	22
a3057_4	Urban (not London)	5441	77.4	0.0	19.7	1.3	0.3	0.1	1.1	22
a3057_5	Urban (not London)	3956	77.4	0.0	19.7	1.3	0.3	0.1	1.1	33
a3057_6	Urban (not London)	3956	77.4	0.0	19.7	1.3	0.3	0.1	1.1	33
a3057_7	Urban (not London)	7912	77.4	0.0	19.7	1.3	0.3	0.1	1.1	33
a3057_8	Urban (not London)	7912	77.4	0.0	19.7	1.3	0.3	0.1	1.1	33
a33_1	Urban (not London)	13421	85.0	0.0	9.0	2.1	2.4	0.5	0.9	17
a33_10	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	32
a33_11	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	32
a33_12	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	27
a33_13	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	27
a33_14	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	27
a33_15	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	27
a33_16	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	18
a33_17	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	18
a33_18	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	18
a33_19	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	18
a33_2	Urban (not London)	13421	85.0	0.0	9.0	2.1	2.4	0.5	0.9	17
a33_20	Urban (not London)	13892	85.9	0.0	9.1	1.6	1.9	0.4	1.1	18

Appendix 3- Sample of emission Factor toolkit outputs (NOx)

Source_Name	Pollutant_Nam	All Vehicle (g/km/	All LDV (g/km/	All HDV (g/km/	Petrol Cars (g/km/	Diesel Cars (g/km/	Taxi (g/km/	Petrol LGV (g/km/	Diesel LGV (g/km/	Rigid HGV (g/km/	Artic HGV (g/km/	Buses/Coaches (g/km/	Motorcycles (g/km/
a3057_1	NOx	0.081	0.064	0.016	0.011	0.028	0.000	0.000	0.024	0.011	0.004	0.001	0.000
a3057_2	NOx	0.081	0.064	0.016	0.011	0.028	0.000	0.000	0.024	0.011	0.004	0.001	0.000
a3057_3	NOx	0.040	0.032	0.008	0.006	0.014	0.000	0.000	0.012	0.005	0.002	0.001	0.000
a3057_4	NOx	0.040	0.032	0.008	0.006	0.014	0.000	0.000	0.012	0.005	0.002	0.001	0.000
a3057_5	NOx	0.025	0.020	0.004	0.004	0.008	0.000	0.000	0.008	0.003	0.001	0.000	0.000
a3057_6	NOx	0.025	0.020	0.004	0.004	0.008	0.000	0.000	0.008	0.003	0.001	0.000	0.000
a3057_7	NOx	0.049	0.040	0.009	0.008	0.017	0.000	0.000	0.015	0.006	0.002	0.001	0.000
a3057_8	NOx	0.049	0.040	0.009	0.008	0.017	0.000	0.000	0.015	0.006	0.002	0.001	0.000
a33_1	NOx	0.153	0.073	0.080	0.016	0.042	0.000	0.000	0.015	0.026	0.045	0.009	0.000
a33_10	NOx	0.102	0.061	0.041	0.015	0.033	0.000	0.000	0.012	0.013	0.023	0.005	0.000
a33_11	NOx	0.102	0.061	0.041	0.015	0.033	0.000	0.000	0.012	0.013	0.023	0.005	0.000
a33_12	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_13	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_14	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_15	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_16	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_17	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_18	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_19	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_2	NOx	0.153	0.073	0.080	0.016	0.042	0.000	0.000	0.015	0.026	0.045	0.009	0.000
a33_20	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_21	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_22	NOx	0.137	0.075	0.062	0.017	0.043	0.000	0.000	0.015	0.019	0.035	0.007	0.000
a33_23	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_24	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_25	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_26	NOx	0.112	0.065	0.047	0.015	0.036	0.000	0.000	0.013	0.015	0.026	0.006	0.000
a33_27	NOx	0.126	0.064	0.063	0.015	0.036	0.000	0.000	0.013	0.020	0.035	0.007	0.000
a33_28	NOx	0.126	0.064	0.063	0.015	0.036	0.000	0.000	0.013	0.020	0.035	0.007	0.000
a33_29	NOx	0.126	0.064	0.063	0.015	0.036	0.000	0.000	0.013	0.020	0.035	0.007	0.000
a33_3	NOx	0.153	0.073	0.080	0.016	0.042	0.000	0.000	0.015	0.026	0.045	0.009	0.000
a33_30	NOx	0.126	0.064	0.063	0.015	0.036	0.000	0.000	0.013	0.020	0.035	0.007	0.000
a33_31	NOx	0.126	0.064	0.063	0.015	0.036	0.000	0.000	0.013	0.020	0.035	0.007	0.000
a33_32	NOx	0.125	0.073	0.052	0.017	0.040	0.000	0.000	0.015	0.017	0.029	0.006	0.000
a33_33	NOx	0.125	0.073	0.052	0.017	0.040	0.000	0.000	0.015	0.017	0.029	0.006	0.000
a33_34	NOx	0.125	0.073	0.052	0.017	0.040	0.000	0.000	0.015	0.017	0.029	0.006	0.000
a33_35	NOx	0.125	0.073	0.052	0.017	0.040	0.000	0.000	0.015	0.017	0.029	0.006	0.000
a33_36	NOx	0.125	0.073	0.052	0.017	0.040	0.000	0.000	0.015	0.017	0.029	0.006	0.000
a33_37	NOx	0.130	0.075	0.055	0.018	0.042	0.000	0.000	0.015	0.018	0.031	0.007	0.000
a33_38	NOx	0.130	0.075	0.055	0.018	0.042	0.000	0.000	0.015	0.018	0.031	0.007	0.000
a33_39	NOx	0.130	0.075	0.055	0.018	0.042	0.000	0.000	0.015	0.018	0.031	0.007	0.000
a33_4	NOx	0.153	0.073	0.080	0.016	0.042	0.000	0.000	0.015	0.026	0.045	0.009	0.000
a33_40	NOx	0.130	0.075	0.055	0.018	0.042	0.000	0.000	0.015	0.018	0.031	0.007	0.000
a33_41	NOx	0.153	0.084	0.069	0.019	0.048	0.000	0.000	0.017	0.022	0.039	0.008	0.000
a33_42	NOx	0.153	0.084	0.069	0.019	0.048	0.000	0.000	0.017	0.022	0.039	0.008	0.000

Appendix 4 : Potential Low Emission Strategy Measures for Western Approach, Southampton

Measures are colour coded in relation to the following four categories:

Promoting low emission vehicles – measures that can support or accelerate fleet transformation through the accelerated uptake of low or zero emission vehicles

Improving efficiency – measures that can improve the way that vehicles are used, or people and goods moved, in order to reduce emissions

Managing demand – mainly measures around modal shift, but also those that can help to reduce overall transport activity

Barrier Mechanisms – improving separation from highway or using barrier mechanisms to reduce exposure

Specific Western Approach LES Measures		
Measure	**Mechanism**	**Notes**
Low Emission/Environmental/Clear Zone: • **Emission criteria for vehicles accessing A33/Western Esplanade, including HGVs/LGVs/Buses/Cars** • **Emission criteria for HGVs travelling eastwards beyond Dock Gate 20/Millbrook Roundabout**	RTRO / HGV routing signs	• Would need to consider national fleet emission profile 2016/2018 • Would need to be focussed on Euro 6/VI • HGVs/cars main contributors, buses/LGVs also to be considered • Vehicle displacement /re-routing considerations • ANPR/manual enforcement • Implementation and scheme management costs • Learnings from London/Oxford/Norwich/poss West Mids
HGV Priority Lane from end M27 to Dock Gate 20/Millbrook Roundabout	RTRO/Additional road lane constructed	Would ease congestion, however, several plans looked at and difficult to reallocate road space
Low Emission Lanes – Bus/HGV/LGV priority lanes for low emission vehicles	RTRO	• Bus service level relatively low, therefore, opportunity to encourage accelerated emission improvement in HGV/LGV/car sectors

		• Could increase congestion/re-routing • Should be aimed at Euro 6/VI
EcoPass System – access charging related to emission standards	RTRO	• Similar to Milan scheme • Scheme acceptability and re-routing considerations • ANPR/manual enforcement • Implementation and scheme management costs
Low Emission Port Development	Public Private Partnership	Port contribution to background levels significant • Further investigation required as to main port sources • Could develop public private initiative • Could provide competitive advantage for port • Consideration of gas infrastructure to support emission reduction activity
Car Share Lane	RTRO	• M606/M62 scheme considered successful • M4 scheme removed • Can increase congestion on remaining restricted road space • Enforcement considerations
Sustainable Freight Consolidation Centre	LSTF	Successful £400k LSTF bid. Currently undergoing tender process. Meachers Global identified as a possible site/bidder. Could remove 100 vehicle deliveries per day to Council/Unis/NHS in first phase. Potential to expand scheme
Low Emission Enterprise Zone/Emission related Business Rates incentive	Business Rates / Planning Policy	Commercial zones to West of City and those accessed by Western Approach could be incentivised through business rates to reduce vehicle emissions/introduce infrastructure for LEVs
Area specific low emission land-use planning measures	Planning Policy/AQAP	Adoption of mitigation based approach to counter cumulative impacts of developments to West of City • Discourage use of high emission vehicles

		• Include provision for low emission vehicle re-charging/refuelling infrastructure • Incentivise uptake of low emission vehicle/specify low emission fleets • Require public sector travel passes for employees • Damage cost approach to achieving site acceptability • CIL and Section 106 considerations • Secure enhanced travel planning measures • Timing to coincide with wider policy update • Introduced through AQAP update • Cf West Mids, Bradford, West Yorks, Sussex
Focussed Public & Private Sector Travel Planning	Public Private Partnership Southampton Travel Plan / AQAP / Grey Fleet Policy	Monitored schemes can reduce vehicle activity up to 30% (cf. Pfizer) • Consider public & private sector targeted home working /delayed start & finish times • Incentives for modal shift • Grey fleet incentives for LEVs
Focussed Freight Accreditation Scheme	LTP / Public Private Partnership	Could compliment Low Emission Enterprise Zones. • FORS • EcoStars • Major benefits if tied into procurement
Smarter Choices - Public Information/Signage on vehicle emissions/Information Portal	LTP/LSTF	• Ongoing activity to facilitate modal shift and LEV take up • Public information campaign
Enhanced Cycle Lane	LTP/LSTF/Cycling ambition/Sustrans	• Consideration of super-cycle highway and associated infrastructure/incentives • Road space allocation considerations • Elevated highway consideration
Park & Ride / Park & Cycle	LTP/LSTF	• Potential to increase modal shift • Suitable site considerations • Potential for introducing Low Emission Buses

SCC Fleet Management	Council Policy / AQAP	Fleet based at Dock Gate 20, with over 400 vehicles, therefore, potential to influence emissions marginally – demonstration of LEVs/leadership considerations. Fleet currently at mainly Euro 5. Currently looking at WLC and possibility of looking at gas vehicle infrastructure with private sector
Alternative Fuel Infrastructure	Public Private Partnership NPPF / AQAP	(See above) • Potential to build on DfT Strategy to Switch HGVs to Gas (due end 2013) • Low Carbon Truck Demonstration • Build on regional capability • Consideration of gas as part of Green Port
Phasing / Gating / Speed Limit Management	LTP	To be discussed
Vegetation barriers	Maintenance contracts	Studies indicate that vegetation barriers can help trap particles but have little effect (poss increase) on reducing NO2
	Southampton Wide LES Measures	
Low Emission Parking	AQAP / NPPF / Work Place Parking Levy	Public and private sector initiatives • NCP annual pass reduction for CO2 • Priority parking/loading bays • Differentiated work place parking levy • Signage
Bus Emission Strategy	Voluntary agreement SQBP, Quality Contracts, AQAP, LTP, Green Bus Fund/Clean Bus Tec Fund	Discussions with GoAhead and First indicate willingness for voluntary Euro III standard city wide (GoAhead more than First). Bus operators may only go beyond BAU if City policy introduced ie through SQBP. • Consideration of emission standards on key routes • Consideration of re-engine/retro fit (DfT Clean Bus Tech Fund) • Consideration of low emission buses (Green Bus Fund or business case for gas)
Freight Emission Strategy	FQP/LTP	Voluntary standard possible but not high enough

		• Focus on infrastructure • Work with City centre businesses / CSR agenda • Promote consolidation centre
Low Emission Land-Use Planning Policies	Planning Policy/NPPF/AQAP	See before - focussed LE Land-use Planning
Taxi Emission Strategy	LTP/AQAP/ Licensing	• Taxi emissions to be assessed • Potential to influence emissions through licensing • Priority ranks for LEVs • Incentives through public sector contracts • Infrastructure for LEVs
Public Sector Procurement • **SCC Fleet Procurement** • **Public sector vehicle emission consideration in award criteria** • **Local sourcing**		Opportunities to cost effectively reduce vehicle emissions of both vehicles purchase and those delivering to City. • Cleaner Road Transport Vehicle Regs 2011 • Govt Buying Standards for Transport • Local sourcing can help local economy – focussed on CO2
Promote shared modes: • **City/development led car clubs** • **Cycle/e-cycle hire schemes**	LTP/LSTF/Sustrans	Ongoing activity.
Smarter Choices	LTP/LSTF	Ongoing activity
Eco Driving	LSTF/LTP/FQP/BQP/FORS/EcoStars /SAFED	Programmes targeted at: • Public • Freight (linked to FQP) • Buses • Taxis

Appendix 5 Southampton City Council – Fleet Model and Whole Life Costs

A simplified model of the Southampton City Council fleet has been created, based on vehicle fuelling data supplied for the 2012-13 year (the latest full year of data). The fleet has a total of 489 vehicles, subdivided into 50 classes. These have been simplified into five classes for the purposes of the model, with a few specialist vehicles such as skip lifters, street sweepers and mobile libraries omitted.

Fuelling data for a sample of vehicles in each class was checked for errors and then analysed in detail. The result was an estimate of the average yearly mileage and mpg for each simplified vehicle class. These estimates were multiplied up by the number of vehicles in each class, and the resulting approximation of total fuel use compared against the original data as a 'sense check'.

For four of the five model vehicle classes, the modelled fuel use was close to the actual data. However, in the case of the RCVs the model predicted fuel use far lower than recorded. The reason for this is unclear, as there are a large number of missing odometer readings in the RCV data, and relatively few vehicles overall. However, compared to other local authority fleets, the mpg figures in the model seemed appropriate, so the yearly mileage was increased until the model gave a similar overall fuel use to that recorded.

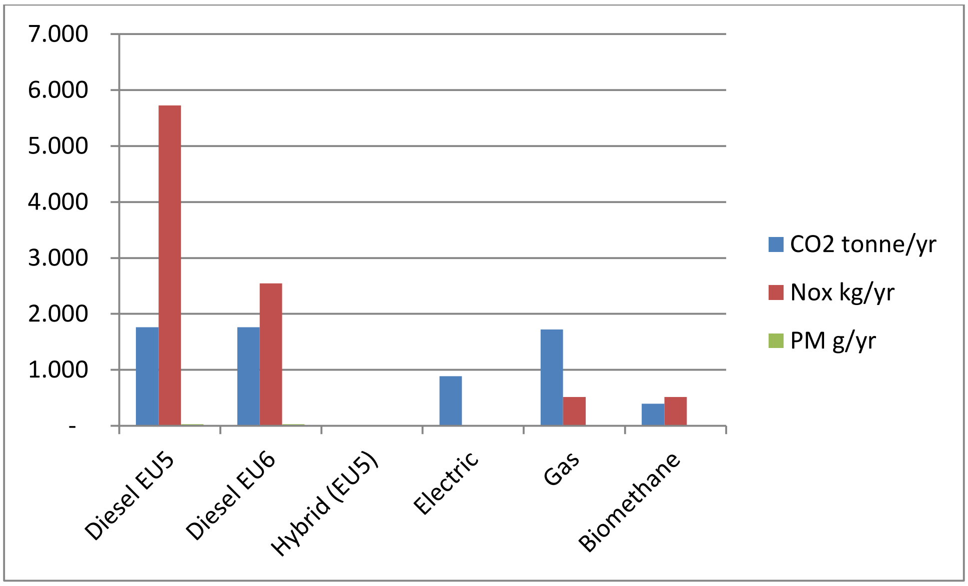
The table below shows the final fleet model:

Vehicle class	Number of vehicles	Average yearly mileage	Average mpg	Total fuel use
Car derived vans, cars and pickups	51	9,235	45.6	47,492
Smaller vans and tippers, 1-2.7t	106	4,193	30.9	66,239
Larger vans, minibuses and tippers, 2.8-3.5t	263	5,014	24.5	247,143
7.5t vans and tippers	12	15,159	19.9	42,114
RCVs (18-26t)	33	7,500	2.9	387,481
Totals	465			790,469

Based on the model figures, estimates were made of the emissions of CO_2, NO_x and particulates from each vehicle class, assuming they are Euro 5/V diesel vehicles. Then estimates were made of the energy use and emissions of alternative hybrid, electric and/or gas vehicles in each class (where such alternatives exist). Differences in purchase price and running cost were also estimated.

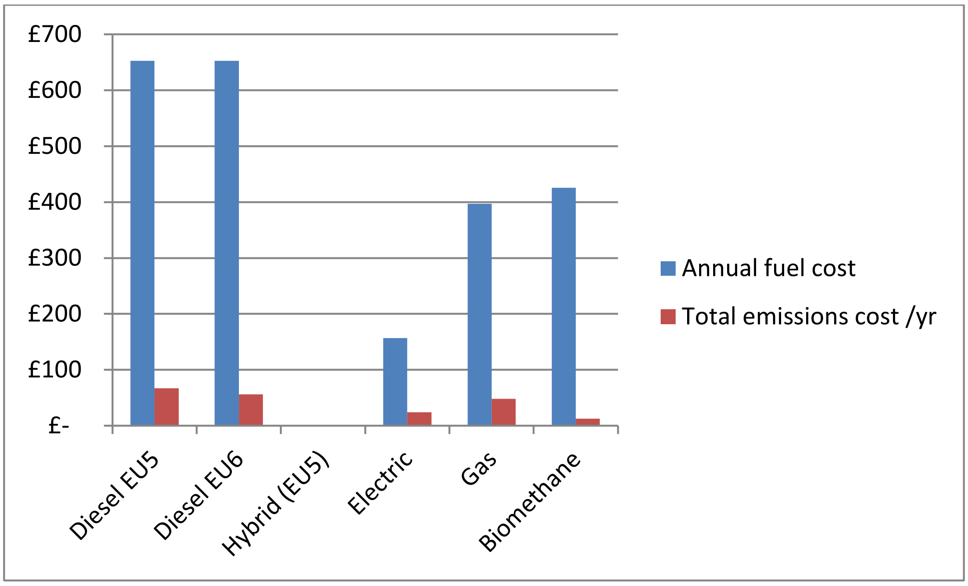
Car-derived vans, cars and pickups

There are around 51 vehicles of these types within the SCC fleet, accounting for about 6% of fuel use as modelled. Using data based on the VW Caddy and Renault Kangoo (which are available in gas and electric variants respectively) the chart below shows the differences in emissions for different drivetrains. (Note that there is no hybrid car-derived van suitable for comparison on the UK market.)



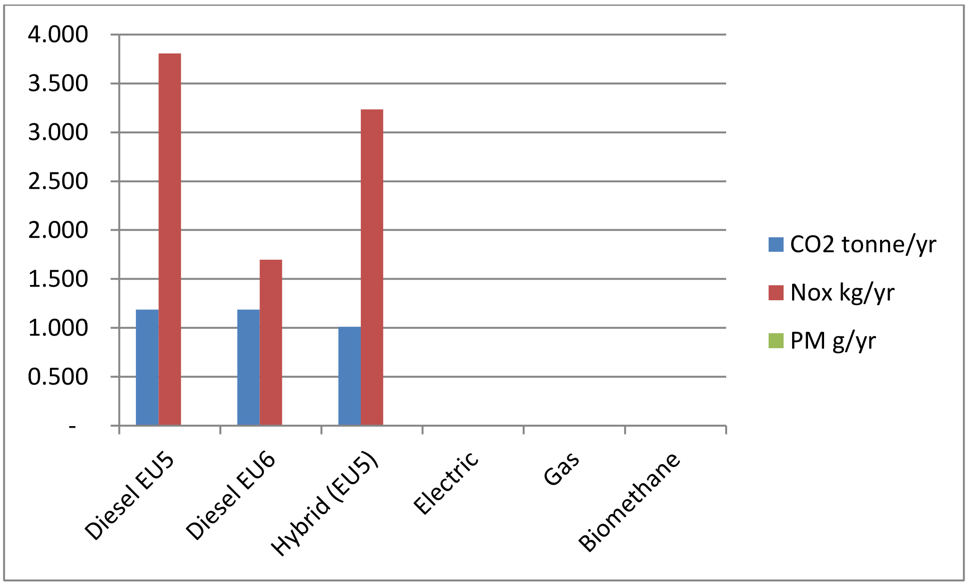
The gas version of the Caddy costs around £640 more than its diesel equivalent. If used in Southampton's fleet, it would save an average of £274 per year if run on grid gas, and £281 per year on biomethane, at current diesel/gas prices[21]. The electric Kangoo costs around £10,000 more than its diesel counterpart[22], and would save an average of £539 per year on fuel and emissions.

[21] This is the combined saving on fuel and emissions costs as worked out using the EU Cleaner Vehicles Directive methodology. It assumes a 5p/kg premium on biomethane, and does not include any allowance for additional gas refuelling infrastructure.
[22] Including the lease of the battery for five years.

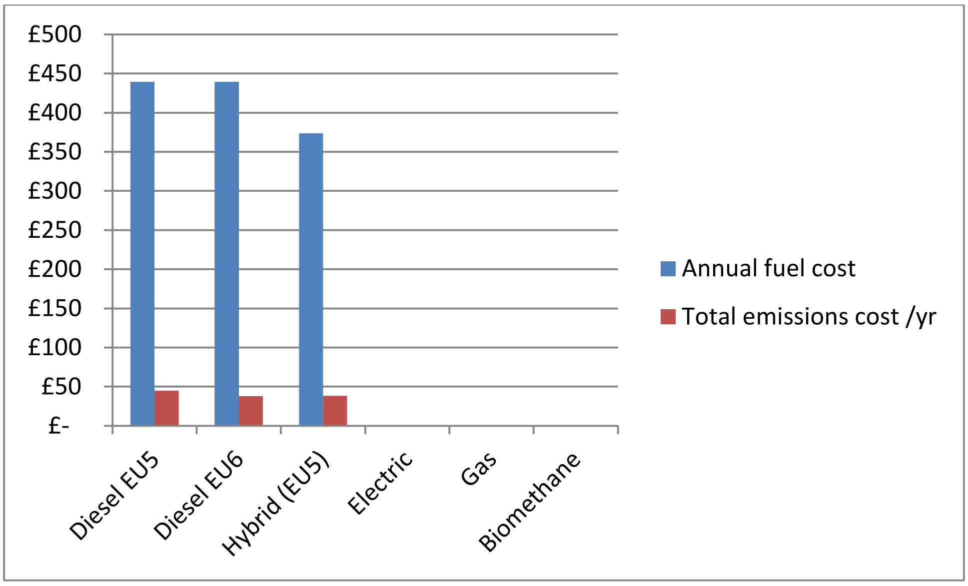


'Smaller' vans, (between 1 and 2.7t GVW)

There are around 106 vehicles of these types within the SCC fleet, accounting for about 8% of fuel use as modelled. Using data based on the Ford Transit and the Ashwoods Transit hybrid conversion, the chart below shows the differences in emissions for different drivetrains. (Note that there are currently no electric or gas vans suitable for comparison on the UK market, although Nissan will soon launch a 1t electric van based on the Leaf drivetrain, and Vauxhall are gauging interest in a range of smaller gas vehicles.)

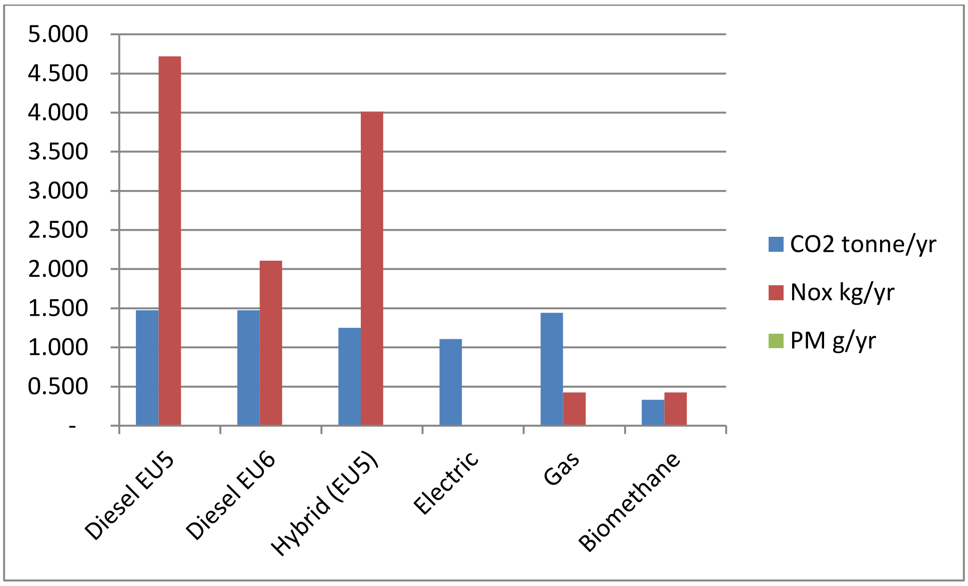


The Ashwoods Transit would save an average of £73 per year in fuel and emissions costs if used in Southampton's fleet, at current diesel prices. The exact additional cost over a standard transit is hard to estimate due to the wide range of deals available on a vehicle as popular as the Transit, but public sector fleets can still claim a grant of £3,430 per van from the DfT for the hybrid, which Ashwoods claim covers all of the additional cost.

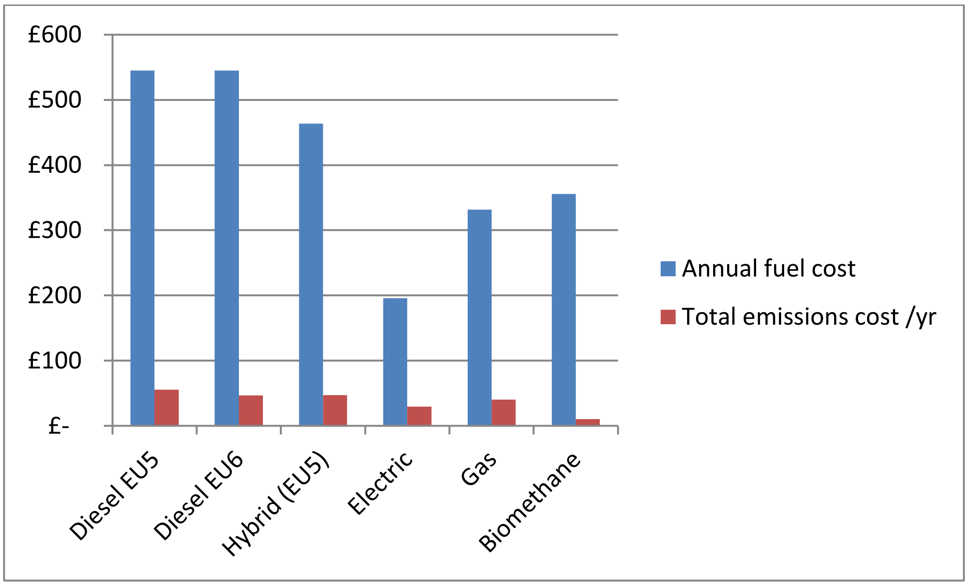


'Larger' vans, minibuses and tippers, 2.8-3.5t GVW

These are by far the most numerous type of vehicle in the SCC fleet, numbering 263 and accounting for about 31% of fuel use as modelled. Using data based on the Ford Transit, the Ashwoods Transit hybrid conversion, the Smith Edison (electric van based on a Transit chassis) and the Mercedes Sprinter NGT (the gas variant), the chart below shows the differences in emissions for different drivetrains.

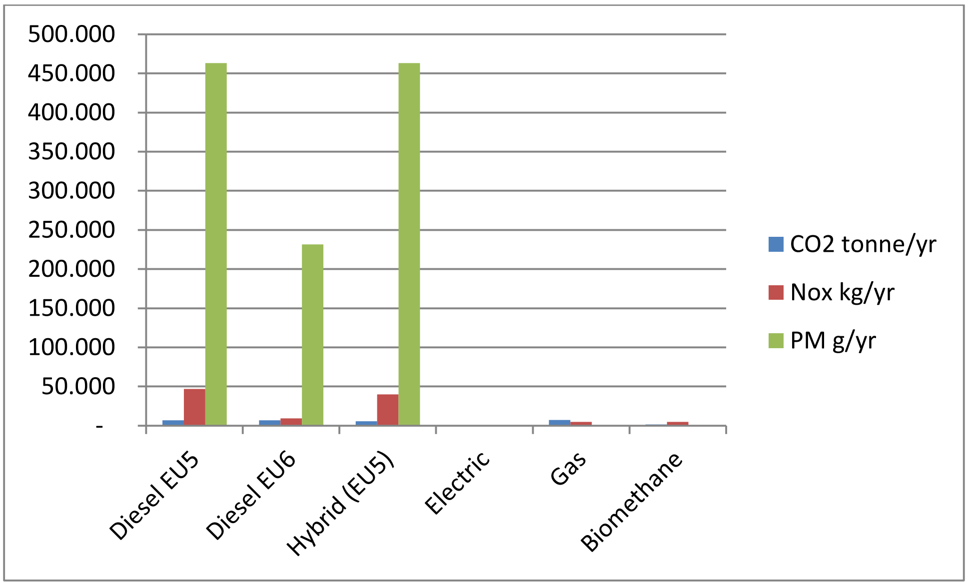


The Ashwoods Transit would save an average of £90 per year on fuel and emissions costs if used in Southampton's fleet in this larger size, at a small additional cost after claiming government funding (see above). The Smith Edison would save £375 per year, but costs £49,566 after subtracting the £8,000 it attracts in government funding. The Sprinter NGT would save £229 per year on grid gas, and £259 on biomethane, and costs £4,000 more than an equivalent diesel Sprinter.



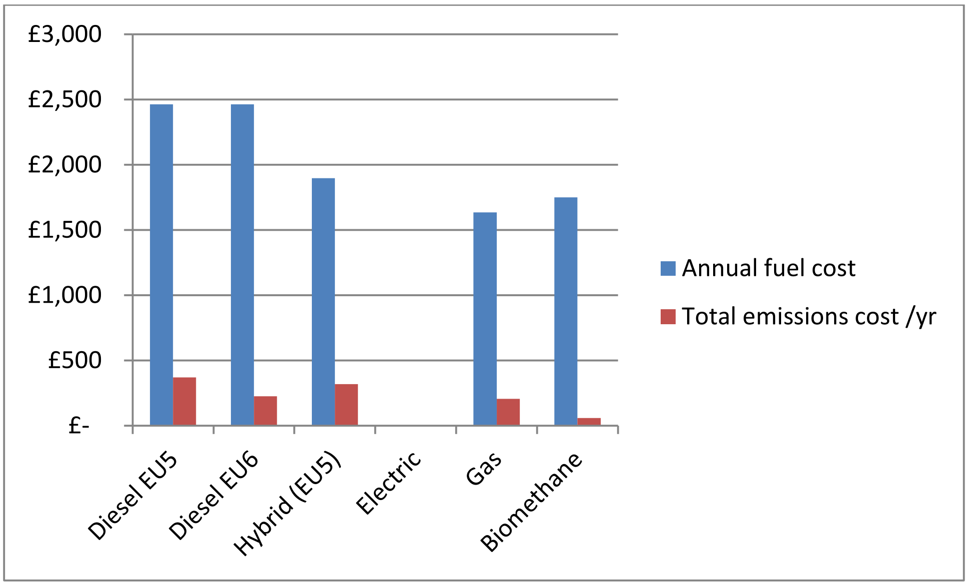
7.5t vans and tippers

There are only 12 vehicles of this size in the fleet as modelled, and they account for just 5% of fuel used. Using data based on the Iveco Eurocargo in diesel and gas versions, and the Fuso Cantor hybrid, the chart below shows the differences in emissions for different drivetrains. Note that there is an electric truck available at this weight, the Smith Newton, but there is no data available on its energy consumption and it costs £78,400.



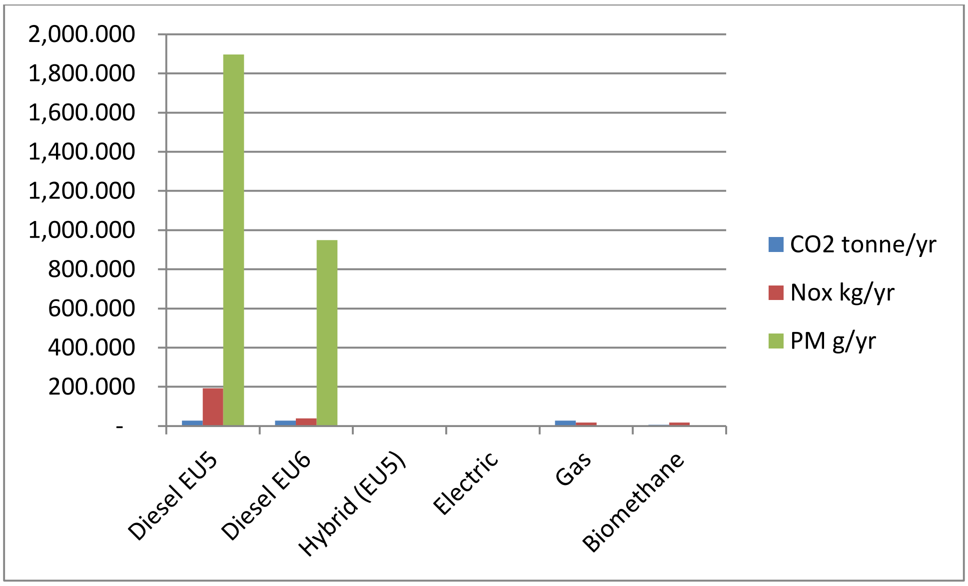
In the graph above, the units have been kept the same as the previous graphs to illustrate the large jump in particulate emissions when moving to heavier vehicles.

The Fuso Cantor hybrid is £7,200 more than its diesel counterpart, and would save around £617 per year on fuel and emissions costs in the Southampton fleet. The Eurocargo gas model would save an estimated £991 per year on grid gas, and £1,022 per year on biomethane [still awaiting price data].



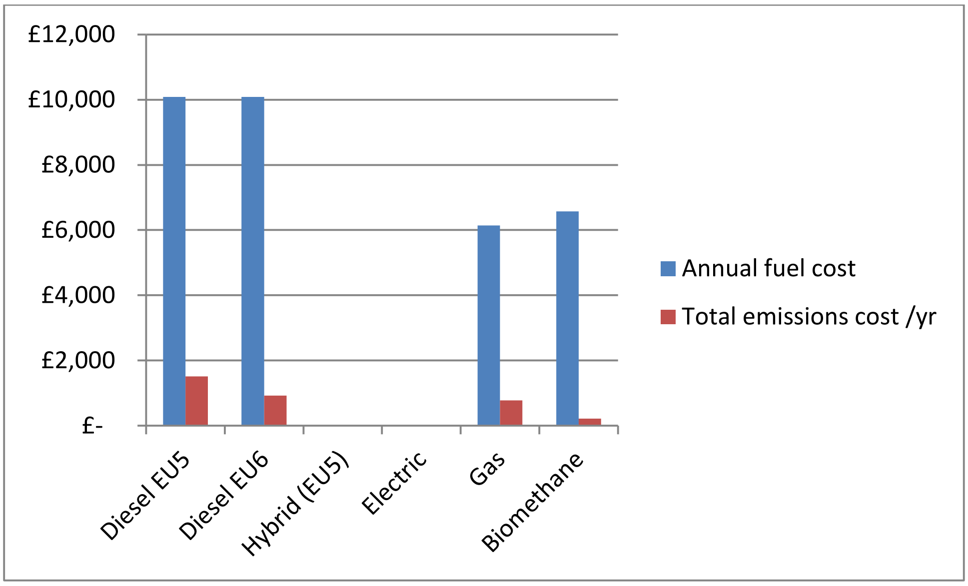
Refuse Collection Vehicles (18-26t)

There are only 33 of these vehicles in the Southampton fleet, but at an average of just 2.9 mpg they account for 49% of the total fuel used. Using data for the Mercedes-Benz Econic and Econic NGT (gas variant) the chart below shows the differences in emissions for different drivetrains. (Note that an attempt was made to get data for the Volvo hybrid RCV, but this was unavailable)

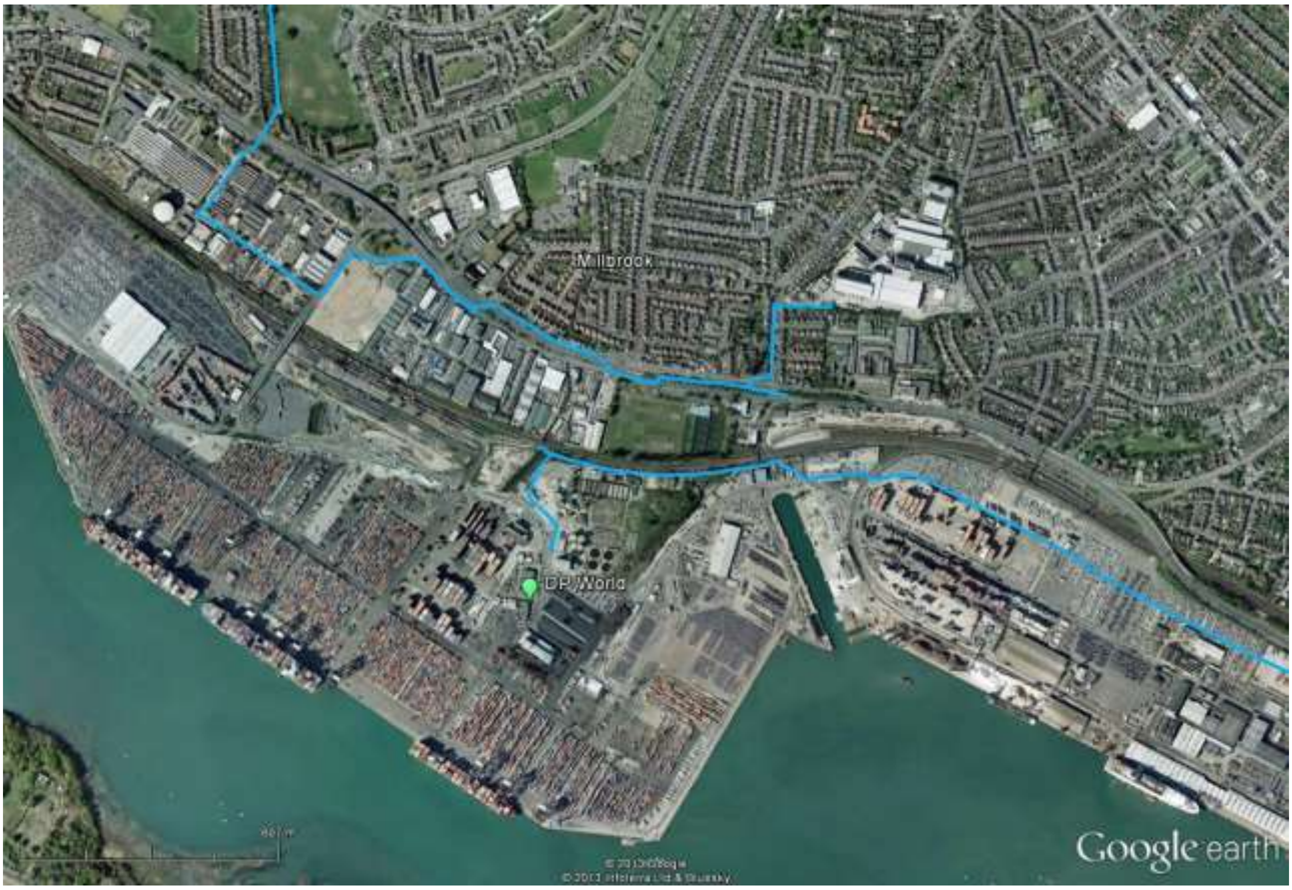


In the graph above, the units have been kept the same as the previous graphs to illustrate the large jump in particulate emissions when moving to heavier vehicles.

The Econic NGT costs around £25,000 more than its diesel equivalent, and would save in the region of £4,682 per year in fuel and emissions costs if run on grid gas, or £4,796 if run on biomethane.



Appendix 6: Compressed Natural Gas (CNG) Pipelines in Port Area



Medium Pressure (MP) pipeline

Not drawn to scale – Use for indicative purposes only

[Not to scale. For indicative purposes only. Image supplied courtesy of CNG Services Ltd]

RICARDO-AEA

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR

Tel: 0870 190 1900
Fax: 0870 190 6318

www.ricardo-aea.com