North East Link
Panel Hearing

Tim Veitch | CEO | Veitch Lister Consulting
Overview of presentation

• Introduction to VLC
• VLC’s role in NEL
• My role and qualifications
• Intro to strategic transport modelling
• Strategic transport modelling for NEL
• Issues raised and my response
Introduction to VLC

• Founded in 1986 by Mike Veitch
• ~50 staff, 44 professional transport modellers (from a range of backgrounds, including Engineering, Mathematics / Statistics, Economics, etc.)
• Major project experience:
  
  - CityLink
  - EastLink
  - Melbourne Metro
  - East West Link
  - Western Ring Road
  - CityLink-Tulla Widening
  - West Gate Tunnel
  - Pacific Motorway widening
  - Sydney Metro
  - WestConnex
  - Canberra Light Rail
  - National Infrastructure Audit (IA)
  - Urban Network Transport Analysis for Australian Major Cities (DoIRD)

• Developers of Zenith models (all around Australia)
VLC’s role in NEL

• Strategic transport modelling using the Zenith model for:
  – Options Assessment
  – The NEL Business Case
  – The NEL EES

• Forecasting travel demands (reflecting anticipated growth in population and jobs)

• Modelling different transport network options (in this case, with and without NEL to quantify impact of the project)
In addition, VLC provided detailed modelling results to other Technical Advisors.

My role as an expert in this panel relates to VLC’s first report (the Transport Modelling Summary Report).
My role and qualifications

• My role in VLC’s work:
  – Expert technical advisor
  – Reviewed and signed off on VLC’s Transport Modelling Summary Report

• My qualifications:
  – 16 years of experience in strategic transport modelling
  – 8 years as VLC’s Technical Director
  – 4 years as VLC’s CEO
  – I led the design & development of our Zenith model of Victoria, which was used on this project
  – Previous involvement in Melbourne projects
    • EastLink, East West Link Needs Assessment, Tulla-Calder Interchange, Melbourne Metro, East West Link, West Gate Tunnel
Correction to my Expert Statement

In my Expert Statement I state:

**East West Link** – During the project, a sensitivity test was also undertaken of the eastern section of East West Link (between CityLink and the Eastern Freeway). The effect was to **increase** demand for North East Link by around 4% at its crossing of the Yarra River.

This should be corrected to say:

“… **decrease** demand for North East Link by around 4% …”

This change does not alter any of the opinions I express in my Expert Statement.
Intro to strategic transport modelling
Travel zones
Core inputs to strategic transport models

- Demographic / land use data for each travel zone
  - Population (including demographic profile)
  - Employment (by industry / occupation)
  - Education institutions
  - Other special generators (e.g. Port / Airport)

- Transportation network
  - Road network (number of lanes, capacities, speed limits, etc.)
  - Public transport network (routes and stops)

- Travel costs (tolls, parking, fuel, public transport fares)
Four step modelling process

1. Trip generation – how many trips?
2. Destination choice – where to?
3. Mode choice – which mode?
4. Trip assignment – which route?

Standard process used by all strategic transport models in Australia.

Each modelling step is “calibrated” using household travel surveys (in this case VISTA 2007-2010).
Outputs of strategic transport modelling

For each scenario the model outputs:
• Estimated number of trips between each origin / destination
• Estimated traffic volumes per road (by vehicle type)
• Estimated average traffic speeds per road
• Estimated public transport passenger volumes (by route / stop)

Outputs are produced for four time periods on an average weekday (during school term time):
• AM peak 7-9am
• PM peak 4-6pm
• Inter-peak 9am-4pm
• Night time off peak 6pm-7am
General Strengths & Limitations of the Model

Strengths

• Useful for predicting the impacts of population and employment growth and changes to the transportation network or travel costs

• Useful for testing and analysing the impact of different scenarios

• Useful for planning of future transport infrastructure and policies
General Strengths & Limitations of the Model

Key limitations

• Relies on third party inputs (e.g. population, employment).
  – Modelling uses official Government forecasts as input.

• Travel demand is only “partially constrained”, which means that forecast volumes can exceed practical capacities of roads / public transport vehicles.
  – Make adjustments to model outputs.

• Model does not explicitly reflect details of traffic intersections and the effect of queuing.
  – Micro-simulation modelling attempts to deal with these limitations.

• Medium-to-long term forecasts are inherently uncertain.
  – State our assumptions, limitations, point out uncertainty
How VLC’s outputs were used in the TTIA

• For the TTIA, VLC’s estimates of percentage changes in traffic (relative to current day) were used, and applied to observed current day traffic volumes, separately by vehicle type (i.e. cars / trucks)

• Forecast growth in peak demand was capped based on practical capacities, with excess demand assumed to travel outside the peak.
Example VLC outputs

*Figure 5.5 - Change in daily traffic volumes (project links faded)*
Example VLC outputs

Figure 5.2 - Origins and destinations of trips using North East Link, daily
Issues raised in expert evidence & conclave

1. Whether the EES modelling is materially different to the Business Case [McDougall]
2. Whether the model over-estimates current day traffic [McDougall]
3. The forecast rate of traffic growth [McDougall, Dunn]
4. Use of the “single distribution” approach to future trip distribution [McDougall, Dunn]
5. Whether induced demand is under-stated [McDougall]
6. Base year validation of traffic volumes and travel times [McDougall, Dunn]
Issues raised in expert evidence & conclave

7. Whether the modelling is likely to under-state future public transport usage [Dunn, Tivendale]
8. Lack of detailed modelling of intersections and queues [Dunn]
9. Whether the forecast traffic is over-stated [Dunn]
10. Whether the forecast time savings are reasonable [Stone]
11. Whether the forecast modal shift is reasonable [McDougall]
12. Whether the toll diversion for trucks is too inelastic [Dunn]
#1 – EES vs Business Case modelling

- McDougall identified inconsistencies between EES and BC documentation of modelling results.

- We agreed in conclave that issues are to do inconsistencies in reporting, and models are not materially different.
#2 – Over-estimation of current day traffic

- McDougall raised concerns that the model over-estimates current day trips, because the model has “more and longer trips” than the VISTA survey.

- Agreed in conclave that:
  - Surveys like VISTA under-report travel
  - VLC analysis indicates that VISTA vehicle driver travel is 20% lower than implied by traffic counts for an average weekday
  - Differences between modelling and VISTA do not necessarily indicate a problem with the model

- Note post conclave: VITM trip rates are also higher than VISTA by a similar scale and for similar reasons to Zenith.
#2 – Over-estimation of current day traffic

Appendix Figure B.6 - Local area daily individual counts scatter chart (observed vs 2016 modelled)
#3 – Rate of future traffic growth

• McDougall raised concerns that VLC’s rate of forecast traffic growth is higher than indicated by recent evidence

• Did not reach agreement in conclave
McDougall states that VKT per capita has been falling since around 2000 or so.
#3 – Rate of future traffic growth

BITRE's observed and scenario projections of total vehicle kilometres travelled per capita compared to modelled forecasts, Melbourne

- BITRE observed
- ABS population adjustment
- Zenith 2016
- Zenith 2026
- Zenith 2036
- BITRE upper baseline
- BITRE lower baseline
- BITRE high VKT scenario
- BITRE low VKT scenario
#3 – Rate of future traffic growth

- VKT per capita dropped a total of 7% between 2004 and 2010, but has been relatively stable since.
- McDougall connects changes since 2004 to increasing density, but there are many other factors at play (particularly in the 2000s).
  - Rapid increases in CBD employment in the mid-2000s
  - Introduction of CBD parking levy in late 2000s
  - Significant increases in fuel prices in the 2000s
  - Falling rates of drivers’ licence holding among young people in the 2000s
#3 – Rate of future traffic growth

- Future traffic growth is **uncertain**, as illustrated by BITRE’s wide range of forecasts.
- In my view, increases or decreases in VKT per capita are very plausible.
- Increases could occur as a result of:
  - Increased use of ride-sharing services (e.g. Uber)
  - Improved traffic management systems (e.g. ramp metering, improved signal optimization)
  - On-going expansion of the urban area
  - Increased mobility of retirees relative to previous generations
  - Reductions in vehicle operating costs
  - Autonomous vehicles
- Decreases could occur as a result of:
  - Increases in urban density
  - Further reductions in car use / licence holding
  - Travel demand management policies (e.g. road pricing)
  - Increases in vehicle operating costs
  - Increases in tele-working
- The changes we are talking about are very much at the margin. Traffic is forecast to grow in any case, the question is whether it will grow slightly faster or slower than population.
- I consider our forecast rate of growth to be well within the plausible range, and a reasonable basis for the EES.
#4 – Use of “Single Distribution” method

- McDougall raised concerns with VLC’s use of the “Single Distribution” approach to future trip distribution.
- McDougall prefers the “Loop through distribution” method on theoretical grounds, and because it produces results more in line with his expectations.

- Did not reach agreement in conclave.
#4 – Use of “Single Distribution” method

- Issue relates to trip distribution, which uses a “gravity model” to predict where people travel to (i.e. to connect origins & destinations).

- “Input travel times & costs” are based on what the world would look like if the 2036 road network (incl. or excl. NEL) was in place today.
Why do we take this approach?

- The gravity model is the weakest component of the four step model, and when it is used to forecast using the “loop through distribution” method it typically predicts that trips will shorten.
#4 – Use of “Single Distribution” method

• Why do we take this approach?
  – This issue has been known for a long time, and indicates that gravity models are *too sensitive* to changes in future congestion levels.
  – We and others recognise this limitation of gravity models, and take pragmatic steps to dampen their responses
    • Common practice in the UK to dampen the responses of gravity models
    • I have seen other approaches used in the USA, where distance is included in the model to dampen the effect of travel time
    • Arup in Australia
#4 – Use of “Single Distribution” method

- McDougall criticises that: “To me, there is no logic in calibrating and validating a modelling process for the base year, then using a different (and illogical) method to forecast future years”
  - In my view this is an idealistic viewpoint which puts too much blind faith in models.
  - The reality is that transport models are developed using cross-sectional (rather than time series) data to reflect a “snapshot” in time (i.e. the base year).
  - There is no guarantee that a model which matches the base year will produce reasonable forecasts.
  - Whenever we produce forecasts or run a scenario, we (as modellers) need to assess whether the results make sense, and whether the model is capable of responding reasonably to certain changes in its inputs.
  - Decades of experience suggest that gravity models (when run using the “undampened loop through” method) erroneously predict the evolution of average trip lengths over time.
  - In these circumstances, I consider it perfectly reasonable (and best practice) to pragmatically intervene in the model to compensate for its limitations.
#4 – Use of “Single Distribution” method

• What impact does VLC’s method have relative to the “loop through distribution” method?
  – Total VKT across model area is 4% higher
  – Demand for NEL is 7% higher
  – Level of induced demand is around 10% higher
  – Traffic impacts on other roads are typically 10% higher

• Traffic impacts are slightly higher using VLC’s method, which I consider conservative from the perspective of the EES.
#5 – Whether induced demand is under-stated

- McDougall raised concerns that induced demand is under-stated, due to use of the Single Distribution method.

- Agreed in conclave that VLC’s approach actually produces larger estimates of induced demand.
#6 – Base year validation

- McDougall and Dunn raised issues with model validation
  - Model over-states total traffic in the study area
  - Model over-states commercial vehicle (truck) traffic in the study area by around 15%
  - Travel times differ from observed on some routes
#6 – Base year validation

- Traffic count locations
#6 – Base year validation

• Daily traffic validation

Appendix Figure B.6 - Local area daily individual counts scatter chart (observed vs 2016 modelled)

• Daily traffic validation is of a high standard, and shows no evidence of over or under prediction.
#6 – Base year validation

- Screenlines

Appendix Figure B.2 - Local study area screenline traffic count
#6 – Base year validation

• Daily screenlines

*Appendix Figure B.12 - Daily screenline maximum desirable deviation comparison*

• Daily screenline validation is of a high standard, and shows no evidence of over or under prediction.
#6 – Base year validation

- AM peak traffic counts

*Appendix Figure B.8 - Local area AM peak individual counts scatter chart (observed Vs 2016 modelled)*

- AM peak validation is of a high standard, but shows a tendency to under-estimate peak volumes on large roads, and over-estimate on small roads.
#6 – Base year validation

- AM peak screenlines

On face value, the model appears to be around 10% high in the AM peak. However, the counts used represent flows between 7-9am, where in actual fact the two hour peak is likely a bit earlier in the study area. VLC analysis suggests that if the true 2 hour peak were used, the counts would be around 7% higher. This indicates that the model is not substantially over-stating the true peak demand.
#6 – Base year validation

- **Commercial vehicles**
  - Modelled flows on the Greensborough / Rosanna Road route are over-predicted by around 15%.
  - Modelled flows across the Yarra River screenline are also over-predicted by around 15%.

- This systematic over-prediction is addressed in the spreadsheeting process applied by other Technical Advisors.
#6 – Base year validation

- Travel times

Appendix Figure B.19 - Rosanna Road Corridor AM peak southbound travel time comparison
#6 – Base year validation

• Travel times

*Appendix Figure B.20 - Rosanna Road Corridor PM peak northbound travel time comparison*
#6 – Base year validation

- Travel times
#6 – Base year validation

- Travel times
  - The model does a reasonable job of modelling aggregate travel times on the main competing route (Greensborough / Rosanna)
  - On some other routes, there are material differences between the modelled travel time and the observed average travel time, particularly during the peaks
  - Peak travel times are very difficult to accurately model, as travel times can be very sensitive and vary widely day-to-day
  - In my view, the standard of the travel time validation is reasonable for the purposes of the EES.
#7 – Public transport forecasts

• Dunn and Tivendale raised concerns that the public transport forecasts might be under-stated.
  – Dunn was concerned that the settings of certain parameter values (e.g. transfer penalties) are different to what he expects, and that these might lead to lower forecasts of public transport
  – Tivendale was concerned that the assumptions around value of time would favour car travel over public transport
#7 – Public transport forecasts

• Response:
  – In my view the parameter values are reasonable, and I have no reason to think they will lead to over or under-statement of future public transport demand.
  – We agreed in conclave that the assumption highlighted by Tivendale actually favoured public transport over car.
  – Public transport patronage is “unconstrained” in the model, meaning that capacities are uncapped. This will tend to favour higher public transport usage.
  – The forecast is for public transport mode share to increase from around 8.4% to around 12.5% in 2036. In my view this is a significant increase.
#8 – Modelling of intersections / queuing

• Dunn expressed concerns about the inability of the model to explicitly account for the effects of traffic intersections and queuing, and the impact this might have on the design of the Project.

• Response:
  – I agree that more detail could have been added, which may have provided more granular insight.
  – However, in my view there is a trade off between precision (i.e. granularity) and accuracy. In my view, modelling these effects:
    • Adds significant complexity
    • Makes results much less stable (they may fail to converge)
    • Is challenging over such a large study area
    • Can make results less accurate (particularly for medium-to-long term forecasting)
  
  – Given these issues, I consider it reasonable to not model these effects in the strategic modelling.
#9 – Whether the forecasts of traffic are over-stated

- Dunn raises concerns that the forecast traffic might be over-stated, and raises particular concerns with the Eastern Freeway, on the basis that:
  - The forecast volumes on the Eastern Freeway east of NEL (280,000) are very large by Australian and world standards, leading to very significant upgrades
  - Bottlenecks (e.g. at Hoddle Street) may prevent traffic from reaching the project
  - Change in VKT per capita is higher than he would expect
  - Travel demand management (e.g. tolls on the Eastern Freeway / road pricing) could be used to manage demand
  - Public transport forecasts may be under-stated

- We did not have time to discuss this in the conclave, but it pulls together many of the points that were discussed.
#9 – Whether the forecasts of traffic are over-stated

• My response:
  – The forecast demands are indeed large.
  – However:
    • Forecast (with the Project) is a range: 243,000 – 284,000.
    • The section of the Eastern Freeway referred to by Dunn carried around 159,000 vehicles per day in 2016, in 6 lanes. This works out to around 26,500 vehicles per lane per day, which is very high by Australian and world standards. On the basis of these volumes, the road warrants upgrading now, and would already be “busy” even as an 8 lane road.
    • By 2036, usage without the Project is forecast to increase to around 170,000. This growth is very likely lower than the natural rate of growth, due to a lack of capacity. Demand is likely to be suppressed, or rerouted onto competing arterial roads.
    • North East Link adds in 6 freeway lanes, with ~¾ of the demand connecting to the east. This adds around 4 freeway lanes worth of demand onto this section (~80,000 vehicles per day).
#9 – Whether the forecasts of traffic are over-stated

- My response:
  - Given the above:
    - In my opinion, the significant increase between the 2036 “No Project” and “Project” cases is reasonable given that the 2036 “No Project” volume is very likely suppressed due to lack of capacity, and given the extra demand added by North East Link.
    - In my opinion, the strategic model’s forecast of around 261,000 vehicles per day is not unreasonable (or around 18,500 per lane per day).
#10 – Whether the forecast time savings are reasonable

• Stone and some of the public submissions questioned whether the forecast time savings are reasonable

• We did not have time to discuss this at the conclave

• I have done some sense checks of the travel times along NEL and its main competing route (Greensborough / Rosanna, etc.). They look reasonable to me.

<table>
<thead>
<tr>
<th></th>
<th>Via existing network</th>
<th>Via NEL</th>
<th>Via existing network</th>
<th>Via NEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>42.8</td>
<td>N/A</td>
<td>24.9</td>
<td>N/A</td>
</tr>
<tr>
<td>2036 No Project</td>
<td>51.5</td>
<td>N/A</td>
<td>28.7</td>
<td>N/A</td>
</tr>
<tr>
<td>2036 With Project</td>
<td>34.9</td>
<td>20.6</td>
<td>23.0</td>
<td>12.2</td>
</tr>
</tbody>
</table>

• Further, in my view, there is not a universal law that time savings always quickly disappear. It depends on the circumstances (e.g. Airport Link in Brisbane).
#11 – Whether the forecast modal shifts are reasonable

- McDougall stated that the predicted mode shifts as a result of NEL are "substantial", but did not appear to criticise their reasonableness.

- We did not have time to discuss this in the conclave.

- Public transport trips in the North East are forecast to reduce by less than 1%.

- In my view, this is reasonable.
#12 – Whether truck toll diversion is too inelastic

• Dunn states:

“I have reviewed the toll diversion curves and note that commercial vehicles are represented as highly inelastic in the model. Whilst I agree that trucks would be less elastic than private vehicles, the curve in my opinion overestimates the number of trucks that would use NEL.”

• We did not have time to discuss this in the conclave.

• Research related to CityLink indicates that the toll elasticity for trucks is around -0.05. The model is consistent with this.
Conclusions

• After reviewing all the relevant documents, and the issues raised during this process, I have a high level of confidence in the reasonableness of the strategic modelling as a basis for the EES.