

The Horsley Drive Upgrade

Environmental Investigation Report

Appendix G – Operational traffic related air quality

June 2017



Operational traffic related air quality

Traffic pollution sources

In considering potential air quality impacts of a road widening project from traffic sources, the important factors are related to emissions and separation:

- Traffic volume
- Traffic mix - including passenger vehicles (both petrol and diesel), light duty vehicles and heavy goods vehicles
- Speed of traffic
- Traffic separation from sensitive receptors

The above factors will be influenced by levels of congestion which affect volume and speed of the traffic flow and the number of traffic lanes and distances to the kerb and beyond. Diurnal variations in the above will also influence localised air quality.

Traffic Volume

1. The existing daily traffic volume on The Horsley Drive is between 32,000 and 40,000 vehicles per day. It is forecast that traffic on The Horsley Drive will grow an average of 2.5 to 2.8 per cent per annum by 2031. In 2031, traffic on The Horsley Drive is forecast in the order of 59,000 vehicles per day. In line with the overall traffic growth, it can be expected that heavy vehicle volumes will also grow. These total vpd levels are subject to diurnal variability and the peak period (usually over two hours) which is accepted as being 10 per cent of this value. So a worst case traffic flow using this estimation technique is ~2,000 vehicles per hour currently but ultimately increasing to ~ 2,500 vehicles per hour (two-way traffic).

Traffic mix

The Australian average traffic fleet has a high-proportion of heavier passenger vehicles than European and even USA fleets. The proportion of diesel engine passenger vehicles within the Australian fleet is increasing but may well plateau within ten years (to be a similar percentage as per overseas, first-world, fleets). Both of these factors result in higher emissions (as g/VKT) of air pollutants, especially particulate matter, but this is offset by newer vehicles having increasing control technology to lower emissions.

The daily number of heavy vehicles recorded on The Horsley drive in the proposal site varied between road sections but is around 7000 vehicles per day at the busiest point. This represented between 10 per cent and 22 per cent of total daily traffic recorded on the road. About 13,000 heavy vehicles per day are forecast to use The Horsley Drive in 2031.

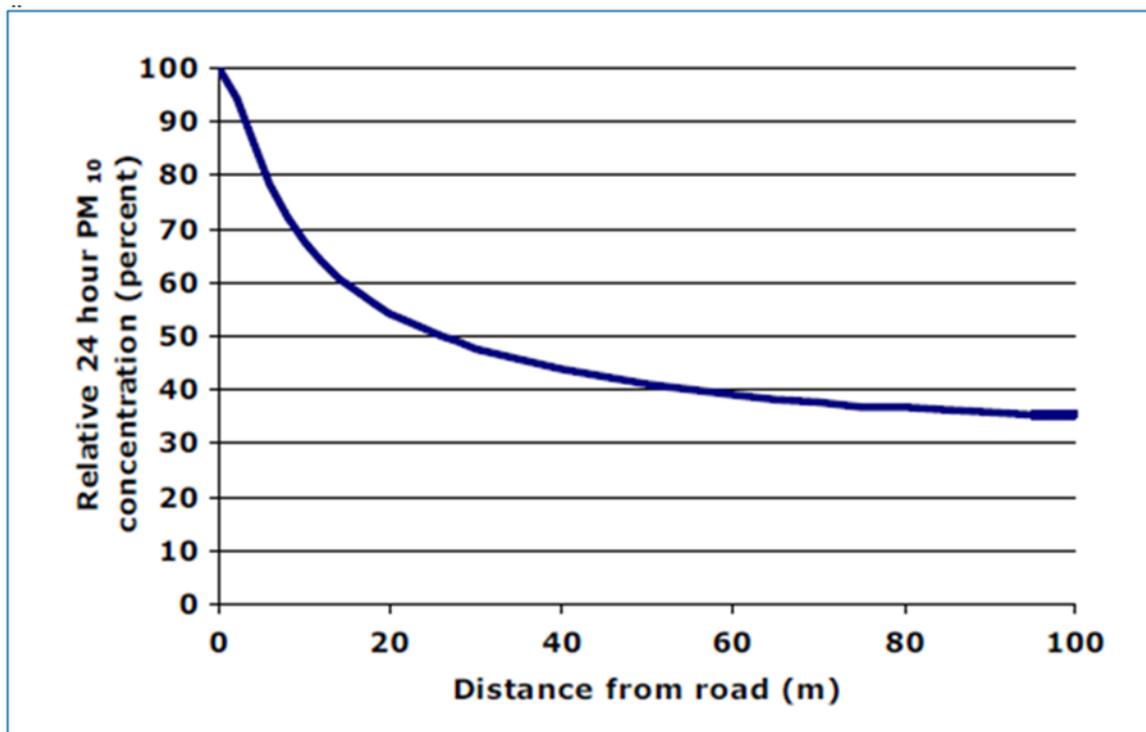
Traffic speed

While the maximum speeds that can be obtained are the set speed limits, congestion and signalised traffic intersections slow the average speeds – especially so during peak periods. While traffic emissions as mass per vehicle kilometre travel (g/VKT) increase with decreasing speed less than 60 kilometres per hour, the slower moving traffic travels a reduced distance.

Traffic separation from sensitive receptors

Modelling studies, backed by monitoring campaigns, are able to assess roadside air quality and consistently predict a rapid decrease in pollutant level as distance from the road increases. As an example, EPA Victoria (EPA 2006) used a model run for a 'typical' 100,000-vehicle-per-day road with four lanes (two each way, no median strip) and symmetric diurnal traffic profile. Figure F1 illustrates a worst-case scenario of this model for PM10, but would have a similar path for other pollutants. This shows the level of PM10 particulate matter as a function of distance from a major road. Pollutant concentrations have a rapid decrease in level within 20 metres of the edge of the road and worst-case concentrations reduce even further with increasing distance.

Figure F1 - AusRoads prediction of reduction in PM10 level with distance from a road



Monitoring Studies of near-road impact of air pollutants

There is a considerable history of road-side monitoring that has been conducted in Australia.

Monitoring Example 1: In Neale and Wainwright (2001) the results of near-road monitoring at 19 sites in Brisbane during July 1994 to April 1997 (a three year study) were examined. Results for NO₂, NO, CO, Lead and PM₁₀ were measured. The study determined that air pollutant levels at open roadside sites do not exceed the relevant Environmental Protection (Air) Policy 1997 (EPP (Air)) goal, even at those sites with large traffic volumes and significant congestion.” (Neale and Wainwright, 2001, p.2). This was found despite one site being located just 10 metres from an arterial road carrying 40,000 vehicles per day and another site at 20 metres from the Ipswich Motorway with 68,800 vehicles per day. In the mid-1990’s the vast majority of vehicles would be considered as having pre-Euro standard of emissions and the existing and future Horsley Drive traffic will have lower emission factors.

Monitoring Example 2: In Victoria, monitoring at the Springvale Rd /Whitehorse Rd intersection (EPA 2004) (monitoring located at 6.0 metres from Springvale Road and 50-60 metres from Whitehorse Road) with 250,000 vehicles per day was undertaken in 2003-04. The traffic count included about five per cent trucks.

During the period monitored the study found that the State Environment Protection Policy (Air Quality Management) intervention levels for particles (PM₁₀), fine particles (PM_{2.5}), nitrogen dioxide (NO₂) and carbon monoxide (CO) were not exceeded on any day.

Levels of the air toxic compounds benzene, toluene, xylenes, and poly aromatic hydrocarbons (PAHs) were found to be low during the study period and Draft National Environment Protection (Air Toxics) Measure (Air Toxics NEPM) investigation levels were not exceeded.” (EPA 2004). Additionally, fleet emission factors would be lower in the proposal site than at the time the monitoring study was undertaken.

Monitoring Example 3: EPA Victoria has also conducted road-side monitoring beside the Westgate freeway (EPA 2005) in both 2004 and 1996-97. The study found that air quality along the Westgate Freeway was likely to continue to meet air quality objectives in the foreseeable future.” (EPA Victoria, 2005. p.1). In 2004 there were 130,000 vpd (13 per cent heavy vehicles) and this was up from 100,000 vpd in the earlier monitoring round of 1996. The monitoring site located north of the freeway was 10 metres from the freeway.

The highest daily averaged PM_{2.5} value measured was 28 µg/m³, which is below the State Environment Protection Policy (Air Quality Management) intervention level. However, daily averaged PM₁₀ was above the intervention level for a total of seven days. Upon further investigation, it was found that on these days, prevailing winds from the north placed significant industrial sources upwind leading to the conclusion that “elevated levels were due to nearby industrial sources rather than the freeway.”

These monitoring results are for a freeway/motorway scenario with traffic counts well in excess of The Horsley Drive. The study which compared findings from 1996-97 with 2004, found that the increase in traffic numbers was off-set by the reduction in fleet emission factors. Therefore, despite a 30 per cent increase in traffic volume, over a less than 10 year time-frame, the impact levels did not significantly increase.

Monitoring Example 4: Francis Street, Yarraville in Victoria has less traffic (20,000 vehicles per day) than The Horsley Drive, but it has a very high heavy vehicle load. EPA Victoria have recently completed a 12-month monitoring campaign (EPA 2013) 5 metres south of the road-side. The results were to be used to update initial monitoring done 10 years previously.

Results for PM_{2.5} monitoring did not breach the daily advisory reporting standard but were slightly above the annual advisory reporting standard during the 12 months of monitoring for this fine particle (EPA Victoria, 2013, p.1). However, the reporting standard referred to is the NEPM level of 8 µg/m³ and not the WHO annual mean guideline of 10 µg/m³.

In 2013 there were a total of seven days when PM₁₀ 24-hour averaged concentrations were above the NEPM daily standard; this exceeds the goal of no more than five days. These findings indicated that high percentage truck use areas can see particulate matter impacts rising to levels of concern at close range to the road (in contrast to all other gaseous indicators, including the class-2 toxic indicators measured in the various studies, which are measured to be within limits even at 5 metres from the road-side).

Monitoring/Modelling Example 5: International road assessments also produce similar findings to the conclusions of the above local studies. In particular, a recent study (Chidsanuphong Chart-asa et al 2013) of a major linking freeway in North Carolina, USA upgrade to include capacity for an extra 40,000 vehicles per day by 2025. The study found that current traffic contributed a relatively small amount to ambient PM_{2.5} concentrations and vehicle-related PM_{2.5} emissions.



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