

North East Link EES – Strategic Transport Modelling

Response to NELP Technical Note 53

William McDougall, 9 September 2019

1. This note gives my responses to NELP Technical Note 53, which contains Tim Veitch's responses to issues raised in my presentation to the IAC on 21 August 2019.
2. I have used the same headings as Technical Note 53 to present my responses, then finally I draw some conclusions and update my recommendations to the IAC regarding the Zenith modelling.

Post-processing of Zenith outputs by Smedley Technical & Strategic

3. Mr Veitch states correctly that the Zenith modelling outputs were post-processed by Smedley Technical by extracting percentage changes relative to traffic volumes for the base year. However, I point out that, in the VLC documentation in Technical Report A, the 2036 Zenith model results are expressed in absolute terms, not incremental to the base year. In any event, my concerns over the accuracy of the Zenith modelling are mainly to do with the way in which it distorts future year projections. Therefore, they are equally valid whether the results are used incrementally or not.

Historical trends in vehicle kilometres travelled per capita

4. I agree with Mr Veitch when he says that *"Looking forward, I remain of the view that there is considerable uncertainty over whether vehicle kilometres travelled per capita will increase or decrease in the future."* However, the 'single loop' method that Mr Veitch defends produces more growth in vehicle-km than a fully-converged, 'loop-through' method would produce, which indicates that he is certain that greater growth in vehicle-km will occur.
5. My concern over the 'single loop' method is not only related to the issue of whether and by how much vehicle-km of travel might grow in the future. However, it was VLC's justification of the single loop method on this basis in Technical Report A that drew my attention to it. My main concern in this respect is that the 'single loop' method 'forces' future growth in trip-km in excess of that which might be produced by land use changes alone. It does so by arbitrarily – and illogically – combining base year travel demand with future year network times and costs to calculate trip distribution.
6. I am still of the firm opinion that the 'single loop' method:
 - is illogical and invalid, in that it arbitrarily combines base year demand with future year network travel times and costs to calculate trip distribution
 - does not comply with established practice guidance, which requires a convergent 'loop-through' approach to demand modelling
 - does not enable demand model convergence to be calculated using the stipulated %GAP metric, which should be less than 0.1% between the last 2 loops of the

demand model, and less than 10% of the change in user costs that the project being modelled produces in any given modelled year.

VLC's approach to running the 'loop through distribution' method

7. Mr Veitch states his belief that *"The approach referred to by Mr McDougall (of using free flow times and costs) is significantly inferior to the approach used by VLC, because free flow travel times and costs are much less realistic than the costs derived from assigning current day demands onto a future year network"*. I do not dispute that statement when applied to a convergent 'loop-through' method, because as Mr Veitch points out, the impact of the seed skims on the final output will be minimal. However, I cannot accept that it is a more realistic approach when used in a 'single loop' approach, as VLC does.
8. Incidentally, another issue requires clarification. As far as I know, VLC have not stated how the future year network travel times and costs are derived for their 'single loop' method. Are they 'free-flow', or do they reflect a loaded network in some way? If it is the latter, then details are required of how they are derived, for each modelled time period. However, knowing these details will not change my view that the 'single loop' method is both illogical and non-compliant.

Changes in travel times under the 'single distribution' and 'loop through distribution' methods

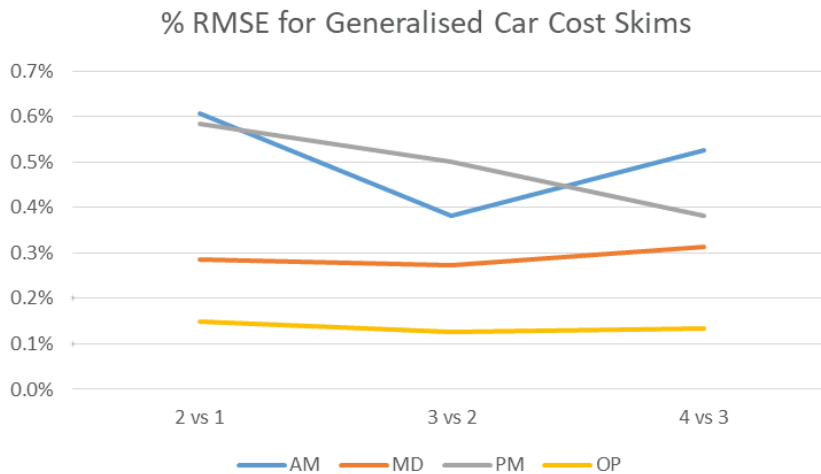
9. I note – and agree with – Mr Veitch's comments about the 'consumer surplus' method of calculating economic benefit. I also note his statement that the difference in NEL consumer surplus benefit between the 'single loop' and loop through' method is approximately 10%, and I agree with his statement that this is not trivial. However, Mr Veitch does not indicate whether the 'loop-through' method benefits are less than, or more than, those from the the 'single loop' method. I expect that logically, it would be 10% less, unless it is due to random fluctuations in a non-converging model, in which case it could be either less, or more.

Convergence of the model

10. In his Figures 1 & 2, Mr Veitch shows results from the five loops of the 'single loop' and 'loop-through' modelling methods, using the same metrics as Figure 1 from the Rogerson & Carnovale paper (Tabled Document 231a).
11. All of the data presented in the Rogerson & Carnovale paper is for the AM peak period. I think that this might be because, at the time of writing (2007), the MITM demand model was an AM peak model only – it may not have been geared up to produce demand estimates for other times of day.
12. Mr Veitch does not state whether the Zenith model data in his Figures 1 & 2 is for the AM peak or not. I suspect that they may be for the total of all four modelled time periods making up the average term-time weekday. If so, this is not a like-for-like comparison, because the Zenith model is run separately for each time period and the results are then aggregated to produce the weekday totals.

13. Demand model convergence should be presented for each time period individually, as VLC does (for the base year model, which is run using a 'loop-through' technique) in Technical Report A VLC Appendix B Figure B.28, reproduced below. This diagram suggests that the base year AM peak model in particular does not converge, nor do the MD or PM time period models. However, as I stated in my presentation, this graph does not use the %GAP metric, which is the stipulated way of expressing demand model convergence, so we cannot be sure of model convergence anyway.

Technical Report A VLC Appendix B Figure B-28



14. In his Figure 3, Mr Veitch presents a graph of the traffic flow on NEL across the Yarra River to illustrate apparent convergence of the demand model. Again, he does not state if this is for the AM peak (to correspond with the Rogerson & Carnovale examples) or for the full weekday. In order to confirm whether the data truly shows model convergence, we need to know what the results are by time period.

15. Finally, Mr Veitch make no reference at all to the requirement for model convergence to be demonstrated using the %GAP metric, as I raised in my presentation. I repeat that Australian and UK transport modelling guidance states that this is a fundamental requirement of demand modelling, to ensure that its results can be used with confidence for decision-making or project appraisal.

16. As already stated, by definition the %GAP metric cannot be calculated for the 'single loop' demand modelling method because it omits the distribution step, replacing it with an arbitrary and illogical single trip distribution calculation. This in itself is yet another reason, if it were needed, to disregard the 'single loop' method.

17. The %GAP metric needs to be calculated for each time period in each modelled year to gauge the degree of model convergence. This can only be done with a 'loop-through' modelling procedure, and the number of loops used must be determined by the criterion of reaching %GAP of less than 0.1% between the last two loops. Furthermore, the %GAP must be a small fraction (ideally less than 10%) of the change in user costs (i.e. the user benefits) associated with the project being assessed. If this cannot be done, then the model as it stands cannot be regarded as 'fit for purpose'.

18. I reiterate my position that the 'single loop' modelling presented for NEL cannot be regarded as 'fit for purpose'.

The effect of not constraining public transport demands

19. Mr Veitch clarifies that the access penalties in Zenith were calibrated in the base year using capacity constraint on public transport. In that case, running the model with 'unconstrained' public transport capacity in future years will probably result in even greater public transport patronage (and less car travel) than if the access penalties had been calibrated for unconstrained modelling. However, this is another illogical and artificial representation of the future.
20. Demand modelling is often used with unconstrained public transport (and sometimes road) capacity, but only at a strategic level to estimate latent demand and to help inform strategic directions for transport planning. Using it in demand modelling at a project level produces unrealistic results for the project in question.
21. Although using unconstrained public transport will underestimate the modelled demand for car travel, it will also distort the overall effects of NEL, especially the Doncaster Busway element.

Clarification of VLC's treatment of forecast value of time increases

22. Mr Veitch clarifies that the assumed value of time increase (of 1.55% per annum, or 36% between the base year of 2016 and the project modelled year of 2036) was only applied in the toll diversion model, by reducing the 2036 toll by 36%. As stated in VLC's NEL EES documentation on the matter, this assumes perfect elasticity between wages growth and willingness to pay tolls.
23. I have found a sensitivity test done by VLC previously, of not applying this adjustment (in the business case documentation for the East West Link). In that situation, the value of time increase was 1.8% per annum (43% over 20 years) but the toll adjustment (33%) was slightly smaller than that used on NEL because at that time an elasticity of 0.8 was used between wages growth and willingness to pay tolls (for car drivers). The result was a 15% reduction of traffic on EWL. This is not trivial and would have significantly affected the traffic-relieving impacts of that project, as well as its financial performance.
24. The rationale for this adjustment is illogical. If real wages are predicted to grow by 1.55% per annum over the next 20 years, then why would this only benefit those using the toll road? Surely it ought to be reflected in a global adjustment to values of time wherever they are used in the future year modelling.
25. It should be noted that this toll adjustment applies to all toll roads, not just NEL, in 2036. Consequently, the adjustment is also present in the 2036 'no-project' case, with discounted future tolls on Eastlink and CityLink. To fully understand what the effect of removing this artificial adjustment is in 2036, the 'no-project' and 'project' cases need to be re-run without it. Discounted tolls on EastLink will increase its traffic flows in the 'no-project' case, possibly resulting in more traffic on the Eastern Freeway which might then be attracted to NEL in the 'with-project' case.

26. Quite apart from the illogicality of applying this wages growth adjustment selectively only to toll road users, the value chosen (1.55%pa) is based on real wages growth of the last 20 years, applied to the next 20. Current projections are for far lower wages growth than this, for some time to come.

Conclusions

27. Mr Veitch's responses in Technical Note 53 do not fundamentally change my concerns about the Zenith modelling for NEL. Although it is reassuring to learn that an averaging technique is used to converge the Zenith model, the results shown in Mr Veitch's graphs do not necessarily prove that the model converges satisfactorily, because it is not known whether they are aggregate weekday results or by time period. In any case, the base year model does not appear to converge in all time periods, and no %GAP metrics have been provided to give the necessary confidence. Furthermore, %GAP cannot be meaningfully calculated for the 'single loop' method at all.

28. I conclude that the Zenith demand modelling cannot be regarded as fit for purpose, regardless of whether its results are used absolutely or incrementally. The main reasons for this are that the Zenith model for NEL:

- requires refinement to more accurately reflect travel and traffic conditions in the base year (as previously documented and discussed).
- uses a future forecasting method that is illogical and produces arbitrary and artificial lengthening of trips in future years.
- has not been shown to converge satisfactorily across all time periods in the base year.
- cannot be demonstrated to converge satisfactorily across all time periods in future years (indeed the illogical 'single loop' method, by definition, cannot converge in the required manner)
- does not realistically model public transport in future years because of the lack of capacity constraint.
- applies an illogical discount to future toll charges on the basis of real wages growth.

29. It is very difficult to establish what overall effect these issues might have on the results for NEL. The base year overestimation and toll discounting issues will increase NEL traffic; the unconstrained modelling of public transport will have an opposite effect; and the lack of convincing evidence on demand model convergence has an unknown impact.

30. I note that no response has been given from Dr Willumsen about these matters. I wonder if NELP has approached him for his views, and if not, whether they intend to do so.

Recommendations

31. I would like to update my recommendations to the IAC on the Zenith modelling as follows:

- Accept that the Zenith modelling as it stands is not 'fit for purpose', for the reasons I have given herein and previously.
- Request NELP to provide additional Zenith modelling as follows:
 - No toll discounting in 2036 'no-project' and with-project' runs.

- Use public transport capacity constraint in future year modelling.
 - Use a convergent 'loop through' modelling method, including full reporting of %GAP values and key model outputs to gauge convergence between loops and model stability, for all time periods in base and future modelled years.
 - Perhaps take the opportunity to update future year modelling to include latest population and employment forecasts (VIF 2019) and future transport network changes (e.g. Suburban Rail Loop). This may not be possible in a short timeframe, however, given the lack of detail available.
- Request NELP to provide a response from Dr Willumsen on the issues I have raised.
32. These actions, whilst not necessarily rendering the Zenith modelling completely 'fit for purpose', might help to evaluate the extent to which some of its distortions affect the results for NEL.
33. I reiterate that I would welcome the opportunity to provide further assistance in these matters. The adversarial nature of the hearings process does not create the ideal environment in which to deal with them; I would have preferred a lot more time, open information-sharing and discussion with VLC than has been the case.

William McDougall, 9 September 2019