ArupTransport

Tyne and Wear Passenger Transport Authority

New Tyne Crossing

Summary of Proof of Evidence on Air Quality

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February 2003

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Job number 57621/76

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1. INTRODUCTION

Michael Andrew Bull will say:

1.1 I hold a BSc in Chemical Engineering from Exeter University and a PhD in Public Health Engineering from Imperial College, London. I am a Chartered Engineer and am a corporate member of the Institution of Chemical Engineers. I am an Associate Director of Ove Arup & Partners International Ltd, and Team Leader of the Environmental Science Team and particularly responsible for managing the air quality assessments undertaken by Arup Environmental.

1.2 I have worked as a professional environmental scientist for approximately 19 years having previously conducted research in environmental science for three years. I have held posts both within industry and as a consulting scientist. I have been responsible for conducting environmental studies for major road improvement and construction schemes, power stations, mineral extraction and waste disposal sites and other major industrial complexes. In addition, I am one of the co-authors of the RTPI Good Practice Guide on Air Quality and Land Use Planning and the ALG Technical Guidance on Air Quality Assessment for Planning Applications.

1.3 I have undertaken air quality assessments of numerous road tunnel schemes including the Dublin Port Tunnel, proposed tunnels on the North Circular Road London, the Hatfield Tunnel on the A1(M), the Holmesdale Tunnel on the M25 and the Heathrow approaches tunnel. In addition, I have undertaken air quality assessment of many road scheme proposals including the M25 and the A1(M) widening, construction of the M4 relief road, the M50 C-Ring in Dublin, and improvements on the M2, A13, A406, A23, M65, A40 and the A63 together with numerous smaller proposals.

1.4 In this instance I have been retained by the TWPTA to advise on air quality issues. I have been the project manager for the air quality assessment undertaken for the environmental statement and am familiar with the scheme. The scope of work for this assessment was as follows:

i. Review of existing air quality in the area;

ii. a qualitative assessment of the impact of the construction activities on air quality;

iii. a quantitative assessment of the impact of the operation of the New Tyne Crossing on the local and global air quality.

iv. a comparison of forecast air pollutant levels with current air quality criteria.

1.5 This document presents a summary of the findings of the above tasks that are described in detail in my full document.

2. AIR QUALITY STANDARDS AND GUIDELINES

2.1 There are a number of air quality standards and guidelines relevant for this assessment based on UK and European legislation. They are summarised below in Table 1.

TABLE 1 AIR QUALITY CRITERIA

Pollutant	Averaging Period	Limit Value/Objective	Year for Compliance	Reference
Nitrogen Dioxide	1 hour mean	200 µg/m^3, not to be exceeded more than 18 times a year (99.8th percentile)	2005	AQS objective
			2010	UK limit value
	Annual mean	40 µg/m^3	2005	AQS objective
			2010	UK limit value
Carbon Monoxide	Running 8 hour mean	11.6 mg/m^3	2003	AQS objective
		10.mg/m^3	2010	Draft UK limit value
Benzene	Running annual mean	16.25 µg/m^3	2003	AQS objective
		5 µg/m^3	2010	Draft UK limit value
1,3 Butadiene	Running annual mean	2.25 µg/m^3	2003	AQS objective
Fine Particulates (PM_{10}) Measurement technique: Gravimetric	Daily mean	50 µg/m^3, not to be exceeded more than 35 times a year (90th percentile)	2004	AQS objective
			2005 (Stage I)	UK limit value
		50 µg/m^3, not to be exceeded more than 7 times a year (98th percentile)	2010 (Stage II)	UK limit value
	Annual mean	40 µg/m^3	2004	AQS objective
			2005 (Stage I)	UK limit value
		20 µg/m^3	2010 (Stage II)	UK limit value

3. EXISTING AIR QUALITY

Air Quality Monitoring

3.1 Air quality monitoring has been carried out by Newcastle City Council for this project, in addition, monitoring is routinely carried out by the Council and on behalf of DEFRA in the area.

Newcastle City Council

3.2 Between January 2000 and April 2001 Arup worked with Newcastle City Council to undertake a monitoring programme in the area. Two main techniques were used, a mobile monitoring unit containing continuous analysers and diffusion tubes that measure average concentrations of nitrogen dioxide and benzene over a period of two to four weeks.

3.3 The diffusion tubes were used at 45 different locations for nitrogen dioxide and 10 locations for benzene near the north and south side of the proposed crossing for a period of 12 months. The results showed that none of these sites recorded an exceedance of relevant air quality standards (note that full results of the monitoring are provided in Appendix A of my full proof).

3.4 The results of the mobile monitoring are shown in Table 2 below.

TABLE 2 – MOBILE AUTOMATIC MONITORING STATION

Pollutant	Statistic	St Peters School, Jarrow *01-01-00 to 30-04-00*	South Portal Entrance *16/05/00 to 14/09/00*	Tyne Tunnel Industrial Estate *1/10/00 to 31/1/01*	Air Quality Objective
Carbon Monoxide	Maximum 8hr mean (mg/m^3)	7.3	7.7	2.6	11.6 mg/m^3 to be achieved by 2003
NO_2	Mean ($\mu g/m^3$)	8	30	33	Annual mean of 40 $\mu g/m^3$, to be achieved by 2005
	No of hourly exceedences of 200 $\mu g/m^3$	3	2	55	18 exceedences in a year
Benzene	Average daily mean ($\mu g/m^3$)	1.6*	2.7**	1.5	Annual mean of 16.25 $\mu g/m^3$, to be achieved by 2003
PM_{10}	Mean ($\mu g/m^3$)	11	11	13	Annual mean of 50 $\mu g/m^3$, to be achieved by 2004
	No of hourly exceedences of 50 $\mu g/m^3$	0	0	0	35 exceedences in a year

*16-02-00 to 11-05-00 **13-05-00 to 09-15-00

3.5 These results show that two of the three sites meet the relevant air quality objectives. One site, (Tyne Tunnel Industrial Estate) showed several exceedances of the one hour nitrogen dioxide objective. However, there are two possible reasons for this. The operators of the mobile unit reported problems with leakage of the calibration gas during the monitoring that would result in high concentrations being recorded. In addition, the site is next to a heavy good vehicles park where movement of vehicles close to the monitor would result in high short term concentrations. The annual mean concentration at this site is below the objective level thus the short term exceedances must be as the result of a local source.

3.6 Therefore, in general, concentrations are within the relevant air quality standards and objectives with one local area of exceedance.

4. AIR QUALITY IMPACTS DURING CONSTRUCTION

4.1 To assess the impacts on air quality during construction I have examined the potential sources of air pollutants and identified sensitive land uses. There are two main types of pollutant to consider, dust and exhaust emissions. Exhaust emissions depend on several factors, however, the magnitude of exhaust emissions from a construction site is very small compared with those from vehicles on the main routes in the area, and they are therefore unlikely to have a significant impact on air quality in the area.

4.2 I have identified the types of construction activity that can give rise to dust emissions and noted that the main environmental effect is likely to be nuisance from soiling of surfaces rather than any adverse health impacts. Adverse dust impacts would be most likely to arise within 100 metres of the construction activity. Although there are several sensitive properties nearby, the potential for dust nuisance can be minimised by the application of mitigation measures. These measure are designed to prevent dust becoming airborne or contain dust laden air within enclosures to prevent dispersion beyond the emission point. The proposed dust mitigation are detailed below in Table 3.

TABLE 3 : MITIGATION MEASURES FOR INCLUSION IN CODE OF CONSTRUCTION PRACTICE AND EFFECTIVENESS

Mitigation Measure for inclusion in Code of Construction Practice	Effectiveness
The enclosure of stockpiles of dusty materials and damping down (where possible) during use.	Moderate/High
The use of hard surfaced areas for easy cleaning and reduction in generation of surface dust.	High
Regular cleaning of hard surfaced areas by brushing and water sprays.	Moderate/High
Hoardings and gates to prevent dust breakout.	Low
Sheeting of vehicles carrying dusty materials.	High
Use of water sprays, and covers, reduction in drop heights and screening during handling and transfer of dusty materials.	High
Location of dust producing activities away from sensitive areas as far as possible.	Moderate/high
Watering of unsurfaced haul roads and consideration of hard surfacing close to sensitive areas.	High
Speed limits on site haul roads.	Moderate

TABLE 3 : MITIGATION MEASURES FOR INCLUSION IN CODE OF CONSTRUCTION PRACTICE AND EFFECTIVENESS	
Use of vertically directed exhausts.	Moderate/high
Exposed areas of site to be sealed and revegetated as soon as possible.	High
Mixing of concrete and/or bentonite slurries to be carried out in enclosed/shielded areas where necessary.	Moderate

4.3 As can be seen from the above table, the measures proposed are effective in reducing dust emissions and will be capable of minimising potential nuisance in the area. These measures are contained within a Code of Construction Practice designed to ensure that environmental impacts are minimised during the construction phase of the project.

4.4 With these measures in place it can be expected that there would be minor adverse impacts during the construction period.

5. IMPACTS DURING OPERATION OF THE CROSSING

Assessment Methods

5.1 To examine the potential air quality impacts during the operation of the tunnel I have followed the guidance contained in Volume 11 of the Design Manual for Roads and Bridges (the DMRB). Using this guidance I have undertaken four separate tasks:

i. a simple screening assessment at several discrete receptors;

ii. dispersion modelling in the area around the tunnel portals

iii. generalised screening assessment to give an overall indication of the air quality impacts of the proposals; and

iv. calculation of the changes in global pollutant emissions from the scheme.

DMRB Screening Method

5.2 The DMRB screening method (task i above) is designed to estimate air pollutant concentrations at receptors to highlight where there may be a potential air quality problem. The method considers the traffic volumes, speeds and composition together with the distance from the road to calculate pollutant concentrations. It is not designed to be an exact indicator of pollutant concentrations but is intended to identify where further, more detailed, assessment is required or to compare different scenarios.

5.3 I have selected several receptors on the northern and southern side of the crossing. These were selected to be representative of the potential impacts of the proposals, receptors located further from the roads would be expected to have a lower impact. Eight receptors were selected and concentrations calculated for the base year of 2000 and for the with scheme and without scheme situations in the years 2006 and 2021.

5.4 The results of the DMRB screening assessment show that none of the receptors are expected to experience an exceedance of the relevant air quality criteria. Concentrations of pollutants in the future years are expected to be lower than the base year with or without the proposals as a result of improvements in emission controls on vehicles. With the scheme in place, forecast concentrations are expected to remain largely unchanged or to increase slightly.

Detailed Dispersion Modelling

5.5 Detailed dispersion modelling was undertaken using the models Caline4 and ISC in the area around the tunnel portals as the DMRB screening method cannot be used in these locations. The models included the potential impact of the emissions from the roads, the tunnel portals and the tunnel ventilation stacks.

5.6 The results of the detailed modelling show that the resulting pollutant concentrations are within the air quality standards and objectives. Some small changes in pollutant concentrations with the scheme are predicted but these are not considered to be significant.

Generalised DMRB Screening Method

5.7 The generalised DMRB screening method is intended to give an overall assessment of the impacts of the scheme along the corridor of the proposals. It takes into account the magnitude of the changes in air quality experienced at receptors and the number of properties affected by these changes. If the calculated value is positive, then the scheme is considered to have an overall deterioration in air quality, if negative, the scheme is considered to have a beneficial impact on air quality. Two scores are produced, one based on the predicted concentration of nitrogen dioxide and the other on particulate matter (PM_{10}). The scores are as follows:

Nitrogen dioxide : -1441

PM_{10} : -259

5.8 The results show that the overall air quality impacts of the scheme as determined by this method are considered to be beneficial. This is due to a number of properties experiencing a relatively large improvement in air quality. Although several properties experience a deterioration in air quality, the increase in concentrations is relatively small hence the overall result is considered to be an improvement.

Global Pollutant Emissions

5.9 The changes in global emissions of air pollutants in summarised below in Table 4 that shows the percentage change in pollutant emissions compared to the Do-Minimum scenario.

TABLE 4 : NET EFFECTS OF THE PROPOSED TUNNEL ON GLOBAL EMISSIONS

Year	With scheme compared to without scheme.	Carbon monoxide	Nitrogen oxides	Hydrocarbons	PM_{10}	Carbon dioxide
2006	% change	-2.8%	-1.4%	-2.9%	-1.6%	-1.4%
2021	% change	-1.3%	-0.6%	-1.2%	-0.6%	-0.6%

5.10 The results show that the scheme produces very little change in the overall emissions of atmospheric pollutants with the proposed new tunnel. The scheme is forecast to produce a small net reduction in emissions as a result of a slight decrease in total vehicle kilometres travelled.

6. CONCLUSIONS

6.1 I have carried out an assessment of the changes in local air quality that are likely to arise following the construction of the New Tyne Crossing. My assessment has considered the results of air quality monitoring in the area, the likely air quality impacts during construction and the impacts during operation of the crossing.

6.2 Existing air quality in the area already meets air quality standards and objectives set for future years at all monitoring sites with the exception of one site where a local source appears to result in short terms exceedances of air quality standards.

6.3 Air quality impacts during construction can be controlled by the application of various mitigation measures to minimise the release of dust into the environment. These measures have been shown to be very effective and should reduce dust impacts during construction to result in a minor adverse impact.

6.4 An assessment of the predicted changes in pollutant concentrations has been made using various techniques. Firstly a graphical screening method intended to identify where an air quality problem may arise has been used. This has demonstrated that properties that are not located close to the proposed tunnel portals will not experience a significant change in air quality following construction of the scheme.

6.5 The second assessment method has been the use of detailed dispersion modelling to determine predicted pollutant concentrations near to the tunnel portals. These results have also shown that the resulting air quality will meet relevant air quality standards and guidelines and that changes in air quality will be relatively small.

6.6 Thirdly the DMRB generalised assessment method has been used to determine the overall effects of the scheme on air quality along the corridor of the proposals. This has shown that the scheme is predicted to give rise to an overall improvement in air quality compared with the Do-Minimum scenario.

6.7 Finally, the global emissions of pollutants have been calculated to compare the with and without scheme scenarios. This has shown that there are very small difference between the two cases although there is a small reduction in emissions in the with scheme scenario as a result of a small reduction in total vehicle kilometres travelled.