Epping Road widening between Essex Street and Blaxland Road, Epping

Appendix K
Traffic air quality

November 2015

Appendix K – Traffic 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 (PV – both petrol and diesel), light duty vehicles (LDV) and heavy vehicles(HV)
- 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.

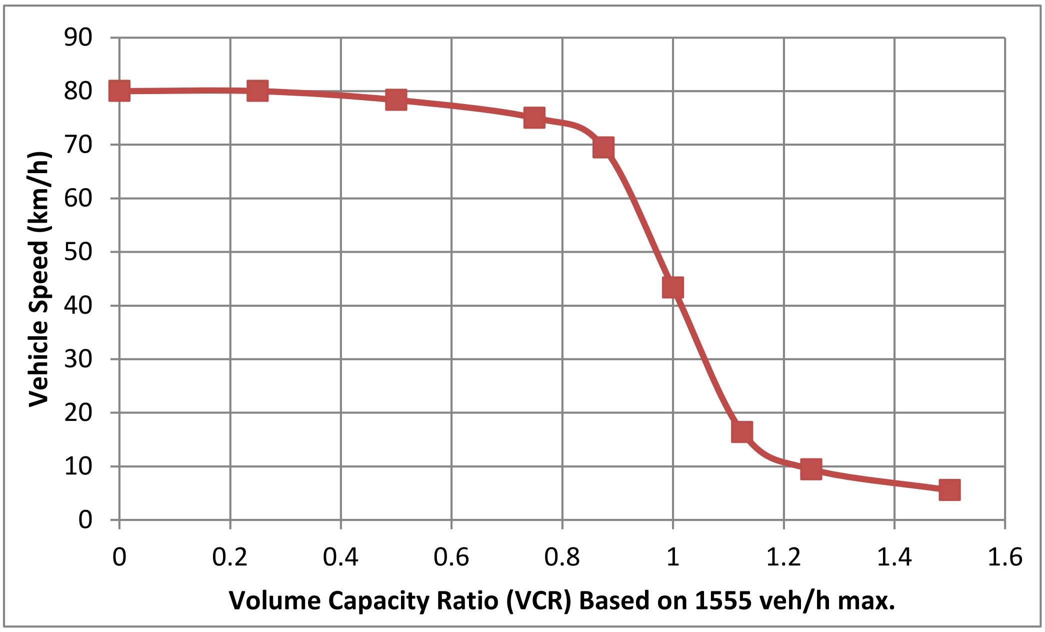
Traffic Volume

Traffic counts are currently (2014) in the order of 35,000-40,000 vehicles per day (vpd) and with forecast traffic growth (and additional road capacity) increasing to ~42,000 vpd in 2016 after the proposed road widening and potentially as high as 45,000-48,000 vpd by 2026. 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 ~2,400 vehicles per hour (two-way traffic).

An alternative estimator of worst-case conditions is the maximum amount of vehicles that can be accommodated by the number of lanes and the traffic speed. Epping Road is to maintain a 60 km/hr speed limit while Essex Street will experience speeds no greater than 50 km/hr.

A traffic-speed relationship can be assumed using the Akcelik relationship (Austroads 2011) shown in Figure K.1. The default volume capacity ratio (VCR) for a lane of traffic can be assumed to be 1,555 vehicles per hour per lane, based on the Melbourne Integrated Transport Model for a 90 km/h freeway (Austroads, 2011, p.29). So at 40 km/hr there will be close to 1,555 vehicles per hour while at a congested 10 km/hr the traffic count increases to nearly 2,000 vehicles per lane per hour. So for a five-lane Epping Road, the maximum worst-case traffic flow is 10,000 vehicles per hour. For a six-lane Epping Road, the maximum worst-case traffic flow is 12,000 vehicles per hour. As this is well above the traffic model estimates, it will be an ad-hoc occurrence associated with a road-network wide incident.

Figure K.1 Modelled vehicle speed with lane capacity ratio.



Traffic mix

Due to the suburban nature of the roads within and around the proposal site and the lack of arterial to freeway/motorway connection, it is found that the heavy vehicle mix for Epping Road and Essex Street is very low at less than two per cent. Heavy vehicles can produce five to ten times the emissions as a passenger vehicle at the likely speeds to be encountered.

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.

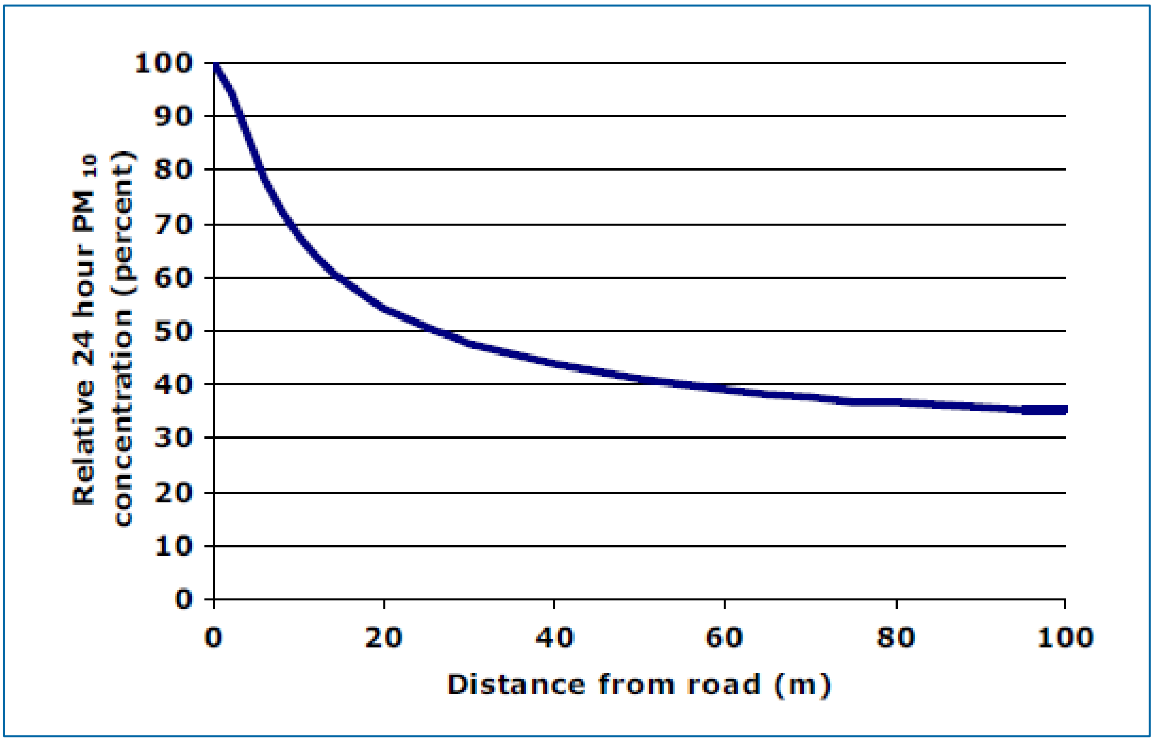
Traffic speed

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 km/hr, 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 K.2 illustrates a worst-case scenario of this model for $PM_{10,}$ but would have a similar path for other pollutants. This shows the level of PM_{10} 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 K.2 AusRoads prediction of reduction in PM10 level with distance from a road



Source: EPA 2006

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 NO_2, NO, CO, Lead and PM_{10} 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 Epping Road and Sussex Street traffic of 2014 and beyond 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 approximately five per cent trucks.

During the period monitored the study found that the *State Environment Protection Policy (Air Quality Management)* intervention levels for particles (PM_{10}), fine particles ($PM_{2.5}$), nitrogen dioxide (NO_2) 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).

The traffic levels and heavy vehicle percentage measured are well in excess of the Epping Road /Essex Street intersection. Additionally fleet emission factors would be lower in the proposal area 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 $\mu g/m^3$, which is below the *State Environment Protection Policy (Air Quality Management*) intervention level. However, daily averaged PM_{10} 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 Epping/Essex intersection. 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 Epping/Essex intersection, 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 $\mu g/m^3$ and not the WHO annual mean guideline of 10 $\mu g/m^3$.

In 2013 there were a total of seven days when PM_{10} 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.