Zenith Model of Victoria

Technical Note 10
Backcasting and Sensitivity Testing

Zenith Version: 2.0.0

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Contents

1 Introduction

The Zenith travel model of Victoria is one of a family of models developed by Veitch Lister Consulting (VLC) for transport planning in Australian cities and regions.

This document is one in a series of technical notes that collectively describe the Zenith Model of Victoria.

1.1 Related Documents

This technical note is the tenth of eleven. The other technical notes are:

- Working Paper 1: Model Validation Framework and Data Sources
- Working Paper 2: Review of VISTA07
- Working Paper 3: Home Based Trip Production Model
- Working Paper 4: Non-Home Based Trip Production Model
- Working Paper 5: Household Segmentation & Travel Market Segmentation Models
- Working Paper 6: Period Allocation and Vehicle Occupancy Models
- Working Paper 7: Mode Choice Model
- Working Paper 8: Destination Choice and Trip Attraction Model
- Working Paper 9: Overall Model Validation
- Working Paper 10: Backcasting and Sensitivity Testing
- Working Paper 11: Reference Case Model Assumptions

1.2 Scope of This Document

This document discusses the backcasting approach and sensitivity tests used to validate the Zenith model. A 'backcast' was undertaken, based upon 2004 conditions (four years before the recalibrated model base year), and the elasticity's for the Zenith model were reviewed through a series of sensitivity tests. The results from these model runs were presented to the Zenith Model Recalibration Technical Reference Group on 8 September 2011.

2 Backcasting Approach

2.1 Introduction

The Zenith model has been recalibrated and validated under the Zenith Model Licensing Agreement with the State of Victoria, and provides a robust basis from which to forecast future travel demands.

In order to add significant confidence in the traffic and patronage forecasts from the Zenith model, a backcasting approach was undertaken, in which the base year (2008) model was modified to represent 2004 conditions, and then compared against the known historic data for 2004.

2.2 Backcasting Assumptions

Following the validation of the base year (2008), the Zenith model was modified, where possible, to represent 2004 conditions. This was achieved via a desktop study which included a review of the following:

- network assumptions in old Zenith models
- city parking prices collected by the Victorian Department for Finance, dating back to 2005
- petrol prices from the Australian Automobile Association for Melbourne
- major road and public transport network upgrades
- fare prices and ticket types from Public Transport Division
- city centre land use information from the Census of Land Use and Employment (CLUE) conducted by the City of Melbourne
- population (estimated resident population) information (2004) and census land use and enrolments (2006) for all of Melbourne
- airport passengers from the Bureau of Infrastructure, Transport and Regional Economics (BITRE)

Following this review, the resultant backcasting assumptions can be seen in Table 1.

Variable	Change (for 2004)
Fuel Price	Reduced from 140 cents to 110 cents
Parking costs	-12%
Road Network	Removal of:
	• EastLink
	• Deer Park Bypass
	• Pakenham Bypass
	• Craigieburn Bypass
	• Calder-Tullamarine Interchange works
PT Network	• Rail Frequencies @ 2004 levels
	• Tram Extension from Blackburn Road to Wantirna South.
	• Extension from Broadmeadows Railway Station to Craigieburn Railway Station
	• All Smart Buses were converted back to Normal Metropolitan Bus.
Fares	Zone 3 re-instated
Population	2004 ERP
Employment	2006 JTW, scaled back based on Clue, and change in population (workers)
Special generators	Airports - based on BITRE passengers 2004
	Externals - 2006 levels

Table 1 – List of Backcasting Assumptions (2004)

2.3 Backcasting Validation

2.3.1 CBD Rail Cordon (AM Peak)

Modelled AM Peak, inbound rail cordon line loads have been compared with DOT (observed) estimates at a cordon surrounding the CBD. This includes the passenger loads approaching Richmond, Jolimont and North Melbourne stations. The various lines have been grouped according to the four major suburban line groups.

Figure 1 compares the total observed and modelled total rail passenger load passing the CBD rail cordon in the AM peak for the base year model (2008) and 2004 back-year.

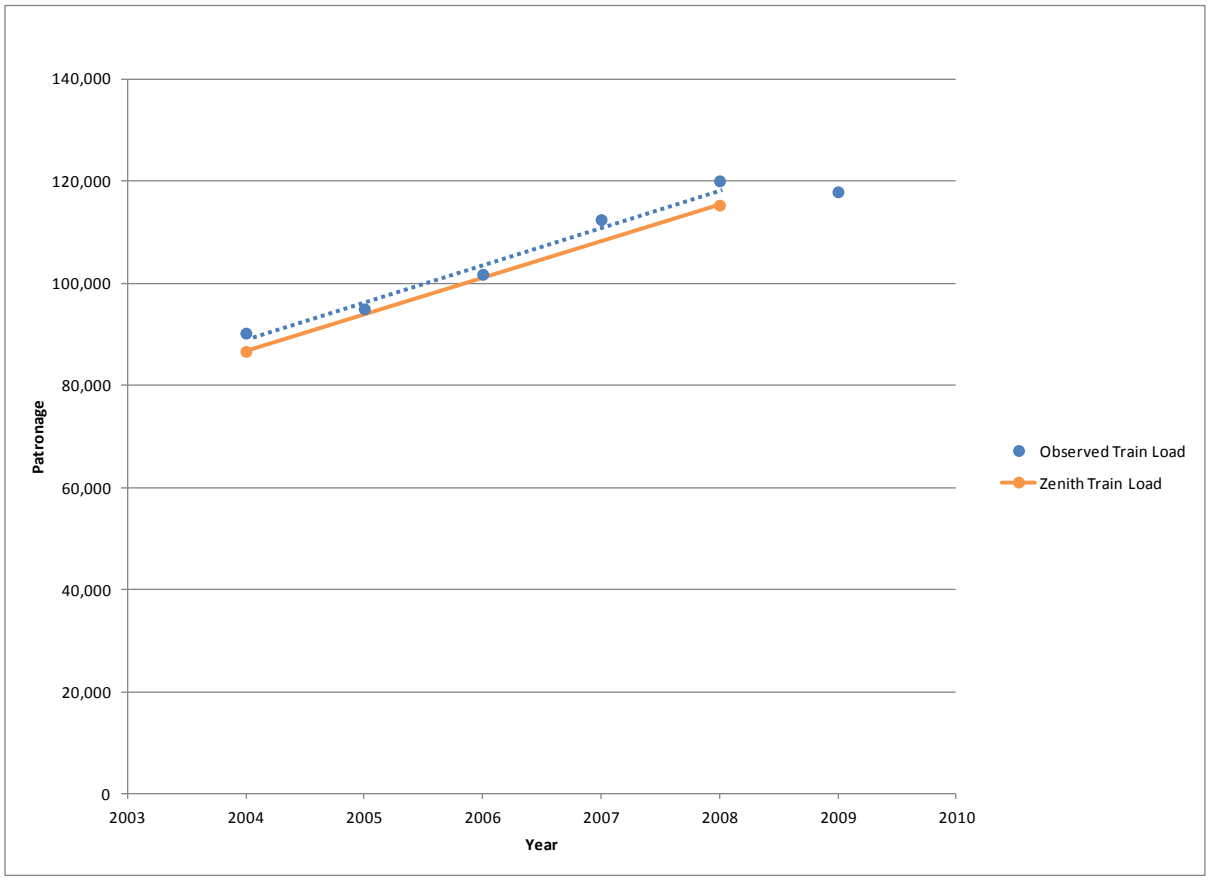

Figure 1 – Total Rail Passengers passing the CBD Rail Cordon (inbound) in the AM Peak

The results shown in Figure 1 indicate a very good relationship between the modelled and observed number of passengers crossing the CBD rail cordon in the morning peak. In back-year (2004) and base year (2008), the model is less than 5% less than the observed values.

Table 2 compares growth in rail passenger load passing the CBD rail cordon by rail group, for the same years.

Line Group	Observed		Modelled	
	Growth 2004 to 2008	CAGR 2004 to 2008	Growth 2004 to 2008	CAGR 2004 to 2008
Northern	12,622	11.8%	10,257	8.9%
Clifton Hill	3,634	6.2%	3,228	6.0%
Burnley	5,056	4.5%	6,214	6.8%
Caulfield	8,509	6.8%	8,937	7.1%
TOTAL	**29,821**	**7.4%**	**28,525**	**7.4%**

Table 2 –Growth in Rail Passengers passing the CBD Rail Cordon (inbound) in the AM Peak, by Rail Group

The growth rates between the back-year (2004) and base year (2008) for each rail line group shown in Table 2 also indicate a very good relationship between the modelled and observed number of passengers crossing the CBD rail cordon in the morning peak. Overall, the model matches the

percentage growth rate (both CAGR 7.4%), but it slightly under-forecasts the scale of absolute growth (-1,300, but only 5% less).

2.3.2 Total Patronage (Daily)

Modelled average daily public transport patronage has been compared to DOT (observed) system wide estimates (including rail, tram and bus), as summarised in Figure 2.

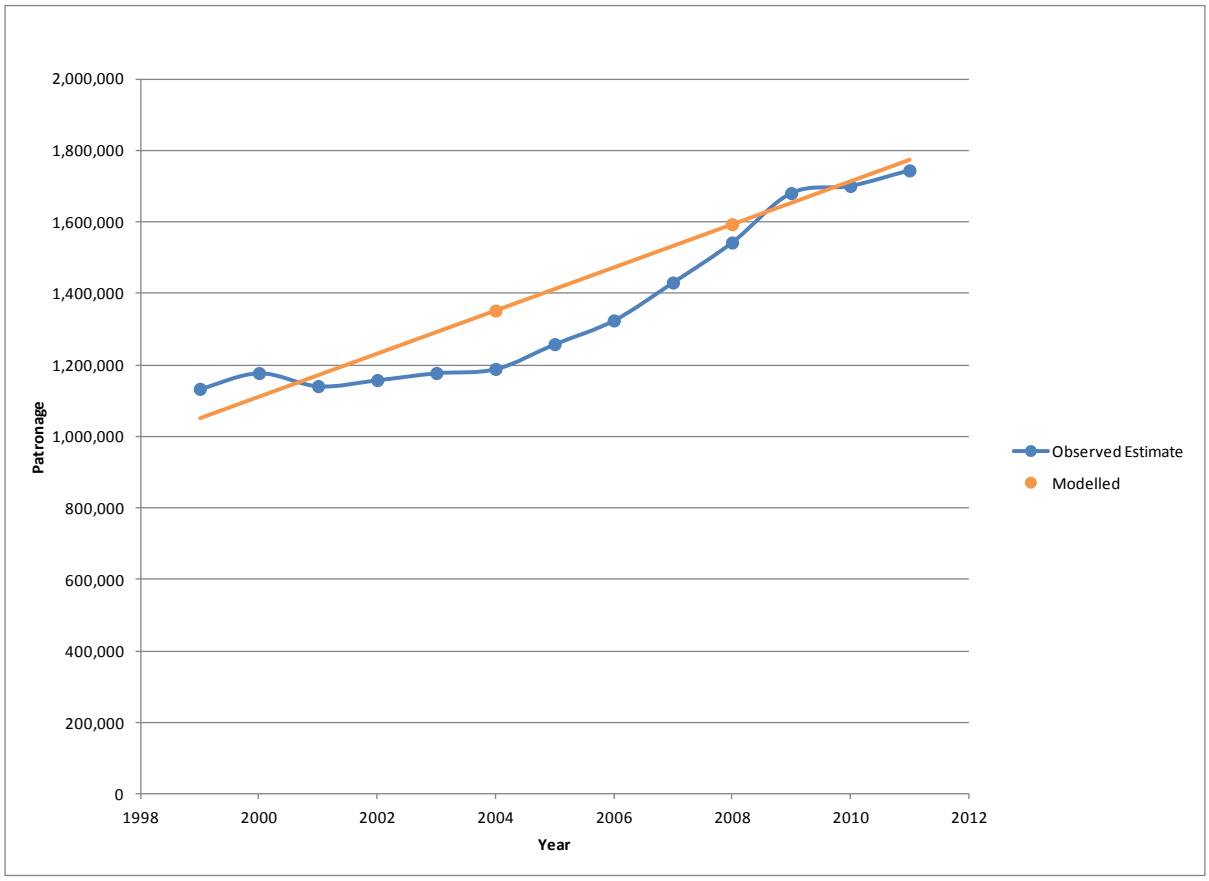

Figure 2 – Total Average Daily Public Transport Patronage

The modelled total average daily patronage across the entire public transport system validates well in the base year (2008), however the back-year (2004) is 13% higher than the observed patronage. When looking at the observed estimates, there is quite a large yearly variation in total average daily patronage. Across the period shown in Figure 2 the growth rate is just under 4%. A breakdown of this data shows that from 1999 to 2004 the growth rate is less than 1% p.a., from 2004 to 2009 it is around 7% p.a, and from 2009 to 2011 it is just over 1% p.a. In comparison, the model has a growth rate just over 4%.

3 Sensitivity Testing

3.1 Introduction

In order to measure the sensitivity of a model to changes in key variables, such as pricing and policy inputs, we use "Elasticities". For example, if fuel prices increase, the number of car trips is expected to reduce. Elasticities relate to the percentage change in travel behaviour as a result of a change in pricing and policy inputs. A higher elasticity indicates the model is more sensitive to small changes in pricing and policy inputs, while a lower elasticity indicates the model is less sensitive.

3.2 Sensitivity Tests

A series of sensitivity tests, involving changes to the pricing and policy inputs, were conducted on the current 2021 reference case, including:

- Service Frequencies
- Fuel price
- City Parking Costs
- Fares
- Public Transport In-Vehicle Time
- Public Transport Transfer Penalties

3.2.1 Sensitivity Testing Results

Figure 3 shows the elasticities of public transport modal and global key statistics, along with global private vehicle key statistics.

Run #	Sensitivity A	Sensitivity B	Sensitivity C	Sensitivity F	Sensitivity D	Sensitivity E	Sensitivity H	Sensitivity J
Year	2021	2021	2021	2021	2021	2021	2021	2021
VLC Option #	Frequency Increase 10%	PT IVT - Improve by 10%	Fares - Decrease 10%	Fuel Price - Increase 1.5% p.a.	Transfer Penalties - Improve 10%	Parking Costs - Increase 3% p.a.	Fuel Price - Decrease by 10%	Parking Charges - Decrease by 10%
	10.0%	10.0%	10.0%	21.4%	10.0%	46.9%	10.0%	10.0%
TOTAL BOARDINGS BY MODE								
Suburban Rail	0.15	0.46	0.20	0.19	0.31	0.17	-0.16	-0.34
Regional Rail	0.38	0.87	0.28	0.30	0.23	0.09	-0.26	-0.28
Total Rail	0.17	0.50	0.21	0.20	0.30	0.16	-0.17	-0.33
Bus	0.41	0.74	0.15	0.22	0.44	0.09	-0.20	-0.16
Tram	0.11	0.68	0.20	0.11	0.45	0.23	-0.09	-0.54
GLOBAL PT STATISTICS								
Total PT Trips	0.13	0.48	0.19	0.16	0.12	0.16	-0.14	-0.33
In Vehicle Passenger Kms	0.20	1.00	0.26	0.26	0.21	0.15	-0.23	-0.33
In Vehicle Passenger Hours	0.18	1.00	0.22	0.23	0.20	0.17	-0.20	-0.35
GLOBAL PRIVATE VEHICLE STATISTICS								
Total Person Car Trips	-0.02	-0.08	-0.03	-0.10	-0.02	-0.05	0.06	0.14
Car KMs	-0.01	-0.05	-0.02	-0.04	-0.01	-0.03	0.03	0.07
Car Hours	-0.02	-0.09	-0.03	-0.07	-0.02	-0.05	0.05	0.16

Figure 3 – Summary of Elasticities of Key Variables (Daily)

In summary the model is most sensitive to changes in-vehicle time (possibly generated through higher speeds and intersection priory) and city parking charges.

The elasticities of key variables, for each of the sensitivity tests, was presented to the Zenith Model Recalibration Technical Reference Group on 23 June 2011, with the detailed model run results provided after the meeting. The Technical Reference Group agreed that the results (including elasticities) all seemed sensible.