Submission No 117

INQUIRY INTO CROSS CITY TUNNEL

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Theme:

Summary

Inquiry into the Cross City Tunnel

—Parliament of NSW Joint Select Committee on the Cross City Tunnel

This Submission

Dr Peter Manins, Chief Research Scientist and science manager in CSIRO Marine and Atmospheric Research, in Melbourne. Fellow of the Academy of Technological Sciences and Engineering, and Fellow of the Clean Air Society of Australia and New Zealand. Expertise is in air pollution meteorology and modelling, with over 33 years of experience and over 200 publications, many in the international literature.

I have been involved with air quality issues of the Sydney tunnels since 1999 including

- a DUAP-initiated and funded review of the M5 East vent configuration and height presented in August 2000, and many follow-up activities including contracts for RTA
  I was invited to give evidence at both the second and third General Purpose Standing Committee No.5 Inquiries into the M5 East Tunnel: in May 2001 and in November 2002.
- Technical advisor to the Cross City Tunnel Air Quality Community Consultative Committee for the past three years; my participation has been funded by RTA.
  I appeared before the present Inquiry in February 2006, giving evidence on the environmental design of Sydney's tunnels, the need for filtration of the tunnels, and the mixed record of support for community consultation mechanisms from agencies involved in the tunnels.
- Reviewer of air quality modelling and impact assessments for the Lane Cove Tunnel Air Quality Community Consultative Committee in 2005 (Manins 2005[1]), funded by Thiess John Holland; and again in 2006, funded by Connector Motorways.
  Recently, several reports of my work about the air quality expectations for the Lane Cove Tunnel have appeared in the press.

I have been invited to discuss a few things relevant to the Inquiry's extended Terms of Reference 1 (j), viz environmental and in-tunnel air quality, and filtration, and I propose doing this by suggesting some questions and brief and extended answers. I am happy to speak to those answers, or to address other questions.

Will the traffic levels in the Lane Cove Tunnel within a year be at levels not forecast until 2016? (Daily Telegraph 19/05/2006 p4)

Information available to me says that daily totals of vehicles a year from opening will be as forecast. These totals are not materially different from those published over five years ago.

Truck numbers, important for air pollution in the Tunnel, are expected to be substantially lower than used to design the Tunnel and those earlier estimates. However, the designers do appear to have underestimated truck numbers in the early afternoon in the eastbound direction.

To expand on this:
Trucks are the dominant source of particle pollution in tunnels, so it is truck numbers, not total traffic numbers, that is the key issue. The latest forecasts from the senior traffic advisor to the Company, Gillian Akers, show that overall truck numbers are expected to be about a third lower those used by the Tunnel designers. In the westbound direction they are about half the overall truck numbers used by the designers.

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[1] Manins, P. C. (2005). Review of air quality modelling for Lane Cove Tunnel / prepared for Lane Cove Tunnel Air Quality Community Consultative Committee under contract to Thiess John Holland Joint Venture C/1074. Aspendale, Vic.: CSIRO Atmospheric Research. 37 p.

Due to a technical assumption, the designers do appear to have substantially under-predicted the number of trucks expected to use the eastbound Tunnel in the early afternoon. While this has a proportionate effect on predicted contribution to early afternoon air pollution from the Marden Road stack, the overall truck numbers expected to use the Tunnel are little affected.

Will air pollution due to the Lane Cove Tunnel be twice as high as design? (Daily Telegraph 23/05/2006 p5; 24/05/2006 p7)

While I expect the amount of particle pollution per-truck to be substantially higher (50–100% higher) than design, I expect this to be balanced by the number of trucks being fewer than expected in the Tunnel. In any case I expect the contribution to air pollution in the vicinity of the Tunnel to be small.

To expand on this:
Manins (2005) concluded that when Lane Cove Tunnel is operating, the per-truck emissions of particles in the Tunnel will be found to substantially higher (50–100% higher) than expected by the designers. In November 2002 in evidence to the third General Purpose Standing Committee No.5 Inquiry into the M5 East Tunnel I showed this to be the case in the M5 East Tunnel. However, the latest information shows that the number of trucks expected to use the Tunnel has been overestimated substantially, except for a few hours in the early afternoons. The end result, as explained in Manins (2005), is that I expect the particle pollution in the Tunnel to be close to the design levels.

My report concluded that the Tunnel emissions of particles are likely to be the same as predicted by the designers except possibly in the afternoon in the vicinity of the eastern Marden Road ventilation stack. Nevertheless particle concentrations in the neighbourhood "should be indistinguishable from background levels at all places".

Essentially, the points are that even if there is a substantial error in some of the numbers used in the design of the Lane Cove Tunnel:

1. in most cases the errors seem to be balanced off by compensating errors, and
2. a big change to the Tunnel's small contribution to the air pollution in the vicinity is still a small contribution.

Is the Lane Cove Tunnel air quality going to be safe?

I can answer this question only in terms of air pollution concentrations and by referring those to air quality standards set by health professionals. In the Tunnel, my conclusions are that we can expect (i) carbon monoxide levels to be satisfactory, and (ii) that while particle concentrations will be high but much lower than in the M5 East Tunnel, it is not possible to relate the short exposure of motorists, about 3 minutes, to existing health measures. In the neighbourhood, including near the ramps to the Tunnel, the contribution to air pollution from the Tunnel and its traffic is likely to be about the same or lower than if the Tunnel did not exist.

To expand on this:
My detailed investigation (Manins, 2005) of the expected air quality performance of the Tunnel and its impact on the neighbourhood showed:

1. The ventilation of the Tunnel is controlled by the requirements to meet exposure to carbon monoxide set by the Minister's Conditions of Approval, which in turn refer to World Health Organisation recommendations.
2. The ventilation system has very large capacity to deal with the consequences of vehicle breakdowns in the Tunnel, so I expect that the WHO recommendations for carbon monoxide exposure will be easily met.
3. I expect in-tunnel particle pollution concentrations to be high, about the same as expected by the designers, and much lower than in the M5 East Tunnel. Since there are

no standards for exposure to particle air pollution for the short time motorists are in the Tunnel, viz, about 3 minutes, I have no way of judging whether this exposure is a threat to health.

4. In the eastbound Tunnel in the early afternoon, I expect the particle pollution in the Tunnel to be substantially higher than design, due to a substantial under-prediction of the number of trucks expected. But this pollution level will be little different to that expected for other hours in the Tunnel.
5. I concluded that the predictions of the designers for neighbourhood particle pollution are essentially correct: the contribution from the Tunnel is likely to be the same as predicted, except possibly in the afternoon in the vicinity of the eastern Marden Road ventilation stack, and that the neighbourhood concentrations "should be indistinguishable from background levels at all places".
6. I drew attention to the possibility of heightened air pollution in the vicinity of the eastern-end ramps to the Tunnel due to confluence of traffic there. Since my report (Manins 2005) I have reviewed a further analysis by the designers which showed that there is expected to be a substantial reduction of emissions from the traffic with the Tunnel operating compared with no Tunnel, around the eastern ramps and especially along Epping Road above the Tunnel. In other words, removal of traffic into the Tunnel will be beneficial to the air quality in those areas.

What are the future health impacts due to Sydney's unfiltered tunnels?

In my view, the M5 East Tunnel requires intervention to reduce the emitted air pollutants. Other Sydney tunnels should follow best practice, which includes in-tunnel particle filtration.

To expand on this:
My ranking of the tunnels in Sydney in order of diminishing air pollution importance is:

1. M5 East Tunnel
2. Cross City Tunnel
3. Lane Cove Tunnel

The evidence of air pollution levels in the M5 East Tunnel, the proximity of residences to the stack, and the number of occasions that portal emissions have occurred, indicate to me that the M5 East is a hazard to the health of motorists, to residents around the stack, and residents near the portals. The concerns faced by motorists include excessive levels of particles, in combination with elevated levels of nitrogen dioxide, and air toxics bound to the particles. The biggest risk is to be stuck in traffic in the tunnel. For neighbouring residents, the pollutants are the same but at lower concentrations and for longer periods.

The Cross City Tunnel may be a hazard to motorists if the traffic in the tunnel builds up to excessive levels, but the ventilation system has huge capacity to keep air pollution levels low. The design uses a third tube to pump vitiated air from the east to the west. This approach is very hungry of electricity and results in substantial production of greenhouse gases. Filtration may allow alternative operating strategies leading to a reduction in the emission of greenhouse gases.

The Lane Cove Tunnel should be the best performer of the three, but best practice would be to include in-tunnel filtration.

Overall for Sydney, background air quality conditions and in-tunnel conditions are expected to improve substantially over the years to 2020 as the vehicle fleet emissions decline strongly for all pollutants except petrol vapours. It is probable that measures such as control of vapour emissions from petrol stations will be mandated to help reduce that problem.

Why isn't in-tunnel filtration being used here when it is working well in other countries?

Sydney tunnels appear to be unique in their combination of high traffic levels and long length. This makes in-tunnel filtration very expensive, especially so if filtration of both particles and nitrogen dioxide is required. And the benefits of the latter are not clear.

To expand on this:
In-stack filtration is often demanded, and may be justifiable for the M5 East stack, given its very poor siting[2] in the bottom of a valley and environmental design with surrounding residences looking down into the stack. These factors indicate that there is a high likelihood of pollution impacts on occasion on those residences and others nearby. But even in the case of the M5 East Tunnel, the improvement of neighbourhood air pollution is the lesser of the two air pollution concerns: the dominant problem is air pollution in the tunnels – particularly particle pollution. In-tunnel filtration should be the first priority consideration, not in-stack filtration. The former would improve the experience of tunnel users (motorists) as well as residents around the stacks.

Sydney tunnels appear to be unique in the combination of high traffic levels (~100,000 vehicles) and long length (~3 km). This makes ventilation and filtration expensive, especially so when filtration of both particles and nitrogen dioxide is specified in response to demands from some quarters. But it is not at all clear whether there is any real benefit from removing nitrogen dioxide from the air—it would require an experimental technology with huge costs. Removal of particles is a well established technology, but is still expensive for the size of volumes of Sydney tunnels.

In my opinion, based on the reported performance of the Tunnel, it is essential that particle filtration or a rethink on the whole ventilation system be done for the M5 East Tunnel. There is in my view a weak case for the Cross City Tunnel to have in-tunnel filtration, and practically no case, other than best practice, to install in-tunnel filtration for the Lane Cove Tunnel.

Why is there such outrage in the community about the government failing to use in-tunnel filtration?

Science backs up the perception in the community that there is a real problem with air quality in the M5 East Tunnel. The public sees that filtration is being installed in tunnels in Norway and Japan and elsewhere as a matter of course, but the RTA keeps telling them that it is not possible or too expensive. And that may well be true if particle and nitrogen dioxide filtration is required.

To expand on this:
Measurements of air quality in the M5 East Tunnel, assessments of the expected air pollution due to reported portal emissions, and reports of breakdowns of in-tunnel monitoring equipment all reinforce negative community perceptions.

However, the major Sydney tunnels present big challenges due to the combination of high traffic levels (~100,000 vehicles) and long length (~3 km). This makes ventilation and filtration expensive, especially so when filtration of both particles and nitrogen dioxide is specified in response to demands from some quarters.

Have the Air Quality Predictions for the Lane Cove Tunnel and Cross City Tunnel been made for the wrong particles, the PM10 particles, rather than the more health-relevant PM2.5 particles?

The short answer is "no". [PM2.5 particles are the smaller particles, those less than 2.5 µm in diameter, that can be breathed into the lungs. Larger particles tend not to be able to penetrate deep into the lungs.]

[2] See also, my evidence tabled to the Committee in February 2006 which expands on this point.

To expand on this:
The designs use the methods of the World Road Association (PIARC) for setting the tunnel ventilation rates. The particle performance is described in terms of PM10 particles, and these are dominated by exhaust emissions from diesels and recently, enhanced to include non-exhaust emissions due to road and tyre dust from all vehicles.

The consequence of using PIARC is that the assumed diesel vehicles are clean burning/well maintained European types. So almost all PM10 is actually PM2.5 or even PM1.0 in the performance designs. Thus the PIARC-based predictions are as applicable to PM2.5 as they are to PM10 – there is no masking of consequences of the important health-relevant particles (PM2.5) by PM10 in the performance design.

The confusion arises because some people approach the issue from a measurement point of view, wherein measurements of neighbourhood PM10 do mask PM2.5 data.

Is the NSW Health 'Air Quality and Respiratory Health Study' of 2000 households around the Lane Cove Tunnel a "waste of time"? (North Shore Times 17/05/2006 p5)

Certainly not, since the Health Study will provide valuable information about the community's respiratory health and some relationship with air quality. The study will see whether changes in traffic patterns after the opening of the Lane Cove Tunnel will improve, worsen or not influence residents' health.

To expand on this:
There are problems with the Study: the sample size is rather small, only one winter and early summer will be available for survey before Tunnel opening, and similarly after the Tunnel is opened. And, despite NSW Health's view, given the experience of the tolled Cross City Tunnel, there is no guarantee that motorists won't go to great lengths to avoid using the Lane Cove Tunnel so traffic levels may be much lower than the first year design level of 111,500 vehicles by the time the follow-up results are collected in the second half of 2007.

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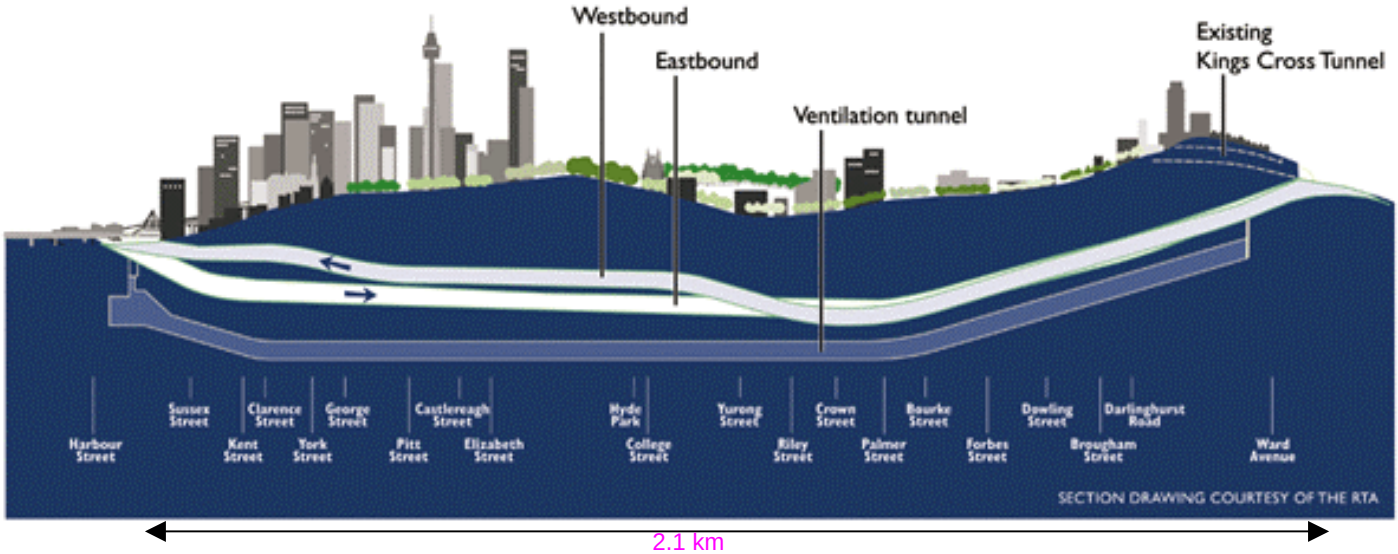
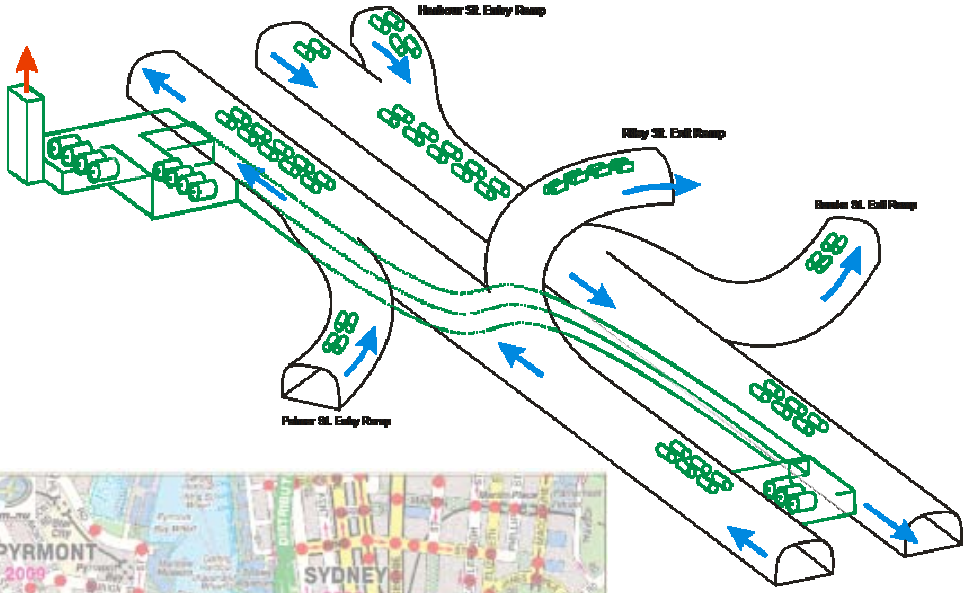
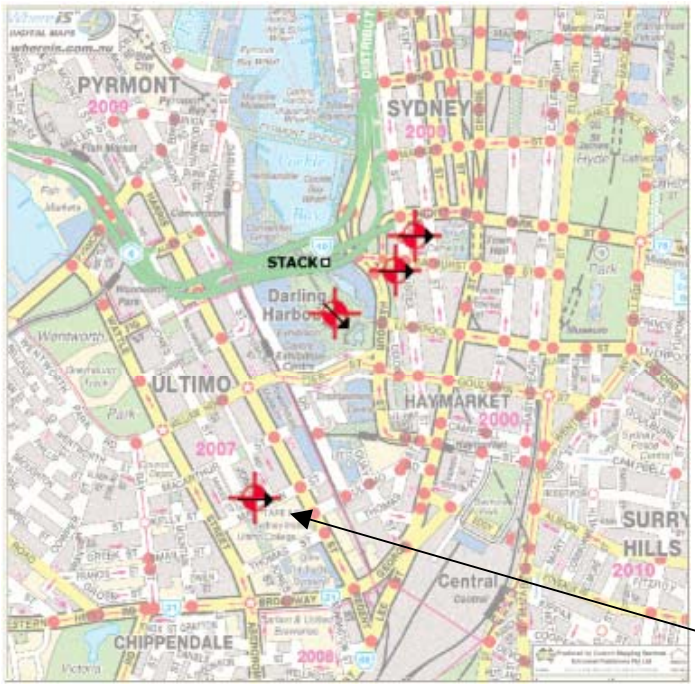
9 June 2006

Cross City Tunnel

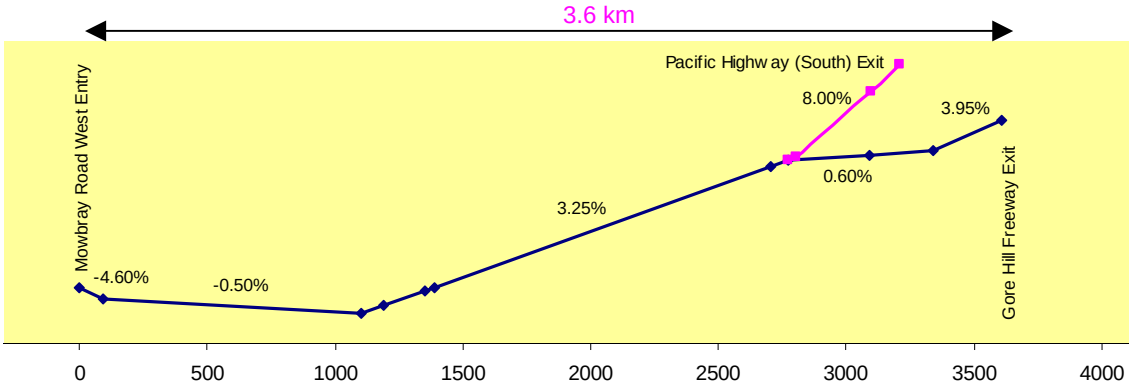




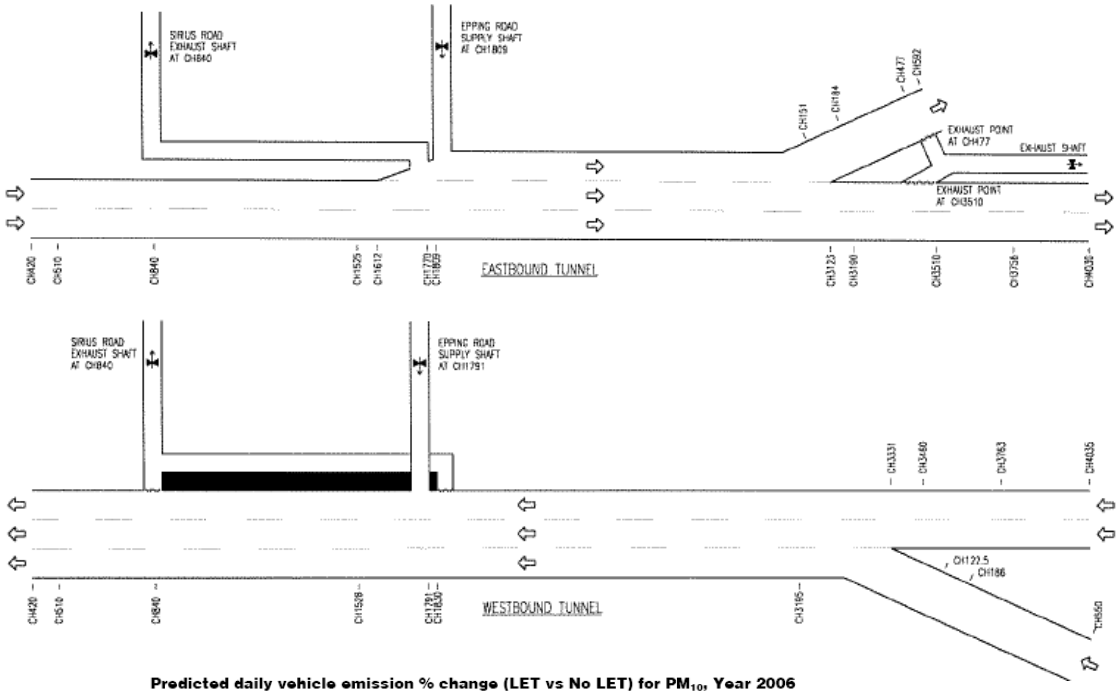


Mary Ann Park is 1200 m SSW of the vent stack

Lane Cove Tunnel



The eastbound Lane Cove Tunnel looking towards the north, showing grades.



Predicted daily vehicle emission % change (LET vs No LET) for PM_{10}, Year 2006