

*Senate Economics Reference Committee
Inquiry into the operations of existing and proposed toll roads in Australia*

Submission by William McDougall Transport Planner

7 July 2017

1 Introduction

This submission relates some of my experiences on reviewing traffic forecasts and cost-benefit analyses for toll road projects. As such it has relevance to the first item in the inquiry terms of reference, namely *“financial arrangements of existing and proposed private toll roads, and transparency, accountability and equity aspects of these arrangements”*. I refer to proposed, not existing, toll roads, primarily Melbourne’s West Gate Tunnel project.

I have worked as a professional consulting transport planner and engineer for over 40 years, of which over 30 have been in Australia. I have been involved in project feasibility, transport modelling and traffic forecasting, economic appraisal, strategic planning and business case development. During my career, I have been directly involved in a few toll road projects as a reviewer and advisor on transport modelling, toll revenue projections and cost-benefit analysis. A summary CV is given in Attachment A.

My recent experiences on the West Gate Tunnel project in Victoria are highlighted in some detail herein. I consider that, from my direct involvement as a peer reviewer, the justification for this project is based on flawed traffic modelling and cost-benefit analysis.

This and other experiences through my career strengthens my opinion that the work done to get a toll road project funded often lacks rigour and thoroughness, and is frequently biased.

2 West Gate Tunnel Project

2.1 Background

In 2015, I was contracted by the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR) Transport Policy and Planning Division to advise on business case development for a range of transport projects. Within this division, I worked for a team which, amongst other things:

- undertook continuous development of the Department’s own transport forecasting model (VITM, or the Victorian Integrated Transport Model); and
- ensured, using peer reviewers and internal auditors, that transport forecasting and economic appraisal was carried out to acceptable standards.

One of the projects I was tasked with reviewing was the Western Distributor (WD), now called the West Gate Tunnel Project. My role on this project was to support an externally-appointed peer reviewer for transport modelling, and to undertake peer review of the cost-benefit analysis.

The WD project was submitted to the Victorian Government for consideration by Transurban. It was assessed under Treasury’s ‘market-led proposals’ guidance. A project review team was set up within DEDJTR (separate from the division I was working in) to undertake the review and appoint consultants to do key components of the work. Veitch Lister Consulting (VLC) did the transport modelling and PwC Australia (PwC) did the economic appraisal.

I was surprised that the DEDJTR project review team, and their appointed consultants, were mostly the same people who had worked on the business case for the East West Link (EWL) under the previous state government. The EWL had just been scrapped by the incoming Andrews government as a key pre-election promise. There had been many concerns and problems expressed with the business case for the EWL, including the transport modelling and cost-benefit analysis.

As the work started, significant technical concerns became apparent. As well as this the work was done to a very short programme. Consequently, the results were not produced early enough for proper review, nor was there time for incorporation of peer reviewers' feedback.

After much deliberation, in the face of frustration and concern that the work would not stand up to scrutiny, I raised concerns at a higher level. Shortly after doing this, I was taken off the WD review work without explanation. The modelling peer reviewer's report was never released. Recently-released EES documentation on the traffic modelling implies that the peer reviewer's comments were addressed, but this was not the case (not in full, at any rate).

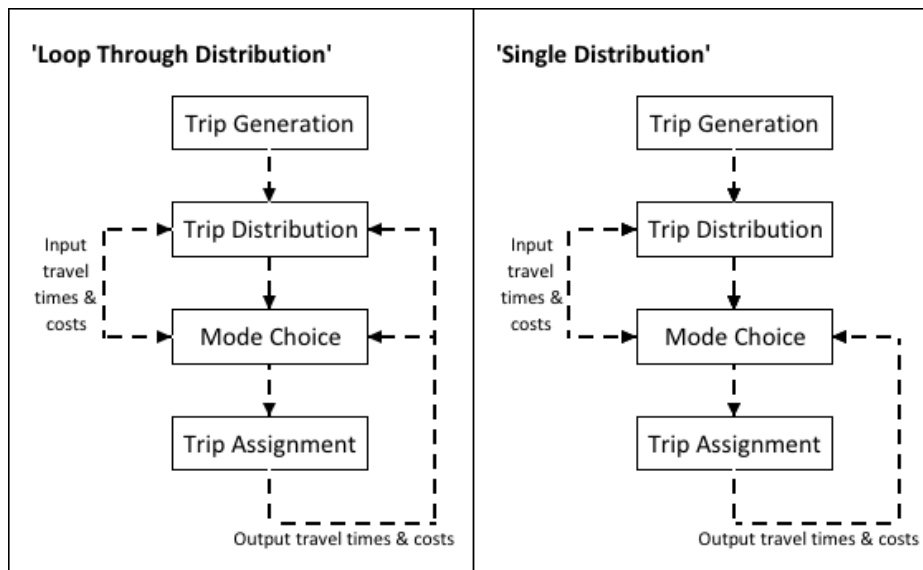
2.2 Transport modelling

At the outset, the four-step transport model to be used for the work (Zenith, developed by VLC and used on the EWL previously) was insufficiently documented and evidence of its validation was incomplete. Proper model validation requires direct evidence of:

- its ability to reproduce relevant recently-observed travel demand and traffic levels;
- its convergence after a suitable number of iterations; and
- the reasonableness of its response to a range of sensitivity tests.

The Zenith team worked to resolve these issues but there were still concerns expressed by myself and the peer reviewer which were never fully addressed, including:

- Zenith produced present-day traffic activity that was significantly higher than recent travel surveys, and results produced by VITM, despite supposedly being calibrated to the same data.
- Zenith used an unusual and untested method to produce future forecasts. VLC call this the 'single distribution' method and maintain that this is better than the way other four-step transport models are used (called a 'loop through distribution' method by VLC). The diagrams below illustrate the difference.



Four-step transport models use an iterative process to reach an answer. This involves loading the forecast demand (from the trip generation step) onto the computerised representation of the network, re-calculating the travel times (using travel time/flow relationships) and re-loading the demand in a loop back through the trip distribution, mode choice and assignment steps. This process is repeated until the results of two successive iterations converge to acceptable tolerances.

Zenith's 'single distribution' method iterates back through the mode choice and assignment steps only, thus keeping trip distribution constant. It does not allow for redistribution of trips due to changes in network conditions.

VLC has presented (for example in the WD EES documentation) a lot of material to justify doing this, mostly concerned with their view that it produces a more accurate result. However, it is illogical to use a four-step model in this way, and to my knowledge no other models are thus used. If a model has been calibrated to replicate existing conditions using full ‘loop-through’ distribution, it is illogical to then omit an essential loop when using the model to represent future years. It is a methodological ‘fudge’ rather than a real attempt to improve the modelling process.

The table below summarises an analysis I did at the time comparing results of using Zenith (in both ‘single’ and ‘loop through’ mode) and VITM in modelled years 2011 and 2031.

Measure	Zenith ¹			VITM ²		Zenith over VITM in 2011	Zenith 'single' over VITM in 2031	Zenith 'loop thru' over VITM in 2031	VISTA 2011
	2011	2031 'single distribution' ³	2031 'loop thru distribution'	2011	2031				
Population (million)	4.89	6.96	6.96	4.11	5.87	19%	19%	19%	
Car trips (million)	8.9	12.1	11.9	7.9	10.7	12%	13%	11%	
<i>increase over 2011</i>		36.0%	33.7%		35.4%				
Average car trip length (km)	14.4	15.4	14.3	10.1	9.8	42%	58%	46%	10.2
<i>increase over 2011</i>		7.1%	-0.6%		-3.6%				
Car km travelled (million)	128	188	171	80.4	104.9	59%	79%	63%	
<i>increase over 2011</i>		46.9%	33.6%		30.5%				
Weekday car km per capita	26.2	27.0	24.5	19.6	17.9	34%	51%	37%	
<i>increase over 2011</i>		2.9%	-6.5%		-8.7%				
Motorised mode share - car	90.5%	85.6%	85.7%	90.8%	86.7%				90.0%
Motorised mode share - PT	9.5%	14.4%	14.3%	9.2%	13.3%				10.0%

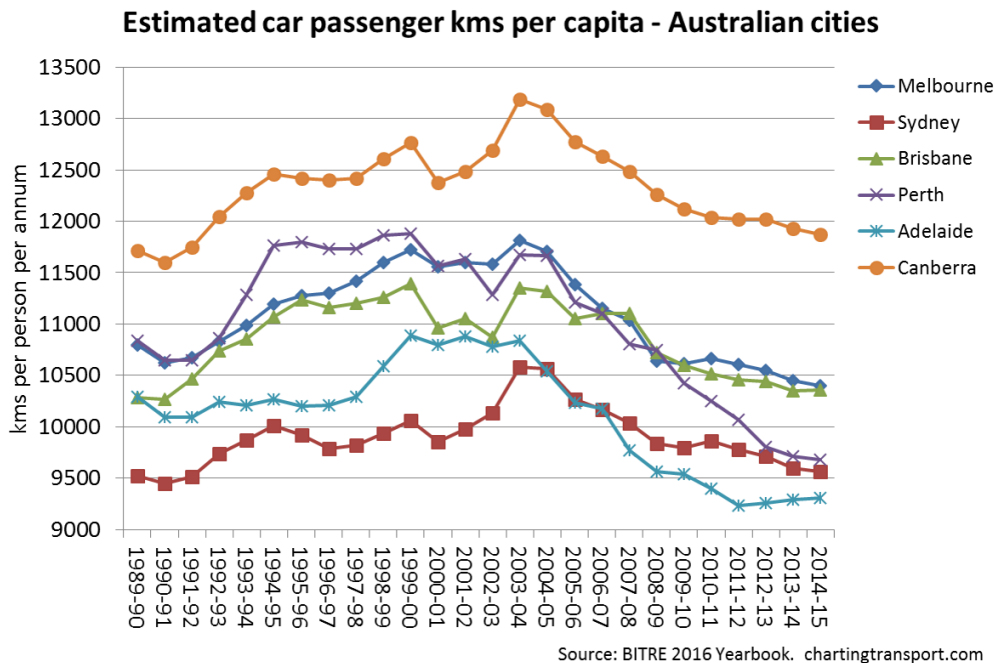
NOTES

1. These figures are from VLC report "Review of Travel Forecasting Methodologies", Sep 2015
2. These figures are from VITM output files for September 2015 reference case
3. This is the method VLC uses on WD (and maybe other projects)

Key issues arising from this comparison are:

- **Population and number of trips:** Zenith covers a wider area than VITM, so encompasses a larger population and produces more car trips (12% more in 2011).
- **Average car trip length:** Zenith has 42% longer car trips in 2011 than VITM, and 58% longer in 2031 ('single distribution'). VITM average car trip length is much closer to VISTA. Zenith's larger modelled area may account for some, but by no means all, of this.
- **Car kilometres travelled:** Zenith has 59% more car vehicle-km in 2011 than VITM, and 79% more in 2031 ('single distribution').
- **Car kilometres per capita:** Zenith 'single distribution' has 51% longer car-km per capita than VITM in 2031. Zenith's car-km per capita increases by 2.9% between 2011 and 2031 (against observed trends for the last ten years; see graph below). It would decrease by 6.5% if 'loop-through' distribution was used, compared with VITM's reduction of 8.7%.

The concern was that Zenith produced more and longer car trips than VITM in 2011, and the 'single distribution' method produced even more (and longer still) trips than VITM in 2031. Therefore, traffic growth projections using Zenith would inevitably be significantly more than those using VITM. VLC have not substantiated their reasons for using the 'single distribution' approach, other than arguing that it does produce more and longer car trips per capita. They assert this to be correct, but it is against observed trends over the last ten years in Melbourne (and indeed in all capital cities in Australia – see graph below).



2.3 Cost-benefit analysis

PwC prepared a proposed methodology for the cost-benefit analysis, to be undertaken using results from Zenith modelling. There were several concerns with the way this was to be done, which I raised with them as peer reviewer. Perhaps the key issues were:

- Inclusion of **additional congestion relief benefits** using a methodology given in the New Zealand Transport Agency (NZTA)’s 2013 Economic Evaluation Manual, which added \$580m-\$780m of present value to the economic benefits in the business case.
- Presentation of **two different benefit-cost ratios** (supposedly complying with Victorian and Infrastructure Australia guidance), but with some questionable interpretation regarding treatment of induced traffic.
- **‘Streaming’ of benefits in future years**, between fixed and variable matrix modelling approaches, which resulted in higher-than-usual benefits in early years.

These are discussed below.

Additional congestion relief benefits

The NZTA’s economic guidance suggests that drivers in New Zealand attach a higher value to time lost in congested road conditions than in ‘uncongested’ conditions. It proposes that additional disbenefits should be added, on a sliding scale between traffic volumes from 70% to 100% of road capacity, to allow for this. PwC include this effect in the benefit stream for the WD. However, I consider that there are three issues with using this approach on the WD project:

- There is no proof that the effect is observed in Australian capital cities, where congestion levels are much higher than in New Zealand generally. PwC did quote some Australian research but in my opinion it was not conclusive enough to warrant including the effect.
- Even if the effect was shown to be applicable, the traffic modelling does not include it (only the cost-benefit analysis). If it was possible to model it, the effect would route traffic away from higher congestion areas. To apply such an adjustment to the economic benefits without also including it in the traffic modelling is incorrect.
- No other Australian cost-benefit analysis I am aware of has incorporated this effect, and it is not mentioned in any Australian guidance. Therefore, its inclusion has overstated the benefits of WD compared to other projects.

Two different cost-benefit ratios

PwC calculated two different cost-benefit ratios by applying their interpretation of both Victorian and IA guidelines. They identified several differences between the two, including their assertion that the IA guidance did not require inclusion of induced traffic.

The guidance then in force did not explicitly mention induced traffic in the main text but it did in appendices, which required that the treatment of induced traffic should be noted and described. Furthermore, there was draft replacement IA guidance issued at the time, which did include explicit mention throughout of the requirement to include induced traffic.

Finally, there is complete acceptance that induced traffic is indeed a real, observed phenomenon, so to exclude it on such a technicality, without stating clearly that it was incorrect to do so, is misleading.

Streaming of benefits in future years

Induced traffic is generally accounted for in four-step modelling by using a ‘variable matrix’ approach as opposed to a ‘fixed matrix’ approach. This is done by re-running the trip generation step on every iteration, thus changing the number and destination of trips due to a change in the network (i.e. a transport project). This is accepted practice.

PwC further reduced the effects of induced traffic (that is, in their interpretation of Victorian practice) by blending results from fixed matrix and variable matrix traffic modelling, based on their assertions that it takes some time for the land use effects of transport projects to occur, thus implying that this accounts for all of the difference between the fixed and variable matrix approaches.

However, the variable matrix approach does not account for land use changes in any case, just the re-distribution of trips around an area due to changes in travel conditions (but with land use fixed). These types of induced traffic are generally smaller than the longer-term redistribution of land uses.

This ‘tweak’ has the effect of increasing the benefits of a project in the early years, which increases the economic benefits because the discount rate has less effect than in later years. It is not done as a matter of course, and I am not aware of it being done on any other projects.

3 Other project experiences

In the early 1990s I worked on a team preparing traffic and toll revenue forecasts for a consortium bidding for City Link in Melbourne. My role was to ensure that the traffic modelling was prepared with reasonable assumptions, and that the toll revenue calculation process was using the traffic modelling results correctly. I found that the overall mentality of the team was to prepare assumptions which stood up to external scrutiny, but were always on the optimistic side (i.e. to give the best traffic and revenue results for the consortium). This was true of all the key variables affecting future traffic growth, particularly land use (population and employment projections) and sensitivities to toll levels.

I had similar experiences when I was later (briefly) involved in similar work on a team bidding for Melbourne’s Eastlink. On that project, I considered at the time that there were optimistic assumptions made about population and employment projections. It would be very interesting to be able to compare the forecasts made at the time with actual changes since Eastlink opened, but this has never been done to my knowledge.

4 Conclusions

My conclusions from these experiences are that those involved in ‘justifying’ transport projects, especially toll roads, often develop bespoke procedures and general attitudes to the work that are biased towards producing bullish forecasts and optimistic economic and financial projections. They have developed many

justifications for the way they do things, especially when these methods depart from usual practice and accepted guidelines. However, many of these justifications do not survive close scrutiny. Independent peer reviews, on the few occasions that they are undertaken, have been, and continue to be, regarded by project teams as a necessary inconvenience and an impediment to their progress instead of a benefit to the outcome. Very few project justifications have been undertaken with the transparency, objectivity and completeness which is required.

The Western Distributor project is a strong case in point. My direct experience as a reviewer confirmed my long-held suspicions of substantial 'optimism bias' in the appraisal process. This is a polite term for what I consider to be deliberate distortion and misrepresentation of traffic forecasts and the economic benefits that flow from them. This was done on what was supposed to have been an impartial assessment of the project from a Government perspective, rather than a proposal by a private proponent or tenderer.

There is much work to be done to bring transport project appraisal procedures up to date in Australia. Recent national efforts to update the procedures under the Australian Transport Assessment and Planning (ATAP) Guidelines are incomplete and do not, in my opinion, address the core issues. It is also unfortunate that there are different guidelines issued by State Treasuries and Infrastructure Australia, for example, instead of establishing a nationally-agreed set of guidelines (with local variations where justified).

Sufficient time and resources must be allocated to accredited independent specialist reviewers to review appraisal work as it proceeds, document any issues arising and ensure that corrections are made where necessary. Their reports should include comments on the reliability of the final results.

William McDougall



Qualifications and affiliations

BSc (Hons) Civil Engineering, City University (London), 1977

Chartered Civil Engineer

Member of the Institution of Engineers Australia

Member of the Chartered Institute of Logistics and Transport

Overview

I am a freelance transport planner, engineer and economist with over 40 years' experience in the UK, Australasia, Asia and the Middle East. I cover all aspects of transport planning and I have directed studies across all transport modes with an emphasis on technical complexity and strategic importance. I have extensive experience in strategy and policy development/analysis, multi-modal studies, economics and financial analysis, multi-criteria appraisal, stakeholder and community consultation, traffic and pedestrian simulation, survey design and transport demand modelling.

Fields of Special Competence

Public Transport and Highway Strategy; Sustainability in Transport; Planning and Feasibility Studies; Management Consulting and Facilitation; Traffic, Economic and Environmental Evaluation; Financial Modelling; Market Research and Surveys; Transport Modelling and Economic Appraisal; Report and Article Writing; Community Consultation; Presentations, Media Articles and Interviews.

Selected Recent Activities

South Yarra Station (2016) – as an expert witness at the EES hearings I presented a case for including platforms at South Yarra on the Melbourne Metro project.

Grattan Institute (2016) – I temporarily joined the Grattan Institute as a Transport Fellow, working on research reports into transport policy and helping to shape the research agenda.

Appraisal Reviews (2015/16) – Advisor to the Victorian Department of Economic Development, Jobs, Transport and Resources on transport modelling and economic appraisal of major projects.

Transport in Cities (2011-2014) – In 2011, my then-employer SKM acquired Colin Buchanan and Partners, which Sir Colin Buchanan founded after writing a seminal White Paper for the UK Government called *Traffic in Towns* in 1963, addressing the dramatic rise in car ownership and use after WW2. To commemorate *Traffic in Towns*' fiftieth anniversary, with Sir Colin's grandson Paul Buchanan, I wrote a series of articles exploring future drivers of change in urban transport. We covered social and demographic trends, technological developments and governance issues.

Melbourne Metro Tram Plan (2013-14) – I managed a study to prepare operating plans for the tram system during and after construction of the Melbourne Metro Rail Tunnel. Construction required temporary closure of Swanston Street, so we developed plans to divert the trams to Elizabeth Street. We also developed a post-Metro tram network which formed the basis for longer-term planning.

Melbourne Airport Land Access Strategy (2012-13) – I directed a landside access strategy for Melbourne Airport. We explored different future growth trajectories and landside transport task requirements, and developed a strategy to provide a context for decision-making on the Airport Rail Link.

Northern Rowville and Doncaster Rail Studies (2011-13) – I led the Victorian Government’s Rowville Rail Study and peer-reviewed the concurrent Doncaster Rail Study. Alongside technical and planning work, I did regular ministerial briefings and public presentations to explain the study findings and recommendations.

Vauxhall Nine Elms Battersea Transport Study (2008-9) – I directed a study into transport needs for a major redevelopment of a large inner London area, including the iconic Battersea Power Station, to accommodate an extra 40,000 people and 20,000 jobs. We demonstrated that the best solution would centre on extending the Underground from Kennington to Battersea Power Station to serve the development area.

Oman Surface Transport Strategy Study (2008-9) – I provided specialist input to a review of the transport sector in Oman, including development of a travel demand model and reporting on future strategic transport needs and policies. My focus was on ways to develop public transport in Muscat, the capital.

Melbourne Metro Rail Tunnel early studies (2006) – I led the development of early concepts for the alignment and design of a new rail tunnel to relieve Melbourne’s inner city loop, and an operating strategy for the rail system to reorganise the services into grouped lines. This work shaped the Rail Network Development Plan released by PTV in 2013.

Melbourne Metropolitan Tram Plan (2003) – I prepared a comprehensive forward plan for the tram network, including route extensions, accessibility measures (platform stops and low-floor trams), tram fleet renewal, depot and power supply upgrades.

North Central City Corridor Study, Melbourne (2001-2) – I managed this study which involved extensive community consultation, frequent ministerial briefings and comprehensive technical studies. We explored a range of scenarios and initiatives and proposed a strategy to develop public transport in Melbourne’s inner north, promote walking and cycling and encourage alternatives to car use.

Summary career history

2014 - present	Sole practitioner exploring new opportunities to contribute to better planning for transport
2016	Transport Fellow, The Grattan Institute (temporary placement)
2010 - 2014	Principal, Sinclair Knight Merz (now Jacobs Engineering), Australia
2008 - 2010	Principal and Project Director, Sinclair Knight Merz UK, London
1997 - 2008	Associate and Team Leader, Sinclair Knight Merz, Australia (Sydney and Melbourne)
1994 - 1997	Director, ODB Consulting, Sydney
1985 - 1994	Director and Project Leader, Travers Morgan Australia (Perth, Melbourne and Sydney)
1977 - 1985	Project Manager and Transport Planner, Travers Morgan and Partners UK (London-based)
1972 - 1977	Bachelors degree student sponsored by Travers Morgan and Partners

Recent Papers and Presentations

- *Politics, funding and transport – the need for systematic reform.* Australian Institute of Traffic Planning and Management National Conference, Adelaide, 2014.
- *Plan Melbourne: will it deliver integrated transport and land use?* Institute of Transportation Engineers (Australia & New Zealand Section) Seminar, Melbourne, 2014.
- *Societal shifts – cities on the move.* SKM Transport in Cities program article, 2013.
- *Autonomous vehicles – the next revolution.* SKM Transport in Cities program article, 2013.
- *2013 in Review.* Engineers Australia Victorian Transport Branch Seminar, Melbourne, 2013.
- *Guiding Melbourne’s Urban Growth: Transport Futures.* UrbanMelbourne Seminar, Melbourne 2013.
- *Rowville Rail Study.* Australian Institute of Traffic Planning and Management, Melbourne, 2012.
- *Vauxhall Nine Elms Battersea Transport Study – Demand Forecasting Methodology.* Transport for London Railplan Forum, London, 2009.
- *Integrated transport planning – what is it and why do we need it?* Victorian Planning and Environmental Law Association Conference, Melbourne, 2007.