16. Air quality

16.1 Introduction

Air quality is a key consideration when examining the overall benefits and impacts of a major public transport infrastructure proposal. Currently, motor vehicle emissions are identified as the predominant source of air pollutants in the south-east Queensland region (Environmental Protection Agency 2008) and the trend of increasing private car use is expected to produce the greatest pressure on Brisbane's air quality over the next 20 years. On a regional level, greater use of public transport may help reduce this pressure by slowing the growth of private car travel. On a local level, it will be important to examine what impact the busway might have on specific areas along the route and propose ways to manage any impacts.

The Rochedale to Springwood corridor is dominated by a six-lane motorway which produces the majority of air pollutants in the study corridor.

Air quality needs to be considered as part of the Concept Design Study for the following reasons:

- the potential air quality issues associated with the construction of the South East Busway extension from Rochedale to Springwood, particularly in relation to dust generation
- the potential emissions produced from the buses utilising the busway once operational
- the potential benefits and opportunities in reducing overall emissions, due to the busway's ability to slow the growth in private vehicle demand.

16.2 Methodology

The Department of Transport and Main Roads has undertaken a significant amount of analysis on air quality issues as they relate to Brisbane's busway network. This included thorough air quality analyses for the Eastern Busway, Northern Busway, Boggo Road Busway, South East Busway, and Inner Northern Busway. From this history, it is understood that busway projects present significant regional benefits into the future as they attract more people onto public transport who would otherwise travel in private vehicles. It is also understood that a busway's potential impacts on local areas along the route require investigation to ensure that air quality standards are maintained.

Detailed air quality analysis investigating the specific benefits and impacts will be undertaken closer to delivery of the busway extension. A desktop assessment considering previous investigations is considered appropriate for the purposes of the Concept Design Study. This is due to:

- expected advances in fuel technologies which may result in fewer emissions
- potential advancements in mitigation technologies which may affect the management of issues
- the need to calculate traffic volumes closer to the time of delivery to ensure a more accurate assessment
- changes to the understanding of health effects relating to air quality
- continual improvements to relevant air quality standards and legislation.

16.2.1 Previous investigations

Pacific Motorway Transit Project

The Pacific Motorway Transit Project included within its proposal an extension of the South East Busway to Underwood Road, Rochedale, and bus lane facilities in the north and southbound directions on the motorway.

As part of Pacific Motorway Transit Project planning, air quality had been investigated within the Eight Mile Plains to Springwood corridor. The Pacific Motorway Transit Project Environmental Approval Report provided air pollutant data sourced from an air quality monitoring station located within Springwood High School grounds. Information on climatic conditions was also presented, sourced from a Bureau of Meteorology site which was located at the Logan City Water Treatment Plant at Loganholme. This information was reviewed to determine the existing air quality within the corridor and can be found within the Pacific Motorway Transit Project Environmental Approval Report – Section A (Connell Wagner 2006).

Eastern and Northern Busway Concept Design and Impact Management plans

These busway projects have completed extensive air quality investigations to determine potential issues and benefits. Each project produced a Concept Design and Impact Management Plan which contained this information. The air quality data was reviewed to gain information on the level of emissions produced by buses and the potential for air quality impacts. These investigations can be found in the Eastern Busway Concept Design and Impact Management Plan, Chapter 19 (2007) and the Northern Busway Concept Design and Impact Management Plan, Chapter 18 (2007).

16.2.2 Additional investigations

The air quality investigation within the Pacific Motorway Transit Project Environmental Approval Report was highly relevant to the South East Busway extension from Rochedale to Springwood and further air quality monitoring was not considered necessary for the purposes of the Concept Design Study. A review of 2008 air quality levels gathered by the Queensland Environmental Protection Agency and Bureau of Meteorology has also been completed.

A review of current air quality standards revealed that the legislation used within the Pacific Motorway Transit Project Environmental Approval Report — the Queensland Government Environmental Protection (Air) Policy 1997 — has been updated since January 2007. The current air quality standards are contained in the Commonwealth National Environment Protection (Ambient Air Quality) Measure and the Commonwealth National Environment Protection (Air Toxics) Measure. These standards have been utilised in the analysis of the current air quality standards undertaken as part of this chapter's air quality assessment.

16.3 Preliminary analysis

16.3.1 Existing air quality

According to previous Pacific Motorway Transit Project studies and a review of 2008 Environmental Protection Agency data, the existing air pollutants within the Rochedale to Springwood corridor do not exceed the nominated standards. It appears that air pollutant levels generated by bus transport are unlikely to increase significantly in the future and in fact some pollutants may even decrease due to technological advancements such as cleaner fuel technologies.

Climatic factors such as wind may influence the air pollutant levels within the Rochedale to Springwood corridor. It was found that during the summer months pollutants are more likely to be dispersed by winds, which may result in lower concentrations. During winter, however, pollutant concentrations may peak due to calmer air conditions. The following information details the data presented in Pacific Motorway Transit Project, which has been updated where necessary.

Air pollutants

The Department of Environment and Resource Management's Springwood monitoring station was used to calculate air pollutant levels. Changes in air pollutant levels can be assessed by comparing the most recent data (2008) to the data presented in the Pacific Motorway Transit Project Environmental Approval Report (recorded in 2004). Both data sets have recorded levels below the relevant standards (including the Environmental Protection (Air) Policy; Air National Environment Protection Measure; and Air Toxics National Environment Protection Measure).

Table 16-1 shows the monitoring results recorded at the Springwood site between February 2007 and January 2008. Table 16-2 shows the 2004 monitoring results adapted from the Pacific Motorway Transit Project Environmental Approval Report.

Table 16-1: Summary of ambient air quality monitoring results, 2007–2008

Pollutant	Averaging period	Maximum	Annual average	Data recovery (%)	Relevant standard
Ozone	4 h	0.038 ppm	—	94	0.080 ppm[1]
	1 h	0.042 ppm			0.10 ppm[1]
Nitrogen dioxide	1 h	0.042 ppm	0.006 ppm	97.1	0.12 ppm[1]
Sulfur dioxide	24 h	0.003 ppm	0.001 ppm	94.4	0.08 ppm[1]
	1 h	0.012 ppm			0.20 ppm[1]
Benzene	24 h	1.5 ppb	0.9 ppb	86.9	3 ppb (annual average)[2]
Toluene	24 h	3.6 ppb	1.3 ppb	81.2	100 ppb (annual average)[2]
p-xylene	24 h	2.4 ppb	1.5 ppb	84.7	200 ppb (annual average)[2]
PM_{10}	24 h	49.3 µg/m³	15.6 µg/m³	98	50 µg/m³ [1]
$PM_{2.5}$	24 h	17.8 µg/m³	4.8 µg/m³	93.4	25 µg/m³ [1]

Source: Environmental Protection Agency, 2008

Table notes:

ppm: parts per million

µg/m³: micrograms per cubic metre

1 National Environment Protection (Air) Measure

2 National Environment Protection (Air Toxics) Measure

Table 16-2: Summary of ambient air quality monitoring results, 2004

Pollutant	Averaging period	Maximum	Annual average	Data recovery (%)	EPP Air 1997air quality goal
Ozone	4 h	0.052 ppm	0.013 ppm	96.3	0.080 ppm
	1 h	0.060 ppm			
Nitrogen dioxide	1 h	0.038 ppm	0.007 ppm	94.4	0.160 ppm
Sulfur dioxide	24 h	0.004 ppm	0.001 ppm	96.3	0.040 ppm
	3 h	0.009 ppm			0.020 ppm (annual average)
	1 h	0.017 ppm			0.200 ppm
Benzene	24 h	1.3 ppb	0.8 ppb	88.5	3 ppb (annual average)
Toluene	24 h	5.9 ppb	2.0 ppb	88.5	2000 ppb
p-xylene	24 h	1.9 ppb	0.8 ppb	88.5	250 ppb (NEPM)[1]
PM_{10}	24 h	40.2 µg/m³	16.6 µg/m³	98.6	150 µg/m³
$PM_{2.5}$	24 h	22.8 µg/m³	6.5 µg/m³	98.1	65 µg/m³ (USEPA)[2]

Source: Environmental Protection Agency, 2005

Table notes:

ppm: parts per million

µg/m³: micrograms per cubic metre

1 National Environment Protection (Air Toxics) Measure

2 USEPA: United States EPA air quality standards

The updated air pollutant data was released by the Environmental Protection Agency in early 2008. The data indicates that there has been no significant change in air quality levels since 2004. In fact, many pollutants have recorded a slightly reduced level and remain well within current standards. Only PM_{10} and $PM_{2.5}$ can be identified as a priority for future investigation due to high maximum levels recorded over 24 hours, which were close to the relevant standard.

Table 16-3 presents a summary of the changes in air pollutant concentrations. It is important to note that the changes in pollutant levels appear to be minor in scale.

Table 16-3: Summary of air pollutant changes since 2004

Pollutant	Recorded change		Exceeds air quality standard
	Maximum levels	Annual average	
Ozone	Lower	—	No
Nitrogen dioxide	Higher	Slightly lower	No
Sulfur dioxide	Lower	Same	No
Benzene	Higher	Slightly higher	No
Toluene	Lower	Lower	No
p-xylene	Higher	Higher	No
PM_{10}	Higher	Lower	No
$PM_{2.5}$	Lower	Lower	No

Climatic conditions

Climatic conditions were recorded at the Logan City Water Treatment Plant. The existing climatic conditions within the corridor can be illustrated by comparing the long-term average climate data recorded in 2008, to that recorded in 2005 (adapted from the Pacific Motorway Transit Project Environmental Approval Report). It was found that the updated data (shown in Table 16-4) does not present any reasonable change, apart from mean rainfall which has decreased annually. Therefore, the information provided within the Pacific Motorway Transit Project Environmental Approval Report remains relevant for the purposes of this Concept Design Study.

Table 16-4: Climate data for Logan City Water Treatment Plant, 2008

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily max temp (^{0}C)	29.7	29.4	28.4	26.4	24.0	21.6	21.4	22.4	24.9	26.4	27.5	28.8	25.9
Mean daily min temp (^{0}C)	20.4	20.0	18.8	15.8	12.5	9.7	8.4	9.2	12.2	14.9	17.0	18.9	14.8
Mean rainfall (mm)	111.7	137.5	115.3	66.6	114.5	64.9	33.7	48.3	43.2	61.6	101.2	128.2	1030.2
Mean 9 am wind speed (km/h)	7.6	7.2	7.1	5.6	5.9	5.2	5.8	5.9	6.2	7.4	7.2	7.3	6.5
Mean 3 pm Wind speed (km/h)	14.8	14.0	14.4	12.9	10.2	9.3	9.9	11.9	13.3	13.8	13.9	13.7	12.7

Source: Bureau of Meteorology, 2008

Table 16-5: Climate data for Logan City Water Treatment Plant, 2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily max temp (^{0}C)	29.7	29.3	28.4	26.2	23.8	21.7	21.2	22.2	25.1	26.0	27.5	28.8	25.9
Mean daily min temp (^{0}C)	20.2	20.2	18.8	15.8	12.6	9.7	8.6	9.2	12.2	14.7	17.0	19.0	15.0
Mean rainfall (mm)	104.0	144.0	131.9	71.7	130.9	53.8	38.6	48.6	45.8	55.2	105.4	128.3	1058.1
Mean 9 am wind speed (km/h)	7.8	7.5	7.0	6.0	6.1	5.5	5.7	6.2	6.5	7.3	7.9	7.8	6.8
Mean 3 pm wind speed (km/h)	15.6	14.7	15.1	12.9	13.7	9.6	10.3	12.5	14.4	14.7	15.1	14.8	13.4

Source: Department of Main Roads, 2006

The tables show that most of the rainfall within the study area occurs during summer and autumn months, with the highest averages occurring in December, February, March and May. The average monthly maximum and minimum temperatures for summer months (according to 2005 data) were 29.3°C and 19.8°C, respectively and 21.7°C and 9.2°C during winter months, respectively. The 2008 data shows no change in these temperatures.

The wind speed recorded at 3 pm is significantly higher than that recorded at 9 am. The average wind speed was also highest in the summer months and lowest in the winter months at both 9 am and 3 pm (Department of Main Roads 2006).

Wind direction data from the Brisbane Bureau of Meteorology has indicated the following predominant wind directions:

- at 9 am:
  - south-westerly during autumn and spring
  - south-easterly during summer
  - westerly during winter
- at 3 pm:
  - north-easterly winds during summer and spring
  - westerly winds during autumn and winter months.

Surface winds are an important consideration when examining air pollutant levels, as emissions are carried in the direction of winds. Winds can also be characterised by local influences and can vary within relatively short distances (1 to 5 kilometres) due to terrain and land use.

16.3.2 Managing issues and opportunities

Road gradients and station design

The road gradient can affect the level of pollutants emitted by buses as steep grades require more engine power, thus producing more emissions. This is particularly important around busway stations as the level of emissions from buses is highest right on the kerb of the busway. The idling time and acceleration of buses are considerations which are to be incorporated into the road design.

Dust generation

During the construction of a busway, generation of dust is an important consideration as it may impact on air quality if not managed appropriately. Potential sources of dust include earthworks and transporting rubble. Current management strategies include covering truck loads and soil stockpiles, laying gravel on off-road access routes, setting speed limits for construction vehicles and using recycled water sprays and wheel washers.

Safety through design and management

Motor vehicle emissions are the dominant source of air pollutants in the Rochedale to Springwood area and the busway extension is not expected to contribute significantly to the rise of harmful emissions within the corridor. Despite this, the Department of Transport and Main Roads is committed to minimising overall emission levels where possible and will complete further air quality studies before the busway is constructed. These studies will ensure that air quality within the corridor remains within the relevant standards in the future.

There are a number of management strategies that can be used to ensure emissions from the busway are kept at a safe level. Emissions from buses are highest right on the kerb of the busway and decrease rapidly with distance. A 'buffer zone' between the busway and sensitive sites can help manage potential emissions. Other potential management strategies include the use of conventional ventilation or air conditioning, permanent sensors in tunnels to monitor air quality, and continually improving the bus fleet to reduce emissions at the exhaust pipe.

Slowing the growth in private vehicle use

Every year, the average car releases around 325 kilograms of harmful gases and more than five tonnes of carbon dioxide into Brisbane's air (TransLink 2007). Busways have the potential to reduce the growth in private vehicle travel by carrying commuters more efficiently. Improvements in the bus fleet, such as utilisation of cleaner fuel technologies, are expected to lead to reductions in pollutants from bus exhausts between 2016 and 2026, despite an increase in bus numbers over this time.

There are significant advantages for air quality when comparing a bus to a car. A full bus produces 11 times less greenhouse gas emissions per person, per kilometre than an average car with just the driver. It only takes six passengers to make the bus a cleaner option. Busways also allow buses to cut their pollution levels in half by travelling on uncongested roads.

By providing an attractive alternative to the car, the busway is expected to slow the growth in private vehicle use along the corridor. Provisions such as high-quality facilities and on-time operations can be incorporated into busway planning to maximise these opportunities. Rising fuel costs may also play an important role in the attractiveness of public transport in the future.

16.4 Future investigations

Total emissions within the corridor

Although emissions from the busway may be predicted now, the air quality within the corridor may differ significantly by the time the busway is constructed. This is due to continual improvements in fuel technologies which may reduce emission levels from cars and buses, and changing land uses surrounding the busway corridor.

Further investigation will be required closer to construction to determine the existing or 'background' air quality within the corridor and the level of emissions expected from the buses operating on the busway. The emissions anticipated from the busway are added to the background air and combined with projected pollution from other potential sources. This total is then compared to the air quality standards.

The emissions anticipated from the busway should be calculated according to a number of factors, as identified within the Eastern Busway and Northern Busway Concept Design and Impact Management plans. These include:

- predicted volume of buses likely to use the busway
- bus speeds and road gradients
- the age of buses and their fuel types
- where busway stations could be located
- changes in bus fleet emissions between 2016 and 2026.

Computer dispersion models may also be used to simulate how the pollution from buses might be blown about and diluted.

Technological advancements

Continual advancements in technology mean that current mitigation strategies may be outdated in future years. A review of best practice mitigation measures will need to be undertaken to ensure that potential impacts will be managed effectively. Improved fuel technologies will also need to be incorporated into determining the type and nature of impacts.

Legislation and standards

Air quality standards continue to change over time due to advancements in technology, updated information and increasing knowledge bases. Current design standards are also continually updated to ensure the design of a busway does not compromise air quality within the project corridor. Any future investigation must review the legislation and standards that are relevant to air quality and incorporate the necessary updates into future monitoring and design.

Identification of sensitive receptors

By the time the project moves to the construction phase, surrounding land uses may differ to what is currently in place within the corridor. If sensitive receptors (for example, schools, child-care centres, health-care facilities) are identified in the future, an investigation should be undertaken to determine the potential for air quality or health impacts. A wind dispersion model may be important in determining the type and nature of impact on surrounding land uses.

16.5 References

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