

19. Air quality

19.1 Overview

The assessment of potential environmental air quality impact on sensitive land uses due to the South Road Superway Project in this section includes consideration of:

- existing road network through ambient air monitoring
- dispersion modelling of the proposed South Road Superway with traffic volumes expected for the year 2031.

The forecast assessment is based on DTEI traffic volume data and road alignment details.

The effects of the project on air quality have been assessed on a local basis. The sensitive receptors identified in the study area are located in the southern area of the proposed alignment (**Figure 19.1**). Industrial sources through the northern area have not been assessed as air quality in this area will be affected by the industrial activities.

The sensitive receptors have been defined as land uses that include educational, health care, parks/recreational facilities and residential land use areas that are within 200 m of the edge of the corridor. These are:

- Angle Park residences
- Days Road residences
- TAFE SA Regency Campus
- Regency Park School
- Uniting Care Wesley Port Adelaide: Regency Green Multicultural Aged Care facility

These receivers have been identified for analysis given their proximity to the road corridor.

19.2 Legislative and policy requirements

The legislation and policy relevant to the South Road Superway Project in relation to air quality are summarised in **Table 19.1**.

Table 19.1. Relevant legislation and policy

Legislation	Description	Relevance to project
<i>Environment Protection Act 1993 (SA)</i>	<p>This Act deals with the protection of the environment and polluting activities. The Act is administered and enforced by the SA Environment Protection Authority.</p> <p>In relation to air quality Section 25 of the Act states: <i>A person must not undertake an activity which pollutes, or might pollute the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.</i></p>	Construction and operation of the proposed road network must comply with the Act. This includes the prevention of environmental harm as detailed in Section 25 of the Act.

Legislation	Description	Relevance to project
<i>Environment Protection (Air Quality) Policy 1994 (SA)</i>	<p>This policy governs the regulation of air pollution.</p> <p>It specifies the maximum pollution levels for stack emission providing for the regulation of industrial pollution and associated source monitoring where required. It does not deal specifically with sources of diffuse pollution, such as motor vehicles.</p>	Construction and operation activities associated with the proposed South Road Superway Project and associated local road network upgrade should comply with the maximum pollution levels specified in this document, insofar as they are relevant.
<i>National Environment Protection Measure for Ambient Air (Ambient Air NEPM) (Cwlth)</i>	<p>This policy sets out national standards and goals for six common air pollutants, 'criteria' air pollutants including lead (Pb), sulfur dioxide (SO₂), carbon monoxide (CO), ozone (O₃), nitrogen dioxide (NO₂) and particulates with mean aerodynamic diameter < 10µm (PM₁₀)</p> <p>The standards and goals set out in the NEPM for AAQ are designed to be measured to give an 'average' representation of general air quality for large urban populations. That is, the NEPM monitoring protocol was not designed to apply to assessing the air quality at locations adjacent to major roads and industrial premises.</p>	Under Section 28A of the EP Act and the NEPC Act 1995, South Australia has adopted the NEPM guideline levels for air quality. This means that NEPM limits apply as Environment Protection Policies and as such are to be taken into account by the SA EPA in assessing air quality concerns and issues.
<i>National Environment Protection Measure for Air Toxics (Air Toxics NEPM) (Cwlth)</i>	<p>This policy is primarily concerned with collection of data on ambient (i.e. outdoor) levels of formaldehyde, toluene, xylenes, benzene and polycyclic aromatic hydrocarbons (PAH) at locations where elevated levels are expected to occur and there is a likelihood that significant population exposure could occur. There is an 8 year goal (since 2004) to gather sufficient data around Australia to facilitate, the development of a mandatory air quality standard for these pollutants.</p>	Any air monitoring data that is and has been collected for the purposes of the Air Toxics NEPM must be assessed against the monitoring investigation levels. They are set as an average level designed to protect air quality and public health for large urban populations.



-  Study Area
-  Sensitive Receivers
-  South Road Superway

**Sensitive Receptors
Adjacent to the
South Road
Superway**

Figure 19.1

19.3 Assessment methodology

The air quality assessment has been conducted in accordance with the South Australian Environment Protection Authority (EPA) *Air Quality Assessment Methodology Guidelines*, (2006) which require the modelling of pollutant dispersion to assess the air quality effect of a development that is likely to have some polluting effect on the ambient environment.

19.3.1 Construction air quality assessment

Air quality assessment includes the assessment of likely effect and the recommendation of the mitigation and management measures that would assist DTEI in meeting the goals of the NEPM when construction of the South Road Superway begins.

19.3.2 Operational air quality assessment

The scope of works and the methodology adopted to assess the air quality impact of emissions from the roadway and diesel locomotive included:

- a review of the relevant state and commonwealth environmental legislation governing the maximum acceptable air quality impact (specifically pollutants stipulated under the National Environment Protection Measure for Ambient Air (Ambient Air NEPM) and the Air Toxics NEPM)
- ambient air monitoring to assess the pollution levels in the existing air environment (Parks Community Centre, Angle Park), comparison with relevant EPA monitoring station data and the behaviour of photochemical pollutants through this region, and particulates
- representing the meteorology in this region by combining the CSIRO developed prognostic meteorological model TAPM with a contemporaneous, observed wind speed dataset
- developing and qualifying a fleet emissions inventory based on National Pollutant Inventory (NPI) emissions estimation techniques for the South Road Superway for the year 2031
- modelling the dispersion of traffic emissions using the CAL3QHCR traffic dispersion model, considering a full year of representative meteorological data
- assessing the cumulative air quality impact (in terms of ground level concentrations must consider the observed background level and predicted effect of road traffic and locomotive emissions) against the ambient air and investigative air toxic NEPM standards
- providing a conclusion outlining the likely air quality effect of the project.

19.4 Existing air quality

To determine the existing background air quality conditions through the proposed route for the South Road Superway Project ambient air quality monitoring was undertaken in the study area. The study area encompasses the area between Hanson Road to the west of the proposed alignment and Churchill Road to the east. The air monitoring was conducted over a 3-week period at a distance approximately 460 metres from the edge of South Road. This distance allowed for the representation of the background level of air quality in the study area.

The pollutants that were monitored included particulates (PM₁₀ and PM_{2.5}), nitrogen dioxide (NO₂), and carbon monoxide (CO). In addition to this discrete sampling for volatile organic compounds was carried out using radiello sampling tubes on a fortnightly basis, with two samples being collected contemporaneously with the continuous criteria pollutant monitoring program. The VOC analysis was carried out purely to indicate the level of air toxics compounds as they are defined in the air toxics NEPM in the air through this region.

19.5 Air emissions inventory

19.5.1 Traffic

Factors affecting traffic dispersion

The factors affecting the dispersion of emissions from mobile sources, traffic as they are applicable to this project are listed and discussed in **Table 19.2**.

Table 19.2. Factors affecting dispersion of noxious air emissions from major carriageways

Factor	Notes
Vehicle fleet composition	Heavy articulated diesel vehicles are the most significant source of PM ₁₀ and PM _{2.5} . This is accounted for in the vehicle composition profile.
Vehicle technology and fuel standard(s)	Pollutant emission factors are expected to decrease with better fuel standards and improvements in combustion and emission control systems in modern vehicles. A negative growth factor was applied to the emission factors to account for this improvement in the analysis of future scenarios.
Speed and queues	Emission rates tend to increase at lower (<30 km/h) and higher speeds (>70 km/h). The expressway standard of the South Road Superway (traffic speed limits being around 90 km/h and largely above 60 km/h) means that queuing and variations in speed are not likely to have significant effects and have thus not been considered in detail in this dispersion model. Furthermore the relatively low traffic volume through the service roads (~20% volume through main alignment) means that any queuing is not likely to lead to significant adverse air quality effects.
Road design	The elevated roadway design dominates a large proportion of the project. The local industries and residential areas will be accessed by "service roads; these pass underneath the elevated roadway, this option therefore allows for a more efficient use of the existing corridor. From an air quality perspective the exhaust of most air emissions at 12 m AGL allows for greater dispersion than if the road were at grade.

Traffic volumes

The South Road Superway Project is expected to have a major effect on the road network through the northern suburbs of Adelaide. The latest population projections by the South Australian Government indicate significant residential and industrial growth through the northern metropolitan regions of Adelaide.

The peak and average annual daily traffic volumes (for the main alignment and service roads) are a conservative approximation and do not represent the actual traffic conditions exactly.

Traffic composition

The knowledge of the percentage of different vehicle classes in the traffic volume is critical to the development of accurate emission factors that will be representative of the air emissions from the fleet. This distribution across the different vehicle classes is based on a commercial vehicle percentage of 8% for the main alignment and 9% for the service roads.

19.6 Effects of project on air quality

The cumulative air quality effect of the South Road Superway Project is presented and discussed in this section. Results are assessed against the stipulated NEPM criteria. The concentrations presented are all cumulative levels that are inclusive of the background ambient concentrations. The modelling assessment showed that the worst case effect from the road is expected to occur through the southern most section between Taminga and Regency Roads where the Superway comes back to the at grade

level. This demonstrates that the elevated roadway structure by its very nature has a notable ameliorating effect upon traffic emissions from the carriageway.

The assessment location was set at various points including the nearest sensitive receptors identified earlier in this section that include the following specifically:

- Angle Park residences
- Days Road residences
- TAFE SA Regency Campus
- Regency Park School
- Regency Green Multicultural Aged Care facility

The assessment height was set at 1.8 m. The facility found to be the most affected was the TAFE SA Regency Campus given its proximity to the carriageway. However the most affected residences were found to be on the corner of Days Road and South Road (**Figure 19.1**).

The results demonstrate that the cumulative air quality effect at the nearest receivers are compliant with the stipulated NEPM Ambient Air Quality guidelines (**Table 19.3**).

The dispersion profiles show the manner in which pollutants are dispersed and ground level concentrations slowly decrease from the edge of the carriageway. The analysis demonstrates compliance with the regulated guideline in the case of NO₂ and compliance also with the advisory guideline for PM_{2.5}. Only PM_{2.5} and NO₂ were considered for this detailed analysis as the predicted concentrations approach the NEPM guidelines. However, the NEPM guidelines were not designed to apply through these areas, they are simply a guideline to be applied through regions that are representative of average urban air quality.

The analysis also gives some indication that traffic is expected to make a decreased contribution to air quality effect into the future with improved fuel quality and technical advancements in combustion and emission control systems in motor vehicles. Further to this the advancement of non-fossil fuel driven motor vehicles will lead to the further reductions in PM and noxious air emissions. This has been accounted in the analysis through the implementation of a negative emissions growth factor.

Table 19.3. Cumulative air quality impacts for NEPM criteria pollutants.

Averaging period	NO _x (ppm)	NO ₂ (ppm)	CO (ppm)	SO ₂ (ppm)				PM _{2.5} (µg/m ³)		PM ₁₀ (µg/m ³)
	1hr	1hr	Annual	8hr	1hr	Daily	Annual	Daily	Annual	Daily
NEPM criterion	-	0.120	0.030	9	0.200	0.080	0.020	25	8	50
Background	0.105	~20% conversion*	0.82	0		0	0	21.2	4.9	33.3
Angle park residence	0.195	0.039	0.0063	0.90	0.001	0.0004	0.0001	22.1	5.1	34.2
Days Rd Residence 1	0.255	0.051	0.0083	0.98	0.001	0.0007	0.0002	23.0	5.4	35.1
TAFESA Regency Campus	0.295	0.059	0.0096	1.09	0.002	0.0009	0.0003	23.8	5.7	35.9
Regency Park School	0.205	0.041	0.0067	0.93	0.001	0.0005	0.0001	22.0	5.1	34.1
Regency Green Multicultural Aged Care	0.205	0.041	0.0067	0.92	0.001	0.0005	0.0001	22.0	5.1	34.1

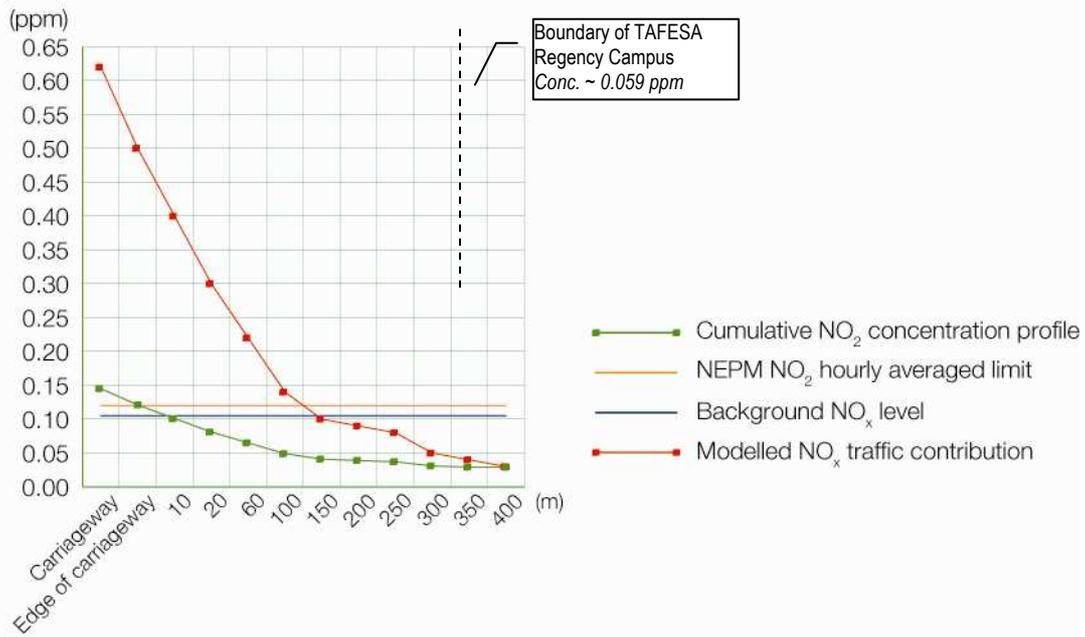
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Averaging period	NO _x (ppm)	NO ₂ (ppm)	CO (ppm)	SO ₂ (ppm)				PM _{2.5} (µg/m ³)		PM ₁₀ (µg/m ³)
	1hr	1hr	Annual	8hr	1hr	Daily	Annual	Daily	Annual	Daily
Facility										
Sunnybrae Farm	0.205	0.041	0.0067	0.90	0.001	0.0005	0.0001	22.0	5.1	34.1

* This level of conversion was derived from the analysis carried out earlier in the report and is a conservative representation of the level of conversion from NO to NO₂ that can be expected given the proximity of the assessed receivers to the road and the distance at which the said observations were made being at the Parks Community Centre (approx. 460 m from the edge of the carriageway) and preceding discussion).

Averaging period	NO _x (ppm)	NO ₂ (ppm)	CO (ppm)	SO ₂ (ppm)				PM _{2.5} (µg/m ³)		PM ₁₀ (µg/m ³)
	1hr	1hr	Annual	8hr	1hr	Daily	Annual	Daily	Annual	Daily
NEPM Criterion	-	0.120	0.030	9	0.200	0.080	0.020	25	8	50
Background	0.105	~20% conversion*	0.82	0		0	0	21.2	4.9	33.3
Angle park residence	0.195	0.039	0.0063	0.90	0.001	0.0004	0.0001	22.1	5.1	34.2
Days Rd Residence 1	0.255	0.051	0.0083	0.98	0.001	0.0007	0.0002	23.0	5.4	35.1
TAFE Regency Campus	0.295	0.059	0.0096	1.09	0.002	0.0009	0.0003	23.8	5.7	35.9
Regency Park School	0.205	0.041	0.0067	0.93	0.001	0.0005	0.0001	22.0	5.1	34.1
Regency Green Multicultural Aged Care Facility	0.205	0.041	0.0067	0.92	0.001	0.0005	0.0001	22.0	5.1	34.1
Sunnybrae Farm	0.205	0.041	0.0067	0.90	0.001	0.0005	0.0001	22.0	5.1	34.1

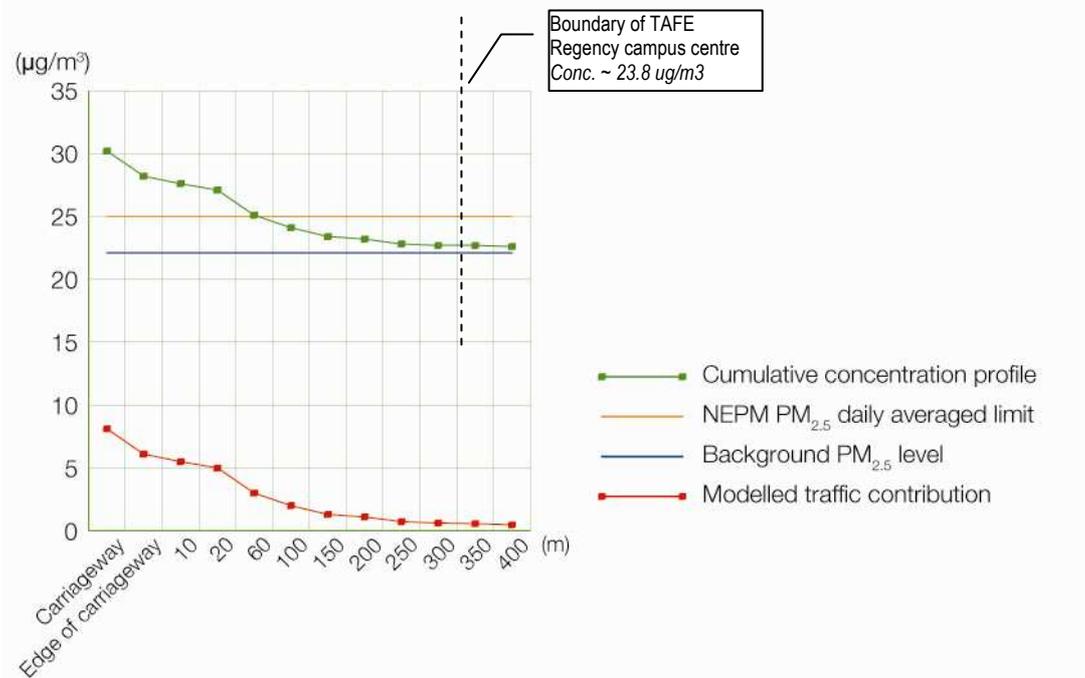
* This level of conversion was derived from the analysis carried out earlier in the report and is a conservative representation of the level of conversion from NO to NO₂ that can be expected given the proximity of the assessed receivers to the road and the distance at which the said observations were made being at the Parks Community Centre (approx. 460 m from the edge of the carriageway) and preceding discussion).



NO₂ dispersion profile (hourly averaged concentration) (parts per million)

[(NO_x = NO + NO₂) ; NO is not a regulated pollutant]

(a) NO₂ pollutant dispersion profile from edge of the carriageway



PM_{2.5} dispersion profile (daily averaged concentration) (micrograms per cubic metre)

(b) PM_{2.5} Pollutant dispersion profile from edge of the carriageway

Figure 19.2. Pollutant dispersion profiles

19.6.1 Air Toxics NEPM

The assessment shows that the worst case predicted levels at all sensitive receptors are compliant with the NEPM investigative standard goals. The predicted results for all of the air toxics compounds fall several orders of magnitude below the investigative goals. Further to this as discussed above, a conservative methodology has been applied in predicting the air quality impacts (Table 19.4) and these are likely to decrease over the assessment period from now to 2031 with the advent of cleaner fuels and more efficient vehicular, combustion and emission control technologies.

Table 19.4 Cumulative air quality impacts for NEPM air toxic pollutants.

Averaging period	Benzene (ppb)	Benzo[a]pyrene (BaP as PAHs) (ng/m ³)	Formaldehyde (ppm)	Toluene (ppm)		Xylenes (ppm)	
	Annual	Annual	Daily	Daily	Annual	Daily	Annual
NEPM advisory level	3	0.3	0.04	1	0.1	0.25	0.2
Background	0.15	ND*	ND*	0.0070	0.0021	0.0012	0.00055
Angle park residence	0.164	0.0007	3.45 x 10 ⁻⁵	7.08 x 10 ⁻³	2.02 x 10 ⁻³	1.05 x 10 ⁻³	5.12 x 10 ⁻⁴
Days Rd Residence 1	0.178	0.0014	6.78 x 10 ⁻⁵	7.16 x 10 ⁻³	2.04 x 10 ⁻³	1.09 x 10 ⁻³	5.24 x 10 ⁻⁴
TAFE Regency Campus	0.200	0.0025	9.80 x 10 ⁻⁵	7.23 x 10 ⁻³	2.08 x 10 ⁻³	1.13 x 10 ⁻³	5.43 x 10 ⁻⁴
Regency Park School	0.164	0.00072	3.18 x 10 ⁻⁵	7.07 x 10 ⁻³	2.02 x 10 ⁻³	1.04 x 10 ⁻³	5.12 x 10 ⁻⁴
Regency Green Multicultural Aged Care Facility	0.164	0.00069	2.95 x 10 ⁻⁵	7.07 x 10 ⁻³	2.02 x 10 ⁻³	1.04 x 10 ⁻³	5.12 x 10 ⁻⁴
Sunnybrae Farm	0.163	0.00066	2.99 x 10 ⁻⁵	7.07 x 10 ⁻³	2.02 x 10 ⁻³	1.04 x 10 ⁻³	5.11 x 10 ⁻⁴

* no representative data available

19.6.2 Industrial areas – Occupational health and safety impacts

Given the nature of the elevated roadway design this allows for greater levels of air dispersion a significantly reduced impact than if the emissions were exhausted at at-grade level. This has allowed for compliance to be with guidelines to be demonstrated. Therefore this has demonstrated that the elevated roadway is compliant with the guidelines.

19.6.3 Operational air quality effects through local roads

The likely air quality effect that could result from increased air emissions, through the increased traffic flow by the expanded local roads such as the expansion of the Naweena Street link is unlikely to lead to significant adverse impacts from an air quality perspective.

Although the increased traffic along the road will not have a positive effect from an air quality perspective, the level of emissions along this corridor is not expected to reach an extent where the cumulative air quality effect on residents or occupants will exceed the ambient air quality NEPM or air toxics NEPM guideline limits. The South Road Superway will also have a discernible adverse effect on the background levels through this region. The increased ambient background level of pollutants and increased traffic flow will lead to a cumulative effect on air quality through this area; nonetheless the effect is not expected to be of any great concern.

19.7 Construction air quality impacts

The key issue associated with the construction of a major transport corridor from an air quality perspective is the management of dust (largely as PM₁₀ and total suspended particles). The main sources of dust are excavation, heavy vehicular movement on unsealed surfaces, and stockpiles. The excavatory processes will leave top soil being highly susceptible to wind erosion. The level of erosion is highly dependant upon the intensity of the various excavatory processes and prevailing winds.

Dust emissions are not only a source of the dynamic processes of excavatory work but also the static sources that form following the activities (i.e. from all exposed surfaces, haul roads and stockpiles). These static sources tend to be the largest contributor to off-site dust effects, if these are not managed appropriately the general nuisance related problems associated with movement of dust plumes off-site into sensitive areas will occur. A construction environment management plan is necessary to ensure that dust effects are minimised. The section that follows highlights some standard and site-specific mitigation measures that would form a part of an iterative construction air quality management plan for this project.

19.8 Mitigation measures to minimise effects

19.8.1 Construction management plan

An air quality management plan would form part of the contractors' environmental management plan developed for the whole project. A plan for this project should incorporate, but not be limited to, the following dust mitigation measures:

- develop a construction traffic management plan to advise all truck drivers, contractors and vehicular machinery operators of designated vehicle access routes and protocols
- position all haulage routes with heavy traffic away from sensitive receivers as much as practicable
- restrict vehicle speeds (e.g. 20–40 km/hr) to minimise wheel-generated dust on unsealed routes
- minimise diesel engine idle times and queuing
- install truck tyre cleaning stations at site boundaries for earth moving vehicles to minimise off-site transport of material, which could cause dust emissions
- where practical cover truck loads where there is potential for dust emissions during transport
- maintain all fossil-fuelled plant and equipment to facilitate efficient operation
- install appropriate emission control mechanisms (e.g. fabric filter on crushers, concrete batchers) to minimise air emissions
- regularly water exposed surfaces, including stockpiles, and unsealed roadways to suppress dust generation; in addition to this the contractor should consider the use of surfactants on various surface types to increase the efficiency of these suppression techniques
- locate stockpiles away from sensitive receivers, as far as practicable
- restrict activities with high dust generating potential (including, heavy excavations and drilling) during periods when strong winds are blowing towards sensitive regions
- engage the affected community through actions including:
 - responding to queries regarding construction methodologies and responding to concerns offered by community members
 - providing regular updates to community members to inform them of upcoming work that could result in any increased levels of emissions.

An air quality monitoring device(s) that records ground level concentrations of particulates (PM₁₀ and TSPs) as well as a TSP deposition gauge could be installed prior to commencement of construction to facilitate further qualification of the air quality impact assessment. The real-time dust monitoring instruments should be sited in compliance with AS2922-1987.

The monitoring program should be scheduled for the duration of the construction program at a location outside the construction site boundary, near the closest sensitive receiver. Through this real time system the contractor can detect times where regulatory limits are going to be exceeded and hence

take remedial actions to mitigate any off site effects. This may include reduced construction activity rates and a stricter interpretation/implementation of the air quality management plan.

19.9 Conclusion

The South Road Superway Project has been designed in such a way, to minimise adverse effects of air emissions from the traffic using the South Road Superway on the sensitive receivers identified in this study. The sensitive receivers that have been identified reside largely through the southern portion of the study area.

The air quality assessment considered the peak cumulative ground level concentration predicted at all the nearest sensitive receptors identified along the route. These predictions were assessed against the mandatory Ambient Air Quality (criteria pollutants) and investigative Air Toxics guideline levels that are part of the NEPM. The air quality impact assessment for the South Road Superway found that the cumulative ground level concentrations through the expected traffic volumes through 2031 will *comply* with air quality guideline limits for nitrogen dioxide, sulfur dioxide, carbon monoxide, particulates as PM₁₀ and PM_{2.5}, benzene, benzo(a)pyrene (BaP) (a marker for PAHs), formaldehyde, toluene and xylenes.

The project will, in the long term, have significant beneficial impacts upon atmospheric air quality through this region by allowing for the construction of a carriageway that enables free flowing traffic. Although traffic makes the largest single contribution to adverse air quality impacts in urban regions, the inevitable growth in the size of cities leads to the growth in traffic which will lead to growth in air emissions. The effective design and efficient management of these transport systems will ensure that the local air environment as well as any regional impacts through operation will be minimised.