25th September 2019

Prof Hugh Durrant-Whyte
NSW Chief Scientist & Engineer
Chair: Advisory Committee on Tunnel Air Quality

Dear Prof Durrant-Whyte

We received from you a request to review aspects of the EIS for both the Western Harbour Tunnel and Beaches Link, specifically relating to tunnel ventilation on behalf of the Advisory Committee on Tunnel Air Quality. Please find below our review.

Yours sincerely

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Review of the Western Harbour Tunnel and Beaches Link EIS – Tunnel Ventilation

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

25th September 2019

The review is based on the documents "Western Harbour Tunnel and Warringah Freeway Upgrade – Technical Working Paper: Air Quality" and "Beaches Link and Gore Hill Freeway Connection - Technical Working Paper: Air Quality", provided to us on 12th August 2019. In detail we consider those sections relating to emissions from the ventilation stacks only.

Background

Tunnel ventilation stacks work by moving the vehicle emissions from ground level to points higher in the atmosphere, which result in longer time and distance for emissions to disperse before reaching ground level. In Sydney, stacks are assisted by ventilation fans that are used to direct the emissions higher into the atmosphere. Dispersion is improved by winds that tend to become stronger higher up into the atmosphere, while wind and turbulence increase mixing of the emitted and background air resulting in dilution.

In developing Environmental Impact Statements for future infrastructure such as roads, proponents rely on modelling for future scenarios, both expected and worse case. Modelling for road tunnels draws on measurements of background air quality, projections of future vehicle emissions on roads, information on tunnel operations, and utilises meteorological and dispersion models. This results in estimations of the maximum concentrations of different pollutants at different locations, including in the vicinity of ventilation stacks and locations in the surrounding area. Therefore, key to a scientific review of a project's air emissions from ventilation stacks is consideration of the data use and modelling approach.

In considering the future impacts of ventilation stacks a number of elements are assessed including the overall methodology, the approach used to calculate the nature and concentration of emissions within the tunnel and thus exiting the stack, and finally the dispersion from the stack. These are discussed in the following sections.

Main findings of the review

Our overall conclusion of these documents is that they constitute a thorough review of high quality. They cover 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.

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.

    b. Emission modelling

The methodology used to estimate in-tunnel emissions to assess in-tunnel air quality and further being used as input to the dispersion modelling of exhaust emitted through the tunnel ventilation stacks, is thoroughly and clearly described in the EIS. A major improvement in the emission modelling compared to the F6 Extension EIS in 2018, is the application of the new PIARC approach for calculating vehicle emissions in tunnels, published in 2019. The new approach builds on the most recent version (version 3.3, launched in 2017) of the European Handbook Emission Factors for Road Transport (HBEFA), frequently used in Europe. This version considers real-driving emissions following "dieselgate" including Euro 6 and is considered state-of-the-art and well suited for traffic conditions typical for tunnels.

Another improvement compared to the F6 Extension ventilation study in 2018 is the modelling of worst-case traffic operation scenarios, which comprise two types: one considering variable speed traffic operation for a range of average speeds ranging from 20 to 80 km/h, and another considering the emission situation during a breakdown or major incident in the tunnel. For all worst-case scenarios in-tunnel air concentrations of NO_2 were calculated to be below the threshold of 0.5 ppm. As in the F6 Extension ventilation study, the most recent knowledge on NO_2/NO_X-ratios in primary vehicle exhaust, provided by the EMEP/EEA Air Pollutant Emission Inventory Guidebook June 2017 update, to derive NO_2 emissions has been applied, and input data on heavy vehicle mass for the emission modelling have been taken from measurements of actual heavy vehicle mass with a 1 hour resolution (0-24) at the Botany WIM (Weigh-in-motion) station near the M5 East motorway.

It needs to be clarified here, that the emission modelling for the tunnel traffic assumes Euro 6 being adopted in Australia for LDV and PCs from 2019. As this adoption has not yet occurred, in-tunnel emissions are likely to be higher in 2027 and 2037 than as presented in the ventilation report. However, since tunnel concentrations are subject to regulatory limits, the emission increase should not affect the tunnel concentrations, since the ventilation system operation will be managed and adjusted accordingly, but the emission rate (expressed in pollutant mass per time unit) through the ventilation stack will increase. This should be addressed in the EIS.

In section 6.2.4.5 it is stated that the new PIARC approach provides emission data as of year 2019 – this is incorrect, the correct reference should be 2018. Furthermore, it is unclear what is meant with the subsequent sentence "Therefore, no degradation for old engine technologies are required to be applied." in this context.

c. Use and evaluation of meteorological and dispersion models (GRAMM, GRAL)

The EIS has given careful attention to the implications for meteorological modelling of the location of the project which may be impacted by the coast and harbour. Coastal locations are likely to experience higher wind speeds than inland locations and potentially different wind directions due to local land-sea breezes. We find that the approach used to address this using the 'Match-to-Observations' function in GRAMM (as recommended in the recent evaluation study of the GRAMM-GRAL package) is highly appropriate in this situation and are comfortable that this is likely to provide the most representative results whilst retaining slight conservatism.

The GRAMM-GRAL dispersion modelling suite has been used appropriately and appears to be giving credible results. The evaluation of the models provided in the EIS (Annexure H) relates to the model's ability to capture dispersion from open roadways. The model's apparent success in doing this (albeit with some conservatism) may be used to infer that they will perform similarly well in predicting dispersion from a ventilation stack, although this cannot be directly verified due to the non-existence of an observational dataset for the ventilation stacks only.

d. Method to estimate NO_2 concentration

The method used has limitations, which the EIS appropriately acknowledges. However, we find the empirical approach of estimating NO_2 concentrations using observational NO_2 and NO_x data to be sound, appropriate and the approach most suited to the purposes of the EIS.