



Chief Scientist & Engineer

OUT17/41683

Ms Naomi Moss
Senior Planner – Transport Assessments
Department of Planning and Environment
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Sydney NSW 2001

By email: naomi.moss@planning.nsw.gov.au

Dear Ms Moss

Comments on the air quality aspects of the EIS of the WestConnex M4-M5 Link proposal (SSI 7485)

I refer to your Department's recent letter noting the exhibition of the Environmental Impact Statement (EIS) for the WestConnex M4-M5 Link project that was submitted in August 2017.

In the same manner as for the WestConnex M4 East and the New M5, the Advisory Committee on Tunnel Air Quality is submitting comments on the air quality aspects of the EIS.

Because of the conflicts of interest that several Committee members have in this matter, we have taken the approach of commissioning a review report by the expert non-conflicted member of the Committee, Dr Ian Longley from NIWA in New Zealand, and another suitably qualified independent expert to work with Dr Longley. As a result my office commissioned Dr Åke Sjödin, from IVL Swedish Environmental Research Institute, Gothenburg, Sweden, to work on the report.

I attach the report by Dr Longley and Dr Sjödin.

Should you have any questions, please contact Dr Chris Armstrong, Director, Office of the Chief Scientist & Engineer, on 02 9338 6745 or chris.armstrong@chiefscientist.nsw.gov.au.

Yours sincerely

Mary O'Kane
NSW Chief Scientist & Engineer

16/10/17



13th October 2017

Prof Mary O'Kane
NSW Chief Scientist & Engineer
Chair: Advisory Committee on Tunnel Air Quality

Dear Prof O'Kane

We received from you a request to review aspects of the West Connex (M4-M5 Link) EIS on behalf of the Advisory Committee on Tunnel Air Quality. Please find below our draft review.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Ian Longley', written in a cursive style.

Dr Ian Longley

Independent Expert: Advisory Committee on Tunnel Air Quality
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Review of the West Connex (M4-M5 Link) EIS

Written by Ian Longley and Åke Sjödin on behalf of the Advisory Committee on Tunnel Air Quality

13 October 2017

The review is based on the West Connex M4-M5 Link Environmental Impact Statement (EIS) published in September 2017. In detail we consider the air quality relevant parts of volumes 1B (Chapter 9) and volume 2C (Appendix I).

Main findings of the review

Our overall conclusion of the West Connex EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS for a project of this scale should. The information presented is of suitable detail and logical in order. The choices made regarding data used and methods followed have been logical and reasonable and it is our view that the benefit of exploring alternative approaches would be questionable or marginal.

Key expectations

This project links the New M5 and M4 East projects, both of which are mainly road tunnels. To some degree these other West Connex projects add road capacity to an existing corridor or route. However, the M4-M5 Link also introduces new high-speed routes across Sydney. It is therefore unsurprising that the EIS predicts an overall increase in vehicle emissions in this area of Sydney relative to the "Do Minimum" option.

It is also unsurprising that this project (as with West Connex as a whole) will redistribute traffic flows in many parts of the city. However, by linking other tunnels together the M4-M5 Link is unique in Sydney in that it substantially increases the time that a vehicle could spend continuously in tunnels.

This means that, from an air quality point of view, this project presents some similarities and differences to the other West Connex projects (M4 East and New M5). The major difference that needs to be explicitly considered is the **cumulative** impacts on ambient air quality, in-tunnel air quality and human exposure to pollutants of the three West Connex projects.

Specific issues

1. Modelling

a. General comments on assessment methodology

We find that the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions, other than lack of inclusion of new information on NO_x emissions from late-model diesel light-duty vehicles – discussed in detail below.

b. Emission modelling

The methodology (models used, assumptions made, etc.) to calculate emissions – in tunnels and on the surface road network, respectively – in the M4-M5 Link EIS is the same as in the New M5 (and M4 East) EIS. The third-party review of the New M5 EIS carried out by us in 2015 concluded regarding the emission modelling: *“To summarize, there seems to be no or few weak points in the emission modelling part of the New M5 EIS”*.

Now, with two years having passed since the last EIS review, the following comments can be made:

- It is stated in the EIS that both of the emission models that have been used for the M4-M5 Link EIS¹ were updated in 2012. Bearing in mind - among other things - the “dieselgate” scandal revealed in 2015, a question and concern thus is if the two models today represent the state of the art regarding emerging knowledge on late-model diesel light-duty vehicles’ (LDVs) NO_x real-world emission performance, including the direct emissions of primary NO₂. For instance, the NO_x emission factors (EFs) for diesel LDVs complying with the Euro 5 emission standard in the European emission model HBEFA (www.hbefa.net) has been updated twice since late 2015, as new knowledge has emerged, each update resulting in higher EFs compared to the preceding model version. A similar evolution has occurred for diesel LDV Euro 6 emissions. This may have implications for both the baseline and the future emission scenarios for NO_x and NO₂ for tunnel traffic and traffic on the surface road network.
- The consequences of the anticipated non-compliance of many late model diesel light-duty vehicles with regard to the NO_x legislative Euro 5 and 6 emission limits are amplified by the expected strong growth in the share of diesel light-duty vehicles until 2033.

Since any detailed vehicle-specific emission factors have not been presented in the M4-M5 Link EIS, it is not possible to assess the consequences for the emission modelling results of the EIS of the two factors mentioned above, although Annexure E of Appendix I of the EIS presents an evaluation of the NSW EPA emissions model conducted in the Lane Cove Tunnel, showing that the model overestimates emissions in that specific application.

¹ For in-tunnel emissions: PIARC Technical Committee C4 Road Tunnels Operation. Road Tunnels: Vehicle Emissions and Air Demand for Ventilation, World Road Association, document 2012R05EN, revised December 2012. For emissions on surface roads: NSW EPA (2012b). Air Emissions Inventory for the Greater Metropolitan Region in New South Wales – 2008 Calendar Year. Technical Report No. 7 – On-Road Mobile Emissions: Results. NSW Environment Protection Authority, Sydney South.

c. In-tunnel air quality

The M4-M5 Link ventilation report is a very ambitious, comprehensive and detailed report, successfully serving its purpose of assessing both in-tunnel air quality and emissions to surrounding environments for further dispersion calculations. One of its main conclusions is that *“the tunnel design meets the in-tunnel pollution criteria for all traffic conditions”*, which is also the most likely one. It has been out of the scope of this review to review all the modelling exercises and calculation results in detail. However, a few remarks of concern can be made, similar to those for the emission modelling part of the M4-M5 Link EIS in general:

- The emission model/emission data (PIARC) used represents the state of knowledge about five years ago (≈ 2012) regarding (real-world) road vehicle emissions².
- The most recently updated emission models, e.g. HBEFA, have in particular revised the emission factors for NO_x valid for late model (i.e. complying with the Euro 5 and 6 standards) diesel light-duty vehicles (passenger cars and light commercial vehicles) to gradually higher values, as a result of many vehicles having much higher emissions in real world driving than anticipated from the emission level given by the Euro standard.
- It is also mentioned in the ventilation report that, as for the PIARC data used, *“The LDV fleet is fixed at 50% petrol and 50% diesel, whereas it is forecast to be dominated by diesel vehicles by the time the M4-M5 link opens”*. This is not consistent with the data presented for the emission model calculations in Chapter 8 in Appendix I of the EIS, where the diesel fraction is considerably lower (Table 8-7).-
- The fleet NO₂:NO_x ratios for Euro 3 and Euro 4 diesel light-duty vehicles (both passenger cars and what is assumed to be light commercial vehicles (entitled “LDV”)) appear to be much higher than what is known from the literature/other emission models.

Since the emission calculations and underlying assumptions presented in the ventilation report of the M4-M5 Link EIS in general are very conservative, the main conclusion about in-tunnel air quality should still be valid, despite the above concerns. A quantitative assessment of the difference in results, if updated and higher emission factors were used, would represent a significant amount of additional work.

We are satisfied that the EIS has comprehensively addressed the issue of cumulative exposure arising from journeys through multiple consecutive tunnels made possible by the M4-M5 Link.

d. Evaluation of meteorological and dispersion models (GRAMM, GRAL)

The GRAMM-GRAL dispersion modelling suite has been used appropriately and appears to be giving credible results. We recognise that the ‘validation’ of the dispersion model presented within the EIS has significant methodological limitations (the observational data available was not collected for, and is not particularly well suited to, this purpose) – this is indeed why a separate study to validate GRAL

² In addition, regarding PIARC data, it is stated in the EIS that *“No methodology for estimating (in tunnel emissions) beyond 2020 is provided”*.

in the Australasian context has been commissioned. However, the validation assessment provided within this EIS indicates that the method for assessing background concentrations, and for modelling short-term ambient NO₂ concentrations (both discussed further below), are now the weakest links in the assessment.

e. Assessment of background air quality

Assessment of background air quality is a surprisingly challenging aspect of any EIS like this. In common with previous West Connex and North Connex projects considerable funds have been spent on air quality monitoring, putting the M4-M5 Link in the enviable position of having a far richer observational dataset available than most, if not all, comparable projects. Within this context, therefore, the assessment of background air quality in this EIS may be seen as good rather than best practice.

We call particular attention to the fact that datasets of < 1 year (due to monitoring starting too late) have been under-used or discarded, despite the fact that these data could be extrapolated to 1 year with acceptable uncertainty.

The consequence appears to be unnecessary uncertainty in several background estimates. This makes it difficult to evaluate dispersion model performance and to explore equity and distributional issues (see further comment below). It also makes it difficult to assess the margin of compliance with the NEPM for PM_{2.5}. This is an issue because Sydney's air quality is marginally non-compliant with the current NEPM and is unlikely to meet the 2025 NEPM target without further interventions (as indicated by projections of future PM_{2.5} emissions provided in the EIS). The role that the West Connex projects could play in meeting the NEPM is difficult to assess without a more accurate understanding of the current state of background air quality.

On the other hand, we do not believe that the weakness in background air quality assessment is seriously influencing the key conclusions of the EIS, and in particular does not impact the health risk assessment.

Therefore, despite these limitations, we find the current assessment of background air quality to be acceptable and fit for purpose. However, we recommend that careful consideration is given to this issue for the assessment of any future road and road tunnel projects in Sydney.

f. Method to estimate NO₂ concentration

The method used has limitations, which the EIS appropriately acknowledges. However, we find the empirical approach of estimating NO₂ concentrations using observational NO₂ and NO_x data to be sound, appropriate and the approach most suited to the purposes of the EIS.

2. Assessment and management of construction impacts

With a few exceptions, the methodology applied for the assessment of construction impacts in the WestConnex M4-M5 Link EIS is the same as the one applied in the New M5 EIS from 2015 (as well as the M4 East EIS, also from 2015). Thus, it is based on the guidance provided by the UK Institute of Air Quality Management in 2014, but adapted for use in Sydney, taking into account factors such as the assessment criteria for ambient PM₁₀ concentrations.

One potentially important distinction, and possible improvement, between the M4-M5 Link and the New M5/M4 East construction impacts assessment is the grouping of the above-ground construction activities for the M4-M5 Link (taking place at a number of separate locations, with the work staggered in time) into 12 distinct compounds. To avoid underestimations of the risks, given that the construction activities in several of these compounds are expected to take place concurrently and in close proximity to one another, the 12 compounds were combined according to seven “worst case” scenarios for the assessment. For each of these scenarios a risk assessment for each of the three dust impacts types (dust soiling, human health and ecological, respectively) and each of the four construction activities (demolition, earthworks, construction and track-out, respectively) was made, i.e. in all 84 individual risk assessments, whereas in the New M5/M4 East EIS in all only 12 individual risk assessments were made. This enabled in the M4-M5 Link case that mitigation measures in some instances could be specifically tailored for individual - or at least groups of - scenarios, which was not the case for the New M5/M4 East construction projects, thus a likely improvement in methodology.

It appears that the risk of dust impacts on human health on average is assessed as being in the range “Medium” to “Low Risk” for the M4-M5 Link, whereas it is assessed as “High Risk” for the New M5, and this should deserve some explanation or attention in the M4-M5 Link EIS.

A potential downside of the M4-M5 Link construction impact assessment compared to that of the New M5/M4 East assessment, is that in the former it appears that the three human receptor categories “Child Care”, “Educational” and “Aged Care” are lumped into one single receptor category “Community”, whereas these are identified separately in the latter. This may be significant for the risk assessment and associated mitigation measures, since small children and elderly people are believed to be more vulnerable to air pollution than the population at large.

3. Assessment conclusions and equity issues

Overall, the project (as assessed) seems to deliver improved air quality at a majority of receptors despite increased emissions and traffic – a simple yet important conclusion that the EIS does not emphasise. However it is unclear how much of this is due to improved pollutant removal/dispersion (i.e. use of stacks) versus spatial redistribution of traffic or emissions.

The EIS clearly indicates that the project leads to some highly localised improvements to air quality in some areas and similarly localised worsening of air quality in other areas. However, it does not discuss whether these changes increase or decrease the range of concentrations, i.e. how changes are related to absolute concentrations. We accept that the SEARS do not require a consideration of equity of impacts, however such a consideration can be of value to stakeholders. A cursory examination of both the maps and the community receptor results appears to show that improvements in air quality (DSC relative to DM scenarios) are predominantly in areas of relatively

poorer air quality, i.e. the project has an overall tendency to narrow the distribution of concentration, reducing inequality of impacts.

4. Health risk assessment

We find the health risk assessment to be sound and agree with its findings.

5. Recommendations for future projects

We note that at least three more major road tunnel projects are being considered for Sydney. We make the following recommendations for any future EIS relating to these projects:

- 1) That meteorological and dispersion modelling considers and responds to the findings of the study: "Optimisation of the application of GRAL in the Australian context", which was commissioned on behalf of the Advisory Committee on Tunnel Air Quality
- 2) Stakeholders consider whether an assessment of equity is desired and should be included in the SEARs.
- 3) After recent studies to validate the emissions and dispersion models used in the West Connex EISs, the methods for assessing background concentrations (see section 1e above) and for modelling short-term ambient NO₂ concentration (see section 1f above), are now the weakest links in the assessment. We recommend that the large amount of ambient air quality data for Sydney that has become available due to the North Connex and West Connex projects is analysed and mined to inform new models of background air quality.

6. Minor errors

- Main report (1B) Table 9-3 –the hourly CO, daily NO₂, annual PM₁₀ and daily PM_{2.5} 'criteria' "by 2020" for New Zealand do not exist. These appear to be the 2002 Guidelines (<http://www.mfe.govt.nz/publications/air/ambient-air-quality-guidelines-2002-update>)

