Department of Infrastructure

Northern Central City Corridor Study

Transport Specialist Study

Initial Appraisal of Strategy Scenarios

March 2003

SINCLAIR KNIGHT MERZ

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Contents

1. Introduction

1.1 The Strategies

This paper discusses the derivation of the NCCC strategies A to G (except E – the Land Use strategy), and reports on and discusses their consequences in relation to the goals and objectives for the study area. Some consequences are determined from forecasts of the Zenith transport model while others are based on our professional judgement informed by studies and experiences elsewhere.

The strategies are to varying degrees hypothetical 'what if' strategies. We have concentrated on the effects of these projects if they were to be achieved and have not generally discussed the practical realities of the processes by which the projects would be achieved. Some elements of the strategies represent a continuation of existing practices while others represent a radical departure from tradition. The detailed discussion of each strategy identifies aspects where we consider that additional investigation would be needed to qualify the results of these assessments in terms of practicality.

Table 1-1 summarises the elements of the strategies. A summary description of each of the strategies is given in Appendix B. It should be noted that each strategy includes all the elements of the preceding strategies, ie they are additive.

Â **Table 1-1 Strategy Elements for Initial Appraisal**

Types of initiative	Base Case	Scenarios for testing						
		A	B	C	D	E	F	G
Significant improvements to bus, tram and rail routes/services		V	V	V	V	V	V	V
Measures to remove traffic from local streets and reduce community severance effects			V	V	V	V	V	V
Improvements to bicycle and pedestrian networks, encouragement of cycling and walking				V	V	V	V	V
Measures to reduce car use such as parking, pricing, policy and behavioural initiatives					V	V	V	V
Land use-related measures to accommodate growth and reduce or minimise the need for travel						V	V	V
Eastern Freeway corridor rapid transit system							V	V
Options within the inner north to improve the efficiency of the arterial network								V

In the case of two strategies, several versions have been investigated:

Ç Strategy F : The Eastern Freeway Corridor Rapid Transit System
- F1: light rail
- F2: heavy rail

Ç Strategy G : The Arterial Road Network
- G: Tunnel with Intermediate Ramps
- G1: Simple Tunnel
- G2: CBD Tunnel

Within each strategy these versions are *alternatives* and are not additive.

The strategies are additional to the Base Case (or Do Minimum), details of which are given in Chapter 2.

1.2 Evaluation

The basis on which we evaluated the various strategies was the 'Assessment Table' which lists the performance indicators under the general headings of 'Social', 'Environmental' and 'Economic'. These summary tables are shown at the end of each chapter. They were developed by the Department of Infrastructure Study Team in conjunction with the Community Reference Group which was formed in the course of this Study. The location-specific goals pertain to the Study Area and the anticipated effects of the various strategies have been evaluated in this context.

However many of the projects will effect areas outside the Study Area such as the eastern suburbs and the metropolitan area in general. We have not attempted to make assessments of the local effects of the strategies *outside* the Study Area. Nor have we compared the performance of the strategies and projects with other metropolitan wide strategies and projects in meeting wider goals.

1.3 Related Reports

The following reports are closely related to this initial appraisal report and referred to within the test.

Booz Allen Hamilton (2002): Appraisal of Transit Strategy Results, August 2002

This report makes an initial appraisal of the two 'public transport' strategies – Strategy A "Significant Improvements to bus, rail routes/services" and Strategy F "Eastern Freeway Corridor Rapid Transit System". The results of that report are summarised in the appropriate chapters of this report.

Sinclair Knight Merz (2002a): Transport Economic Impacts of the Initial Strategies, August 2002

This report describes the transport economic impacts of the various alternatives based on factors such as construction costs, operating costs and travel times.

Sinclair Knight Merz (2002b): Car and Truck Origin and Destination Survey; Alexandra Parade and Hoddle Street, June 2002.

This survey undertaken on Thursday 6th September 2001 involved the manning of about 60 survey stations and recording the details of 70,000 sightings of number plates to determine traffic patterns including the amount of through traffic.

Maunsell (2002): Land Use and Demographic Change – Implications for Transport Planning.

This report describes Strategy E "Land Use – Related Measures to accommodate growth and reduce or minimise the need for travel".

Sinclair Knight Merz (2002c): Draft – Major Road Strategies Specification Paper 07.doc, January 2002.

This report describes the range of major road projects considered and outlines the process of short listing these projects for testing.

2. The 2021 Base (or Do Minimum) Case

2.1 Introduction

The 2021 base case is the scenario assumed to apply without any specific improvements to the NCCC study area. It is based on DoI population and employment forecasts revised and reissued in February 2002 and a range of committed transport initiatives specified by DOI.

2.2 Planning Assumptions

Population and employment projections have been adopted for the NCCC study from preliminary work by DOI on the demographic implications/outcomes of the Metropolitan Strategy. These projections predict somewhat greater growth in the study area (and adjacent areas as well, especially the CBD and surrounds) than the previous ('Victoria in Future' 1999) forecasts.

Â **Table 2.1 Population and Employment Projections**

David For some reason this table seems to be truncated on the bottom.

	Dwellings			Population			Employment		
	1996	2021	% growth	1996	2021	% growth	1996	2021	% growth
Abbotsford	1,700	2,900	71%	3,800	5,800	53%	8,500	9,800	15%
Carlton	3,700	6,200	68%	8,400	12,400	48%	14,400	17,900	24%
Carlton North/Princes Hill	4,100	4,900	20%	8,800	9,600	9%	2,100	2,500	19%
Clifton Hill/Fitzroy North	5,800	7,300	26%	13,100	14,500	11%	4,500	4,400	-2%
Collingwood	2,300	3,600	57%	5,300	7,300	38%	8,000	8,100	1%
Fitzroy	3,600	5,700	58%	8,700	11,800	36%	10,700	12,300	15%
North Melbourne	2,800	3,100	11%	5,900	6,100	3%	8,200	12,600	54%
Parkville*	1,400	1,600	14%	5,400	4,800	-11%	15,000	16,100	7%
Total	**25,300**	**35,300**	**40%**	**59,300**	**72,400**	**22%**	**71400**	**83900**	**18%**
CBD	1,200	8,200	583%	2,600	15,200	485%	150,100	192,000	28%
CBD and surrounds	5,700	15,900	179%	12,100	30,200	150%	210,400	273,200	30%
Metro Melbourne	1,199,300	1,723,500	44%	3,283,300	4,153,100	26%	1,401,500	1,967,300	40%

2.3 Road Projects

Most road projects in the base case are located in the middle and outer suburbs and will not have a significant bearing on traffic demands and patterns in the NCCCS Study Area. Exceptions include the extension of the Eastern Freeway to Ringwood and construction of the Scoresby Freeway. The projects included are:

- upgrade of the Western Ring Road including 6 laning of the following sections:
  - Western Highway to Sunshine Avenue
  - Keilor Park Drive to Calder Freeway
  - Tullamarine Freeway to Hume Highway
- 6 laning of the Metropolitan Ring Road (Hume Highway to Greensborough)

- extension of Monash Freeway to Narre Warren (Hallam Bypass)
- Eastern Freeway Extension to Ringwood
- Western Freeway (Deer Park Bypass)
- Hume Freeway (Craigieburn Bypass)
- Scoresby Freeway (6 lanes Ringwood to Princes Highway, 4 lanes Princes Highway to Mornington Peninsula Freeway)
- Dingley Arterial (Warrigal Road to Boundary Road)
- upgrade of the Calder Freeway/Tullamarine Freeway interchange
- Pakenham Bypass
- Cooper Street duplication
- Pascoe Vale Road duplication
- Calder Freeway (upgrade from 4 to 6 lanes between Keilor Park Drive and Melton Highway)
- duplication of Mickleham Road between Alanbrae Terrace and Barrymore Road
- duplication of Somerton Road (Hume Highway to railway level crossing)
- Greensborough Bypass (6 lanes)
- Western Freeway at Leakes Road (all movements interchange)
- Princes Freeway - Westgate Freeway to Maltby Bypass - 8 lanes
- Princes Freeway - Maltby Bypass to Geelong - 6 lanes
- Upgrade Point Cook Road from 2 to 4 lanes
- duplication of Plenty Road from Centenary Drive to McDonalds Road
- Macedon Street (Sunbury) - duplicate between Evans Street and Horne Street
- duplicate Kingsbury Drive between Plenty Road and Waiora Road
- Edgars Road - extend and duplicate between Kingsway Drive and Cooper Street
- Melton Highway - duplication from Sydenham Rail Line to The Regency
- Berwick Cranbourne Road - duplication between the Princes Freeway and South Gippsland Highway
- Cranbourne Frankston Road - duplication between McClelland Drive and Warrandyte Road
- Fitzgerald Road - duplication between Leakes Road and Dohertys Road
- Taylors Road underpass of Sydenham Rail Line
- Buckley Street upgrade (Footscray)
- upgrade of Plummer Street (Port Melbourne)

2.4 Public Transport Projects

The following public transport initiatives have been included in the 2021 base case:

- all tram and train services have a 20% higher frequency
- Box Hill tram extension
- Knox Tram extension
- Sydenham Rail Extension
- Bus priority lanes would be provided in an outbound direction (to supplement existing inbound lanes) on Victoria Street.
- A park and ride facility would be operating at the Doncaster Road/ Eastern Freeway intersection.
- Smartbus Route 1 – Springvale Road (existing routes 888 & 889): 15% improvement in existing travel times as a result of bus priority initiatives; reduced interchange penalties at Burwood Highway Light Rail, Nunawading Station, Glen Waverley Station, Springvale Station and Chelsea Station
- Smartbus Route 2 – Blackburn Road (existing routes 703): 15% improvement in existing travel times as a result of bus priority initiatives; reduced interchange penalties at Burwood Highway Light Rail, Blackburn Station, Syndal Station and Clayton Station
  - express rail services on Ringwood, Frankston and Dandenong Lines
  - Cranbourne East Rail Extension
  - Busway on Springvale Rd between Nunawading and Springvale rail stations new Light Rail on North Road between Huntingdale Station and Monash University.

Except for the general frequency improvements, the initiatives do not affect the study area. The Base Case did not include the Victoria Street bus priority lanes nor the Doncaster park and ride proposal. These are implicitly taken into account in Strategy A by the specification of a 15% reduction in bus route times from increased road priority and the specification of easier interchanges between public transport vehicles.

3. Strategy A: Significant Public Transport Improvement

3.1 Introduction

The aim of this strategy is to significantly improve public transport services in order to increase public transport usage and to reduce road congestion levels. A detailed analysis of its impacts is reported in the Booz Allen Hamilton report 'Appraisal of Transit Strategy Results, which we summarise below.

3.2 The Model Test

In this strategy, all public transport services running through or affecting the study area were assumed in the modelling to be substantially improved through a combination of greatly increased service frequencies, faster on-street running times, easier interchange and access, and greater reliability. The objective of increasing the proportion of trips made on public transport is compatible with the metropolitan strategy which aspires to 20% of trips being made on public transport by the year 2020.

The detail of the extensive changes is to be found in the accompanying BAH report, but in broad terms they encompass:

- for rail:
  - 50-100% increase in service frequencies,
  - an improved rail/tram/bus interchange at Flinders Street station;
  - much easier interchange with tram and bus at all other stations;
  - more convenient park-&-ride and kiss-&-ride arrangements;
- for tram, reflecting the concepts of Tram 109:
  - service frequencies increased by 50%;
  - 25% reductions in route times;
  - improved reliability;
  - new, improved rolling stock;
  - upgrades to major tram stops (Super Stops)
  - re-routeing to extend the coverage of some tram services (routes 59, 57, 19);
- for bus, reflecting Smartbus concepts:
  - 10 minute peak service frequencies and 100% increase in off peak services;
  - redesign of existing routes and provision of new routes to give greater coverage outside and inside and outside the study area
  - 15% reduction in route times from increased road priority;
  - quality and reliability improvements, including new vehicles;
  - easier interchange with tram and other bus services.

The physical changes needed to achieve these very wide ranging improvements have not been the subject of a design exercise and, as such, their feasibility has been assumed and the consequent passenger benefits are to a degree hypothetical.

Road priorities would be needed to achieve these improvements, the traffic impacts of which are not generally reflected in the forecasts. The exceptions to this are Johnston, Elgin and Hoddle Streets, whose traffic capacities have been reduced.

3.3 The Impacts

The public transport improvements are to services which route through the study area or are considered to affect the study area. As such we focus our analysis on the study area 'corridor', which includes all travel within, to and through the area, but it should be borne in mind that the schemes also have substantially wider impacts.

Overall, the public transport share of corridor travel increases substantially from 23% to 31% of all journeys, a 37% increase in public transport patronage affecting both peak and offpeak. Much of this is attracted from car, and car use drops by 10%. These effects are greatest for the longer journeys to and through the study area and least for travel within the study area.

Public transport journeys may involve more than one public transport mode (eg tram and train) and there are therefore more public transport boardings than journeys. This difference between boardings and journeys increases in Strategy A, with more journeys involving an interchange, presumably reflecting the assumed greater ease of interchange for all services.

Rail passengers (boardings) in the corridor (Bayside and Hillside services) increase by 21%, very much less than the 50-100% increase in capacity assumed in the strategy. On the other hand, as the base case rail services were overcrowded, much of this additional capacity would in fact be utilised. The increases vary by line, with some showing more than 50% increases in patronage (St Albans, Upfield and Werribee).

Yarra and Swanston tram patronage in the corridor more than doubles and the number of bus passengers is forecast to increase by 80%. As for rail, the change varies by route. For example tram routes 11, 19, 24, 42, 109 & 58 more than triple their patronage.

In any refinement of this strategy, attention will need to be given to a number of practical consequences of its impacts:

- the implied peak tram frequencies along Swanston Street would require some services to be diverted to parallel routes such as Elizabeth Street and William Street;
- peak tram passenger loads on some routes (eg 19, 55, 11, 109 and 86) may not be achievable and imply high levels of overcrowding; crowding would be high on other routes too; overcrowding is known to deter passengers, a matter which we have not allowed for in the forecasts, and would have safety implications;
- the increase in peak direction trains is thought to be excess of tolerances for existing operations/infrastructure, which are designed to provide a reliable rail service. This would require improved infrastructure (signalling and train control) to meet the 20% by public transport by 2020 expectations.

3.4 The Assessment Table

Â Table 3-1 Scenario A = Base 2021 Scenario + Public Transport Improvements

Our assessments are shown in *italics*

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Has more impact than any other single strategy in reducing private road travel and associated noise effects. This will be slightly balanced by increased tram and bus vehicles through NCCC*
	Concentration of air pollutants at relevant sites according to adopted standards	*Due to the considerable impact in reducing private vehicle movements this has a strong positive impact on pollutants*
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*Should have a positive impact due to reduction in more accident generating travel modes*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	*Increased patronage and service levels in evening/weekends should have a strong positive impact*
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	
	Effect on other public areas, streetscapes	
	Effect on heritage protection/interpretation	
	Effect on urban settings	
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*Almost half increased transit use is from reduced NCCC through traffic*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Substantially increases the number of travel options available to all members of the community but particularly assists disadvantaged groups*
	Sense of place/neighbourhood	
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Strong positive impacts*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Strong positive impacts*
	Car driver/passenger mode share by time period	*Strong positive impacts*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Strong positive impacts*
	Public transport mode share by time period and mode (rail, tram, bus)	*Strong positive impacts*
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Walk/cycle trips decline and are encouraged onto transit*
	Cycling/walking mode share by time period	*Walk/cycle trips decline and are encouraged onto transit*
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	*Neutral*
Protecting and enhancing biodiversity	Effect on natural habitats	
	Effect on exotic habitats	
	Effect on water quality	
	Effect on ground contamination	

Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Strong positive impacts*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Reduced private road travel should reduce traffic congestion making commercial vehicle movements marginally easier*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*Reduced private road travel should reduce traffic congestion making vehicle movements marginally easier*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

4. Strategy B: Traffic on Local Streets

4.1 Introduction

The primary aim of this strategy is to divert through traffic from local residential streets to the arterial road network.

4.2 The Model Test

In order to appreciate the impacts of achieving the maximum diversion of traffic away from local streets, the Zenith model was run with a very low free flow speed of 10 km/h for the nominated local streets in the study area. The test did not attempt to represent the real measures that might be taken to achieve this objective, being more concerned with establishing the potential consequences. This test was indicative only. It did not assume a corresponding increase in traffic capacity of the arterial roads which would not be 'calmed'. The affected links are:

- Abbotsford Street
- Arden Street/ Wreckyn Street/ Grattan Street
- Bouverie Street
- Bowen Crescent/ Holtom St West/ Park Street
- Canning Street (North Melbourne)/ Shell Street/ Haines Street/ Errol Street
- Carlton Street
- Chetwynd Street
- Dryburgh Street
- Faraday Street
- Gatehouse Street
- Gipps Street/ Victoria Crescent/ Murray St/ Church Street (north of Victoria Street)
- Langridge Street/ Gertrude Street
- Melrose Street
- Mollison Street
- Nelson Street/ South Audley Street
- Nicholson Street (Abbotsford)
- Oak Street and Park Street (Royal Park)
- Pigdon Street/ Scotchmer Street/ Michael Street/ North Tce (the ability to cross Lygon Street on Pigdon Street and cross St Georges Road on Scotchmer Street have also be removed – median closure)
- Queensberry Street
- Richardson Street/ Reid Street
- Roseneath Street/ Trenerry Crescent
- Rushall Crescent
- Smith Street
- The Avenue/ Walker St
- Wellington Street

Perhaps unrealistically, it is assumed in the model that these speed changes will not affect tram or bus running times. Some of these routes carry trams and buses. Other parallel routes also carrying buses and trams would also experience more congestion.

4.3 The Impacts

As would be expected for such local road network adjustments, the model forecasts no overall strategic effects on car travel demands in and around the study area. There are however significant changes in traffic levels on some individual routes – generally about 10% higher than Strategy A.

Â **Table 4-1 Traffic Speed Estimates**[1]

Code	Location	Base 2021	AM Avg. Speed (km/h)		Strategy A	AM Avg. Speed (km/h)		Strategy B	AM Avg. Speed (km/h)	
			AB	BA		AB	BA		AB	BA
	Alexandra Parade									
2a	- East of Nicholson St	101,200	34	20	98,600	35	23	111,400	29	15
2b	- West of Nicholson St	63,700	41	23	63,000	40	27	66,400	40	22
	Nicholson Street									
2c	- North of Alexandra Pde	36,000	39	21	34,400	40	29	37,200	37	28
2d	- South of Alexandra Pde	38,600	19	39	34,800	28	42	39,600	23	39
3	Royal Parade	41,400	43	24	36,200	44	33	45,500	42	26
5	Hoddle Street	101,700	49	21	91,900	41	26	100,800	33	23
9d	Johnston Street	27,400	30	18	18,300	37	20	20,200	32	15
10	Brunswick Street	20,100	21	35	17,000	30	36	21,400	24	34

The implementation of the test in the model all but eliminates traffic flows from the local streets in the study area. Daily traffic increases on the remaining roads in the study area by 5% overall; for one in ten of the road links in the study area the traffic increase exceeds 25%. This has the effect of an overall slowing down of the study area network of almost 2km/h throughout the day (the average speed on the network is 35-38km/h). One in seven links in the study area recorded a speed reduction in excess of 5km/h.

Reductions in speeds of this magnitude would be noticeable by regular drivers. In practice, the peaks would extend.

[1] Figures are rounded.

Specifically, higher traffic flows and greater congestion are experienced on most of the non-local streets in the study area network, as traffic is concentrated on these main routes. Traffic speeds are lower throughout the day. Examples of affected routes are:

- Brunswick Road
- College Crescent/Cemetery Rd/Princes Street/Alexander Parade route
- Johnston Street
- sections of Victoria Parade/Street
- Dryburgh Street
- Curzon Street/Harker Street
- Royal Parade
- Flemington Road
- Nicholson Street
- Elizabeth Street
- sections of Queens Parade
- Hoddle Street
- Swanston Street (north of Victoria Street)
- Lygon Street
- Brunswick Street
- Elgin Street/ Johnston Street (Collingwood and Fitzroy)

Higher traffic flows and greater congestion are experienced on all routes carrying tram lines and bus services[2]. There is thus a potential conflict between the strategies for diverting traffic onto main arterials and those concerned with improving public transport services using these same arterials. Examples of these roads are:

- the Elliott Avenue/ Princes Street/ Alexander Parade route
- Johnston Street
- Royal Parade
- Flemington Road
- Nicholson Street
- Elizabeth Street
- Hoddle Street
- Swanston Street
- Lygon Street
- Brunswick Street
- Elgin Street/Johnston Street (Collingwood and Fitzroy)

[2] The impacts of the slower bus and tram service times on public transport patronage have not been allowed for in the forecasts for this strategy or succeeding strategies C, D, E, F or G.

Many of the affected routes have sections whose adjacent land uses are retail, residential or schools and thus to some degree in conflict with the increased traffic flow. The increase of traffic on the streets which would remain available for through traffic would be sufficient to be noticed by residents and traders. Unlike many of the traffic management schemes that have been implemented in the past, Strategy B would deflect high traffic volumes onto these arterial roads.

Finally, in a few circumstances, traffic appears to divert to local roads outside the immediate NCCC study area, which are not subject to traffic calming measures. For example the amount of traffic in Union Street, Brunswick is forecast to increase quite significantly even though it is located well north of Park Street, which was one of the roads to be downgraded.

An extract of a previous discussion paper describing the formulation of the local street strategy to be tested appears as Appendix C of this report. It highlights some of the issues which would need to be addressed if this radical Strategy B were to be achieved.

4.4 Conclusions

Our conclusions are that traffic calming measures will reduce traffic on local streets and the consequence will be an increase in traffic and congestion on the remaining network. If the comprehensive changes used in this strategy were to be implemented the consequences would be very significant for existing road and public transport users and, as such, the local streets strategy would need to be carefully designed to minimise the deleterious impacts on public transport services.

Treatments to protect local areas are funded by local councils. In practice many local communities find the reduction in access which is entailed in excluding through traffic outweighs the amenity and safety benefits of the schemes. Many local communities have chosen to slow all traffic including through traffic and hence reap amenity gains rather than prohibit traffic movements explicitly. It is the role of consultation practices to identify the optimum residential amenity versus accessibility balance.

An important consideration is the nomination of the route hierarchy enabling local streets to distinguished from other roads which have a larger role to play. Unfortunately they are a large number of streets in the Study Area which fall between these two categories. In practice this means there is a significant degree of tension implicit in managing streets such as Wellington Street, Smith Street, Arden Street and Scotchmer Street.

Finally, the adverse impacts on public transport services and adjacent land uses of increased arterial road congestion resulting from widespread street closures would appear to be incompatible with the wider objectives for the study and metropolitan areas.

An appropriate approach to finding the best-judged solution would therefore be to use more detailed studies and consultation to identify truly local streets and undertake a consultation process with the residents on appropriate means of restraining through traffic. In finalising the details of the strategy, the wider impacts (on public transport and other land uses) should also be influential.

4.5 The Assessment Table

Â **Table 4-2 Scenario B = Scenario A + local street/amenity improvements**

Our assessments are shown in *italics*

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Shift in traffic from low volume streets to high volume streets.*
	Concentration of air pollutants at relevant sites according to adopted standards	
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*While there will be risk reductions on local streets, there will be increased accident risk on other streets with conflicting land uses – the net result is likely to be a small reduction in accidents.*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	
	Effect on other public areas, streetscapes	*Improvement in selected local streets.*
	Effect on heritage protection/interpretation	
	Effect on urban settings	
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*Substantial reductions on the streets to which the improvements are applied.*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Reduced accessibility due the consequent increases in journey times on the unimproved network (on average a speed reduction of almost 2km/h; for one in ten links a reduction greater than 5km/h).*
	Sense of place/neighbourhood	*Increased for local streets – decreased for other streets.*
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Neutral-but more stop start driving*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Neutral*
	Car driver/passenger mode share by time period	*Neutral*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Increased delays to buses and trams could impact negatively on public transport patronage.*
	Public transport mode share by time period and mode (rail, tram, bus)	
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Neutral*
	Cycling/walking mode share by time period	*Neutral*
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	*Neutral – positive on streets freed of through traffic.*
Protecting and enhancing biodiversity	Effect on natural habitats	
	Effect on exotic habitats	
	Effect on water quality	
	Effect on ground contamination	

Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Reduced accessibility due the consequent increases in journey times on the unimproved network (on average a speed reduction of almost 2km/h; for one in ten links a reduction greater than 5km/h)*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Increased commercial travel costs due the consequent increases in journey times on the main road network (on average a speed reduction of almost 2km/h; for one in ten links a reduction greater than 5km/h)*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*No travel is suppressed, but there are increased costs due the consequent increases in journey times on the main road network (on average a speed reduction of almost 2km/h; for one in ten links a reduction greater than 5km/h)*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

5. Strategy C: Pedestrian and Bike Networks

5.1 Introduction

There are many hundreds of initiatives which could conceivably form part of a pedestrian and bicycle strategy for the NCCC area. Many of these are small scale in nature and relate to particular geographic locations. Our purpose was to identify a general range of measures, which are within the bounds of reasonableness. It was not our intention to specify in *detail* what these initiatives might be.

Although there is some overlap in the programs and facilities which cater for pedestrians with those which cater for cyclists, eg shared use paths, many of the measures which cater for pedestrians are quite separate from those which cater for cyclists and are therefore presented separately. The background to the specification of Strategy C is presented in Appendix D.

Figure 2 shows the network of on road and off road routes. The strategy tested was based on the submission by Bicycle Victoria to the Study. It envisages a fine grained network of marked on-road routes. Importantly these routes would be continuous and this would require a number of major projects to overcome existing 'blockages'.

5.2 Evaluation of Walking Strategy

Although we have not made estimates of the amount of walking and cycling which are likely in future, we have used existing data to illustrate the degree to which these modes could increase their modal shares.

In the "Issues and Trends Report" (August 2001) the amount of travel which was contained *completely* within the study area was estimated. This is shown in the following table.

Â **Table 5-1 Summary of Average Weekday Travel Movements**

Source: Issues and Trends Report – Figure 4-3.

	NCCC Area			
	Within	**In and Out**	**Through**	**Total**
Trips/weekday	160,000	400,000	360,000	920,000
	17%	44%	39%	100%
Transport Mode				
Private car	36%	72%	75%	67%
Public transport	2%	18%	24%	17%
Walk/bike	62%	10%	1%	16%
Total	**100%**	**100%**	**100%**	**100%**

In estimating the scope to increase the amount of walking within the study area we have taken into account the following points:

- a number of overseas studies have shown that walking can have an almost 100% mode share of trips between 0 – 1km in length;
- the mode share for walking drops steeply for trips greater than 2km;
- we can assume that the trips described as "internal" in the table above can be approximated as those which are the primary target market for conversion to walking;
- already, 62% of these trips are by walking or cycling;
- if we were to assume all of the remaining 38% of trips were to be converted to walking the amount of walking would increase by 60%;
- most of this transfer would be from trips presently made as a car driver or a car passenger because few of these trips are made by public transport;
- the infrastructure to support walking ie. footpaths, traffic signals and lighting has been developed over 100 years. Even if a major effort were to be directed towards upgrading this infrastructure over a period of 20 years to 2021 much of the existing infrastructure would remain.

These points suggest that the increase in walking even with very ambitious and successful programs is likely to be limited to less than 50% unless land use intensity increases (see comments below for the 'base case' and Strategy E). The conversion of these trips to walking will not substantially reduce car traffic because most car trips are not short. Using the figures in Table 5-1 the number of "intra area" trips represents 57,600 car trips out of a total of 615,000 car trips. ie. around 9% car trips, and a much lower proportion of vehicle kilometres.

This is not to say that promotion of walking is not a legitimate and worthwhile strategy but that its effectiveness in reducing car travel is likely to be limited. There are very persuasive equity and health arguments for improving conditions for pedestrians. The people most likely to benefit from the type of walking infrastructure projects described in this strategy are likely to be the most vulnerable ie. the young, the old, the frail, those with disabilities.

It is also the case that, in terms of air quality, the elimination of short car trips is particularly significant because they would reduce 'cold starts'. The early part of each trip by car contributes a disproportionate amount of air pollution.

It is also possible that walking could increase its modal share of trips which presently cross the boundaries of this study area ie. described as 'In and Out' in Figure 5-1. However, with the exception of the CBD itself to the south of the study area, there is a lack of destinations just outside the study area to attract walking trips. The eastern and western boundaries are formed by the Merri Creek, the Yarra River and the Tullamarine Freeway.

5.2.1 Increased Land Use Density

The amount of walking will depend very much on the number of destinations within walking distance – say less than 2km. It is therefore very sensitive to the density of

development. For example the high level of walking which takes place in the CBD can be largely attributed to the number of destinations within walking distance. Likewise a number of European studies have shown that people living in urban areas walk about twice the distance each year than those living in rural areas.

If the intensity of land uses were to increase ie. doubling the employment density and doubling the residential density then we would expect that, in broad terms, the amount of walking would double. Increases in population and employment density of this amount would lead to corresponding shortages of parking which, in turn would lead to more walking.

The 'base case' for all the strategies has assumed that there would be a very significant increase in the residential population and the number of jobs in the Study Area. See Table 2.1. It shows that the Study Area 2021 population would be 22% higher than 1996 levels. The equivalent increase for employment would be 18%. Both of these increases are less than the equivalent metropolitan-wide figures of 26% growth in population and 40% increase in employment.

The 'base case' increase of population and employment would therefore lead to a greater range of destinations within walking distance of *existing* residents and workers as well as newcomers. These percentages are significant and should see walking taking a greater share of trip making for all the strategies tested. However, as described earlier this increase would not be sufficient to reduce vehicular traffic levels – merely to suppress the rate of increase.

Strategy E considers further intensification of land use over the base case.

5.2.2 Recreational Walking

Anecdotal observations suggest that since the early 1980's the amount of recreational walking by adults has increased - these trips are taken into account in the above figures. However, if trends continue we would expect to see an increase in recreational walking – hopefully at the expense of sedentary activities. Although an increase in walking is beneficial for health reasons, it is unlikely to lower the amount of car travel. If the increase in regular exercise is accompanied by car trips to gymnasiums and swimming pools then the opposite is likely.

Table 5-2 contains comments on the 16 individual elements contained in the walking strategy specification tested.

Â **Table 5-2 Specific Comments in Elements of the Walking Strategy**

Behavioural Programs	
Ç Program to encourage walking	This includes programs to encourage walking which are not part of "travel smart" (part of Strategy D) and includes such programs as the 'Walk and Talk' program, the 'Walking Bus' and programs to encourage walking for health reasons. These programs are likely to increase the amount of recreational walking, particularly for the target groups. The degree to which they will increase walking for functional reasons eg. to the shop, to school, is less clear. The proportion of these sorts of trips undertaken on foot has been sharply reducing in recent years in both Australia and in the UK.
Management and Regulation	
Ç Stricter enforcement of leash laws and fouling by dogs	Stricter enforcement of bylaws relating to dogs will primarily effect the behaviour of people who find dogs most threatening, such as the elderly and children. Surveys we have carried out of children's perceptions in outer suburbs shows that dogs are as significant as traffic in the minds of primary aged children.
Ç Shared path codes	Shared path codes will hopefully reduce the inherent conflicts which occur on heavily used trails, such as the Merri Creek. Within the study area, usage levels on the Capital City trail are increasing and conflicts between dog walkers, pedestrians and cyclists, are becoming significant.
Ç Pedestrian impacts as part of development applications	More attention to the conditions affecting pedestrians around development sites will have significant effects locally. These will be particularly important in the parts of the study area which are undergoing rapid redevelopment, typically from light industrial to residential, such as in parts of Collingwood and Fitzroy. Encouragement of better pedestrian access and public pathways around re-developments would make local access easier by foot. This would have added benefits to local traders.
Ç Driveway removal demolition permits	Better footpath surfaces will be most valued by those with disabilities, the frail and those pushing or being carried in wheeled vehicles. Details such as the amount of side slope, the existence of bull noses and poor detailed design have a disproportionate effect on the irritations of walking, and pushing wheeled vehicles.
Ç Reduced footpath clutter	Although footpath clutter makes for exciting and interesting shopping and eating areas, they can cause irritating delays and difficulties for the frail and those who rely on walking aids. Even a single point walking stick increases the effective width required for a pedestrian. Walking frames and motorised chairs increase it even further.
Land Use	
Ç Change of land use along walking routes	Some important walking routes do not have passive surveillance. Changes of land use to provide passive surveillance will be most valued by the people already walking along these routes and would lead to enhanced feelings of security.
Infrastructure along streets	
Ç New shared paths in parks	There are very few places within the study area where constructing new paths across reserves would provide widespread benefits (as distinct from very local benefits).
Ç Navigation and signage	Improved navigation and signage are likely to be most helpful to visitors and newcomers. The contacts with community groups and interviews with a wide range of local people undertaken in the early stages of this study indicated that the study area is not an area where people often have trouble finding their way.

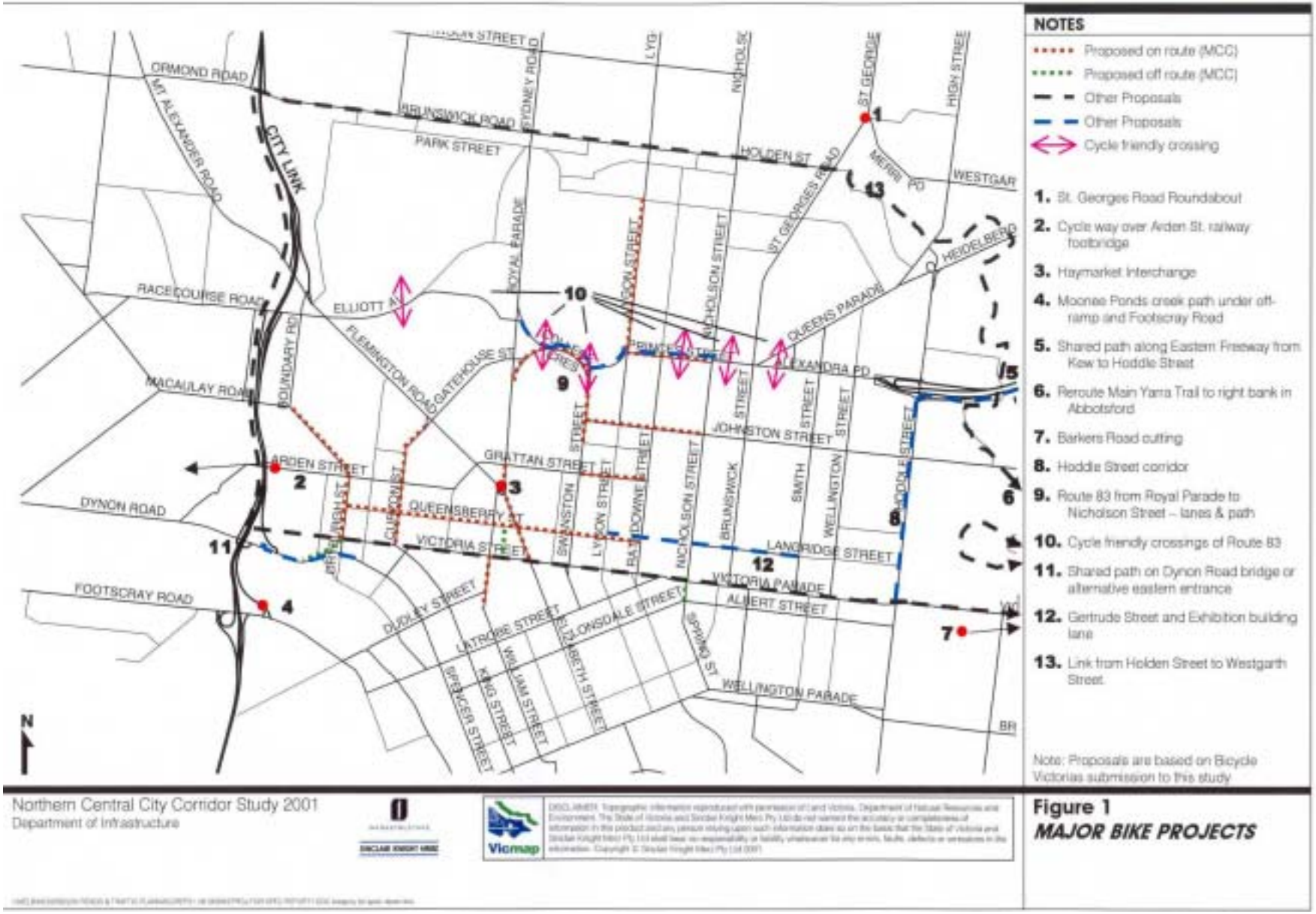
Infrastructure along streets (cont)	
Ç New push button pedestrian signals across arterial roads	Difficulties crossing arterial roads were the most widely reported problem confronting pedestrians within the study area. Increasing the number of push button signals across arterial roads from 43 (existing) to 101 would ensure that there would be very few arterial roads without a crossing at least every 200 metres. This would greatly increase crossing opportunities for pedestrians. Such a strategy may also lead to increases in pedestrians safety. A major issue would be the loss of kerb side parking near new crossings, particularly where they occur in shopping areas. Pedestrians would still walk on the most direct routes across arterial roads. We have undertaken detailed studies which show that few pedestrians go out of their way to use push buttons signals. Therefore an important effect of additional push button signals would be that more people would be protected by signals when crossing arterial roads, rather than pedestrians taking the benefit of more direct walking routes. The addition of more push button pedestrian signals would result in added delays to vehicular traffic and public transport vehicles. The degree to which vehicular traffic including trams and buses, would suffer additional delays depends on the details of the traffic signal operation of the new sites – particularly signal linking. The added delays can be mitigated by linking the operation of pedestrian signals with nearby intersections as is already common. Likewise it is common for trams approaching pedestrian operated traffic signals to delay the introduction of the walk phase to reduce delays to trams.
Ç Improve street lighting	See comments for change of land use along walking routes above.
Ç Change traffic signals operation	Changing the operation of existing traffic signals to make them more responsive to pedestrians' needs is likely to lead to reduced frustration levels and increasing levels of compliance by pedestrians with less walking against 'don't walk' displays. The effect on overall levels of walking would be marginal.
Ç Footpath repair and replacement	The effects would be similar to those described above for smoother walking surfaces.
Ç Improving lane ways for pedestrians	The effects would be similar to those described above for smoother walking surfaces.
Ç Continuous verandahs along shopping streets	Improving the coverage of verandahs in the shopping streets would have the most benefit on very hot sunny days and on very wet days. This weather protection would be most valued by people who are already walking. We would not expect increased weather protection to increase walking levels very much.
Infrastructure at Destinations	
Ç Sitting and propping places along walking routes	The addition of additional sitting and propping places along walking routes would be most valued by the frail elderly, particularly those with respiratory and heart conditions. This would have the effect of increasing their ability to live independently and maintain social contacts out of home. They would facilitate social contact where they were located at meeting places and at tram and bus stops.

5.2.3 Conclusions

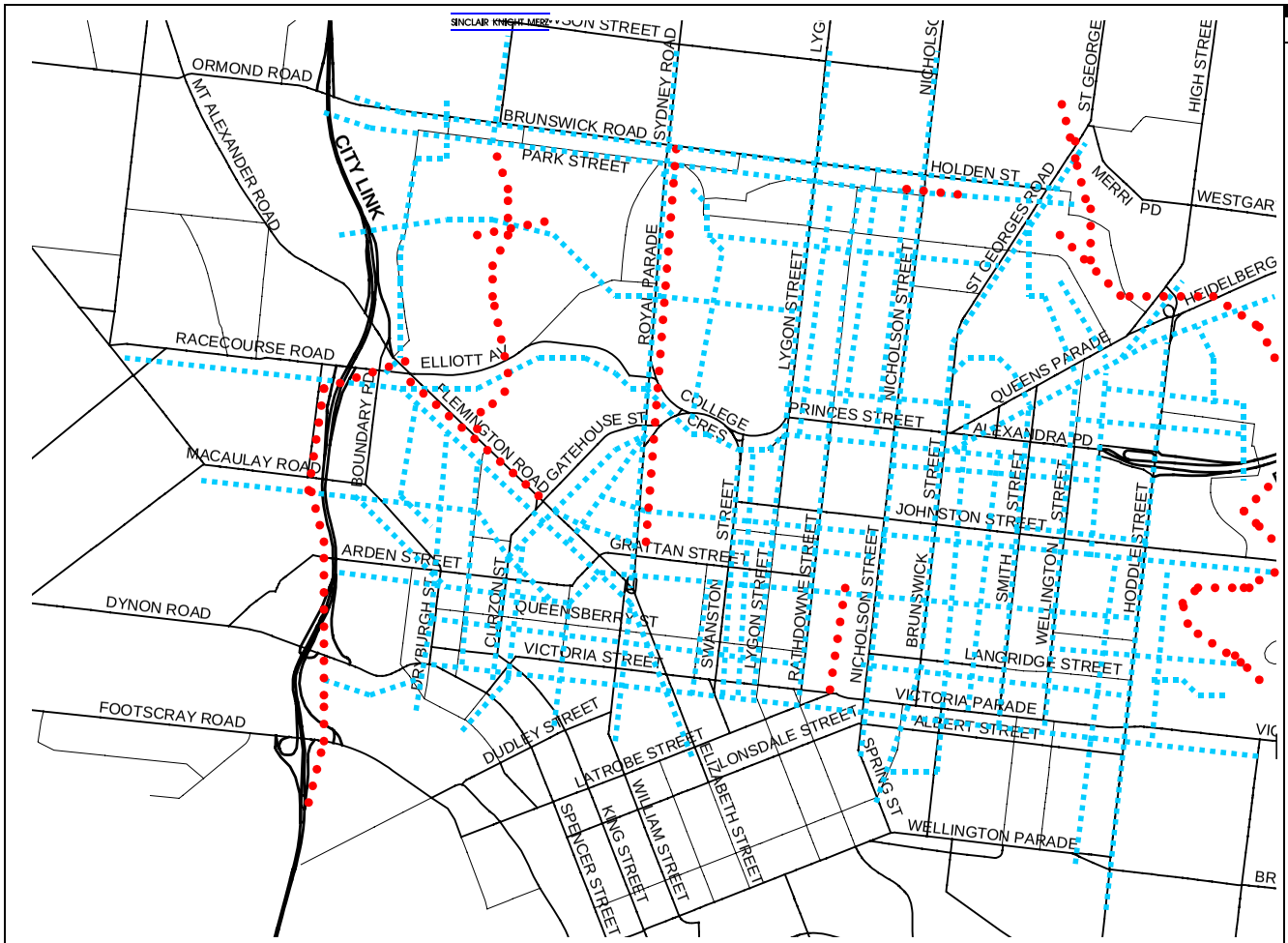
We can draw the following conclusions:

- walking already has the major share of local trips within the Study Area;
- the increases in population and employment assumed to eventuate as part of the 'Melbourne metropolitan strategy' are likely to increase the amount of walking – irrespective of any explicit strategy;
- there are significant reasons to improve conditions for pedestrians, relating to health and to the added vibrancy of street life; the pedestrians most likely to benefit from improved infrastructure for walking are those most vulnerable – the old, the disabled and the frail / elderly;
- improving infrastructure for walking should be part of a long term strategy – although much can be achieved in the short term, the immense size of the task means sustained investment over a long period would be needed.

Â **Figure 5-1 Major Bike Projects**



Â Figure 5-2 Bike Route



NOTES

Proposed On Road Route

Proposed Off Road Route

a) The primary purpose of this diagram is to show what a fine grained bicycle network would look like.

b) These routes are those defined in the Bicycle Victoria submission to the NCCC study. Alignments of some routes are diagrammatic.

c) A limited number of the on road and off road routes shown have already been constructed.

d) On Road routes include both those on local and those on arterial roads.

e) Some of these route upgrades are already specified in the MCC Bike Plan (2002 – 07) and VicRoads programs.

Northern Central City Corridor Study 2001
Department of Infrastructure

BIKE ROUTES

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5.3 Evaluation of Bicycle Strategy

5.3.1 Increasing Mode Share

In assessing the potential for increasing the mode share for trips by bicycle we have again used the VATS data from the Issues and Trends report.
The normal range for trips by bike is substantially further than by walking. Trips of 5km are very common even by cyclists of limited fitness. Recreational cyclists travelling on main roads typically travel 40km on their daily training runs (round trip). Many of the trips across the boundary of the Study Area would be well within the range of moderately fit cyclists. The 3.5km distance between the northern and southern boundaries of the Study Area means that many of the through trips could also be transferred from the motorised modes to cycling.Therefore, unlike walking, there is a much greater scope to increase the existing mode share of cycling. Moreover, it would be developing from a smaller base.

In assessing the potential for increasing the cycling mode share there are a range of previous experiences which are helpful.

- Cultural attitudes towards cycling would appear to be as important a determinant as the provision of infrastructure. Levels of cycling vary widely even between similar cities.
- Levels of cycling are sensitive to age and gender. The majority of cyclists in the study area are adult males. Most also have drivers licences. Cultural attitudes towards females cycling would seem to be as important if not more important to participation as individual fitness levels.
- Although changes in cultural attitudes to cycling are likely to take a long time, changes over the past two decades have been quite marked. These changes have been primarily attitudes to;
  - off road recreational cycling – characterised by ‘mum, dad and the kids’ on weekends;
  - on road cycling for triathlons and racing – characterised by lyrca-wearing main road cyclists, and
  - off road mountain bike riding as a legitimate and popular recreational pursuit.

  Changes in community attitudes to *utilitarian cycling*, eg trips to shops, to friends, to work and to cycling by females could well follow in the next decade.
- Except for the relatively recent introduction of VATS data there has been no long term monitoring of cycling levels. Old photographs of street scenes and anecdotal evidence suggests that cycling levels were far higher in the period 1900 – 1960 than today. Before 1950 nearly all roads and streets were available to cyclists-even inexperienced cyclists. Increases in car usage have meant that this basic infrastructure is no longer available because of the danger cars represent. The introduction of on-road bike facilities over the past decade can be seen as an attempt to regain the infrastructure which has been lost to bike riders.
- Creating on-road space which is explicitly allocated to cyclists is an important step in changing behaviour and cultural attitudes. By providing basic cycling infrastructure more people will see cycling as a possible mode for utilitarian trip making. This is a much sounder strategy than the alternative of encouraging

cyclists by publicity campaigns and visible signage without providing the basic network to ride on. It is important to differentiate between high profile projects which *appear* to assist cyclists and high profile projects which actually do.

- It is important that continuous *networks* of bike routes be created where they are needed – not just where they can be provided easily.
- There are a wide range of different cyclists with different needs. Experienced main road cyclists require direct routes with priority over intersecting streets to take them to their destinations quickly. Their needs are best met by treatments and line marking along arterial roads. More diffident cyclists who are adverse to hearing traffic require routes along the local street networks with assistance when crossing arterial roads ie by traffic signals or pedestrian operated traffic signals.
- Paradoxically the improved design of bikes eg. gearing and wide tyres to cope with urban riding has taken place while the use of bikes for functional trip making may have declined. Although bike usage in China, The Netherlands and Vietnam is very high the technical sophistication of the bikes is basic.
- Bike *ownership* levels are very high and the number of new bikes sales rival the number of new car sales. Many bikes bought for recreational use are also suitable for utilitarian riding in urban environments. Moreover the real costs of buying a new bike have fallen over recent years.
- There is a greater propensity for mode switching between public transport, car passenger, bike and walk, than between these modes and 'car driver'.
- Counts of cyclists using arterial roads have shown dramatic increases following the introduction of better cycling conditions. Two examples are the bike lanes on St Kilda Road and the redevelopment of Swanson Street through the CBD. It is significant that the two most heavily used routes into the CBD were explicitly designed for bikes – Swanston Street and the Yarra bike path – both of which have carried steadily increasing numbers of cyclists. New cyclists are very conscious which roads are explicitly marked for their use.

5.3.2 Funding

The funding required for the cycling strategy is significantly less than that for the other 'build' strategies – both public transport and road. However it would require funding at over double the level than has historically been the case. Historically the funding of bike facilities has been spread between a wide number of sources including local government (local routes, bike parking) public transport operators (bike parking), state government (routes of metropolitan importance – both off road and on road – VicRoads and Parks Victoria) and builders (end of trip facilities).

5.3.3 Road Safety

The effect of increased cycling on road safety has been subject to a number of studies which have shown in general the following results.

- Accident levels per bike kilometre are somewhat higher than accident levels per car kilometre.
- Cyclists who choose to ride on footpaths have lower accident levels per cycling hour than those who choose to ride on roads. (Monash University Accident Research Centre – 1988)

- Older male riders have much lower accident rates than younger male riders.
- Regular riding increases health levels and leads to fewer premature deaths, particularly from heart disease. A major quantitative study in the UK showed that the increase longevity because of regular exercise more than offset the increased risk from road accidents.

The degree to which individual bike projects have been monitored has been quite variable. In Victoria, on-road changes such as marked bicycle lanes and wide kerb side lanes have been subject to a great deal of detailed evaluation. These studies have shown significantly reduced stress levels on the part of cyclists and increased separation between cyclists and the vehicles which overtake them. Although there are difficult methodological problems in actually *proving* that road markings for bikes reduces accident rates, it is very clear that all the evidence points in that direction. (See Sinclair Knight Merz's 2001 Study for VicRoads Road Safety Section.)

In Table 5-3 we have made specific comments on the individual elements which make up the cycling strategy components of Strategy C.

5.3.4 Interaction with Other Strategies

The on-road component of the strategy interacts with the other strategies in the following ways.

- Strategy A : Public Transport Improvements
  The resumption of arterial road space for bus and tram operations such as for tram super stops, or exclusive lanes for buses or trams could threaten cycling conditions by squeezing cyclists. Particular care would be required in the detailed design of new facilities to ensure that cycling conditions would not be significantly downgraded.

- Strategy B : Local Streets Strategy
  Although local street traffic calming in itself is not a threat to cyclists, care is required in the detailed design. Cyclists may well benefit where longer continuous routes are traffic calmed.

- Strategy G : The Tunnel Options
  These options would relieve the surface road network. This could provide the opportunity to resume more arterial road space for cyclists.

Table 5-3 Specific Comments on Elements of the Cycling Strategy

Behavioural Programs	
in other strategies	
Management and Regulations	
Legalise bikes in MCC Gardens	Legalising cycling in the Carlton Gardens and the Fitzroy Gardens, say by the declaration of shared paths, would have important local effects. It would provide continuity to the important north south route along Canning Street. The most important aspect is that it would legalise what is already happening without severe adverse consequences. Cyclists are probably already using these routes, albeit illegally. These routes are almost certainly much safer than the parallel roads. Bicycle/car collisions are

	unfortunately very common; typically 50 to 100 deaths in Australia each year. Fortunately the incidence of bicycles/pedestrian collisions is very low by comparison.
Land Use	
Ç in other strategies	
Bike Route Infrastructure	
Ç Arterial Road lane markings	A major element of the strategy would be marking of arterial roads including the colouring of bike lanes where cyclists particularly need protection. The primary beneficiaries of these measures would be cyclists who are already riding and new cyclists. Explicit road markings add to the sense that cyclists are legitimate road users. The degree to which bike markings would disadvantage others will depend on the details. Parking and through traffic capacity potentially could be reduced by the application of the bike strategy. The widespread introduction of road markings on arterial roads in Melbourne over the past two decades has not lead to any significant disadvantages to other road users. We therefore expect that an intense application of line marking in a small area would also perform similarly. Conversely it is difficult to see bike markings which would seriously disadvantage other road users being accepted politically. The detail design and evaluation of individual line marking projects is beyond the brief. However, it is very likely that the more difficult sections of arterial roads will need minor widening or structural change to provide continuity for cyclists. There is only limited opportunity within the Study Area to develop a comprehensive off-road bicycle network. Therefore if the basic infrastructure to support any significant level of cycling is to be provided it will be by mainly providing space on-road.
Ç Lane markings on local streets	To achieve a fine grained cycling network, as shown on Figure 5-2 local streets would be modified. There would be a wide variety of treatments – depending on local circumstances. On the busiest streets this may mean separate bicycle lanes on the left hand sides of local roads. Where the local street is narrow and only has slow moving vehicles then cyclists would be able to mix 'nose-to-tail' with vehicular traffic and minimal road marking would be necessary. Critical to the success of the fine grained network on the local streets system will be treatments to enable cyclists to cross arterial roads. Many of these are already provided, and indeed the location of crossing points of arterial roads such as push button signals dictate the particular local streets which would be most appropriate for developing continuous bike routes along.
Ç Additional crossings of arterial roads	These are necessary to assist the more diffident cyclists on the local street bicycle network to cross to local street networks on the opposite side of arterial roads. One such arterial road is Alexandra Parade/Princes Street. The strategy nominates six points on this route. Although the precise treatment at each location will depend on location – specific circumstances several general comments can be made. These points are not generally critical to overall traffic capacity during peak periods providing that care is taken in the detailed design and operation. They generally assist pedestrian crossing at these points and those crossing the route to reach public transport stops. However, they can delay trams and buses – depending on the details. Where such a treatment involves road narrowing such as may occur along a clearway the effects on other traffic may be significant – again this is dependent on the details.
Ç Road resurfacing for bikes	The beneficiaries of road resurfacing would be existing cyclists and new cyclists particularly those riding bikes with narrow tyres. Uneven road surfaces can have a major effect on rider comfort but can also be major contributory factor in accidents. Uneven road surfaces can cause cyclists to lose control and fall.

Ç Signage to assist navigation	The strategy envisages that once routes are completed and up to a high standard they can then be signed to include destination and distance information. Signage *without* the basic infrastructure would be a counter productive exercise. The groups who would receive most benefit from cycling are newcomers to the study area, visitors and those who are riding outside familiar territory, such as those from nearby suburbs. Because cyclists have a greater range than pedestrians they more often find themselves in unfamiliar territory. Many of the shortcuts and good routes are only found by experience. This particularly applies to back street routes and access routes to cross natural barriers such as the Yarra River and manmade barriers such as the Tullamarine Freeway. Navigation signage by itself is unlikely to increase cycling levels, except perhaps on popular recreational routes such as the Capital City Trail and access routes to the Yarra River.
End of Bike Trip Facilities	
Ç Improved bike parking at workplaces, education, shops, railway stations, and transport terminals	The provision of better bike parking which is more secure or more convenient is greatly valued by cyclists. The provision of leaning rails for short term parking near shops is quite cheap and when unoccupied can be used for propping places for pedestrians. Secure bike parking in medium density housing, employment and educational institutions is critical. The significant advantage of cycling is that a cyclist can ride very close to their ultimate destination. This is lost if there is no convenient or secure parking near by.
Ç Showers available at workplaces	Showers, storage and changing facilities are particularly valued by cyclists who ride long distances in special clothing or riding during the summer months or in rain. The absence of these facilities can rule out cycling as a practical mode for longer distances. Other beneficiaries for these types of facilities are the cyclists' fellow workers.

5.4 The Assessment Table

We have made no forecasts of the impacts of the walk and pedestrian strategies. Indeed any attempt to make such forecasts would be subject to high uncertainty. The suggested outcomes in the table are thus based on our reasonable judgment that a major investment in these strategies would increase walking and cycling, some of which would be diverted from other mechanised transport modes. The table represents the net effect of all the elements in Strategy C.

Â Table 5-4 Scenario C = Scenario B + walking and cycling initiatives

Our assessments are shown in *italics*.

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Positive but small effects.*
	Concentration of air pollutants at relevant sites according to adopted standards	*Positive but small effects.*
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*Unclear: while any reduced car use will effect accidents, the increased exposure/conflict of pedestrians and cyclists with motor vehicles brings increased risks. Health benefits likely to outweigh accidents.*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	*Some positive, some negative. Legalising riding in MCC Gradens may be slightly negative. The completion of the Capital City Trail would significantly increase access to the Darebin Creek valley, the Yarra River and other points of local interest.*
	Effect on other public areas, streetscapes	*Some positive, some negative*
	Effect on heritage protection/interpretation	*Some positive, some negative*
	Effect on urban settings	*Some positive, some negative*
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*Neutral.*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Enlarges travel choice, improves accessibility by walk and bike. Additional traffic signals would reduce accessibility by car.*
	Sense of place/neighbourhood	*Slightly positive*
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	*Strongly positive*
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Positive but small effects.*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Positive but small effects.*
	Car driver/passenger mode share by time period	*Positive but small effects.*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Probably neutral.*
	Public transport mode share by time period and mode (rail, tram, bus)	*Probably neutral.*
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Positive effects.*
	Cycling/walking mode share by time period	*Positive effects.*
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	*Much greater provision.*
Protecting and enhancing biodiversity	Effect on natural habitats	*Neutral*
	Effect on exotic habitats	*Neutral*
	Effect on water quality	*Neutral*
	Effect on ground contamination	*Neutral*

Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Provision of greater access choice will particularly benefit tourism and recreation, particularly the off road bike paths. Additional traffic signals would reduce accessibility by car.*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	*Not applicable*
	Changes of land use (eg from commercial to residential)	*Not applicable*
	Accessibility to/from residential areas	*Wider choice of travel mode*
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Neutral.*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*By enlarging travel choice the strategy will increase efficiency. Additional traffic signals would reduce accessibility by car.*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	*The benefits of cycling and walking projects external beyond the transport sector to include health and recreations.*
	Regional economic effects (effect on businesses etc)	

6. Strategy D: Reduce Car Dependency

6.1 Introduction

Measures considered with the purpose of reducing the volume of car travel are parking, pricing, policy and behavioural initiatives. Any strategy might comprise a combination of such measures.

Parking policies can be directed at a wide range of actions, including provision of and control of access to parking spaces, including allocating access rights between competing users, and the pricing of parking spaces.

Pricing policies that could influence car travel through the Study Area include:

- levying access charges on drivers, eg. tolling the Eastern Freeway or a 'road user charge' cordon around the CBD
- reducing the price of public transport.

Behavioural initiatives designed to influence travel and parking behaviour include:

- facilitating businesses to inaugurate company travel plans or seeking to influence individuals' travel choices;
- provision of public information on the location, availability and prices of parking spaces (eg. the recently-introduced real-time information on available parking places in and around the CBD);
- reinforcement of desirable associations between parking and other activities, eg shopping) by coordinating parking discounts for such activities;
- combining parking and free or subsidised local public transport (eg. the CBD-perimeter parking stations around the Perth CBD combined with a free bus service from stations into the CBD).

With the exceptions of local street parking and to a lesser extent the Eastern Freeway toll, these measures would impact on all residents and businesses in the metropolitan area and are not focused on the NCCCS study area.

6.2 Parking Policies

We distinguish parking in Melbourne CBD from that in the study area.

6.2.1 CBD Parking

Parking Supply

The following types of public parking spaces are available in the Study Area:

- on-street – usually metered during week days and Saturdays; oriented to use by short term visitors to the CBD and usually metered to allow parking times of between 15 minutes and 2 hours;
- off street – commercial spaces available for short and long term demand;
- off street – private, associated with residential or commercial tenancies and not available to the public.

Melbourne City Council's policies are set out in its transport strategy (Melbourne City Council, 1997:45): *"the availability of car parking is a critical influence in business location decisions and the ability of the City to remain competitive with suburban locations as an accessible and desirable location for entertaining and retailing. Car parking is therefore an important component of the central city transport network.*

Melbourne's Transport Policies collectively support maximising the use of public transport to and within the City." Council's current policy states: *"Council will manage parking to meet the needs of shoppers, short-term visitors and business clients while encouraging commuters to use public transport."*

To achieve this strategy, Melbourne City Council pursues a number of policies relating to the availability and pricing of parking spaces, information and marketing about the availability of short term parking, influencing the pricing practices of and improving coordination between the disparate commercial parking operators.

Council's focus is on improving the supply of and availability of short term parking, while discouraging the supply of commuter parking. Commercial parking operators place their priority on long term (ie. commuter) parking. Council's on-street parking is also markedly cheaper than the equivalent parking off-street.

Sinclair Knight Merz reported (SKM, September 2001): *"The Melbourne CBD (including Southbank but not including Docklands) has approximately 60,000 off-street parking spaces, this is 35 off-street parking spaces per 100 employees. These spaces are used for commuters as well as city visitors. In future there will be 500 new … spaces associated with the Federation Square and 1000 new bays at the Queen Victoria Hospital site developments. There are also 6,100 spaces planned or already available in the Docklands area (covering the Stadium, Victoria Harbour, Batmans Hill, NAB, and the World Trade Centre).*

Parking Demand

Demand for parking emanates from a wide variety of drivers, with widely varying needs with respect to time, duration, cost of and accessibility to parking spaces. Because the CBD experiences parking saturation for most of the week, changes in the availability of parking will usually affect the distribution of parking between different types of user, the balance between car and other forms of transport and the tendency for some CBD parking to be displaced into adjoining areas.

Business Employees

A proportion of CBD commuter parking is funded directly by private and public businesses, so that the cost is not born by the employees. In some cases, employees are charged a parking fee on a before-tax basis, which reduces the costs to the employee. In some of these cases, the employee company owns or leases the spaces directly.

A proportion of employees who drive to work park in commercial, off-street parking. Most operators offer attractive fees for long term or daily parking (eg. the 'early bird' daily parking fee is a substantially reduced rate for cars parked in 'deep stacked' garages but is only available for cars that typically arrive before 9.30am and leave after 5.00pm, thereby avoiding the need for staff to move the car during the day). This

type of parking requires minimal staff management and utilises spaces remote from entry and exit.

Melbourne City Council has a policy of not permitting the provision of parking in some of the more central areas of the CBD. However, this policy is resisted by developers, who seek some on-site parking to make the building more attractive to tenants. In the case of some major developments, eg. Crown Casino, Docklands, Queen Victoria site, the State Government has taken over the development approvals process and has favoured a more generous provision of parking than has Melbourne City Council.

Commercial long term parking is available in areas close to and bordering the CBD (eg. major parking areas are available at Crown Casino, Docklands, Victoria Museum, the Arts Centre). Other medium and smaller stations are available within the CBD, some being owned by Melbourne City Council, some by private parking operators.

An unknown proportion of employee parking is funded directly by employers as part of a salary package. Some is funded by employees via FBT schemes, whereby the employees' parking costs are a before-tax deduction, so that the employee bears only part of the cost. Some parking is paid directly as out-of-pocket expenses by employees.

Shoppers and Visitors to the CBD
Shoppers who drive into the CBD can use either commercial off-street parking or on-street metered parking. Suitable short term commercial parking for deliveries etc is available within and close to the central retail area.

Other Entertainment Venues
Major entertainment venues, particularly those constructed in more recent years, provide substantial on-site parking, which is available to patrons of those venues (Crown Casino, Docklands Stadium, Victoria Museum, the Arts Centre in St Kilda Road, the MCG and Flinders Park). Older venues, such as many cinemas, do not provide any parking. Some of these are used on weekdays by CBD workers.

Options to Change the Supply of CBD Parking

Options that would constrain the supply of CBD parking include limiting the construction of additional commuter spaces relative to the increase in demand for parking as CBD employment increases, converting existing long term spaces to short term parking (eg. reducing the availability of on-street parking) or increasing cost of spaces.

Melbourne City Council can only control the price of on-street metered parking and off-street parking in stations under its ownership (eg. the parking areas adjoining the Victoria Market). Commercial operators have demonstrated a preference for commuter parking and commercial short term spaces are priced at a premium relative to commercial long term spaces and Council's short term, on-street spaces. Neither Melbourne City Council nor the State government has any direct control over the pricing policy of commercial operators. However, it would be feasible for Council to influence the price of long term parking by applying a differential rate to it. Other attempts by Council to increase the proportion of parking allocated to short term

parking via requirements associated with planning permits has not been entirely effective, due to the reluctance of parking operators and difficulties in enforcement.

Response of Specific User Groups to Increased Parking Prices

Commuter Parking
Because employees' CBD parking is funded in different ways, the effect of any price increase on individual drivers would vary. Overall responses of car drivers to the different pricing regimes will depend on the costs directly born by them, or on the employers' responses to the changed costs to their businesses. Employees who bear none or only part of the costs, are considered to be less likely to change their driving or parking behaviour in response to price increases than will those individuals who bear the full costs. Therefore, reductions in commuter car trips to the CBD are likely to occur predominantly in drivers who bear the full costs of commuter parking fees.

The extent to which commuter parking will be displaced by price increases will be influenced by the extent of the increase, the relative convenience and cost of the home-CBD public transport alternative vis-à-vis the convenience of displacement parking in the study area – including the cost/convenience of the public transport link and the costs of the displaced parking spaces.

As a test using the model, we have forecast the effects of assuming that all commuters to the CBD would incur an additional parking charge of $10/day. Such charges impact on employees who commute by car to and from CBD workplaces in the morning and evening peak periods. The forecast is for peak car travel to the CBD in the morning peak (and from the CBD in the evening peak) to reduce substantially (by more than 80%) as a result of the higher charges (Table 6-1).

Some of these car users switch to public transport. The consequent increase in peak public transport trips to/from CBD destinations is 12%. As a result, public transport would account for over 95% of peak trips to/from CBD destinations.

Â **Table 6-1 2021 Peak period trips to and from Melbourne CBD Destinations**

Person trips	Strategy B	Strategy D	Difference
By car	37,000	7,000	-80%
By public transport	153,000	172,000	+12%

Notes: table excludes counter-peak direction trips which are not affected by CBD long term parking charges, that is, it encompasses am peak trips to the CBD and pm return trips; figures in the table are rounded.

However, the car travel of CBD commuters accounts for a very small proportion of peak car travel in the metropolitan area (about 1%, Table 6-2). Overall, the increase in parking charges reduces car travel in the peaks by very little (about 1.5%). With interpeak travel unaffected, the impacts on daily car trips are very small indeed.

Â **Table 6-2 Person trips by car**

	2001	2021 base	Strategy A	Strategy B	Strategy D
Am peak					
Trips to the CBD	27,000	25,000	18,000	17,000	3,000
All car trips	1,481,000	1,833,000	1,784,000	1,781,000	1,755,000
% trips to the CBD	1.8%	1.3%	1%	1%	0.2%
PM peak					
Trips from the CBD	29,000	28,000	21,000	20,000	4,000
All car trips	1,649,000	2,077,000	2,024,000	2,020,000	1,986,000
% trips from the CBD	1.7%	1.4%	1%	1%	0.2%

Note: figures in the table are rounded.

The impacts on car travel in the study area are greater than the Melbourne-wide effects because of the closeness of the study area to the CBD and the consequently greater importance of CBD-related traffic. The overall effect is a reduction in peak traffic in the study area of about 5%. This is due to the CBD-related reduction in peak through traffic of about 9%.

The model test assumes (a) that all CBD employees would experience a large increase in parking costs and (b) that there is no alternative displacement parking. To the extent that these are unrealistic assumptions, the model estimates of the impacts of CBD long term parking charges will be an overestimate of what can practically be achieved[3].

Residential and Short Term Parking
It is unlikely that residential CBD parking would be displaced, due to the high value that households traditionally place on easy access from car to dwelling. Likewise, it is expected that for shorter term visits by car, eg. shopping, entertainment and visits to businesses, parking outside the CBD would not be attractive choice, due to the relatively much larger increase in trip time or reduction in convenience.

6.2.2 Parking in the Study Area

Parking Supply

The following types of parking spaces are provided in the Study Area:

- on-street – in residential, industrial and commercial areas;
- off street – public spaces, usually in parking areas owned by the municipality and located in or close to commercial centres;
- off street – private property, based on the historic characteristics of existing development or, for newer development, based on permit requirements that are dependent on Council policy.

[3] These are unrealistic because (i) there may be alternative parking, albeit further from workplaces, (ii) many employees park in employer owned or leased spaces, for which it may be difficult to levy an additional rate and/or to ensure that this is passed on to employees. Those with access to subsidised parking usually have permanent parking spaces paid for on a monthly basis. Those who pay on a daily basis are unlikely to be subsidised and often make use of 'early bird' opportunities. These people would be more sensitive to increased parking charges. The taxation system could be the most effective mechanism to increase payments by drivers with employer provided spaces.

On-Street Parking – Residential Areas
On-street, kerbside parking is provided in unmarked and line marked spaces. Spaces can be available on:

- an unlimited, unpriced basis or
- controlled by way of various types of restriction and costs, all subject to enforcement – eg. free but time-restricted parking, metered parking, loading bays, arterial road clearways, residents parking schemes (which can be applied during specified hours, eg. evenings and weekends only, all the time or when there is likely to be major conflicts over access to parking, as where the area is close to major entertainment venues, eg. sports grounds).

Typically in the older suburban areas, commercial parking extends into nearby residential areas during business hours but residents parking schemes are applied at other times, so that evening parking associated with restaurants and evening entertainment can be constrained to commercial areas or their fringes.

On-Street Parking – Commercial Areas
On-street parking can be:

- uncontrolled and marked or unmarked
- in marked spaces with various signed time limits
- subject to various parking fees, applied through coin-operated meters.

Parking controls can be varied during the day, so that loading bays convert to free commercial use outside daytime business hours (with benefits for such late-operating businesses as restaurants or cinemas).

On major arterial roads, the availability of commercial parking may be affected by peak-hour requirements for clearways.

Off-Street Public Parking
Councils have, over the years, provided a wide range of off-street public parking areas in commercial centres. These car parks may have been funded through various sources, including Council's capital works program, separate rate schemes funded by land owners in the centres and by parking contributions paid in association with redevelopment approvals. Spaces are typically line marked, parking can be free or fee-based and subjected to nominated time limits.

Where fee-based public parking occurs, it is usually under the control of the municipality but direct management may be contracted out. Where spaces are available in public car parks used for short term parking, the effectiveness of the car park's use is strongly influence by its accessibility and visibility from the major access roads.

Off-Street Commercial Parking
Parking may be provided in various types of off-street private properties. These include parking spaces provided by major developers as part of the development and required as part of the development approval (eg. shopping centre or cinema parking areas) but may also include parking spaces leased to residents in housing with no private parking – not untypical in the inner suburbs. Management of the large

commercial parking areas is generally by the property owner or lessee. In some cases, the development approval may impose some requirements for some degree of public access to such parking spaces. Where these spaces are used for short term parking, high levels of visibility and accessibility are needed to ensure their efficient use.

Private Off-Road Parking
These spaces are usually directly associated with particular premises and include parking spaces associated with both residential and business properties. Issues relating to these spaces are:

- The lack of on-site parking for many older dwellings, due to the small lot sizes, narrow frontages and high site coverage; also because, after provision of driveway access, the net increase in parking (on-site less lost kerbside parking relating to the cross-over) may not be significant
- Streetscape and traffic management issues relating to the necessary frequency of crossovers.

It is typical that Councils, in granting approval for new development, will make an allowance for a property's existing parking shortfall, as to do otherwise would impose a penalty on the redevelopment, resulting in a serious impediment to improvements in land use and development that would, in other respects, be highly desirable.

Parking Demand

Demand for parking comes from a wide variety of drivers, with widely varying needs with respect to time, duration, cost and accessibility of parking spaces.

Because of the historic character of housing in the Study Area, a large proportion does not have on-site parking, so that residents as well as their visitors are obliged to park in the street. With narrow property frontages, there are many areas where there is insufficient kerbside available for this need.

In addition, daytime parking from retail areas, including demands by both shoppers, other visitors to the centre and retail/commercial staff, usually extends well beyond the boundaries of any successful retail centre. In the evening, the extensive areas of restaurants and hotels providing meals and entertainment create further competition for kerbside parking. Other uses in the Study Area that generate kerbside parking demand beyond that for which they make provision include the universities and local schools, major hospitals, major sporting venues and public parks.

CBD-bound commuters are observed to use available kerbside parking near public transport stops in the Study Area, particularly outside the bounds of areas of high levels of parking controls or near ancillary destinations within the Study Area (eg. commuters driving children to schools in the Study Area and then catching public transport into the city or elsewhere).

Typical Parking Conflicts

Competition for parking spaces is endemic across the Study Area, with only the fringe areas to the north, north-west and north east being relatively free of competition. In most areas, councils are obliged to find a way of balancing the needs of the different parties – employees, visitors to commercial, retail and recreational activities, residents and their visitors. The development of off-street municipal parking areas helps

alleviate some problems and can assist the viability of centres that depend on car access for a significant proportion of their business.

The residents parking schemes managed by the two councils are designed to provide residents and their visitors with access to kerbside parking close to their homes. Parking permits are typically available on a per/household basis (eg. in the City of Melbourne, two permits/dwelling) and can be used within a defined precinct. In the early days of such schemes, precincts were defined widely and some residents found it convenient to use the permits for parking at other destinations within the precinct (ie. where trips could be wholly contained within the precinct. Consequently, precincts are now more narrowly defined. Advice from the City of Melbourne indicates that the number of resident parking permits substantially exceeds the available kerbside spaces within the relevant precincts.

One of the implications of increased prices of commuter parking within the CBD (or reduced commuter parking spaces) is that there would be increased demand for parking areas for CBD commuters in the Study Area. This would increase the pressure on long term, free kerbside parking near public transport stops in the Study Area. If this caused a nuisance to residents or businesses in the Study area, it could be addressed by additional parking management.

Parking Management Policies

A reduction in on-street parking, whether wholly or selectively, can be used to improve the amenity in residential areas or to encourage the use of non-car transport by reducing the feasibility of car trips. Actions to support this end include:

- Physically reducing existing spaces or constructing additional spaces (eg. using new median strips to remove existing, centre-of-road parking (eg. as in Parkville, during the 1980s and 1990s)
- Re-allocating parking spaces between competing users to change the advantage of one group relative to another (eg. by increasing the areas limited to cars with resident parking permits, thereby reducing parking for other drivers)
- Changing the metered pricing of spaces or the duration of parking (as in converting 4 hour to 1 hour parking).

The effect on other drivers and land uses of any increased provision of residents' parking and/or the reduction in kerbside spaces available for non-residents would vary, depending on the nature of the parking that is displaced.

Where employee parking is significantly reduced, this may affect the viability of local businesses by increasing difficulties in recruiting appropriate staff. If shopper parking is reduced, this may affect the viability of retailing centres by reducing business as car drivers chose to shop elsewhere. Likewise, a reduction in the availability of parking for restaurants and entertainment venues would reduce the viability of such venues.

We expect that policies directed to substantially reducing the parking available for many businesses or their clients could lead in the medium term to substantial changes in land prices and business activities in the Study Area. The existing pattern of commercial activities has developed in the context of, and dependent on, the existing levels of public accessibility which includes, as an important component, access by car.

Parking issues that Melbourne City Council has identified include the under-use of public off street parking areas at all times of peak parking demand, the availability of private off-street parking during peak parking, provision of resident parking permits well in excess of available kerbside spaces and misuse by residents of the 'visitor' parking permits for their second cars. Initiatives that Melbourne City Council is considering include information and pricing systems that would encourage greater use of commercial off-street parking, resident parking permits to be subject to fees as well as the possibility of some form of rationing related to the extent of property frontage, together with a reduction in kerbside parking where this would offer substantial streetscape improvements (eg. replacing centre-of-road parking with landscaped medians).

Parking Policy Options

There are three broad policy options for the study area that could be a part of the NCCCS strategy.

Policy 1: maintain the status quo with respect to the current level of on-street parking while allowing a reasonably degree of ongoing development within the Study Area. This policy would be reflected in actions requiring all new development, whether residential, commercial or institutional, be able to satisfy any parking demand on-site.

Policy 2: reduce the existing level of on-street all-day employee parking in residential areas, requiring various management and enforcement measures to reduce long term, mainly employee, parking outside industrial and commercial zones. Parking spaces could either be re-allocated or withdrawn to improve amenity.

Policy 3: significantly reduce the extension of all non-resident parking into residential areas. This policy would require a combination of measures that would remove all existing non-residential parking outside industrial and commercial zones.

While all policies could include some provision for off-street parking (eg. Melbourne City Council's present proposal for an off-street parking station under Argyle Square, Carlton), we would assume only limited developments in this respect, on the basis that additional off-street parking should be user-funded and that funding would only be likely to support limited and fairly specific parking developments.

If it is the objective to avoid the risk of parking policy undermining the local economy, it follows that policies 2 & 3 can be applied in any local area only to the extent that there exists accessible, affordable public off-street parking capacity capable of providing satisfactorily for the displaced demand. While this may be a feasible objective for commuters (policy 2), off-street parking is unlikely to be perceived to be a practical alternative for other visitors to the area.

Other feasible policies could be a combination of the above three eg: tighter control over the issue of resident parking permits plus the introduction of on street parking meters for 'outsiders'.

6.3 Pricing Policies

6.3.1 The Model Tests

We have used the traffic model to test two issues, and we provide an insight into the impacts of other measures. The issues are:

- reducing public transport fares;
- tolling the Eastern Freeway in conjunction with the Strategy F improvements to public transport in the corridor.

6.3.2 Halving Public Transport Fares

According to the model, the general metro-wide consequences of such a large reduction in fares would be:

- an overall increase in public transport passengers of about 12%; for bus the increase would be 9% and for tram and train 15%; some of these would be diverted from car trips;
- a consequent large loss of revenues to public transport operators (in excess of 40%) which would need to be provided for by government;
- a small reduction in car traffic of about 1%.

Slightly larger reductions in car traffic (perhaps 3%) might be expected in the NCCC study area due to the higher than average share of public transport.

6.3.3 Tolling the Eastern Freeway

Among the schemes being considered in the public transport component of the strategies is improved transit along the Eastern Freeway corridor. If this were to be based on light or heavy rail technologies, the capital costs could be substantial. It has therefore been suggested that a toll on Eastern Freeway traffic could provide a financial contribution to improved public transport infrastructure in this corridor.

In this test, tolls were assumed along the Eastern Freeway between Doncaster Road and Hoddle Street in Strategy F (E Freeway Transit). The tolls are based upon an overall 75c toll per vehicle in 2001 prices. The toll has been shared between three locations between Hoddle Street and Doncaster Road.

Location	Approximate Percentage of the Freeway Length	Toll Value Applied (cents)
Eastern Fwy - Hoddle St to Chandler Hwy	25%	19
Eastern Fwy – Chandler Hwy to Burke Rd	50%	37
Eastern Fwy - Bulleen Rd to Doncaster Rd	25%	19
Total	100%	75

The nature of the impacts of this type of toll is well known from past work (for example, UK studies of motorway charging). E. Freeway traffic levels are reduced by

about 5%, diverting traffic mainly to alternative routes, for example Johnston Street, Heidelberg Road and Westgarth Street. There has been a small increase in public transport patronage (0.5% on M> Tram). As intended the toll revenues of ca. $30m per annum (calculated for 2021) would make a significant contribution towards the financing of the strategy (capital cost of less than $300m).

As described, this test was designed only to generate revenues to offset the costs of Strategy F. The tolls are therefore low and minimise the impacts on traffic. It is however possible to envisage larger toll levels intended also to reduce congestion costs but, as is evident from the test reported above and is also reported in international literature, the consequences would be unsatisfactory with larger scale diversion of traffic to more local already congested routes. For congestion charging to be effective at managing traffic demand it would need to be applied on a cordon or wide area basis.

6.3.4 General Discussion

Road user charging may encompass increased fuel taxes, direct charging across the metropolitan area (for example at a series of cordons and screenlines) or a charging cordon around the Melbourne CBD. Such policies tend to attract extreme public reaction and have internationally proved very difficult to implement. There are also considerable concerns over the difficult-to-forecast commercial impacts of pricing cordons around specific areas such as CBDs, especially if parts of the CBD economy are weak and suffering competition from out-of-town centres.

These policies are therefore not specific to the NCCC study area but affect all of Melbourne. Tolls are a sensitive issue because the present Government is strongly opposed to them. However, tolls and cordon charging were raised as options in community consultation and are being considered for that reason. Because many of these pricing policies appear politically and publicly unacceptable, the nature of the following discussion is to answer the question “what might be the consequences if it proved feasible to implement such measures?”

Road pricing is the strongest form of demand restraint and can be highly effective in generally reducing traffic congestion and car use, although there will be increased congestion on routes close to and by-passing the cordon. Public transport benefits from increased patronage. To be effective, high prices must be charged.

Unlike measures applied to CBD parking, a CBD pricing cordon would also intercept car users other than commuters, including through traffic and car journeys at times of day other than the peaks. Notwithstanding this larger market, the analysis of the CBD parking charges reveals that car traffic to and from the Melbourne CBD accounts for a small proportion of car use in the metropolitan area. For this reason, and also because of concerns over the economic impacts of pricing on the CBD and the equitable distribution of charges, some jurisdictions have considered pricing traffic more widely. This could be by imposing a number of pricing cordons/screenlines across the urban area (such as was considered for London, but not implemented) or, particularly where congestion charging was desired, by using GPS technologies to provide continuous charging across the road network varying by time and location. Current systems of tolling are mainly point-based (often to finance new roads) and CBD cordons (eg Trondheim, Bergen, Oslo, Stockholm and Singapore). However, continuous systems have been studied (eg in New Zealand and Hong Kong) and are

currently being researched (eg in The Netherlands and in trials in Helsinki and Gothenburg) because, being more flexible, they are generally recognised as being able to address some of the shortcomings of cordon charges.

We have not addressed such road user charging measures in this review.

Elsewhere, fuel taxation provides a means of increasing the costs of car use. This is more feasible because Australia's fuel taxes are low by international standards. At present, increases of the magnitude needed to influence travel demand are self-evidently politically unacceptable. A sensitivity test undertaken with the model suggests that very large increases in fuel prices would be needed to achieve any appreciable effect on road traffic. Australia having among the lowest fuel prices in developed countries, there is no reason to doubt this broad conclusion.

Likewise, public transport fares could be reduced by further subsidies. The general consequences of reduced fares are, as the model test illustrates, increased government subsidy, growth in public transport patronage and a small impact on road traffic. The policy is particular disadvantageous where elements of the public transport system are currently near capacity and the additional patronage would generate overcrowded services and thereby would require further and expensive infrastructure investment. This is an effect which principally relates to fixed rail systems, and the model forecasts suggests that tram and rail patronage would be the most affected by such a policy. The extent to which such fare changes are feasible within present contractual arrangements would also need to be considered.

6.4 Behavioural Initiatives

Options

It is internationally recognised that major reductions in traffic demand are only possible if residents change their behaviour and travel habits. Approaches that are being investigated by many countries, and that do not require major changes to the cost of travel, are:

- Company Travel (or Green) Plans, by which the employer seeks to encourage more sustainable travel habits in commuting and business travel, and
- Travel Behaviour Modification Programmes based on personal interview techniques (such as Travel Smart) which seek to influence individual's personal travel habits.

These programmes typically provide improved information to residential areas, workplaces, or schools to encourage greater use of public transport, walking and cycling. Green travel plans can also involve administrative changes within work places to increase the use of 'socially beneficial' modes including car pooling. Typically they include provision of high occupancy vehicle car parking spaces at workplaces, information on public transport services and promotional events, such as walk to work days. Small scale infrastructure improvements such as shower facilities and more appropriate bike parking can form part of these programmes. The Victorian government through the Department of Infrastructure and The Sustainable Energy Agency of Victoria is presently establishing several of these programmes in the metropolitan area.

The Sustainable Energy Agency has already commenced work on implementing green travel plans at selected employment locations. The City of Darebin just north of the Study Area is a partner in the program. The City of Melbourne has commenced work with at least three major employers in establishing green travel plans. There have been more substantial developments elsewhere (internationally).

There are several well-developed forms of travel behaviour modification programs. One form is 'Living Neighbourhoods' with its component tool of 'Travel Blending'. This is based on a community development type model developed by Steer Davies Gleave. A second form called 'Individualised marketing' has been developed by Socialdata and has been marketed under the name TravelSmart in Perth. This program is based on telephone surveys of households and for some, subsequent home visits, and has also included a schools component.

Potential Outcomes
Results of the studies of TravelSmart in Perth are publicly available. The following consequences for Perth are reported:

- a reduction in the car share of all travel of about 6 percentage points from 60% to 54% (equivalent to a 10% reduction in car trips);
- an increase in the public transport share of 1 percentage point from 6% to 7% (on buses a 25% increase in passengers was observed);
- more walking and cycling, their share of travel increasing from 14% to 18%.

Smaller changes have been reported elsewhere. A 500 resident sample of Frome (UK) residents recorded a 6% reduction in car use and a 10% increase in public transport trips (Local Transport Today, April 2002). Trials in Denver (USA) achieved no change in solo driving or vehicle kilometres (BTRE Report 105, 2002).

Extracts below from the conclusions of a review of the effectiveness of personalised journey planning techniques by the UK Department of Transport summarise the position.

> *The potential for these techniques ….. is very large in the UK. …. The extent to which personalised journey planning techniques have been implemented is not great enough to allow a full evaluation of effectiveness….. It is clear that the techniques will generally only work 'on their own' where there is a large gap in perception between what exists and what people believe exists……. Policy makers should not yet expect that the impacts of these initiatives will be predictable. … If they are used as part of a wider strategy to change travel behaviour then it is very likely that the full benefit of the strategy will be felt.*

These ideas are presently being piloted in Victoria, and we are of the view that they will be important aspects of future strategy if their effectiveness in Melbourne is demonstrated. Those aspects which are concerned with personalised marketing of public transport services will clearly have particular relevance as public transport services are improved. As yet, however, there is no evidence on which we can base an estimate of the long term impacts of these techniques in the specific context of Melbourne.

6.5 The Assessment Table

Â **Table 6-3 Scenario D – Scenario C + measures to reduce car use**

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	
	Concentration of air pollutants at relevant sites according to adopted standards	
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	CBD Parking: small reduction Road Pricing: potentially large reduction Behavioural: potential reduction
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	
	Effect on other public areas, streetscapes	
	Effect on heritage protection/interpretation	
	Effect on urban settings	
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	These policies do not specifically focus on local streets
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	CBD Parking and Pricing: these measures reduce travel choices; accessibility is improved for continuing car users. Behavioural: neutral
	Sense of place/neighbourhood	
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	CBD Parking: small reduction Pricing: potentially large reduction Behavioural: potential reduction
	Car driver/passenger mode share by time period	CBD Parking: small reduction Pricing: potentially large reduction Behavioural: small reduction
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	CBD Parking: small increase Pricing: potentially large increase Behavioural: potential increase
	Public transport mode share by time period and mode (rail, tram, bus)	
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	CBD Parking: potential increase Pricing: potential increase Behavioural: potentially significant increase
	Cycling/walking mode share by time period	
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	
Protecting and enhancing biodiversity	Effect on natural habitats	
	Effect on exotic habitats	
	Effect on water quality	
	Effect on ground contamination	

Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	Study area parking: risk of negative impacts in options 2 and 3 CBD Parking: neutral Pricing: potentially severely negative impact of higher prices Behavioural: neutral
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	Study area parking: improved access to residential spaces CBD Parking: beneficial effects of reduced peak congestion Pricing: reduced congestion offset to a degree by higher prices Behavioural: potential improvement due to fewer other vehicle trips
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	CBD Parking: negative: overall cost of travel is increased Pricing: negative: overall cost of travel is substantially increased Behavioural: neutral
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

7. Strategy E: Land Use

This strategy is discussed in a separate paper by Maunsell Australia.

8. Strategy F: Doncaster Area Rapid Transit

8.1 Introduction

This strategy provides a new light or heavy rail service on the Eastern Freeway termed the Doncaster Area Rapid Transit (DART). A detailed analysis of its impacts is reported in the Booz Allen Hamilton report 'Appraisal of Transit Strategy Results', which we summarise below.

8.2 Light Rail (Strategy F1)

8.2.1 The Model Test

The high performance light rail service has been assumed to have the following broad characteristics (more detail of the extensive changes is to be found in the accompanying BAH report):

- a high frequency route (every 4 to 5 minutes) from Doncaster Shoppingtown along Doncaster Road and the Eastern Freeway, then through the study area to Melbourne University and the CBD and St Kilda, with a limited number of stops at strategic locations;
- there would be a dedicated alignment along much of the route, including the Eastern Freeway, Alexandra Parade, Nicholson Street and Elgin Street to Melbourne University;
- high quality stations with park-&-ride provision would be provided at the most significant stops en route.
- some bus routes would be re-designed as feeders to the rapid transit service.

8.2.2 The Impacts

The DART is forecast to carry 69,000 passengers (boardings) each weekday in 2021. This is above average for trams in Melbourne but well below the best performing tram routes.

Figure 8-1 shows the profile of forecast weekday boardings and alightings on the service in the city bound direction. The maximum weekday flow of 32,000 passengers (two-way) on the DART would occur as the route enters the Study Area (at Hoddle Street). South of the CBD daily light rail flows are forecast to reduce to around 10,000 passengers per day (two-way), suggesting that the service could be stopped at Flinders Street instead of extending to St Kilda.

Â **Figure 8-1 DART Light Rail Load Profile – City Bound Services Per Day**

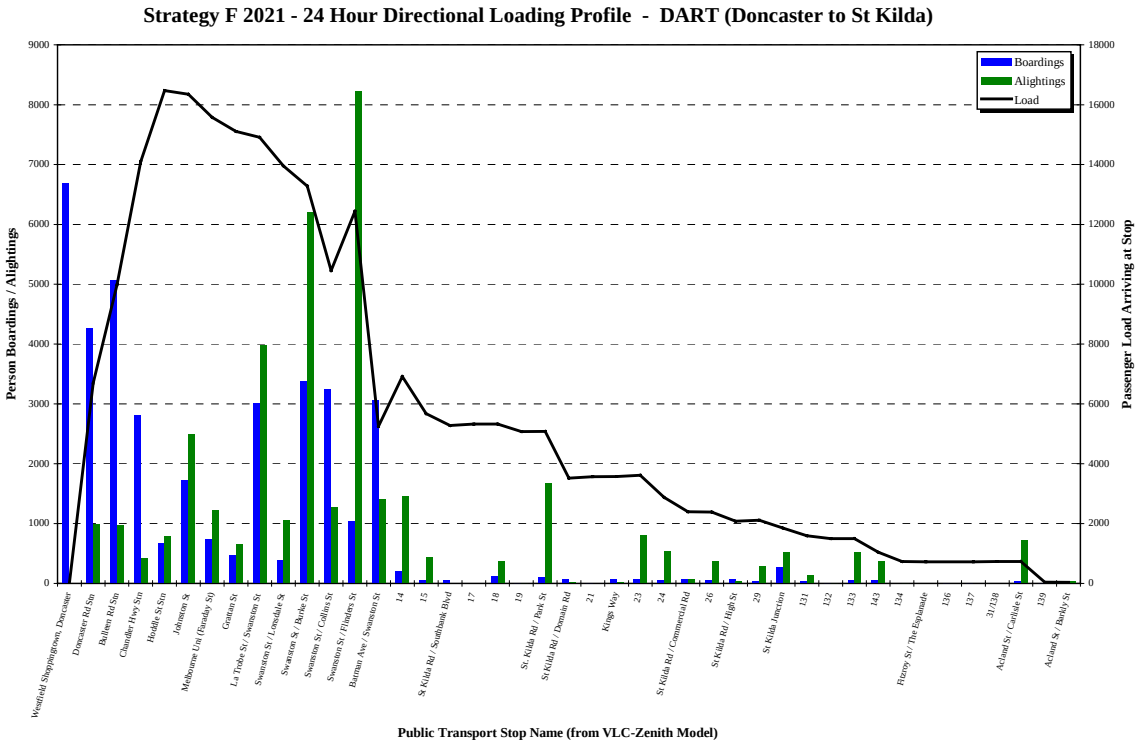


Chart provided by Booz Allen Hamilton

As might be expected, there would be large reductions in bus passengers, by more than 50% on the Eastern Freeway routes. These services are operated as feeder buses to DART. Reduced loadings on these buses may suggest service levels on these routes are somewhat generous. In addition feeder routes will need to make a significant number of vehicle turnaround movements at tram stations such as Doncaster Hill. This will require road design and infrastructure provision to enable efficient movement of feeder buses without generating localised congestion.

These results suggest that about 80-90% of DART patronage in the Eastern Freeway corridor would be derived from existing (improved) public transport services (mainly bus); the remainder being trips diverted from car.

In 2021, 4,600 trips a day are forecast to be attracted to public transport, mainly from car. Of these, 1,900 are in the inner north study area. These relatively small effects are mainly because the rapid transit link (and the associated bus service changes) is compared with the already substantially-enhanced Eastern Freeway bus services in Strategy A. Improved public transport in the Doncaster corridor results in a significant increase in public transport mode share compared with the 'Do-nothing' or 'business as usual' scenario.

8.3 Heavy Rail (Strategy F2)

8.3.1 The Model Test

The new rapid transit service using heavy rail has been assumed to have the following broad characteristics:

- a high frequency (of at least every 4-5 minutes) from Doncaster Shopping Town to Parliament/Flinders Street station;
- express services (at 110kph) which would stop only at new stations along the Eastern Freeway (Bulleen Rd and Chandler Highway) and Victoria Park; other services would stop at all stations after Victoria Park on the Epping/Hurstbridge Line; two thirds of the services would be express;
- the main stations would be of high quality with park-&-ride and re-designed bus feeder services.

8.3.2 The Impacts

Excepting that unlike the LRT option F1 the heavy rail option does not run through the CBD to St Kilda, the impacts of the scheme are very similar. The most important difference is that the maximum 2-way flow of 35,000 for the heavy rail option is 10% greater than that for light rail. This is reflected in a higher diversion from car (7,200 trips per day) and slightly greater reduction in Eastern Freeway bus patronage.

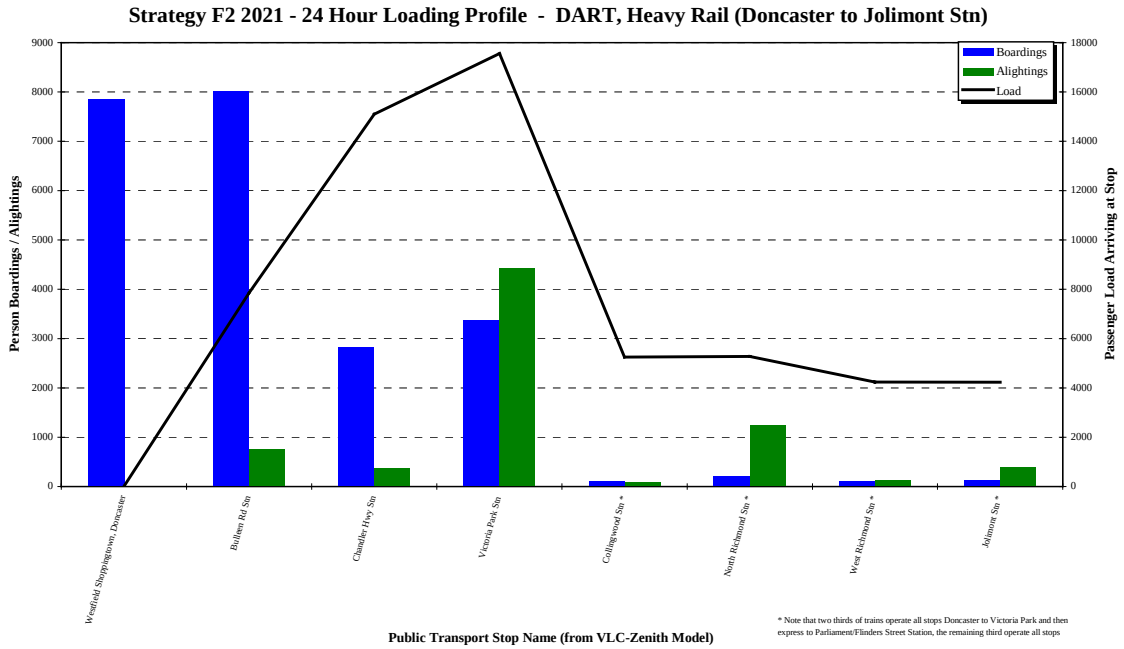
Figure 8.2 shows the distribution of city bound weekday loadings on the DART heavy rail service which can be compared to Figure 8-1 for the DART light rail service.

The highest inbound daily load is just under 18,000 passengers which compares to just over 16,000 for the DART LRT (Figure 8-1). It is interesting that there is a high volume of inbound alightings at Victoria Park Station with DART heavy rail. This is indicative of a major difference between the LRT service respect to the NCCC corridor. The LRT provides much better access to and from NCCC whilst the railway is better suited to potential NCCC through travel markets.

DART heavy rail has a larger impact in reducing bus loadings than the LRT service. Hence, as with LRT, the viability of the service levels proposed on the feeder bus network may be questionable. In addition the large number of feeder bus vehicle movements are more concentrated to fewer stations for the heavy rail service compared to LRT. This suggests more challenges in designing infrastructure for effective feeder bus movements and passenger interchanging to DART heavy rail than LRT.

Â Figure 8-2 DART Heavy Rail Load Profile – City Bound Services per Day

Chart provided by Booz Allen Hamilton



8.4 The Assessment Tables

Â Table 8-1 Scenario F1 = Scenario D + Eastern Freeway Light Rail

Our assessments are shown in *italics.*

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Reduces private road travel and associated noise effects. This will be slightly balanced by increased tram vehicle movements through NCCC*
	Concentration of air pollutants at relevant sites according to adopted standards	*Due to the reduced private vehicle movements this has a positive impact on pollutants*
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*Should have a positive impact due to reduction in more accident generating travel modes*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	*Increased patronage and service levels in evening/weekends should have a strong positive impact*
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	
	Effect on other public areas, streetscapes	
	Effect on heritage protection/interpretation	
	Effect on urban settings	
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*Most increased transit use is from reduced NCCC through traffic*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Increases the number of travel options available to all members of the community but particularly assists disadvantaged groups. Main impacts are on Eastern Freeway corridor catchments.*
	Sense of place/neighbourhood	
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	

Goal	Indicator	Possible outcome
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Positive impacts*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Positive impacts*
	Car driver/passenger mode share by time period	*Positive impacts*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Positive impacts*
	Public transport mode share by time period and mode (rail, tram, bus)	*Positive impacts*
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Walk/cycle trips increase marginally as a part of this strategy. Mostly within and through NCCC.*
	Cycling/walking mode share by time period	*Walk/cycle trips increase marginally as a part of this strategy. Mostly within and through NCCC.*
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	*Neutral*
Protecting and enhancing biodiversity	Effect on natural habitats	
	Effect on exotic habitats	
	Effect on water quality	
	Effect on ground contamination	
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Positive Impacts*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Reduced private road travel should reduce traffic congestion making commercial vehicle movements marginally easier*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*Reduced private road travel should reduce traffic congestion making vehicle movements marginally easier*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

Â Table 8-2 Scenario F2 = Scenario D + Eastern Freeway Heavy Rail

Our assessments are shown in *italics*.

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Reduces private road travel and associated noise effects.*
	Concentration of air pollutants at relevant sites according to adopted standards	*Due to the reduced private vehicle movements this has a positive impact on pollutants*
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*Should have a positive impact due to reduction in more accident generating travel modes*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	*Increased patronage and service levels in evening/weekends should have a strong positive impact*
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	
	Effect on other public areas, streetscapes	
	Effect on heritage protection/interpretation	
	Effect on urban settings	
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*Most increased transit use is from reduced NCCC through traffic*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Increases the number of travel options available to all members of the community but particularly assists disadvantaged groups. Main impacts are on Eastern Freeway corridor catchments.*
	Sense of place/neighbourhood	
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Positive impacts*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Positive impacts*
	Car driver/passenger mode share by time period	*Positive impacts*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Positive impacts*
	Public transport mode share by time period and mode (rail, tram, bus)	*Positive impacts*
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Walk/cycle trips increase marginally as a part of this strategy. Mostly to/from and through NCCC.*
	Cycling/walking mode share by time period	*Walk/cycle trips increase marginally as a part of this strategy. Mostly to/from and through NCCC.*
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	*Neutral*
Protecting and enhancing biodiversity	Effect on natural habitats	
	Effect on exotic habitats	
	Effect on water quality	
	Effect on ground contamination	

Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Positive Impacts*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Reduced private road travel should reduce traffic congestion making commercial vehicle movements marginally easier*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*Reduced private road travel should reduce traffic congestion making vehicle movements marginally easier*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

9. Strategy G: Arterial Road Network

9.1 Introduction

Our aim was to identify road projects which appear to be feasible and practicable and have the potential to provide and enhance benefits to both transport users and the community within the study area. We have not sought a maximum road-building strategy but one that would ameliorate severe and economically inefficient road congestion identified in the Existing Conditions Report and relieve central and inner area routes of unsuitable traffic that does not need to be there.

9.2 The Arterial Road Network

The major road concepts investigated as part of the study have focused on the arterial road network as defined by the VicRoads declared road system. This declared road system, as previously detailed in the NCCCS Engineering Existing Conditions Report, includes the following key roads in the Study area:

- Hoddle Street
- Nicholson Street
- Royal Parade
- Flemington Road
- Various roads in North Melbourne
- Victoria Parade/ Victoria Street
- Alexandra Parade/Princes Street/College Crescent/Macarthur Road/Elliott Avenue
- Brunswick Street/ St Georges Road
- Queens Parade/ Heidelberg Road
- Brunswick Road (Nicholson Street to the Tullamarine Freeway)
- City Link
- Eastern Freeway

The primary purpose of these roads is to provide for the major north-south, east-west and CBD access movements. The remainder of the road system provides the collector network for these major arterial roads and caters for local access and the myriad of other movements on the total road system.

The 'Existing Conditions Report (Transport) – August 2001' report identified a number of road-related issues and problems in the Study area following discussions with the NCCCS Community Reference Group and VicRoads, and from previous studies in the area. It reported on the high levels of traffic congestion experienced along the Alexandra Parade route, resulting from the interaction of east-west traffic

along this route with the major north-south arterials in the study area, as well as at the intersection of Hoddle Street with both Johnston and Victoria Streets.

As part of the present study an origin/destination survey was carried out of traffic to and from the Eastern Freeway; Sinclair Knight Merz (2002 b). This survey indicated that:

- 12% of the existing westbound Eastern Freeway traffic at Hoddle Street is through traffic destined for the City Link/Tullamarine Freeway corridor and to the west beyond City Link;
- 39% of the Eastern Freeway traffic at Hoddle Street is destined for the CBD and the immediate environs (Fitzroy and Collingwood) via Alexandra Parade and Hoddle Street;
- 35% of articulated trucks on the Eastern Freeway were destined for City Link/ Tullamarine Freeway corridor or further west.

The Princes Street/ Alexander Parade route also acts as a connecting link between the north-south routes for drivers traversing the area.

In principle, many of these demands could be diverted to other routes to relieve pressure on the local road network.

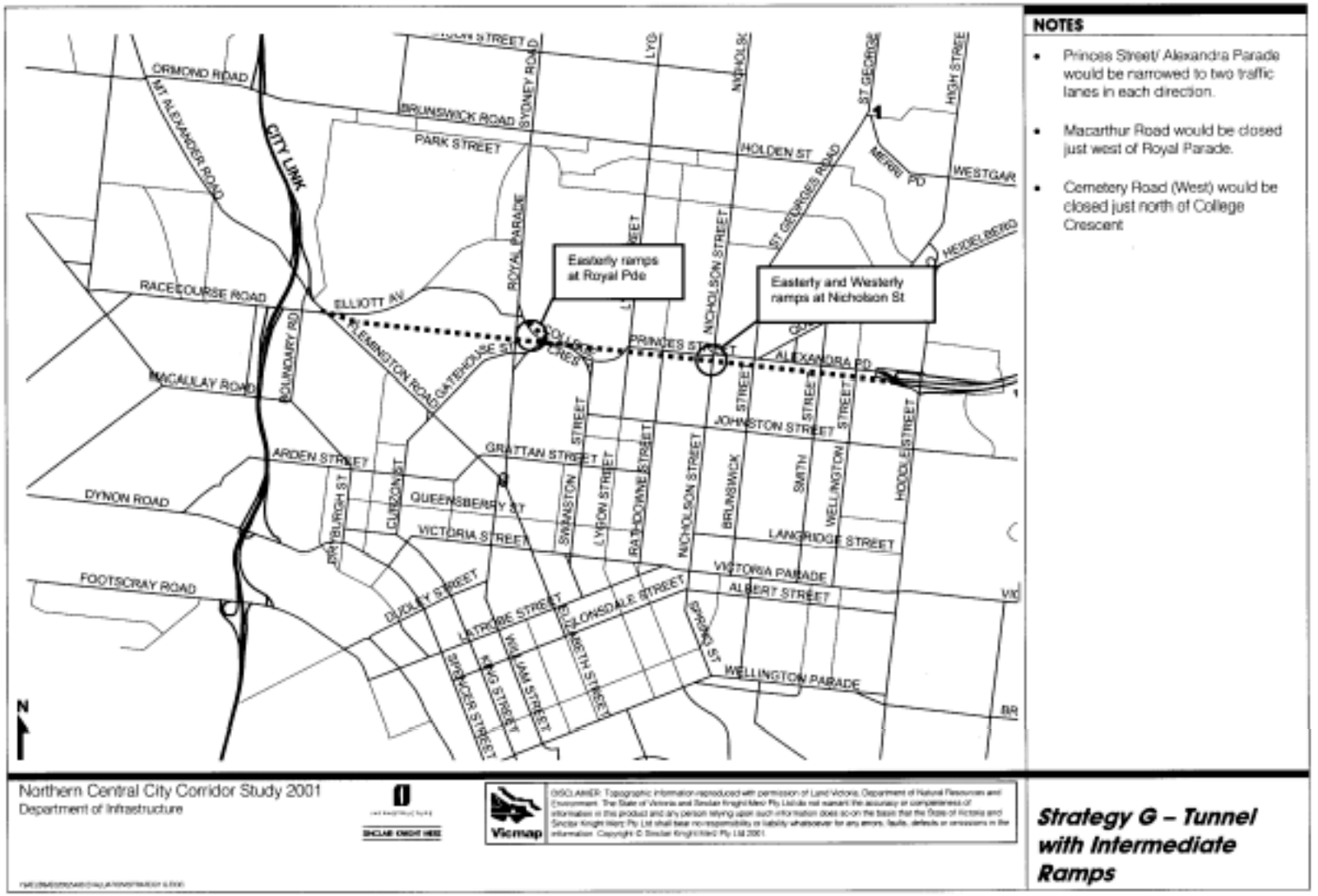
9.3 The Role of Traffic Management Measures

Traffic management measures such as better traffic operation, reversible lanes, local road widening and clearways, could be used to increase the traffic efficiency of the existing arterial road network.

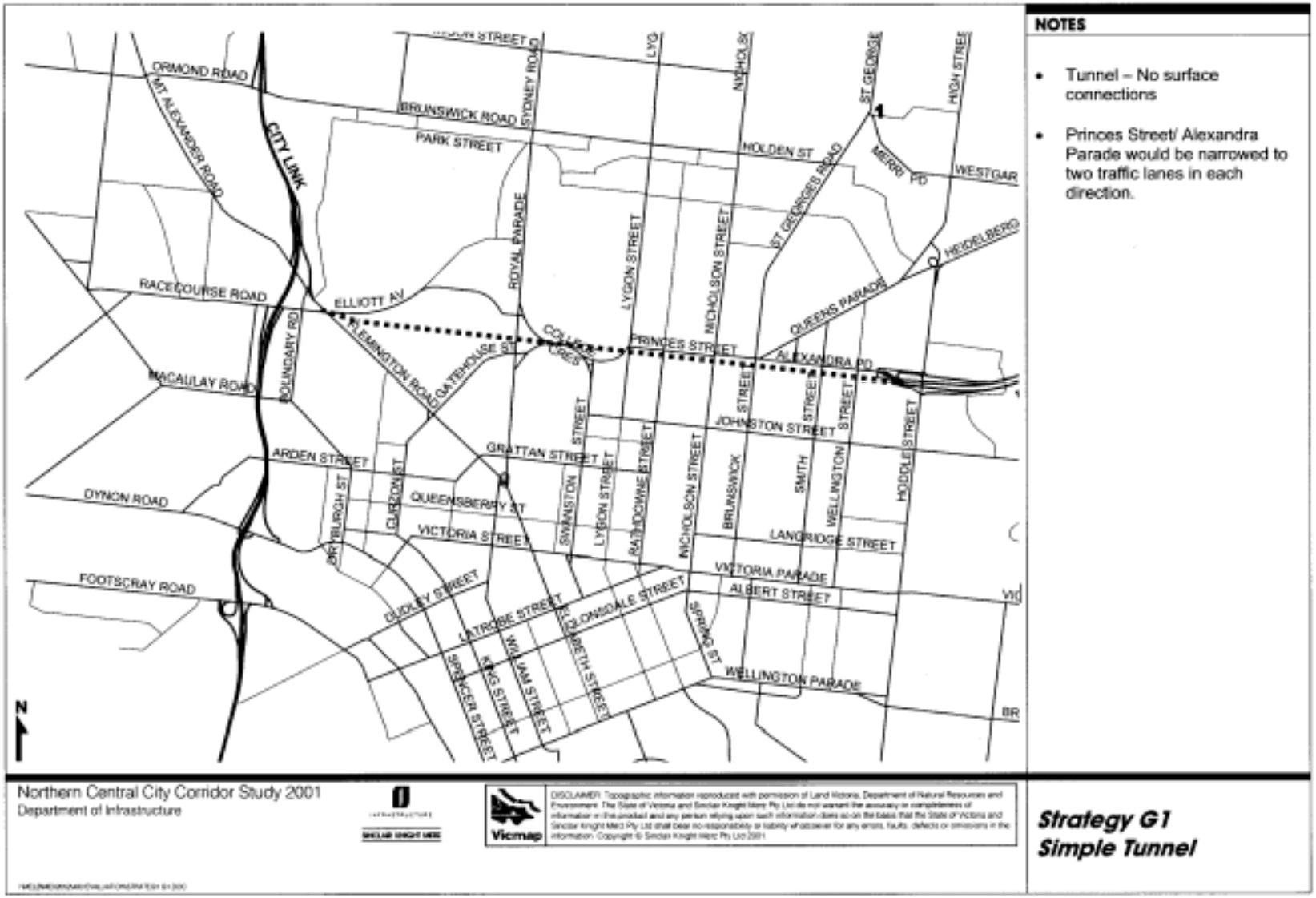
The roads that have the most severe traffic congestion problems are Hoddle Street, Alexandra Parade, Johnson Street and Victoria Parade. Over the past thirty years the Study area has been subject to intense effort by traffic managers who have attempted to increase the traffic carrying capacity of the arterial road network. Most of the types of traffic management measures usually used to improve traffic carrying efficiency have already been implemented. There is some potential for extending the time when parking bans apply and fine tuning the operation of existing traffic signals, and some of these possible schemes are included in other strategies, such as public transport priority. One such measure is the relocation of tram stops from the approach side of major intersections to the departure side. This would leave the approach side with a greater opportunity to carry right turn and through movements in the space which would have been previously occupied by a tram safety zone. This would assist right turning vehicles and attract ‘rat running’ drivers back to arterial roads who are detered by difficulties turning right at major intersections. However, there is little prospect that such measures would have a major effect.

Thus, although there will be locations where better traffic management techniques could still improve traffic carrying efficiency, we consider these are not sufficient to make a substantial overall impact on the Study Area. This conclusion should not be taken to imply that there is no merit in the final strategy of including a recommendation for a major traffic management review of the area to make the best use of the existing capacity. Indeed, this is likely to be essential if the eventual strategy involves the calming of local streets and the diversion of some road capacity to other uses, such as public transport or bike lanes.

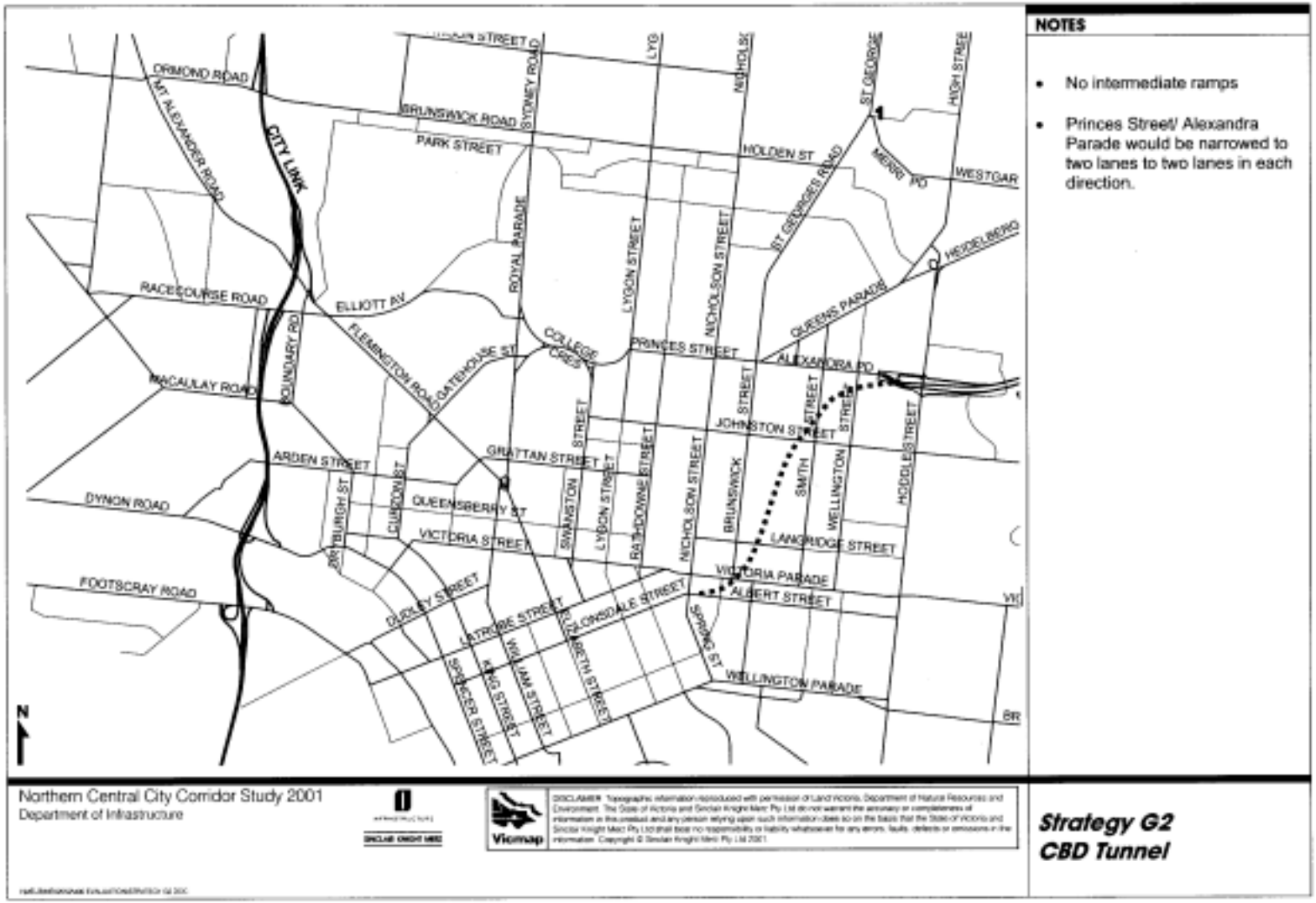
Â **Figure 9-1 Strategy G – Tunnel with Intermediate Ramps**



Â **Figure 9-2 Strategy G1 – Simple Tunnel**



Â **Figure 9-3 Strategy G2 : CBD Tunnel**



9.4 Selection of the Major Build Concepts

We approached the transport agencies when considering which road projects should be included in this strategy. They indicated that there were few major road projects which had been developed for the Study Area. The most comprehensive work available was carried out within the Department of Infrastructure some years ago. That work was commissioned by the (then) Minister for Roads and Ports in August 1999 and is documented in a draft report entitled "Northern City Corridor Study".

The major road building projects tested in this strategy were those which we considered most effective in meeting the objectives of the Study Area from the previous study, based on our review of existing conditions. This selection process is documented in Draft – Major Road Strategies Specification Paper by Sinclair Knight Merz (2002). We concluded that three different tunnel options should be tested. They are designated G, G1 and G2:

- Strategy G: a link between the Eastern Freeway and City Link (Figure 9-1) having intersections with surface streets close to Royal Parade and Nicholson Street;
- Strategy G1: a link between the Eastern Freeway and City Link (Figure 9-2) without intermediate surface connections;
- Strategy G2: a tunnel between the Eastern Freeway and the eastern side of the CBD at Albert Road (Figure 9-3).

The concepts are intended to contribute significantly to reducing the through traffic role of the Alexandra Parade/Princes Street/Elliott Avenue route and/or to provide an improved CBD access route to/from the Eastern Freeway. All tunnels would have two traffic lanes in each direction. They were designed to illustrate the potential effects of a major road building project within the study area.

Major capacity improvements to other arterials such as Brunswick Road, Victoria Parade, Royal Parade and in the area south-west of Flemington Road (North Melbourne) were considered in the aforementioned paper but were rejected because of their anticipated limited effectiveness in meeting the study goals.

Several years ago VicRoads commissioned John Piper and Associates to investigate the feasibility of providing grade separation at critical intersections along Hoddle Street. VicRoads officers reviewed their report during the present study. The result of both the investigation and review was that the inherent physical constraints mean that there are no designs which are feasible – at least in the short to medium term.

9.5 Details of the Tested Schemes

Strategy G: East-West Tunnel with Intermediate Surface Connections

This would provide a new dual two lane mainly tunnelled link from the Eastern Freeway east of Hoddle Street to near Flemington Road. There would be a separate tunnel for each direction.

Eastern Portals

At the eastern end the tunnel would commence in the vicinity of the rail bridge, the portal being west of the existing westbound traffic split to Hoddle Street and Alexandra Parade.

Nicholson Street/ Brunswick Street Interchange

A full diamond interchange would be provided with the surface street network near Nicholson Street. The location of each of the portals to and from single lane ramps would be as follows:

- the westbound exit to Alexandra Parade would reach the surface 170 metres east of Brunswick Street;
- the westbound entry from Alexandra Parade would be between Brunswick Street and Nicholson Street, 140 metres west of Brunswick Street;
- the eastbound exit to Alexandra Parade would be in Princes Street 130 metres west of Nicholson Street;
- the eastbound entry from Alexandra Parade would be between Brunswick Street and Nicholson Street, 180 metres west of Brunswick Street.
- all portals could be located within the existing right-of-way of Alexandra Parade and Princes Street.

All ramp lengths were assumed to be about 500 metres to enable a relatively easy grade to and from the tunnels.

Royal Parade Interchange

A half diamond interchange would be provided to the surface street network near Royal Parade. Both entry and exit ramps would be easterly orientated and reach the surface approximately 150 metres east of Royal Parade, utilising the existing road space of Cemetery Road West and intersecting with Royal Parade at the existing intersection. Cemetery Road West, east of the tunnel portals would be closed, hence Cemetery Road West would not link up with College Crescent.

The existing Macarthur Road connection to Royal Parade opposite the above intersection would be closed on the western side of Royal Parade. Local access to Macarthur Road (and the Zoo) from Royal Parade would be provided by The Avenue South.

Other works in this area would include:

- 'left in' and 'left out' only from Gatehouse Street (and The Avenue South);
- closure of the outer separator breaks on the western side of Royal Parade (between Gatehouse St and Macarthur Rd) to prevent traffic from Gatehouse Street (and The Avenue South) directly accessing the tunnel entry ramp.

Flemington Road Interchange

The westbound exit portal would be located in Racecourse Road west of Flemington Road just before Boundary Road. The eastbound entry portal would be immediately east of Flemington Road in Elliott Avenue. Elliott Avenue/Macarthur Road, east of

the portal would be reduced to one lane in each direction. This would provide access to the Zoo and other park facilities.

Strategy G1: East-West Tunnel without Surface Connections

This is the same as Strategy G apart from the exclusion of the two intermediate interchanges at Nicholson Street/Brunswick Street and Royal Parade.

Strategy G2: CBD Tunnel

The tunnel to the CBD would entail the following changes.

- separate tunnels for each direction;
- an eastern portal at the Eastern Freeway very similar to that described in Strategy G, although it is likely that the city bound entry to the tunnel would be south of the lanes leading to Alexandra Parade;
- portals in Albert Street just west of Gisborne Street; Albert Street traffic west of Gisborne Street could enter/exit the tunnels, but the link to Albert Street east of Gisborne Street would be closed. This location was selected to test the concept but other locations should be examined if this concept were to be considered further.

9.6 A General Comparative Analysis of the Impacts of the Tunnel Options

We compare the effects of the three options in terms of broad performance measures in this section, and then discuss their individual impacts in more detail in Section 9.7.

9.6.1 Overall Impacts on Travel by Mode

Overall strategic travel demands generated in study area are little affected by the three options (Table 9-1) ie: trips which start or end within the study area. The reason that these road improvements are not forecast to lead to strategic shifts in travel patterns (more car use, less public transport patronage) seems likely to be because the time saving for individual journeys are relatively small, of the order of a few minutes.

Table 9-1 Daily Trips by Transport Mode in 2021 Generated by the Study Area (000's)

Note: Changes are relative to Strategy F.

Trips by Mode	Strategy F	Strategy G	Strategy G1	Strategy G2
Car	572	573	573	573
Public Transport	414	413	414	413
Other (walk, cycle)	232	232	232	232

9.6.2 Diversion of Traffic from Streets in the Study Area

An overall perspective on the impacts of the tunnels on east-west traffic through the Study Area is gained by the analysis in Table 9-2, which shows the traffic crossing a

north-south screenline near Nicholson Street. The increase in total screenline flows over Strategy F indicates that the provision of additional road capacity has attracted additional traffic to the Study Area from east west routes to the north and to the south of the study area. This effect is least for the CBD tunnel option. Each tunnel would carry around 75,000 vehicles/day which is substantially more traffic than the increase in total east west traffic. There would therefore be a decrease in the east west traffic levels on the parallel surface roads.

Â **Table 9-2 Total East-West Traffic Across a Screenline just East of Nicholson Street**

	2001	2021				
		Base	Strategy F	Strategy G	Strategy G1	Strategy G2
Tunnel Traffic	-	-	-	94,720	78,480	70,860
Surface Traffic	216,460	267,880	215,280	162,560	168,340	161,080
Total Traffic Flow	216,460	267,880	215,280	257,280	246,820	231,940
Changes in Surface Traffic Over 2021, Strategy F	N/A	N/A	N/A	-52,720 (-24%)	-46,940 (-21%)	-54,200 (-25%)

Footnote: The screenline is between Holden Street and Albert Street.

A more detailed analysis of the effects of reach of the tunnel options on traffic volumes is given in Table 9-3 for a selection of about 25 roads in the study area (and Appendix E provides this information for about 100 locations). The following main points emerge from the table.

Compared with Strategy F:

- traffic levels would increase on Racecourse and Boundary Roads with east-west tunnel options, on Albert Street with the CBD tunnel, and on the Eastern Freeway in all options;
- roads that would experience traffic relief include in all options: Cemetery Rd West, Alexandra Parade, Hoddle Street;
- Victoria Parade and Albert Street would experience traffic relief only with the two east-west tunnel options:
- the effects on Nicholson Street North differ between the options: lower traffic levels are experienced north of Alexandra Parade in the east-west tunnel options, and south of Alexandra Parade with the CBD tunnel;
- Royal Parade and Racecourse Road benefit from less traffic with the CBD tunnel option;
- Scotchmer, Reid, Langridge and Gatehouse Streets were traffic calmed in the local streets strategy and carry very low traffic levels;
- Holden, Johnston and Brunswick Streets experience at most only marginal increases in flows in some of the options.

Thus, as would be expected, the provision of a road tunnel connecting two freeway standard routes enables traffic to pass under the study area and would generally reduce traffic levels on the existing routes. Some routes well outside the study would also be relieved significantly. These include routes to the south of the CBD and routes as far north as Bell Street. This indicates that this project should also be evaluated in a metropolitan context rather than solely a local NCCC context.

The tunnels would have a marked effect on reducing the traffic flows on Alexandra Parade. Even the tunnel to the CBD (G2) has a marked effect as far west as Lygon Street. For example 2021 traffic in Princes Street would be around 28,000 veh/day (Option 6), 40,000 veh/day (Option G1) and 41,000 veh/day (Option G2). This compares with about 66,000 veh/day with Strategy F and an existing level of about 65,000 veh/day. See Table 9-3. The tunnel options would be significantly more effective in achieving a reduction in Alexandra Parade traffic levels than the preceding Strategies A to F.

9.6.3 Traffic Levels on the Schemes

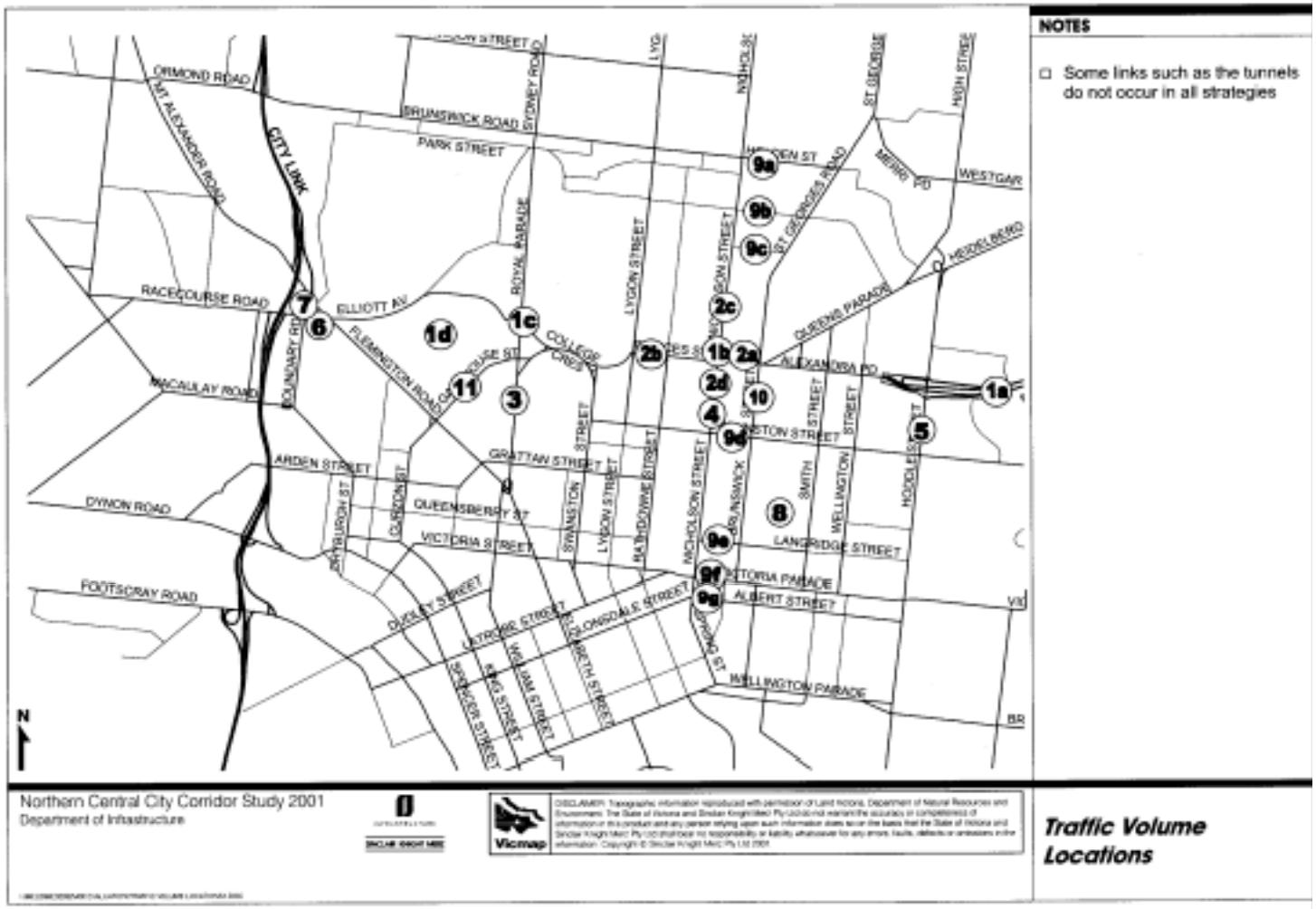
The daily traffic volumes in the tunnel were estimated to be similar. Each tunnel would carry a little over half the daily traffic presently carried by the Eastern Freeway just east of Hoddle Street. These volumes are similar to those presently carried by the Burnley tunnel:

- G - 80,860 veh/day (under Royal Park),
  - 94,720 veh/day (east of Hoddle Street)
- G1 - 78,480 veh/day (whole length)
- G2 - 70,860 veh/day (whole length)

9.6.4 Traffic Speeds

Traffic speeds and journey times consequently improve on most roads throughout the study area due to the reduced traffic flows. See Appendix A for the speeds on specific road links for Strategies G, G1 and G2.

Â **Figure 9-4 Traffic Volume Locations**



Â Table 9-3 Estimated Traffic Flows

Note:

- Each figure represents weekday 2 way flow as estimated by Zenith
- See Figure 9-4 for the location of the points.

	Year	2001	2021								
Code	Location		Base Model	Strategy A 'Public Transport'	Strategy B 'Local Streets'	Strategy C 'Walking & Cycling'	Strategy D 'Pricing and Behavioural'	Strategy E 'Land Use'	Strategy F 'Dart'	Strategy G 'Tunnels' G: Tunnel with Ramps	G1: Simple Tunnel	G2: Tunnel to CBD
1a	**Eastern Fwy** East of Haddle St	135,680	161,580	151,860	144,340	Not Modelled in Zenith	142,620	Not Modelled in Zenith	135,820	156,740	161,200	152,420
1b	**Eastbound Exit Ramp** (Nicholson Interchange)	N/A	N/A	N/A	N/A		N/A		N/A	11,720	N/A	N/A
1b	**Eastbound Entry Ramp** (Nicholson Interchange)	N/A	N/A	N/A	N/A		N/A		N/A	8,800	N/A	N/A
1b	**Westbound Exit Ramp** (Nicholson Interchange)	N/A	N/A	N/A	N/A		N/A		N/A	6,120	N/A	N/A
1b	**Westbound Entry Ramp** (Nicholson Interchange)	N/A	N/A	N/A	N/A		N/A		N/A	10,380	N/A	N/A
1c	**Cemetery Rd West** East of Royal Pde (Tunnel Ramps)	31,000	33,960	32,580	35,460		35,280		34,940	20,960	19,280	27,780
1d	**Tunnel** Under Royal Park	N/A	N/A	N/A	N/A		N/A		N/A	80,860	78,480	N/A
2a	**Alexandra Pde/Princes St** East of Nicholson St	91,000	101,160	96,620	111,420		109,880		92,680	52,560	55,100	56,980
2b	**Alexandra Pde/Princes St** West of Nicholson St	64,780	63,720	63,020	66,420		65,760		61,580	28,640	40,460	41,180
2c	**Nicholson Street** North of Alexandra Pde	31,560	36,020	34,440	37,180		36,900		36,340	33,880	33,440	36,720
2d	**Nicholson Street** South of Alexandra Pde	32,860	38,620	34,640	39,800		38,880		37,000	37,640	35,720	31,720
3	**Royal Pde** South of Gatehouse St	34,760	41,400	36,220	45,520		44,560		44,360	45,180	43,620	41,520
4	**Nicholson St** South of Alexandra Pde	32,400	38,160	34,940	39,020		38,300		38,500	37,640	35,160	31,380
5	**Haddle St** South of Eastern Fwy	93,160	101,720	91,940	100,800		99,700		103,480	94,540	95,820	88,000
6	**Racecourse Rd** East of Boundary Rd	28,080	38,580	36,160	36,760		35,660		36,060	65,020	69,840	28,120
7	**Boundary Rd** btw Racecourse Rd & Flemington Rd	20,420	26,960	24,900	22,160		21,940		21,420	30,360	31,960	21,140
8	**CBD Tunnel Link** btw Eastern Fwy & CBD (Albert Rd)	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	70,860
9a	**Holden St** East of Nicholson St	13,180	16,960	15,440	17,120		16,780		17,780	17,020	18,680	18,460
9b	**Scotchmer St** East of Nicholson St	7,740	13,200	11,880	20		20		20	0	0	0
9c	**Reid St** East of Nicholson St	6,380	13,200	11,520	140		140		140	100	100	60
9d	**Johnston St** East of Nicholson St	23,520	27,420	18,340	20,220		19,960		20,480	20,100	20,240	21,400
9e	**Langridge St** East of Nicholson St	2,380	8,060	4,600	520		480		600	740	680	780
9f	**Victoria Pde** East of Nicholson St	52,300	62,040	58,220	57,820		55,340		59,140	51,280	53,260	53,380
9g	**Albert St** East of Nicholson St	17,960	25,820	23,220	24,180		22,820		24,440	20,060	20,260	70,880
10	**Brunswick St** North of Johnston St	16,260	20,060	17,000	21,440		20,900		20,060	21,840	20,900	20,580
11	**Gatehouse St**	12,420	14,720	13,960	220		180		160	40	60	140

9.7 Traffic Operation of Each Tunnel Option

The detailed impacts and operational aspects of each tunnel option are outlined below. In each case the changes described are due to the introduction of tunnel(s) on top of Strategies A to F which were assumed to be already implemented.

9.7.1 Strategy G : Tunnel with Intermediate Ramps

Traffic impacts

A series of spreadsheets are attached as Appendix A and describe the changes in traffic volumes at key locations within the study area, which we summarise here.

The new connection focuses traffic along the new corridor between the Eastern Freeway and City Link and the impact of this would be:

- traffic on the Eastern Freeway at the approach to Hoddle Street would increase by 23,000 vehicles per day (vpd) to 169,000 vpd;[4]
- City Link traffic north of Flemington Road would increase by up to 6,000 vpd to 135,000 vpd.

This traffic would mainly be diverted from other routes and there would consequently be very significant traffic relief to the following routes:

- Princes Street/Alexander Parade traffic levels would halve from the base case of up to 100,000 vpd to 25-50,000 vpd depending on the location;
- only local traffic would remain on Cemetery Road, College Street, Macarthur Road and Elliott Avenue;
- Hoddle Street south of the Eastern Freeway would reduce by 8-10,000 vpd;
- traffic in Victoria Parade would fall from 59,140 vpd to 51,080 vpd which is similar to existing levels;
- Brunswick Road traffic would reduce by up to 10,000 vpd;
- Flemington Rd traffic would reduce by 4-7,000 vpd.

Some of the roads that connect with the tunnel are forecast to experience traffic increases, in particular:

- Eastern Freeway and City Link North ;
- Macaulay, Racecourse, Boundary and Mt Alexander Roads;
- Royal Parade south of the tunnel.

The significant reduction in traffic using Alexandra Parade would provide the opportunity to convert existing road space to other uses. Alternative uses could be public transport, cyclist/pedestrian paths or landscape/gardens.

[4] Our preliminary calculations show that this increase could be accommodated by the existing lanes on the Freeway east of Hoddle Street. The existing long westbound queues on the Freeway during the morning peak are due to a lack of capacity on the surface road network at Hoddle Street rather than lack of capacity on the Freeway itself.

Reductions in traffic on Brunswick Road, Cemetery Road, College Crescent and Macarthur Road would improve the amenity of the areas through which these roads pass. Reductions on Hoddle Street and Flemington Road, roads that are heavily congested, mean an increased level of service for motorists would be provided on these routes.

- The provision of ramps to the surface street network from the tunnel at Nicholson Street and Royal Parade suggests intuitively that traffic volumes on these roads would increase over that expected without the tunnel. It is also conceivable that Hoddle Street traffic flows could decrease. The model predicts indicates that Royal Parade would increase by 1,000 vpd, Nicholson Street would increase by 600 vpd and Hoddle Street would decrease by 8,500 vpd.

  The predictions are not entirely expected, with Hoddle Street volumes being forecast to decrease by more than the combined increase in Royal Parade and Nicholson Street. This is not what would be expected if the majority of traffic using Hoddle Street was destined for the CBD. The model predictions suggest that some of this traffic may be crossing the study area diagonally via Hoddle Street and Victoria Parade (or other routes) and this traffic would divert to the tunnel as an alternate route making the north-south component of their trips outside the Study Area. Eg: City Link past West Melbourne.

Traffic Flow in Tunnel

The new road connection would provide for two separate tunnels with two traffic lanes in each. Depending on the design speed adopted, the capacity of the new road connection could range from 1,900 vehicles per hour per lane (design speed 80km/h) to 2,000 vehicles per hour per lane (design speed 100 km/h).

The capacities quoted are from the AustRoads Roadway Capacity Guide and are theoretical values for ideal freeway conditions. The capacities may be less for this tunnel with grades (possibly up to 5%) and narrow shoulders. However this is balanced by the experience that capacities up to 2,300 vehicles per hour per lane (4,600 veh/h for 2 lanes) have been measured on the Monash Freeway.

The predicted volumes in the tunnel are in the range 80,000 – 100,000 vpd, with peak 2-way volumes predicted to be 7,400 vph in the AM and 7,900 vph in the PM. The theoretical capacity of the new road link is about 4,000 vehicles per hour 1-way, or 8,000 vehicles per hour 2-way. The peak volumes would therefore be close to the tunnel capacity and flow conditions would be likely to be unstable if there were to be interruptions to service.

Assuming a 24hr/12hr volume split of 1.35, this suggests 12 hour volumes in the range 60,000 – 75,000 vpd, which in turn suggests an average hourly 2-way volume of 5,000 – 6,200 vpd during the daytime. This equates to a volume/capacity ratio of 0.625 – 0.775, or an average Level of Service (LOS) between “C and D” during daytime hours. Both level of service C and D are in the zone of stable flow, with LOS D being at the upper limit.

Average travel speeds predicted by the model are in the range 50 – 55 km/h.

Weaving Length

The length available for weaving between the eastbound entry ramp from Royal Parade and the eastbound exit ramp to Alexandra Parade (near Nicholson Street) is 250 metres based on a 5% maximum grade on the ramps. The peak entering volume from Royal Parade is approximately 1,100 vph and the peak exiting volume is 1,300 vph. This gives a potential maximum weaving volume of 2,400 vph assuming no drivers travel directly from the Royal Parade on-ramp to the Nicholson Street off-ramp. This is in excess of the suggested maximum weaving capacity of 1,800 vph for a simple (single lane) weave manoeuvre.

Solutions available to address this issue include: steepening the ramp grades to provide a longer weave length between the ramps, providing a third lane over the weave length, or omitting one pair of ramps.

Flow on Ramps

Traffic flows on the various ramps are tabulated below.

Â **Table 9-4 Tunnel G Estimated Traffic Volumes on Ramps**

Ramp Location	24 hour volume	AM Peak volume	PM Peak volume
Royal Pde Ramps (2)*	20,960	2,140	1,830
Nicholson WB Exit	6,120	530	560
Nicholson WB Entry	10,380	910	1,050
Nicholson EB Exit	11,720	1,310	990
Nicholson EB Entry	8,800	740	900

* Note – individual ramp volumes not available at Cemetery Road West Ramps. However based on the estimates for 24 hour (2 way) flows of 10,480 veh/day the one way peak hour flows would be about 1000 veh/hour.

All ramps are proposed as single lane with theoretical capacities of 1,700 vehicles per hour (ignoring the effect of intersections near the ramp terminal). Generally ramp volumes are well below capacity. The ramp with the highest peak volume is the eastbound exit ramp in the AM Peak and enters Alexandra Parade 130 metres west of Nicholson Street. This should provide sufficient distance from the intersection traffic signals to not adversely effect the capacity of the ramp, particularly as the ramp has an exclusive lane and vehicles would not need to merge with Alexandra Parade traffic unless wanting to head south along Nicholson Street.

Ventilation

Vent stacks would most likely be provided at each exit portal, this being the most favoured method of ventilating tunnels. Intermediate stacks near Hoddle Street and Flemington Road would not be required. At the eastern portal, the stack could be located in the freeway reservation and would be a reasonable distance from any residences. At the western portal, several options would need to be evaluated. These would include sites in Royal Park near Flemington Road or beside Racecourse Road. The latter would most likely require some acquisition of private land. Use could be

made of remnants of the small number of properties that may be required on Racecourse Road between Flemington and Boundary Roads.

Intersection Performance

Two critical intersections are near the western portal on Racecourse Road and where the tunnel ramps would surface in Alexandra Parade near Nicholson Street. Some preliminary analysis of the performance of these intersections was undertaken.

Alexandra Parade/Nicholson Street Intersection
SIDRA analysis was undertaken based on the existing intersection lane configuration and also for one lane on Alexandra Parade being dedicated to buses (or other HOV). In summary, congestion at the intersection in 2021 with Strategy G implemented would be worse than currently exists. The calculated intersection degree of saturation increases from 1.0 to 1.5 in the AM peak and from 1.4 to 1.6 in the PM peak. Converting one lane on Alexandra Parade to buses or other HOV increases the degrees of saturation to 1.7 in both the AM and PM peaks.

Racecourse Road/Boundary Road Intersection
Analysis of the signal operation at this intersection indicates severe congestion would be caused by westbound traffic exiting from the tunnel and turning right into Boundary Road to access City Link northbound. This congestion occurs in both the AM and PM peaks. The intersection was modelled for the existing lane configurations at the intersection.

Calculated degrees of saturation of these levels would be sufficient to lead to lengthy queuing in the tunnels and on the approaches to the tunnels. This indicates that a rework of the design of the western terminal of the tunnel and at Nicholson Street would be highly desirable if this project were to proceed. We do not consider that these are 'fatal flaws' in the design but they are significant design challenges to be met at the preliminary design phase if the tunnel were to be considered further.

9.7.2 Strategy G1 – Simple Tunnel without Intermediate Surface Connections

The local impacts of this option would be very similar to Strategy G in the vicinity of Hoddle Street and of Flemington Road. There would however, be no intermediate ramps to the surface.

9.7.3 Strategy G2 – CBD Tunnel

Unlike the east-west tunnels, traffic relief would be concentrated in the Collingwood and Fitzroy areas.

Collingwood/ Fitzroy

The tunnel would relieve both north-south and east-west streets. These changes would be sufficiently large to be noticeable. Eg: in 2021 Hoddle Street traffic would drop from 103,480 veh/day to 86,000 veh/day which is lower than present (2001) levels. Strategy G2 would be more effective in reducing traffic on other north-south routes:Lygon Street just south of Grattan would carry only 16,580 vpd compared with 19,260 vpd (Strategy G);

- Nicholson Street just south of Alexander Parade would carry 31,700 vpd compared with 37,640 vpd (Strategy G);
- Rathdowne Street just south of Victoria Street would carry 40,600 vpd compared with 44,080 vpd (Strategy G); and
- Swanston Street just south of Elgin Street would carry 13,280 vpd compared with 16,080 vpd (Strategy G).

East-West Routes

There would be a southward shift in east-west traffic towards the CBD. This would relieve routes such as Alexandra Parade and Racecourse Road but increase traffic on Victoria Street – particularly west of the Exhibition Gardens. Some of these increases on the east west routes in the western part of the Study Area would be:

- Victoria Parade just east of Nicholson would increase to 63,380 vpd compared with 51,080 (Strategy G);
- Victoria Street just east of Chetwynd Street would increase to 29,460 vpd compared with 25,580 vpd (Strategy G); and
- Flemington Road just south of Elliott Avenue would increase to 63,540 vpd compared with 53,540 vpd (Strategy G).

The CBD Terminal

The most intense changes would be focussed on the north east corner of the CBD. Although a detailed analysis has not been carried out of the operation of this terminal we consider that Zenith was not able to simulate the complexity of the traffic arrangements. The forecast additional traffic would be too high to manage without major changes to the terminal treatment of the tested scheme.

There would be considerable congestion if the traffic flows were concentrated at one location – envisaged by Strategy G2 as being Albert Road. The anticipated traffic flow in the tunnel of about 70,000 veh/day is approximately the same as carried by King Street in the CBD – significantly more than is presently carried by Albert Street – about 16,000 veh/day. Although much of this traffic is likely to be simply diverted from other nearby roads such as Hoddle Street, the issue is the *concentration* of traffic.

Tram services are also concentrated in this corner of the CBD and particular attention would be required to ensure that any congestion would not unduly effect their operations.

- to overcome the difficulties presented by such a concentrated flow of traffic it is likely that major changes would be required to the *network* of roads in the immediate vicinity of the CBD tunnel portal;
- schemes based on the separation of the two tunnel portals and/or a one way street network serving the tunnel portals hold promise that a satisfactory terminal arrangement might be devised. This would be a critical exercise if this scheme were to pursued.

9.8 The Assessment Table

Â **Table 9-5 Scenario G – Scenario F + Arterial Road improvements**

Our assessments are shown in *italics.*
The assessments are generalised across the three versions of this strategy – G, G1 and G2.

Goal	Indicator	Possible outcome
Social: Improve amenity and liveability of the inner north by:		
Significantly reducing the impacts of noise and air pollution from transport	Extent of noise-sensitive land uses (especially residential) exposed to low/medium/high changes in noise exposure.	*Decrease in traffic on many roads leads to general reduced impact.*
	Concentration of air pollutants at relevant sites according to adopted standards	*Could be some localised negative impact at tunnel portals as a result of vent stacks. Need careful design and location of stacks to minimise or avoid local impacts. Positive impact due to less traffic on surface roads.*
Improving safety – reducing fatalities/casualties to or beyond state targets	Casualty accidents broken down by all modes of transport (motorised and non-motorised, people and goods movement)	*Small overall improvement - very slight increase in traffic is more than offset by higher quality (safer) route – about fewer 10 casuality accidents per year.*
	Safety/security risk assessment at key locations related to travel routes and/or interchanges, and sensitive land uses	*The diversion of traffic away from surface routes will reduce its impact on sensitive land uses*
Significantly enhancing urban landscape and heritage values in key areas	Effect on parklands	*Greatly improved environment in Royal Parade due to the removal of through traffic including trucks, but offset by potentially small negative impact on Royal Park in vicinity of western portal.*
	Effect on other public areas, streetscapes	*Potential for streetscape improvement due to need for less road space on surface streets.*
	Effect on heritage protection/interpretation	*Positive where traffic reduced – negative where the tunnels meet the surface.*
	Effect on urban settings	*Positive impact due to less traffic.*
Minimising through traffic on local streets	Car/truck traffic levels on local/collector streets (relate to accepted standards of traffic levels on relevant streets - 'environmental capacity')	*No further effect, this is already achieved by the Strategy B components. However, if the local street strategy were only partly implemented the reduction of congestion on the arterial roads would reduce traffic on local streets.*
Improving access and travel choices for residents, visitors and workers, including disadvantaged groups	Indices of transport accessibility (by mode) to homes, jobs and services by all modes (including walking and cycling)	*Improves accessibility by road. Reduced traffic levels on most streets will have some small beneficial effects on bus and tram users, walkers and cyclists.*
	Sense of place/neighbourhood	*Generally positive where traffic reduced – negative where the tunnels meet the surface.*
Providing facilities for people with mobility disadvantages	Contribution to Disability Discrimination Act (DDA) compliance levels	*No further effect, this is already achieved by other Strategies.*
Environmental: Protect and enhance environmental sustainability in the inner north by:		
Ensuring a contribution to overall reductions in greenhouse gas emissions	Estimated total greenhouse gas emissions (by mode of transport) - both metropolitan-wide and for travel to, from, within and through the inner north	*Small overall improvement, slight increase in overall traffic but more efficient travel.*
Reducing car use for travel through, to/from and within the inner north	Car driver/passenger trips, trip-km and trip-hours by time period	*Overall traffic is very slightly increased, but most perceptible impacts will be a marked reduction in traffic on surface streets.*
	Car driver/passenger mode share by time period	*Neutral, no perceptible effects.*
Substantially increasing public transport mode share	Public transport trips, trip-km and trip-hours by time period and mode	*Neutral. Model forecast is for a very slight reduction, but this does not allow for the effects of any improvements in bus/tram running times and greater reliability due to reduced congestion – particularly on the north-south tram routes.*
	Public transport mode share by time period and mode (rail, tram, bus)	
Increasing the use of walking and cycling	Cycling/walking trips, trip-km and trip-hours by time period	*Does not specifically cater for walking/cycling although reduced traffic levels on surface streets may marginally improve conditions for these modes.*
	Cycling/walking mode share by time period	
	Amount of cycling and walking infrastructure provision (lane-km, path-km)	
Protecting and enhancing biodiversity	Effect on natural habitats	*No impact.*
	Effect on exotic habitats	*No impact.*
	Effect on water quality	*Treatment of ground water entering tunnel could be an issue but is likely to be manageable.*
	Effect on ground contamination	*Unlikely to be any impact.*

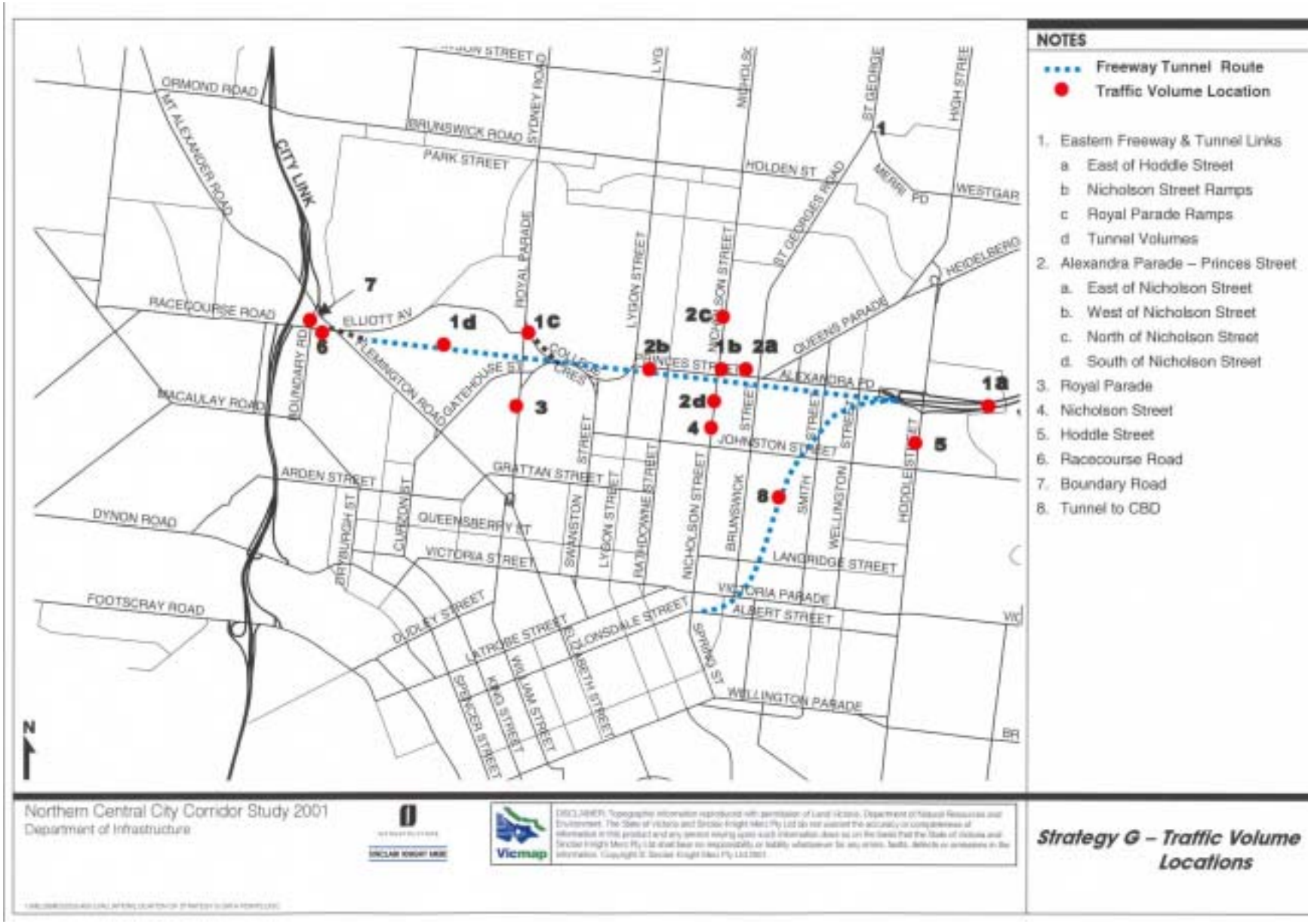
Goal	Indicator	Possible outcome
Economic: Support growth in economic activity, especially in and around Melbourne's CBD, by:		
Enhancing access for commercial activities including tourism and recreation	Accessibility to recreational, cultural and commercial areas in and around CBD and in the inner north	*Directly improved by road. May be consequent minor improvements in bus and tram running times due to reduced traffic levels.*
Catering for increased residential population in the inner north and surrounding areas	Area of existing or potential residential land affected (ha)	*Reduction in traffic volumes on surface roads means additional traffic as a result of increased residential development can be accommodated.*
	Changes of land use (eg from commercial to residential)	
	Accessibility to/from residential areas	
Providing for commercial travel movements, including safe, efficient primary routes for freight	Goods vehicle-km and vehicle-hours of travel, resulting estimated overall user costs of goods movement within, to/from and through the inner north	*Significant road journey time savings.*
Efficiently serving travel needs through, to/from and within the inner north	Business/private person-km, person-hours by mode of travel, resulting estimated overall cost of travel by different modes	*Significant road journey time savings.*
Maximising the economic return on investment in transport and land use initiatives	Capital and operating costs ($M and $M per year)	*Capital cost $723 million.* *Operating cost $2 million per annum*
	Economic evaluation results (user and non-user benefits, private/public sector provider impacts, other Government impacts, benefit/cost ratios)	
	Regional economic effects (effect on businesses etc)	

Appendix A Strategy G : Traffic Volumes and Speeds

This appendix shows Zenith estimates of traffic speeds and traffic volumes for the three versions of Strategy G for the locations shown in the diagram on the following page.

- Strategy G : Tunnel with Intermediate Ramps
  - Base year (2001).
  - Base case (2021).
  - Strategies A to G implemented (2021).
- Strategy G1 : Simple Tunnel
- Strategy G2 : CBD Tunnel

Â **Figure A-1 Traffic Volume Locations**



Do Nothing Case 2021

			24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
	Route/Link	Link		Both directions	Both directions	AB	BA	AB	BA
1	Eastern Fwy & Tunnel Links	Mid block btw Boundary Rd & Royal Pde	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Royal Pde/Cemetery Rd West (tunnel ramps)	33,860	3,210	3,350	25.1	28.3	30.1	24.1
		Eastbound Exit (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Eastbound Entry (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Westbound Exit (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Westbound Entry (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		East of Hoddle St	161,580	15,190	16,540	84.8	41.3	48.2	73.0
2	Alexandra Pde/Princess St	Mid block west of Nicholson St	51,200	5,400	5,670	47.4	37.6	36.7	34.5
		Mid block east of Nicholson St	101,160	9,570	9,960	33.6	20.1	20.7	34.9
	Intersection of Nicholson St	North Approach	36,020	3,500	3,550	39.0	21.1	24.0	39.6
		South Approach	38,620	3,570	3,790	19.5	39.2	33.5	25.7
		West Approach	63,720	6,580	6,320	41.0	23.5	24.8	28.6
		East Approach	101,160	9,570	9,960	33.6	20.1	20.7	34.9
3	Royal Pde	South of Tunnel	41,400	3,900	4,170	43.2	24.4	26.8	41.7
4	Nicholson St	South of Alexandra Pde	38,160	3,530	3,740	38.9	20.5	27.0	33.3
5	Hoddle St	South of Eastern Fwy Westbound Exit	101,720	9,240	9,710	49.0	20.9	18.7	43.5
6	Racecourse Rd	Immediately east of Boundary Rd	38,580	3,620	3,880	11.6	26.9	25.7	11.6
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	26,980	2,190	3,110	36.0	28.5	15.3	34.5

STRATEGY 'G' (2021)

	Route/Link	Link	24 hour flow	AM peak hour flow			
				AB	BA	Both directions	AB
1	Eastern Fwy & Tunnel Links	Mid block btw Boundary Rd & Royal Pde	80,860	3,850	3,550	7,400	4,020
		Royal Pde/Cemetery Rd West (tunnel ramps)	20,960	920	1,220	2,140	1,160
		Eastbound Exit (Nicholson Interchange)	11,720	1,310	0	1,310	990
		Eastbound Entry (Nicholson Interchange)	8,800	0	740	740	0
		Westbound Exit (Nicholson Interchange)	6,120	530	0	530	560
		Westbound Entry (Nicholson Interchange)	10,380	0	910	910	0
		East of Hoddle St	158,740	5,730	8,620	14,350	8,750
2	Alexandra Pde/Princess St	Mid block west of Nicholson St	28,640	810	1,520	2,330	1,530
		Mid block east of Nicholson St	52,560	3,050	1,670	4,720	2,520
	Intersection of Nicholson St	North Approach	33,680	1,130	1,730	2,860	1,780
		South Approach	37,640	1,840	1,350	3,190	1,350
		West Approach	44,040	1,890	2,050	3,940	1,160
		East Approach	54,640	2,550	2,280	4,830	3,580
3	Royal Pde	South of Tunnel	45,160	1,500	2,340	3,840	2,390
4	Nicholson St	South of Alexandra Pde	37,640	1,840	1,350	3,190	1,350
5	Hoddle St	South of Eastern Fwy Westbound Exit	94,940	2,900	5,600	8,500	4,840
6	Racecourse Rd	Immediately east of Boundary Rd	65,020	2,190	3,630	5,820	2,200
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	30,380	1,720	780	2,500	2,280

Difference between Strategy 'G' and Base Year 2001

	Route/Link	Link	24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
				Both directions	Both directions	AB	BA	AB	BA
1	Eastern Fwy & Tunnel Links	Mid block btw Boundary Rd & Royal Pde	80,860	7,400	7,910	51.3	58.5	52.7	55.4
		Royal Pde/Cemetery Rd West (tunnel ramps)	-10,040	-360	-930	8.4	5.3	5.7	13.6
		Eastbound Exit (Nicholson Interchange)	11,720	1,310	990	41.9	0.0	57.7	0.0
		Eastbound Entry (Nicholson Interchange)	8,800	740	900	0.0	70.6	0.0	68.2
		Westbound Exit (Nicholson Interchange)	6,120	530	560	64.5	0.0	64.4	0.0
		Westbound Entry (Nicholson Interchange)	10,380	910	1,050	0.0	66.7	0.0	64.4
		East of Hoddle St	23,060	2,620	2,580	-6.5	3.2	4.2	-7.1
						0.0	0.0	0.0	0.0
2	Alexandra Pde/Princess St	Mid block west of Nicholson St	-17,220	-2,130	-1,580	4.6	4.6	3.4	9.9
		Mid block east of Nicholson St	-38,440	-3,170	-3,270	-30.4	17.6	-7.1	-17.0
	Intersection of Nicholson St	North Approach	2,120	140	260	0.4	2.6	2.7	-1.1
		South Approach	4,760	380	370	4.0	-3.3	-0.2	-1.6
		West Approach	-20,740	-1,730	-2,120	8.8	-13.4	10.3	-11.4
		East Approach	-36,360	-3,060	-2,940	-24.1	4.6	-19.1	4.4
						0.0	0.0	0.0	0.0
3	Royal Pde	Immediatley south of tunnel portal	10,400	810	830	-2.1	-4.7	-3.5	-2.8
						0.0	0.0	0.0	0.0
4	Nicholson St	South of Alexandra Pde	5,240	420	430	-14.8	14.0	12.3	-15.7
						0.0	0.0	0.0	0.0
5	Hoddle St	South of Eastern Fwy Westbound Exit	1,780	640	740	-11.9	4.0	-10.7	-4.4
						0.0	0.0	0.0	0.0
6	Racecourse Rd	Immediately east of Boundary Rd	36,940	3,260	3,390	-4.4	-31.0	-21.4	-11.6
						0.0	0.0	0.0	0.0
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	9,960	1,100	760	-16.8	2.5	-12.8	0.3

Difference between Strategy 'G' and Do Nothing (2021)

			24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
	Route/Link	Link		Both directions	Both directions	AB	BA	AB	BA
1	Eastern Fwy & Tunnel Links	Mid block btw Boundary Rd & Royal Pde	80,860	7,400	7,910	51	59	53	55
		Royal Pde/Cemetery Rd West (tunnel ramps)	-12,900	-1,070	-1,520	16	10	9	18
		Eastbound Exit (Nicholson Interchange)	11,720	1,310	990	42	0	58	0
		Eastbound Entry (Nicholson Interchange)	8,800	740	900	0	71	0	68
		Westbound Exit (Nicholson Interchange)	6,120	530	560	65	0	64	0
		Westbound Entry (Nicholson Interchange)	10,380	910	1,050	0	67	0	64
		East of Hoddle St	-2,840	-840	-1,080	-1	11	14	-1
2	Alexandra Pde/Princess St	Mid block west of Nicholson St	-22,560	-3,070	-2,970	8	8	11	18
		Mid block east of Nicholson St	-48,600	-4,850	-5,000	-23	22	0	-13
	Intersection of Nicholson St	North Approach	-2,340	-640	-410	4	10	9	1
		South Approach	-980	-380	-390	9	1	8	0
		West Approach	-19,680	-2,640	-2,430	-6	7	28	-12
		East Approach	-46,520	-4,740	-4,670	-17	9	-12	9
3	Royal Pde	Immediatley south of tunnel portal	3,760	-60	-90	-1	3	3	-1
4	Nicholson St	South of Alexandra Pde	-520	-340	-340	-11	19	14	-8
5	Hoddle St	South of Eastern Fwy Westbound Exit	-6,780	-740	-960	-9	6	-5	-1
6	Racecourse Rd	Immediately east of Boundary Rd	26,440	2,200	2,350	-1	-23	-13	-7
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	3,400	310	-330	-15	8	-4	3

Difference between Do Nothing (2021) and Base Year 2001

	Route/Link	Link	24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
				Both directions	Both directions	AB	BA	AB	BA
1	Eastern Fwy & Tunnel Links	Mid block btw Boundary Rd & Royal Pde	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Royal Pde/Cemetery Rd West (tunnel ramps)	2,860	710	590	-7	-5	-4	-4
		Eastbound Exit (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Eastbound Entry (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Westbound Exit (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Westbound Entry (Nicholson Interchange)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		East of Hoddle St	25,900	3,460	3,660	-6	-7	-9	-6
				0	0	0	0	0	0
2	Alexandra Pde/Princess St	Mid block west of Nicholson St	5,340	940	1,390	-3	-4	-7	-8
		Mid block east of Nicholson St	10,160	1,680	1,730	-7	-5	-7	-5
	Intersection of Nicholson St	North Approach	4,460	780	670	-4	-8	-6	-2
		South Approach	5,740	760	760	-5	-4	-8	-1
		West Approach	-1,060	910	310	14	-20	-18	1
		East Approach	10,160	1,680	1,730	-7	-5	-7	-5
3	Royal Pde	Immediatley south of tunnel portal	6,640	870	920	-1	-8	-7	-2
4	Nicholson St	South of Alexandra Pde	5,760	760	770	-4	-5	-2	-8
5	Hoddle St	South of Eastern Fwy Westbound Exit	8,560	1,380	1,700	-3	-2	-5	-4
6	Racecourse Rd	Immediately east of Boundary Rd	10,500	1,060	1,040	-4	-9	-8	-4
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	6,560	790	1,090	-2	-5	-9	-3

STRATEGY 'G1' Simple Tunnel (2021)

	10. Route/Link	Link	24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
				Both directions	Both directions	AB	BA	AB	BA
1a	Eastern Fwy & Tunnel Link	East of Hoddle St	161,200	14,540	15,610	83.6	50.8	62.2	71.1
1d		Mid block btw Boundary Rd & Royal Pde	78,480	7,230	7,750	48.6	64.7	59.1	52.6
1c	Cemetery Rd West	East of Royal Pde	19,280	1,700	1,680	39.7	38.4	41.3	37.4
2	Alexandra Pde/Nicholson St	North Approach	33,440	2,890	3,110	42.8	30.8	32.7	41.3
		South Approach	35,720	3,050	3,260	29.2	41.4	41.1	29.0
		West Approach	40,480	4,180	3,140	28.9	28.9	46.7	46.7
		East Approach	55,100	4,870	5,210	28.5	13.4	12.9	28.0
3	Royal Pde	South of Tunnel	43,620	3,670	3,990	42.4	31.5	31.6	41.3
4	Nicholson St	North of Johnston St	35,160	3,030	3,220	41.3	30.5	30.2	41.1
5	Hoddle St	South of Eastern Fwy Westbound Exit	95,620	8,470	8,690	40.2	26.9	12.7	44.6
6	Racecourse Rd	Immediately east of Boundary Rd	69,840	6,150	6,850	10.3	4.3	8.8	4.2
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	31,980	2,750	2,710	18.5	34.9	11.4	38.0

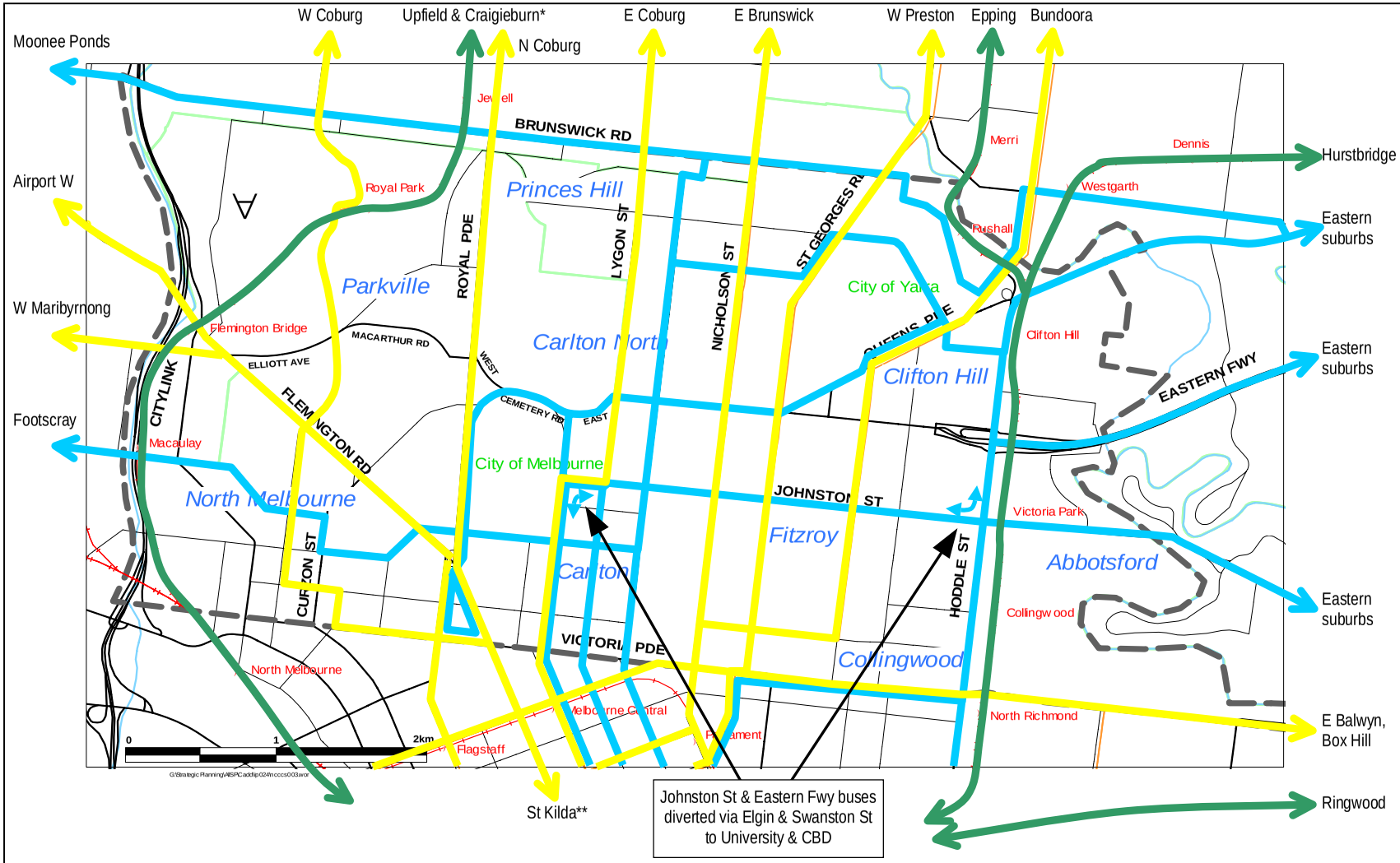
STRATEGY 'G2' CBD Tunnel (2021)

	Route/Link	Link	24 hour flow	AM peak hour flow	PM peak hour flow	AM average speed		PM average speed	
				Both directions	Both directions	AB	BA	AB	BA
1a	Eastern Fwy	East of Hoddle St	152,420	13,750	14,960	53.7	86.1	74.4	63.2
1c	Cemetery Rd West	East of Royal Pde	27,780	2,540	2,730	29.6	32.4	32.1	28.9
2	Alexandra Pde/Nicholson St	North Approach	36,700	3,290	3,500	38.7	27.4	28.7	37.4
		South Approach	31,700	2,570	2,860	36.1	43.9	43.2	34.7
		West Approach	41,180	3,730	3,890	29.5	42.5	43.3	30.6
		East Approach	56,980	5,280	5,610	20.2	12.1	11.5	21.0
3	Royal Pde	Mid block btw Gatehouse St & Gratten St	41,520	3,420	3,780	42.9	35.4	35.1	41.6
4	Nicholson St	North of Johnston St	31,380	2,560	2,830	43.8	36.9	35.6	43.2
5	Hoddle St	South of Eastern Fwy Westbound Exit	86,000	7,730	7,990	45.8	31.7	15.4	48.0
6	Racecourse Rd	Immediately east of Boundary Rd	28,120	2,540	2,480	25.6	34.3	34.6	29.5
7	Boundary Rd	Mid block btw Racecourse Rd & Flemington Rd	21,140	2,030	1,740	36.2	31.2	31.2	38.1
8	CBD Tunnel Link	Mid block btw Eastern Fwy & CBD (Albert Rd)	70,860	6,210	6,630	52.9	76.8	75.2	55.5

Appendix B Strategy Diagrams

The following diagrams were produced by the Department of Infrastructure earlier this year to summarise the main elements of the strategies.

Strategy A – Improvements to public transport



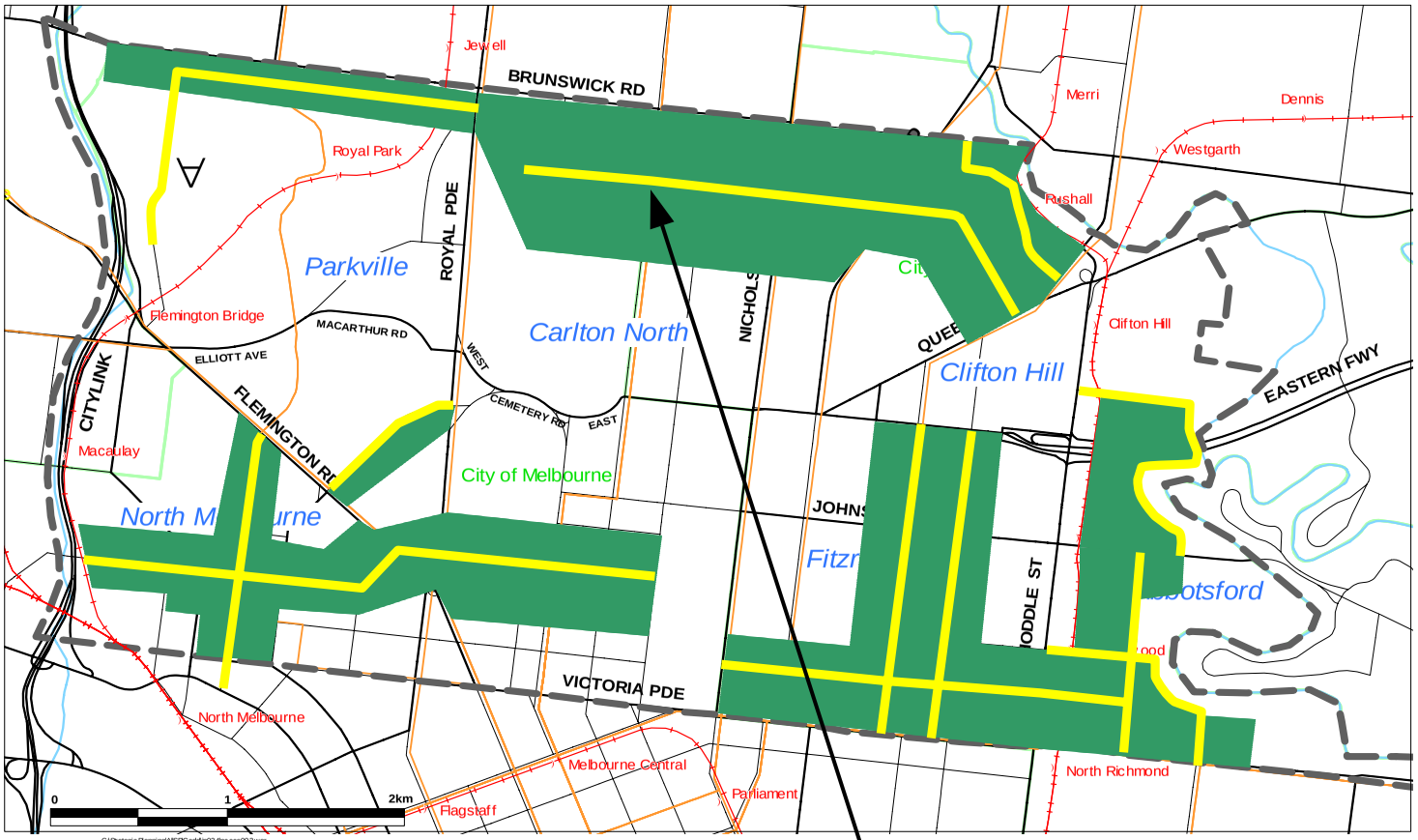
Rail – increased frequency, improved bus/tram access to stations, improved park and ride, *Craigieburn services via Upfield line

Tram – increased frequency, faster travel times, improved reliability and vehicle quality, **Elizabeth St services extended to St Kilda

Bus – increased frequency, improved route coverage, faster journey times, extended evening services, Smartbus-style

NOTE: Improvements apply throughout the entire lengths of relevant services

Strategy B – A plus local street management and amenity improvements

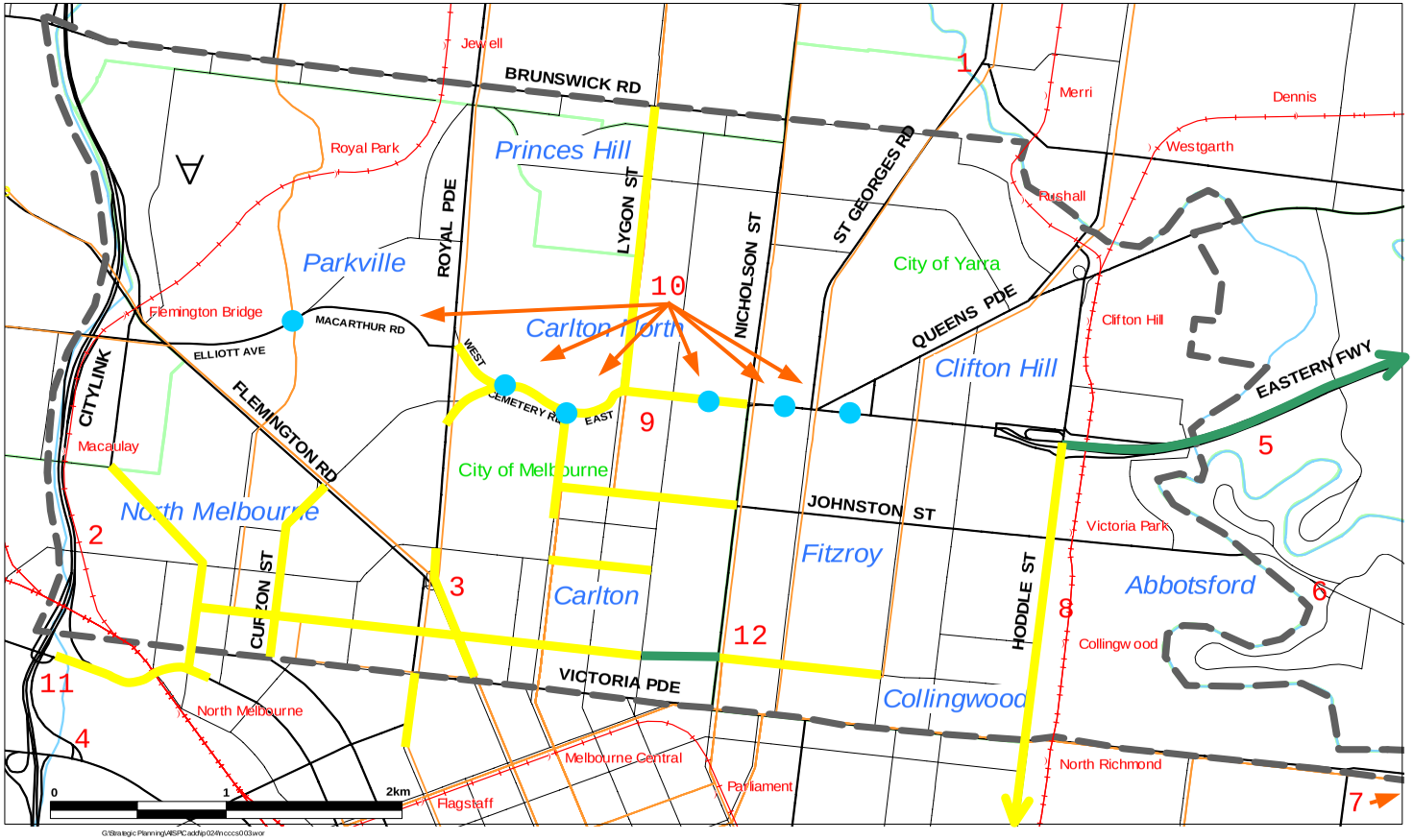


Possible median closure on Lygon Street to prevent through movement between Pigdon and Scotchmer Streets

Local streets – where measures to remove through traffic and reduce traffic speeds (except buses) could be applied

Adjacent areas – where amenity improvement and further traffic management would be required in association with identified local streets

Strategy C – B plus cycling and walking initiatives



New bicycle routes
- On-road
- Off-road
- Cycle-friendly crossings

Bicycle priority projects*

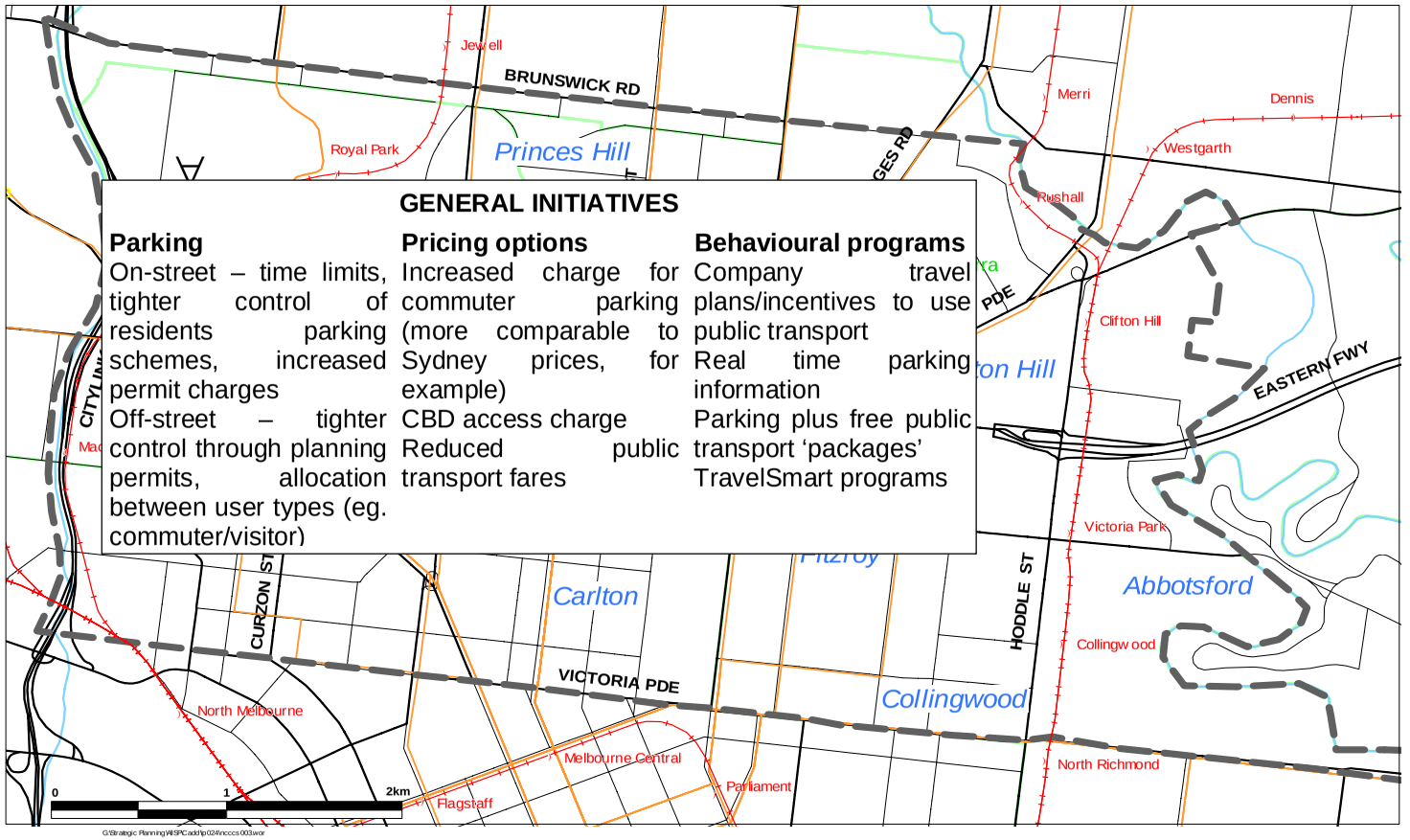
1 St Georges Rd roundabout
2 Cycleway on Arden St footbridge
3 Cycling facilities at Haymarket roundabout
4 Moonee Ponds Creek path under Footscray Rd & off ramp
5 Shared path along Eastern Fwy Kew-Hoddle St
6 Reroute main Yarra Trail to right bank (west) in Abbotsford
7 Barkers Rd cutting path
8 Hoddle St corridor
9 Lanes and path Royal Pde to Nicholson St
10 Cycle friendly crossings of east-west route
11 Shared path on Dynon Rd bridge
12 Path on Gertrude St & Exhibition Buildings land

* Based on Bicycle Victoria's submission to NCCCS

Area-wide initiatives

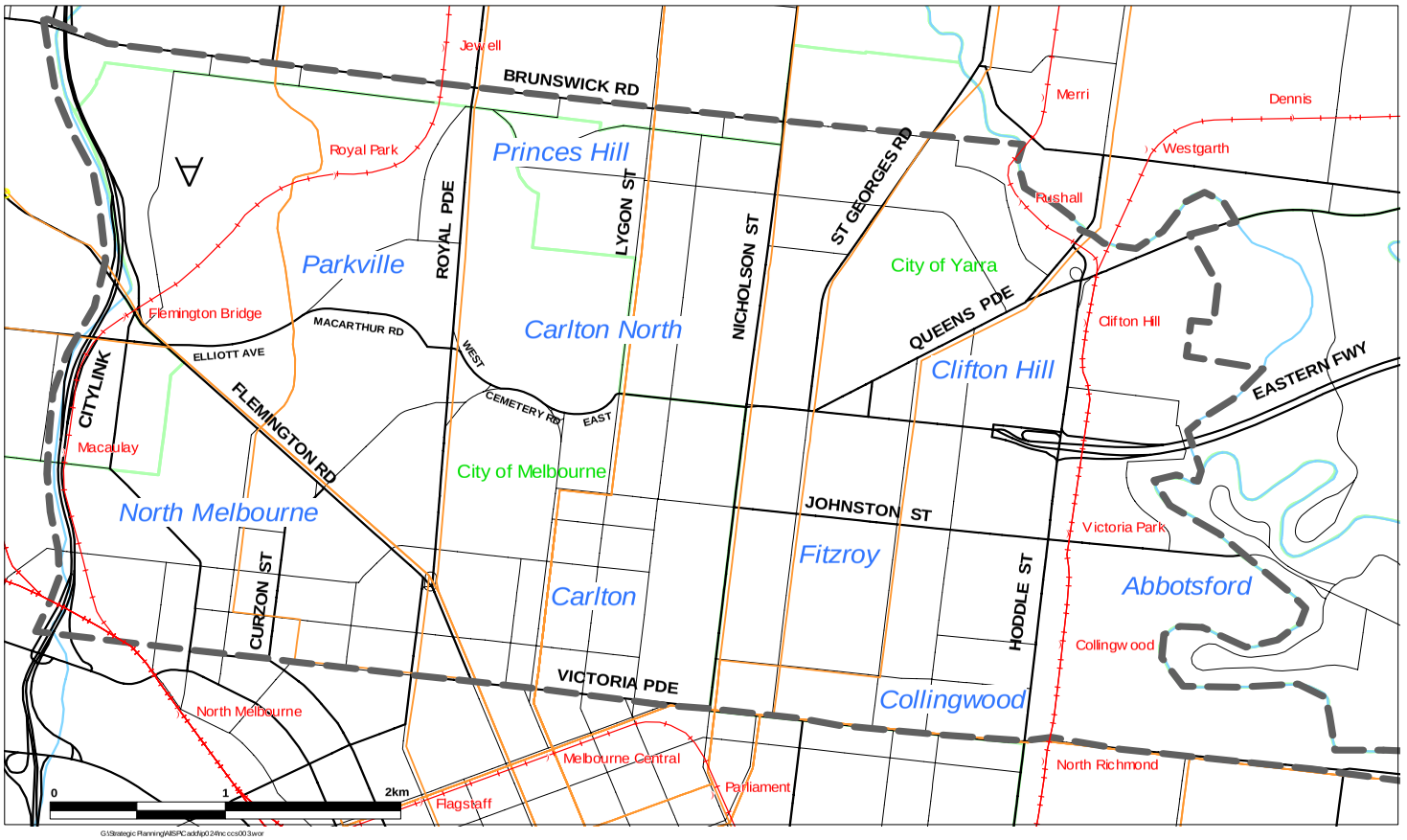
Programs to encourage walking and cycling
Management and regulation initiatives
Legalise riding on paths and in MCC gardens
Push button pedestrian signals every 200m on arterial roads
Improved pedestrian priority at signal intersections
Footpath repair and replacement
Continuous verandahs along shopping streets
Improved lighting along walking routes
Sitting and propping places along walking routes
Arterial road bike lane markings
Local streets marked for cycling
Road resurfacing for bikes
Bicycle route signage
Improved bike parking at work, school, shops
Shower/change facilities at workplaces

Strategy D – C plus measures to reduce car use/dependency

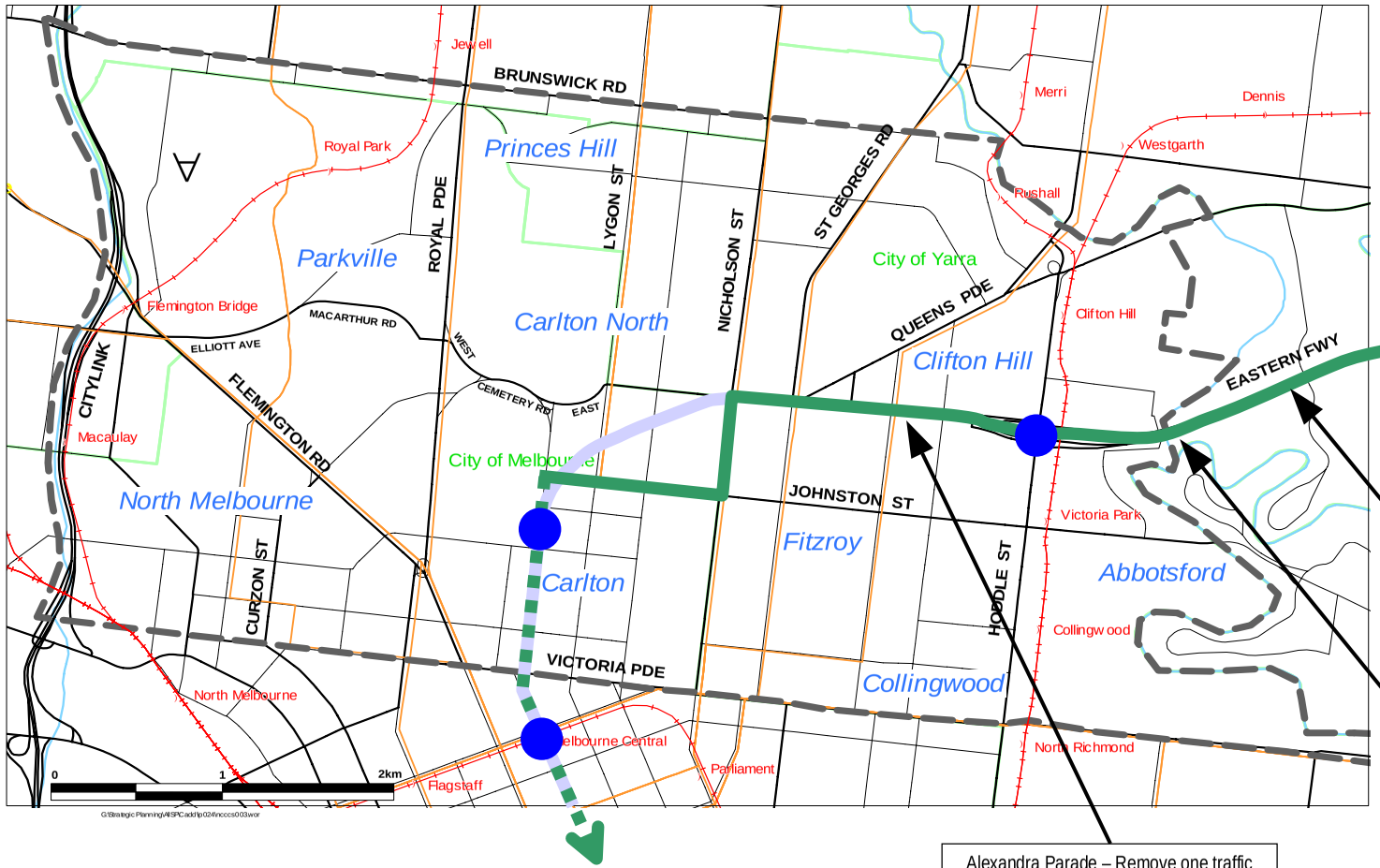


Strategy E – D plus land use initiatives

(awaiting input from land use specialist)



Strategy F – E plus Doncaster area rapid transit (DART) system



Dedicated bus or light rail system to Doncaster Shoppingtown via Doncaster Road, interchanges (bus feeder and park & ride) at Doncaster Shoppingtown, Doncaster Road, Bulleen Road and Chandler Highway.
Peak period bus lanes on Freeway from Doncaster Road to Blackburn Road (connection for buses to/from The Pines).

Eastern Freeway – no road space taken west of Bulleen Road (rapid transit facility in median)

Sensitivity test – congestion charging on Eastern Freeway traffic to raise funds for rapid transit system development

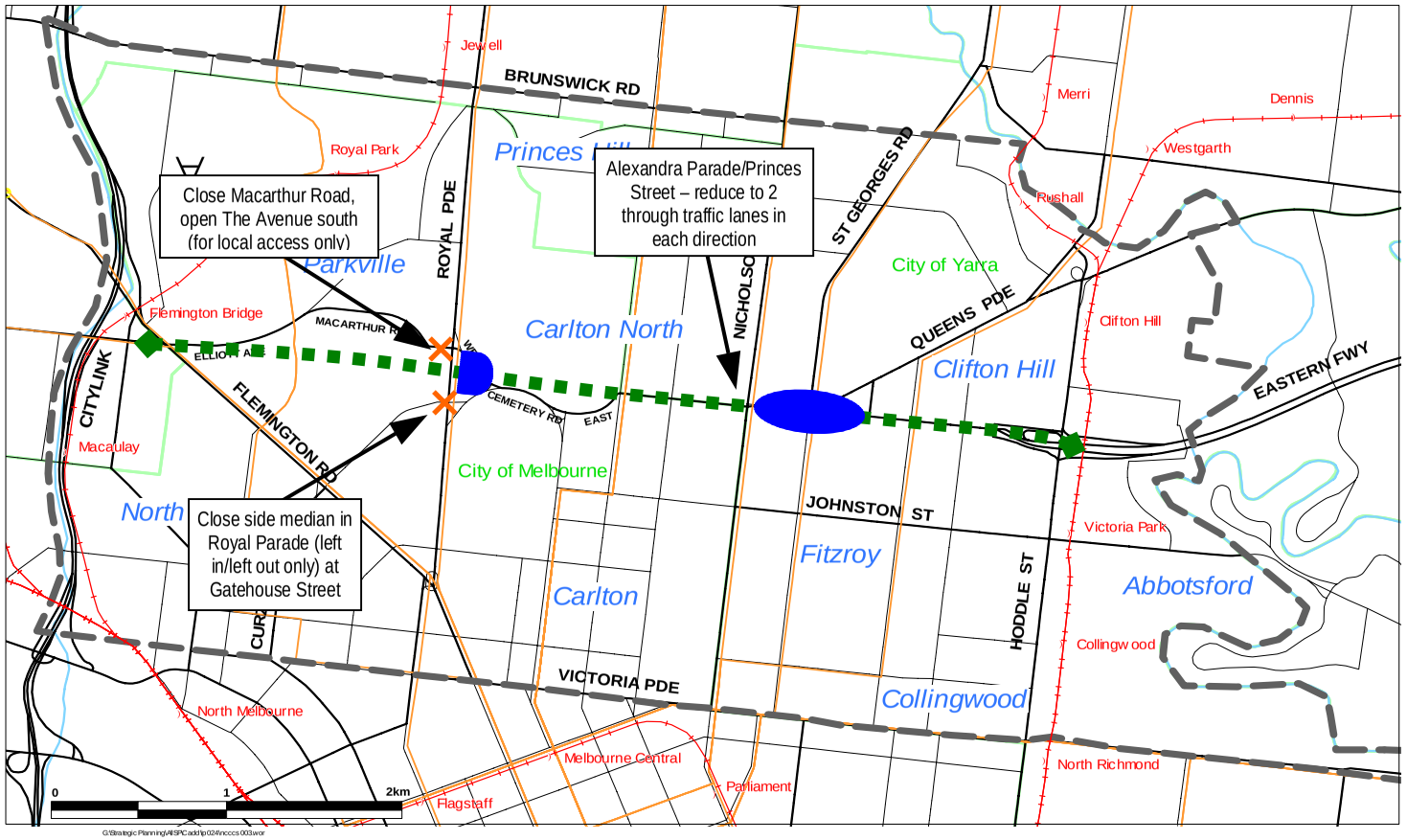
Alexandra Parade – Remove one traffic lane in each direction for rapid transit facility

Initial (road-based dedicated bus or light rail system)

Ultimate (possible longer-term underground light rail system)

Interchange areas (Hoddle Street, University, Melbourne Central)

Strategy G – F plus improvements to arterial roads in inner north (east-west tunnel link)



Four-lane tunnel

Interchange areas with surface arterial roads

Appendix C Background Discussion of the Local Street Scheme (Strategy B)

Traditional local area traffic management measures, often referred to as 'traffic calming', vary from quite restrictive schemes involving bans on turning movements and road closures, to other schemes, such as those based around roundabouts and the construction of slow points, which aim to slow traffic on local streets. We consider that such schemes offer the most technically feasible approach to achieving a diversion of traffic from local streets to arterial roads.

Many non-physical advisory and encouragement techniques have been emerging with the aim of reducing speeds and traffic volumes in local streets. These include the familiar speed display signs advising drivers what their speed is, and techniques which rely on self-awareness, peer pressure and raising the social conscience of drivers to change behaviour. While schemes which rely on changes in driver attitudes and behaviour are promising, the take-up has been slow.

It is also now technologically practical to identify individual vehicles and to toll vehicles electronically from the roadside. However, we consider it unlikely that schemes which rely on charging non-local vehicles for travelling on local streets will achieve public acceptance and the costs may be prohibitive.

Based on current community values we consider that the most likely local area traffic management schemes will be those which achieve modest diversions of traffic and rely on slowing traffic or small local diversions on those streets which are clearly seen by the community as local streets. The main impediment to more ambitious schemes has been the reluctance of local residents to accept restrictions on accessibility in return for amenity gains. The residents who suffer loss of access are not always the same as those who enjoy the residential amenity gains.

The options for roads which have residential frontage but carry arterial-like traffic volumes, much of it through traffic, are less clear. Experience shows that two factors inhibit more direct traffic management intervention on these types of street:

- much of the community sees through traffic as legitimate on these types of street, partly through historical usage, and
- higher traffic volumes are more difficult to accommodate on nearby arterial roads and are not welcomed on parallel local streets.

Appendix D Background to Strategy D: Pedestrians and Cyclists

The following notes formed part of the paper we distributed earlier in the study. It is reproduced here to provide some background to the individual elements of these strategies.

D.1 Pedestrian Initiatives

There is no pedestrian strategy at the national or state levels. However, we understand that the Victorian State Government will soon embark on a walking strategy which will involve a wide range of state government agencies including health, recreation and transport.

At the local government level, the Melbourne City Council has prepared a walking strategy which is part of the draft urban design strategy. This has not been formally endorsed by the Council but has been circulated to a limited number of professionals. The City of Yarra has no formal walking strategy but the former City of Collingwood prepared a report in 1994 which outlined a series of measures and procedures which would assist walking in the (then) City of Collingwood (City of Collingwood Pedestrian Strategy by Loder and Bayly 1994).

Initiatives contained within a walking strategy could be administered by a wide range of state government departments and a range of departments within each local government area. In the following discussion we have grouped the initiatives under the headings of behavioural programs, regulation and administration, land use changes and physical infrastructure.

D.1.1 Behavioural Programs

Green Travel Plans and Travel Behaviour Modification Programs

These programs typically improve information to residential areas, workplaces, or schools to encourage greater use of public transport, walking and cycling. These programs are considered in the reduced car dependency Strategy D.

Safety Oriented Pedestrian Programs

Traditional pedestrian safety programs include:

- Safe routes to school - administered by VicRoads,
- Walksafe - administered by VicRoads,
- Walk with Care - administered by VicRoads for the elderly pedestrians.

Programs to Encourage Walking

The Department of Infrastructure has recently commenced a ‘walking bus’ just north of the Study Area in association with the City of Moreland. The walking bus is modelled on a traditional bus with one parent acting as the driver at the front of a group of school children and a second parent at the rear acting as the conductor. The walking bus has a set route and set timetable to and from school each day.

The state government has a number of promotional programs through VicHealth to promote regular exercise as a means to health, including walking. One example is the Neighbourhood Walk and Talk program which has been operating since 1995. It is aimed at small groups composed of people who are not presently active. Other government organisations such as the National Heart Foundation have well developed publicity programs to encourage regular walking.

D.1.2 Management and Regulation

The following types of initiatives could be included.

- More strict enforcement of leash laws for the control of dogs. Research has shown that the fear of dogs is as significant as the fear of traffic in the minds of primary aged children.

- Stricter enforcement of existing laws regarding dog droppings.

- The introduction and greater publicity of shared path codes to minimise conflicts between pedestrians, cyclists, dog walkers, skateboarders, and other users, eg on the Yarra Path and Capital City Trail.

- The requirement that new land use developments include pedestrians as part of traffic impact statements. At present, the consideration of pedestrian issues in traffic impact statements is infrequent - pedestrians are a legitimate part of the traffic stream. This is a metropolitan responsibility.

- Establishment of better educational programs for professionals practising in engineering, urban design and architecture to improve their skills in the design of infrastructure projects. This has long been a major shortcoming in comparison with centres of learning for the other modes such as road traffic, public transport, bikes and aviation. This is a metropolitan responsibility, not specific to the NCCC area.

- The requirement of the removal of driveways in demolition permits. Many footpaths in the Study Area are quite irregular because pedestrians are required to negotiate uneven and sloping driveways that are no longer used.

- Reduce clutter on footpaths. Display boards and general clutter within shopping centres while bringing vitality and street life, can reduce the walking experience - especially for those with disabilities who require a wide berth.

D.1.3 Land Use Changes to Improve the Environment Beside Walking Routes

The separate land use strategy includes major land use changes such as intensification of employment and residential population to increase the mode share by walking

cycling and public transport. Therefore the effect of the intensification of land uses to increase walking and cycling will not be considered in this strategy. However, more limited changes can be made to streetscapes and the land used along the more popular walking routes to increase the level of passive surveillance and improve the social environment for walking. Types of initiatives in this category include:

- replacement of warehousing and large scale factories with housing that faces pedestrian routes eg the eastern end of Gipps Street in Abbotsford to access the Yarra River trail;
- the establishment of lines of sight to pedestrian routes perhaps by the removal of vegetation where it prevents surveillance.

D.1.4 Infrastructure along routes

New routes across major barriers

Although this is important in many urban areas, the nature of the Study Area is that there are few natural barriers. Where they do occur they do not have land uses on each side which requires strong pedestrian connections. The most likely barrier that may require to be breached is the Yarra River upstream of the Bridge Road bridge which may be possible in connection with the redevelopment of the west bank of the River.

New shared paths in parks

There are some locations where more direct pedestrian paths through parks could be provided. However they are relatively few.

Navigation and Signage

Melbourne City Council is developing pedestrian signage, but this related principally to the CBD and for tourist traffic. There are no proposals that we know of to significantly change signage levels in the Study Area.

New push button signals across arterials

The major barriers to pedestrians are those formed by traffic along arterial roads. Although there are relatively few specific proposals to introduce more pedestrian operated signals we could conceive of a strategy whereby the number of pedestrian operated signals could increase significantly.

For the purpose of considering the limits of a strategy which emphasises pedestrian access we have targeted a maximum spacing of about 200m for signalised crossings on all arterials in the Study Area. This would imply a maximum diversion of 100m to cross at signals, and result in 58 new pedestrian signals. This figure excludes arterials which have minimal pedestrian demands across them.

The basis of posulating this as part of a pedestrian strategy to be tested is as follows.

- The difficulties in crossing arterial roads were the number one pedestrian problem that the public complained of in the problem definition phase of the Study.
- The maximum diversion of 100m seems to be a reasonable pedestrian level of service – particularly for inclusion in the initial round of strategies within this

study many of which were deliberately framed to be more extreme 'what if' strategies.

- Although this level of service is to some extent arbitrary it is no less so than the equivalent level of service criteria for public transport and for vehicular traffic.

Table D-1 Traffic Signals: Pedestrian and Bike Strategy

	Existing	Test Strategy	Increase
Intersection signals	122	122	0
Push Button Road Crossing	43	101	58
Total	165	223	58

The consequences for the roads affected would be a loss of capacity (perhaps as much as 10%) and additional delays to road traffic. In situations of high pedestrian densities, there would however be compensating time savings to pedestrians. Although the increase in traffic signal sites from 165 to 223 (+35%) in relatively small in percentage terms it would draw attention to the way in which pedestrian operated signals would be operated. There are a range of modes of operation from 'instant response' to pedestrian demand to signals only allowing pedestrians at times when it would be unlikely that vehicles would be present. This latter mode of operation is sometimes referred to as the signals being coordinated with adjacent traffic signals.

Change traffic signal operation

There are a wide range of measures to improve conditions for pedestrians when crossing arterial roads. These include such measures as:

- instant response when push button activated – applicable along many arterial roads where the arrival of vehicle bunches is unpredictable;
- conversion of existing pushbutton signals to 'puffin' operation whereby the green phase for pedestrians is extended for slow pedestrians;
- early start for pedestrian movements crossing turning traffic so that pedestrians are more visible to conflicting drivers;
- the addition of zebra crossings such as across left turning lanes.
- suppression of the pedestrian phase if a tram is detected.

Footpath repair and replacement

Both the Cities of Yarra and the City of Melbourne have well developed programs to repair and replace footpaths. This includes footpaths damaged by tree roots, the upgrading of substandard pram ramps, and the repair and adjustment of surface irregularities. Definitive estimates are unable to be made by the City of Yarra and the City of Melbourne on future investment in footpath maintenance. There are particular difficulties in the City of Yarra in balancing the needs of pedestrians with drainage because most drainage is above ground rather than underground.

If we assume that 10km of footpath are repaired or replaced in the Study Area each year this equates to about 3% of the total length of footpaths.

Improving laneways for pedestrians

Many of the mixed use and residential redevelopments in the southern part of the Study Area in Fitzroy, Collingwood and Abbotsford are situated beside narrow laneways or narrow streets. Many of these have very uneven surfaces and narrow (or non-existant) footpaths. These laneways could be upgraded as conditions imposed on redevelopment permits or as part of ongoing pedestrian improvement strategies.

Continuous verandas along shopping streets

Verandahs provide protection from the sun in summer and from the rain in winter. The City of Yarra has no strong policy on the addition of verandahs. Melbourne City Council requires that if verandahs are included in redevelopment applications then they should be set back to prevent fouling by large trucks over the kerb line.

It would seem reasonable to assume that a strategy which gave high priority to pedestrians might increase the coverage of the verandahs along the shopping strips by perhaps three percent per year which, if present coverage is 50% in Smith, Brunswick and Lygon Streets, would notionally provide complete coverage after 17 years.

Lighting along selected Walking Routes

A concerted effort to improve pedestrian conditions would almost certainly see an increased level of public lighting along some routes. For the purposes of this exercise would assume lighting on every fifth road or street would be improved by 50% resulting in around 10% increase in running and maintenance costs for lighting.

D.1.5 Infrastructure at Destinations

Railway stations – DDA (Disability Discrimination Act) Access

Both Connex and M-Trains have proposals to comply with DDA requirements by 2030. This includes a wide range of measures from minor projects such as the addition of handrails to major projects such as the replacement of steep ramps. These projects have been dealt with in the public transport strategy (A).

Tram stops – better shelter

Likewise these have been considered in the public transport strategy and include such measures as those proposed for the Route 109 super stops.

Tram stops – DDA Access

The gradual introduction of low floor trams and the modification of existing tram stops have been considered in the public transport strategy.

Sitting and propping places along walking routes

The City of Melbourne's 'Walkable City' strategy draws particular attention to the creation of places where it is pleasant and attractive to stop, in addition to formal seats and public spaces. This includes private spaces such as footpath dining. Many elderly pedestrians find walking long distances without a break particularly exhausting and value spaces where they can 'stop and prop' before recommencing their journey.

Traditionally these places have been limited to town centres and commercial strips. However, within 20 years we could expect that a concerted walking strategy would see these opportunities to extend to less frequented routes.

D.2 Bike Initiatives

In common with pedestrians a major aspect of any strategy to facilitate cycling must include 'behavioural' and 'trip end' facilities as well as route infrastructure. The initiatives to improve cycling have been grouped under the headings of behavioural programs, management and regulation, land use, bike route infrastructure, and end of bike trip facilities.

D.2.1 Behavioural programs

There is a substantial overlap between behavioural programs to increase walking and those to increase cycling because of the health and fitness benefits. In common with pedestrians many of the behavioural programs are directed at improving cycling safety.

D.2.2 Management and Regulations

Legalise riding on footpaths for adults

Although it is now legal for children to ride on footpaths it is not legal for adults unless there is special signing. On many roads within the Study Area riding on footpaths would appear to be much safer than the parallel routes along busy arterial roads. Previous studies (for example that by Monash University Accident Research Centre) have shown that a large proportion of cycling already takes place on footpaths and that footpath riding is relatively safer. Although pedestrians, especially the elderly fear footpath cycling, there are very few instances of cyclists causing casualty accidents to pedestrians.

Legalised Bikes in MCC Gardens

This is a long standing issue and revolves around the perceived conflict between pedestrians and cyclists in Gardens – as distinct from Parks. This particularly effects the continuity of the very popular Canning Street bike route through Carlton which effectively terminates just north of the Carlton Gardens. A strategy that emphasises provision for cyclists could well see legalised cycling in MCC Parks in the forecast period.

D.2.3 Land Use

The issues involved in more intense land uses are very similar to those discussed earlier for pedestrians ie they will be dealt with in the land use strategy which considers intensification of employment and population within the Study Area.

D.2.4 Bike Route Infrastructure.

Arterial road lane markings.

A pro-bike strategy could envisage that most, if not all, arterial roads in the Study Area would make provision for on-road bike markings. These could be in the form of wide kerbside lanes, parking and bike lanes, exclusive bike lanes or advanced stop line bike storage boxes at traffic signals. There are current proposals to increase bike markings on arterial roads in the Study Area. In most cases this will require the

narrowing of existing lanes eg bike lanes could be provided in Langridge Street in Collingwood, provided that the adjacent vehicle traffic lanes were narrowed.

Some strategic arterial road links have quite inadequate cycling conditions along them. Macarthur Road through Royal Park is a key route for cyclists but is most inadequate. A separate and parallel shared path would greatly assist cyclists.

Lane markings on local streets

The nature of lane markings on local streets will be quite variable according to the particular street. In slow speed streets where it is practical to have vehicular traffic and bikes sharing the same road space the local street bike network will be largely defined by signage rather than regulatory markings. The Bicycle Victoria proposals received as part of the present study incorporate an intensive fine grained network of bike routes on local streets.

New links across existing barriers

Relative to other areas there are few major natural barriers which require cyclists to circumnavigate. However, two significant barriers are the west bank of the Yarra River through Abbotsford and the Merri Creek which prevents a direct link between Holden Street and Westgarth Street in Westgarth.

Road resurfacing for bikes

Road surface conditions in many parts of the Study Area are quite unsuitable for narrow tyred road bikes. Often cyclists are required to negotiate the most uneven surface on the left side of the road which is where gravel and other material accumulates. Resurfacing arterial roads is an important adjunct to a bike strategy.

Signage to Assist Bicycle Navigation

Signage along the Capital City Trail and the Yarra Trail is already of a relatively high standard. It provides distances and directions to important destinations. A network of improved signage along non arterial routes would provide directions for riders who do not necessarily have a well developed mental map of the Study Area. This could be staged by signing the most popular feeder routes to the Yarra Path and the Capital City Trail.

D.2.5 End of Bike Trip Facilities

Improved bike parking at workplaces/education and shops

Responsibility for bike parking, particularly long term bike parking, primarily rests with individual businesses, schools and building developers.

Showers at work places

Again, responsibility rests primarily with private businesses. It would seem that the most cost effective way to increase the number of bike friendly workplaces is to negotiate with the land developers during the development application phase.

Bike parking at tram stops, bus stops, and railway stations

This includes such factors as shelter from wind, rain, active and passive surveillance during the day and night and provision of bike lockers at railway stations. These are

all dealt with in general terms in the strategy for public transport and are not considered in this strategy.

D.3 A Suggested Bike and Pedestrian Strategy for Initial Testing

We have adopted the following criteria for including items in the bike and pedestrian strategy for testing in the initial round of appraisals:

- they would be feasible in financial terms if the community were to accelerate assistance to pedestrians and cyclists ;
- they would be reasonably cost effective in meeting the objectives outlined for the Study Area in terms of economic, social and environmental objectives.
- they are not included in the other strategies which are part of this study
- they would not be part of a general metropolitan strategy eg: educational programs for professionals.

Using these criteria we have nominated the particular proposals outlined in the previous chapters which should be included in a bike and pedestrian strategy for evaluation. A summary of these is shown in Table 4-1 for pedestrian initiatives and for Table 4-2 for cycling initiatives

Table D-2 Summary of Pedestrian Initiatives

	DEALT WITH IN OTHER STRATEGIES?	INCLUDED IN RECOMMENDED STRATEGY?
Behavioural Programs		
Travel plans and travel behaviour modification	Yes	No
Safety Orientated pedestrian programs	No	No
Programs to encourage walking	Yes	No
Management and Regulation		
Stricter enforcement of leash laws and fouling by dogs	No	Yes
Shared path codes	No	Yes
Pedestrian impacts as part of development applications	No	Yes
Educational programs for professionals	No	No
Driveway removal demolition permits	No	Yes
Reduce footpath clutter	No	Yes
Land Use		
More intense land use	Yes	No
Change of land use along walking routes	No	Yes
Infrastructure along routes		
New routes across major barriers	No	No
New Shared paths in parks	No	Yes
Navigation and signage	No	Yes
New push button pedestrian signals across arterial roads	No	Yes
Improve Street Lighting	No	Yes
Change traffic signals operation	No	Yes
Footpath repair and replacement	No	Yes
Improving lane ways for pedestrians	No	Yes
Continuous verandahs along shopping streets	No	Yes
Infrastructure at Destinations		
Railway Stations – DDA access	Yes	No
Tram Stops – better shelter	Yes	No

	DEALT WITH IN OTHER STRATEGIES?	INCLUDED IN RECOMMENDED STRATEGY?
Ç Tram Stops – DDA access	Yes	No
Ç Sitting and propping places along walking routes	No	Yes

Â Table D-3 Summary of Cycling Initiatives

	DEALT WITH IN PRECEDING STRATEGIES?	INCLUDED IN RECOMMENDED STRATEGY?
Behavioural Programs		
Ç Green Travel Plans and Travel Behaviour modification programs	Yes	No
Management and Regulation		
Ç Legalise riding on footpaths for adults	No	Yes
Ç Legalise bikes in MCC Gardens	Yes	Yes
Land Use		
Ç More intense	Yes	No
Bike Route Infrastructure		
Ç Arterial road lane markings	No	Yes
Ç Lane markings on local streets	No	Yes
Ç New links across existing barriers	No	No
Ç Road resurfacing for bikes	No	Yes
Ç Signage to assist navigation	No	Yes
End of Bike Trip Facilities		
Ç Improved bike parking at workplaces, education , and shops	No	Yes
Ç Showers available at workplaces	No	Yes
Ç Bike parking at tram stops, bus stops and railway stations	Yes	No

Appendix E DoI Data for Modelled Traffic Volumes on Selected Roads

Summary of Zenith model outputs

Northern Central City Corridor Study

Modelled traffic volumes on selected roads

Summary of Zenith model outputs (CV = commercial vehicles) - indicative only

Road	From	To	2001 Calibrated model			2021 Base case						2021 Strategy A - PT improvements					
			AM pk	Daily		AM pk	Daily		Diff from 2001			AM pk	Daily		Diff from 2001		
			All veh	All veh	CV	All veh	All veh	CV	All veh		CV	All veh	All veh	CV	All veh		CV
			Total	Total	Total	Total	Total	Total	AM pk	Daily	Daily	Total	Total	Total	AM pk	Daily	Daily
Abbotsford St	Arden St	Haines St	2,040	8,700	1,250	3,020	17,340	2,510	48%	99%	101%	2,060	11,920	2,050	1%	37%	64%
Abbotsford St	Haines St	Flemington Rd	1,240	5,340	740	1,500	7,880	1,130	21%	48%	53%	1,060	6,020	950	-15%	13%	28%
Abbotsford St	Victoria St	Arden St	1,400	6,760	950	1,780	10,980	1,950	27%	62%	105%	1,360	8,940	1,570	-3%	32%	65%
Alexandra Pde	Brunswick St	Nicholson St	15,780	91,000	11,830	17,400	101,160	13,470	10%	11%	14%	16,820	98,620	14,210	7%	8%	20%
Alexandra Pde	Gold St	Smith St	12,520	70,320	7,800	14,300	83,680	10,060	14%	19%	29%	13,780	80,720	10,430	10%	15%	34%
Alexandra Pde	Smith St	Brunswick St	11,360	64,940	7,190	13,160	77,100	9,170	16%	19%	28%	12,640	74,680	9,580	11%	15%	33%
Arden St	Citylink	Macaulay Rd	2,520	14,860	2,540	3,620	21,900	4,380	44%	47%	72%	3,180	19,720	4,260	26%	33%	68%
Arden St	Curzon St	Courtney St	2,020	11,540	1,650	3,500	19,480	3,170	73%	69%	92%	2,440	16,440	2,930	21%	42%	78%
Arden St	Macaulay Rd	Curzon St	3,020	16,720	2,310	3,840	23,500	3,370	27%	41%	46%	3,440	20,900	3,610	14%	25%	56%
Boundary Rd	Macaulay Rd	Racecourse Rd	1,900	12,020	1,710	2,520	15,500	2,070	33%	29%	21%	2,320	14,260	2,280	22%	19%	33%
Brunswick Rd	CityLink	Grantham St	5,120	25,340	1,700	6,560	32,100	2,250	28%	27%	32%	6,020	29,900	2,270	18%	18%	34%
Brunswick Rd	Grantham St	Sydney Rd	4,060	20,840	1,620	5,020	25,100	2,080	24%	20%	28%	4,420	23,560	2,110	9%	13%	30%
Brunswick Rd	Lygon St	Nicholson St	4,260	23,980	1,910	5,760	31,080	2,610	35%	30%	37%	5,280	30,220	2,780	24%	26%	46%
Brunswick Rd	Sydney Rd	Lygon St	4,740	27,020	2,340	5,760	31,060	2,860	22%	15%	22%	5,260	30,200	2,900	11%	12%	24%
Brunswick St	Alexandra Pde	St Georges Rd	2,820	12,460	1,630	3,980	18,220	2,270	41%	46%	39%	2,940	14,780	2,100	4%	19%	29%
Brunswick St	Gertrude St	Moor St	2,560	13,040	2,050	3,060	16,140	2,280	20%	24%	11%	2,760	15,800	2,520	8%	21%	23%
Brunswick St	Johnston St	Alexandra Pde	3,620	16,260	2,040	4,200	20,060	2,470	16%	23%	21%	3,380	17,000	2,340	-7%	5%	15%
Brunswick St	Moor St	Johnston St	2,620	13,460	1,830	3,000	16,260	2,150	15%	21%	17%	2,660	15,160	2,320	2%	13%	27%
Brunswick St	Victoria Pde	Gertrude St	3,400	15,200	2,330	3,580	18,160	2,690	5%	19%	15%	3,140	16,820	2,780	-8%	11%	19%
Cemetery Rd E	Lygon St	Swanston St	7,320	40,960	4,850	8,540	46,520	5,740	17%	14%	18%	8,160	45,860	6,030	11%	12%	24%
Cemetery Rd W	Swanston St	Royal Pde	5,000	30,980	2,930	5,840	33,860	3,340	17%	9%	14%	5,440	32,580	3,370	9%	5%	15%
Citylink	Brunswick Rd	Dynon St	8,960	39,500	3,700	10,880	52,780	4,830	21%	34%	31%	9,260	47,520	4,620	3%	20%	25%
Citylink	Dynon St	Brunswick Rd	3,660	35,140	3,100	5,140	47,580	4,650	40%	35%	50%	4,680	42,180	4,060	28%	20%	31%
Curzon St	Victoria St	Haines St	2,880	15,940	2,390	4,020	21,500	3,120	40%	35%	31%	3,380	18,820	3,160	17%	18%	32%
Dryburgh St	Victoria St	Arden St	3,240	20,300	3,150	3,980	23,580	3,530	23%	16%	12%	3,440	21,200	3,760	6%	4%	19%
Eastern Fwy	Gold St	Yarra Bend	7,240	68,640	7,700	10,160	81,460	9,700	40%	19%	26%	9,600	75,700	9,810	33%	10%	27%
Eastern Fwy	Yarra Bend	Gold St	16,220	67,040	7,430	17,460	80,120	9,510	8%	20%	28%	15,960	76,160	9,770	-2%	14%	31%
Elgin St	Swanston St	Nicholson St	3,920	25,680	3,160	4,800	30,840	4,080	22%	20%	29%	2,720	16,880	2,330	-31%	-34%	-26%
Elizabeth St	Flemington Rd	Victoria St	6,420	39,100	6,320	6,660	40,980	6,750	4%	5%	7%	6,560	40,300	7,000	2%	3%	11%
Elizabeth St	Grattan St	Flemington Rd	5,640	33,860	5,760	6,620	36,060	5,940	17%	6%	3%	5,820	34,300	6,460	3%	1%	12%
Elliott Ave	Flemington Rd	Macarthur Rd	5,080	31,200	2,910	6,060	35,700	3,580	19%	14%	23%	5,660	34,160	3,520	11%	9%	21%
Errol St	Arden St	Victoria St	600	2,880	490	1,440	8,340	1,500	140%	190%	206%	780	6,200	1,370	30%	115%	180%
Flemington Rd	Abbotsford St	Elliott Ave	9,460	55,240	7,100	10,480	61,640	7,970	11%	12%	12%	9,880	58,860	8,140	4%	7%	15%
Flemington Rd	Elizabeth St	Grattan St	6,500	40,520	6,050	6,920	44,720	6,520	6%	10%	8%	6,980	44,260	6,850	7%	9%	13%
Flemington Rd	Gatehouse St	Abbotsford St	8,400	52,260	7,090	9,320	55,220	7,350	11%	6%	4%	8,940	54,420	7,780	6%	4%	10%
Flemington Rd	Grattan St	Gatehouse St	7,180	45,420	6,480	7,760	48,800	6,920	8%	7%	7%	7,900	47,700	7,050	10%	5%	9%
Gatehouse St	Bayles St	Flemington Rd	2,040	12,420	2,010	2,500	14,740	2,370	23%	19%	18%	2,380	13,980	2,460	17%	13%	22%
Gatehouse St	Bayles St	Royal Pde	2,040	12,420	2,010	2,500	14,740	2,370	23%	19%	18%	2,380	13,980	2,460	17%	13%	22%
Gatehouse St	Royal Pde	College Cr	2,180	12,200	1,800	2,020	13,180	1,990	-7%	8%	11%	1,900	12,840	2,070	-13%	5%	15%
Gertrude St	Brunswick St	Smith St	840	2,940	340	1,000	7,360	1,070	19%	150%	215%	660	4,660	630	-21%	59%	85%
Gertrude St	Nicholson St	Brunswick St	500	2,380	260	1,140	8,080	1,100	128%	239%	323%	800	4,600	560	60%	93%	115%
Grattan St	Elizabeth St	Flemington Rd	2,940	17,800	2,410	4,100	23,720	3,750	39%	33%	56%	3,520	21,580	3,610	20%	21%	50%
Grattan St	Rathdowne St	Swanston St	2,360	12,920	1,380	3,380	20,240	2,720	43%	57%	97%	2,620	16,480	2,340	11%	28%	70%
Grattan St	Swanston St	Royal Pde	3,220	19,360	2,530	4,600	26,560	3,980	43%	37%	57%	3,900	24,240	3,990	21%	25%	58%
Harker St	Haines St	Flemington Rd	3,520	18,820	2,660	3,780	20,700	3,110	7%	10%	17%	3,320	18,720	2,930	-6%	-1%	10%
High St	Queens Pde	Westgarth St	5,340	31,680	4,010	6,300	37,100	4,480	18%	17%	12%	5,660	35,100	4,580	6%	11%	14%
Hoddle St	Johnston St	Langridge St	13,820	85,260	10,740	15,340	93,580	12,310	11%	10%	15%	14,000	85,080	12,030	1%	0%	12%
Hoddle St	Langridge St	Victoria St	12,740	81,280	10,690	14,100	88,940	12,090	11%	9%	13%	13,300	83,260	12,310	4%	2%	15%
Hoddle St	Queens Pde	Alexandra Pde	8,640	48,820	4,960	9,680	57,640	5,480	12%	18%	10%	9,160	54,900	5,590	6%	12%	13%
Holden St	Nicholson St	St Georges Rd	2,240	13,180	1,290	3,320	16,980	1,630	48%	29%	26%	2,420	15,440	1,550	8%	17%	20%
Johnston St	Brunswick St	Smith St	4,060	21,320	2,200	4,920	26,220	3,010	21%	23%	37%	3,020	18,460	2,330	-26%	-13%	6%
Johnston St	Hoddle St	Masons Lane	3,840	22,360	2,290	5,280	25,420	2,700	38%	14%	18%	3,080	17,980	2,030	-20%	-20%	-11%
Johnston St	Nicholson St	Brunswick St	4,580	23,980	2,630	5,200	28,020	3,290	14%	17%	25%	2,960	18,760	2,340	-35%	-22%	-11%
Johnston St	Smith St	Wellington St	4,800	21,840	2,160	4,400	25,040	2,760	-8%	15%	28%	3,120	17,180	2,020	-35%	-21%	-6%
Johnston St	Wellington St	Hoddle St	4,120	20,920	1,970	3,800	24,660	2,740	-8%	18%	39%	2,880	18,340	2,200	-30%	-12%	12%
Lygon St	Elgin St	Grattan St	2,820	16,080	2,270	3,540	22,140	3,270	26%	38%	44%	2,860	17,600	2,830	1%	9%	25%
Lygon St	Elgin St	Princes St	4,140	24,300	3,370	5,040	30,240	4,160	22%	24%	23%	4,680	28,200	4,440	13%	16%	32%
Lygon St	Grattan St	Queensberry St	2,160	12,180	1,910	2,600	15,200	2,310	20%	25%	21%	2,100	13,400	2,260	-3%	10%	18%
Lygon St	Princes St	Brunswick Rd	5,100	30,160	4,150	5,800	35,180	4,570	14%	17%	10%	5,280	31,560	4,820	4%	5%	16%
Lygon St	Queensberry St	Victoria St	3,860	21,480	3,280	4,300	25,040	3,880	11%	17%	18%	3,880	22,560	3,790	1%	5%	16%
Macarthur Rd	Elliot Ave	Royal Pde	4,840	29,460	2,750	5,740	34,000	3,420	19%	15%	24%	5,380	32,460	3,360	11%	10%	22%
Macaulay Rd	Boundary Rd	City Link	3,120	18,800	2,380	4,440	23,240	3,070	42%	24%	29%	3,500	21,200	3,010	12%	13%	26%
Macaulay Rd	Haines St	Arden St	4,360	26,880	3,710	5,180	30,840	4,130	19%	15%	11%	4,620	28,620	4,480	6%	6%	21%
Macaulay Rd	Haines St	Boundary Rd	4,880	30,480	4,060	6,560	37,900	5,080	34%	24%	25%	5,600	34,800	5,230	15%	14%	29%
Nicholson St	Alexandra Pde	Johnston St	5,620	32,860	5,060	6,480	38,620	5,980	15%	18%	18%	5,500	34,840	6,250	-2%	6%	24%
Nicholson St	Alexandra Pde	Newry St	5,440	31,540	4,120	6,360	36,020	4,550	17%	14%	10%	5,780	34,440	4,760	6%	9%	16%
Nicholson St	Johnston St	Victoria St	5,560	30,960	5,100	6,240	35,260	5,530	12%	14%	8%	5,680	33,940	6,290	2%	10%	23%
Nicholson St	Newry St	Brunswick Rd	5,200	30,040	3,030	5,980	35,780	3,810	15%	19%	26%	5,520	32,700	3,690	6%	9%	22%
Peel St	Flemington Rd	Victoria St	5,120	30,620	5,110	5,620	33,880	5,520	10%	11%	8%	5,380	33,120	6,060	5%	8%	19%
Princes St	Nicholson St	Rathdowne St	11,340	64,780	8,310	11,960	63,720	8,340	5%	-2%	0%	11,640	63,040	8,820	3%	-3%	6%
Princes St	Rathdowne St	Lygon St	8,920	45,860	5,240	9,820	51,200	6,270	10%	12%	20%	9,480	51,640	6,860	6%	13%	31%
Queens Pde	Alexandra Pde	Heidelberg Rd	7,420	43,660	6,640	9,140	52,180	7,480	23%	20%	13%	8,220	49,180	7,800	11%	13%	17%
Queens Pde	Heidelberg Rd	High St	5,600	33,440	4,180	6,680	39,400	4,710	19%	18%	13%	5,980	37,220	4,810	7%	11%	15%
Queensberry St	Lygon St	Rathdowne St	2,360	11,180	1,940	2,340	13,320	2,140	-1%	19%	10%	1,820	13,200	2,470	-23%	18%	27%
Queensberry St	Lygon St	Swanston St	1,960	12,020	2,270	3,360	19,720	3,400	71%	64%	50%	2,520	16,200	3,240	29%	35%	43%
Queensberry St	Swanston St	Peel St	2,280	13,580	2,030	3,780	23,300	3,810	66%	72%	88%	2,800	18,560	3,330	23%	37%	64%
Racecourse Rd	Flemington Rd	Stubbs St	5,240	29,200	3,080	6,900	41,180	4,950	32%	41%	61%	6,260	37,620	4,700	19%	29%	53%
Rathdowne St	Princes St	Newry St	2,440	13,720	1,680	2,960	18,620	2,390	21%	36%	42%	2,420	16,260	2,390	-1%	19%	42%
Rathdowne St	Princes St	Victoria St	5,880	34,000	5,760	5,380	32,320	4,820	-9%	-5%	-16%	4,920	29,040	4,990	-16%	-15%	-13%
Royal Pde	Gatehouse St	Brunswick Rd	6,880	39,560	5,810	7,640	44,500	6,280	11%	12%	8%	7,020	41,140	6,620	2%	4%	14%
Royal Pde	Gatehouse St	Grattan St	5,960	34,820	5,600	7,020	40,720	6,080	18%	17%	9%	6,180	35,960	6,110	4%	3%	9%
Smith St	Alexandra Pde	Queens Pde	1,380	6,280	710	1,900	10,840	1,320	38%	73%	86%	1,760	9,360	1,250	28%	49%	76%
Smith St	Johnston St	Keele St	2,460	15,560	1,950	2,980	20,640	2,700	21%	33%	38%	2,340	18,060	2,640	-5%	16%	35%
Smith St	Keele St	Alexandra Pde	2,300	15,360	1,800	2,860	20,140	2,570	24%	31%	43%	2,280	18,180	2,560	-1%	18%	42%
Smith St	Victoria Pde	Johnston St	2,280	12,340	1,780	3,080	17,320	2,400	35%	40%	35%	2,400	15,620	2,340	5%	27%	31%
St Georges Rd	Brunswick St	Holden St	3,660	17,580	2,450	4,080	20,560	2,460	11%	17%	0%	3,800	18,500	2,740	4%	5%	12%
Swanston St	Cemetery Rd W	Elgin St	1,960	12,780	1,670	2,300	14,540	1,920	17%	14%	15%	1,820	12,520	2,000	-7%	-2%	20%
Swanston St	Grattan St	Elgin St	2,740	15,300	2,410	3,600	18,900	3,020	31%	24%	25%	2,740	16,240	2,970	0%	6%	23%
Swanston St	Victoria St	Grattan St	2,320	13,300	2,820	2,860	17,140	3,300	23%	29%	17%	2,200	14,480	3,340	-5%	9%	18%
Victoria Pde	Brunswick St	Nicholson St	8,660	52,300	8,810	10,060	62,020	10,230	16%	19%	16%	9,360	58,220	10,470	8%	11%	19%
Victoria Pde	Hoddle St	Rokeby St	8,920	54,860	8,960	10,260	62,060	9,930	15%	13%	11%	8,780	57,760	10,590	-2%	5%	18%
Victoria Pde	Rokeby St	Cambridge St	8,760	53,600	9,100	10,060	60,500	10,060	15%	13%	11%	8,580	56,540	10,790	-2%	5%	19%
Victoria St	Chetwynd St	Elizabeth St	4,020	23,520	4,680	4,360	26,340	4,940	8%	12%	6%	4,120	24,660	5,200	2%	5%	11%
Victoria St	Curzon St	Dryburgh St	2,880	18,840	3,300	3,700	23,440	4,080	28%	24%	24%	3,520	22,600	4,520	22%	20%	37%
Victoria St	Elizabeth St	Rathdowne St	8,440	50,800	8,840	9,200	55,740	9,500	9%	10%	7%	8,620	53,840	10,040	2%	6%	14%
Victoria St	Hawke St	Chetwynd St	3,740	20,800	3,750	4,520	26,720	5,130	21%	28%	37%	3,880	23,340	4,870	4%	12%	30%
Victoria St	Hoddle St	Lithgow St	3,360	19,340	3,140	4,180	23,780	3,610	24%	23%	15%	3,620	22,060	3,690	8%	14%	18%
Victoria St	Nicholson St	Rathdowne St	8,280	48,560	8,120	9,880	60,080	10,030	19%	24%	24%	8,880	55,780	10,220	7%	15%	26%
Wellington St	Johnston St	Alexandra Pde	2,920	18,640	2,290	3,560	20,640	2,330	22%	11%	2%	3,560	20,560	2,630	22%	10%	15%
Wellington St	Victoria Pde	Johnston St	2,580	16,480	2,410	3,220	19,320	2,610	25%	17%	8%	3,300	18,240	2,760	28%	11%	15%
Wreckyn St	Courtney St	Flemington Rd	2,320	13,200	1,940	3,440	20,560	3,350	48%	56%	73%	2,640	18,660	3,380	14%	41%	74%
E-W Tunnel	Eastern Fwy	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Eastern Fwy	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Royal Pde	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Flemington Rd	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Flemington Rd	Royal Pde	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Eastern Fwy	Albert St	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Albert St	Eastern Fwy	0	0	0	0	0	0				0	0	0			

Northern Central City Corridor Study

Modelled traffic volumes on selected roads

Summary of Zenith model outputs (CV = commercial vehicles) - indicative only

Road	From	To	2001 Calibrated model			2021 Strategy B - local street mgt						2021 Strategy D - CBD parking price increase					
			AM pk	Daily		AM pk	Daily		Diff from 2001			AM pk	Daily		Diff from 2001		
			All veh	All veh	CV	All veh	All veh	CV	All veh		CV	All veh	All veh	CV	All veh		CV
			Total	Total	Total	Total	Total	Total	AM pk	Daily	Daily	Total	Total	Total	AM pk	Daily	Daily
Abbotsford St	Arden St	Haines St	2,040	8,700	1,250	100	760	180	-95%	-91%	-86%	100	740	180	-95%	-91%	-86%
Abbotsford St	Haines St	Flemington Rd	1,240	5,340	740	120	660	150	-90%	-88%	-80%	80	620	150	-94%	-88%	-80%
Abbotsford St	Victoria St	Arden St	1,400	6,760	950	0	0	0	-100%	-100%	-100%	0	0	0	-100%	-100%	-100%
Alexandra Pde	Brunswick St	Nicholson St	15,780	91,000	11,830	18,820	111,420	15,900	19%	22%	34%	18,400	109,880	15,990	17%	21%	35%
Alexandra Pde	Gold St	Smith St	12,520	70,320	7,800	14,040	82,220	9,990	12%	17%	28%	13,680	81,500	10,010	9%	16%	28%
Alexandra Pde	Smith St	Brunswick St	11,360	64,940	7,190	14,220	82,820	10,110	25%	28%	41%	13,800	81,560	10,070	21%	26%	40%
Arden St	Citylink	Macaulay Rd	2,520	14,860	2,540	220	1,640	590	-91%	-89%	-77%	60	1,360	530	-98%	-91%	-79%
Arden St	Curzon St	Courtney St	2,020	11,540	1,650	140	1,120	190	-93%	-90%	-88%	120	1,060	190	-94%	-91%	-88%
Arden St	Macaulay Rd	Curzon St	3,020	16,720	2,310	80	680	80	-97%	-96%	-97%	80	640	80	-97%	-96%	-97%
Boundary Rd	Macaulay Rd	Racecourse Rd	1,900	12,020	1,710	2,580	16,460	2,710	36%	37%	58%	2,660	16,300	2,720	40%	36%	59%
Brunswick Rd	CityLink	Grantham St	5,120	25,340	1,700	5,600	28,080	2,360	9%	11%	39%	5,500	27,820	2,340	7%	10%	38%
Brunswick Rd	Grantham St	Sydney Rd	4,060	20,840	1,620	5,300	28,000	2,580	31%	34%	59%	5,180	27,800	2,580	28%	33%	59%
Brunswick Rd	Lygon St	Nicholson St	4,260	23,980	1,910	5,740	34,140	3,480	35%	42%	82%	5,360	33,520	3,470	26%	40%	82%
Brunswick Rd	Sydney Rd	Lygon St	4,740	27,020	2,340	6,220	35,740	3,760	31%	32%	61%	6,140	35,420	3,720	30%	31%	59%
Brunswick St	Alexandra Pde	St Georges Rd	2,820	12,460	1,630	3,700	17,800	2,440	31%	43%	50%	3,580	17,460	2,440	27%	40%	50%
Brunswick St	Gertrude St	Moor St	2,560	13,040	2,050	3,560	19,120	2,930	39%	47%	43%	3,240	18,560	2,880	27%	42%	40%
Brunswick St	Johnston St	Alexandra Pde	3,620	16,260	2,040	4,080	21,440	2,850	13%	32%	40%	3,840	20,900	2,850	6%	29%	40%
Brunswick St	Moor St	Johnston St	2,620	13,460	1,830	3,460	18,940	2,790	32%	41%	52%	3,080	18,360	2,740	18%	36%	50%
Brunswick St	Victoria Pde	Gertrude St	3,400	15,200	2,330	3,960	21,240	3,260	16%	40%	40%	3,620	20,720	3,210	6%	36%	38%
Cemetery Rd E	Lygon St	Swanston St	7,320	40,960	4,850	7,940	47,060	6,510	8%	15%	34%	7,560	46,180	6,400	3%	13%	32%
Cemetery Rd W	Swanston St	Royal Pde	5,000	30,980	2,930	5,920	35,460	3,900	18%	14%	33%	5,780	35,280	3,850	16%	14%	31%
Citylink	Brunswick Rd	Dynon St	8,960	39,500	3,700	9,760	49,760	4,900	9%	26%	32%	9,140	48,280	4,840	2%	22%	31%
Citylink	Dynon St	Brunswick Rd	3,660	35,140	3,100	4,920	44,700	4,490	34%	27%	45%	4,380	43,560	4,430	20%	24%	43%
Curzon St	Victoria St	Haines St	2,880	15,940	2,390	4,080	23,100	4,030	42%	45%	69%	3,600	22,140	3,930	25%	39%	64%
Dryburgh St	Victoria St	Arden St	3,240	20,300	3,150	4,420	27,420	4,850	36%	35%	54%	4,140	26,680	4,850	28%	31%	54%
Eastern Fwy	Gold St	Yarra Bend	7,240	68,640	7,700	9,480	71,940	9,380	31%	5%	22%	9,220	71,080	9,430	27%	4%	22%
Eastern Fwy	Yarra Bend	Gold St	16,220	67,040	7,430	15,000	72,380	9,290	-8%	8%	25%	14,500	71,540	9,340	-11%	7%	26%
Elgin St	Swanston St	Nicholson St	3,920	25,680	3,160	3,120	20,180	2,870	-20%	-21%	-9%	3,100	19,840	2,820	-21%	-23%	-11%
Elizabeth St	Flemington Rd	Victoria St	6,420	39,100	6,320	7,380	46,280	7,670	15%	18%	21%	7,000	45,360	7,800	9%	16%	23%
Elizabeth St	Grattan St	Flemington Rd	5,640	33,860	5,760	7,560	47,620	9,460	34%	41%	64%	7,360	46,860	9,530	30%	38%	65%
Elliott Ave	Flemington Rd	Macarthur Rd	5,080	31,200	2,910	6,500	39,420	4,470	28%	26%	54%	6,340	39,140	4,410	25%	25%	52%
Errol St	Arden St	Victoria St	600	2,880	490	0	140	40	-100%	-95%	-92%	0	140	40	-100%	-95%	-92%
Flemington Rd	Abbotsford St	Elliott Ave	9,460	55,240	7,100	10,060	60,640	8,690	6%	10%	22%	9,800	59,900	8,800	4%	8%	24%
Flemington Rd	Elizabeth St	Grattan St	6,500	40,520	6,050	8,460	52,600	8,520	30%	30%	41%	8,260	51,980	8,650	27%	28%	43%
Flemington Rd	Gatehouse St	Abbotsford St	8,400	52,260	7,090	10,420	62,280	9,310	24%	19%	31%	10,160	61,600	9,450	21%	18%	33%
Flemington Rd	Grattan St	Gatehouse St	7,180	45,420	6,480	8,020	50,060	7,950	12%	10%	23%	7,680	49,260	8,060	7%	8%	24%
Gatehouse St	Bayles St	Flemington Rd	2,040	12,420	2,010	0	220	40	-100%	-98%	-98%	0	200	40	-100%	-98%	-98%
Gatehouse St	Bayles St	Royal Pde	2,040	12,420	2,010	0	220	40	-100%	-98%	-98%	0	200	40	-100%	-98%	-98%
Gatehouse St	Royal Pde	College Cr	2,180	12,200	1,800	1,180	10,160	1,540	-46%	-17%	-14%	1,080	9,620	1,490	-50%	-21%	-17%
Gertrude St	Brunswick St	Smith St	840	2,940	340	520	3,120	410	-38%	6%	21%	480	3,100	410	-43%	5%	21%
Gertrude St	Nicholson St	Brunswick St	500	2,380	260	120	520	50	-76%	-78%	-81%	80	460	50	-84%	-81%	-81%
Grattan St	Elizabeth St	Flemington Rd	2,940	17,800	2,410	60	440	100	-98%	-98%	-96%	20	400	90	-99%	-98%	-96%
Grattan St	Rathdowne St	Swanston St	2,360	12,920	1,380	60	280	20	-97%	-98%	-99%	40	180	20	-98%	-99%	-99%
Grattan St	Swanston St	Royal Pde	3,220	19,360	2,530	60	380	40	-98%	-98%	-98%	20	260	40	-99%	-99%	-98%
Harker St	Haines St	Flemington Rd	3,520	18,820	2,660	3,920	22,200	3,640	11%	18%	37%	3,540	21,380	3,560	1%	14%	34%
High St	Queens Pde	Westgarth St	5,340	31,680	4,010	5,700	34,680	4,270	7%	9%	6%	5,500	34,260	4,230	3%	8%	5%
Hoddle St	Johnston St	Langridge St	13,820	85,260	10,740	16,300	100,140	14,330	18%	17%	33%	15,760	98,760	14,390	14%	16%	34%
Hoddle St	Langridge St	Victoria St	12,740	81,280	10,690	16,480	99,940	14,620	29%	23%	37%	15,940	98,540	14,680	25%	21%	37%
Hoddle St	Queens Pde	Alexandra Pde	8,640	48,820	4,960	8,140	48,520	6,150	-6%	-1%	24%	8,040	48,260	6,110	-7%	-1%	23%
Holden St	Nicholson St	St Georges Rd	2,240	13,180	1,290	2,680	17,120	2,240	20%	30%	74%	2,660	16,780	2,260	19%	27%	75%
Johnston St	Brunswick St	Smith St	4,060	21,320	2,200	3,400	19,720	2,390	-16%	-8%	9%	3,280	19,460	2,360	-19%	-9%	7%
Johnston St	Hoddle St	Masons Lane	3,840	22,360	2,290	4,000	24,700	2,930	4%	10%	28%	3,860	24,400	2,920	1%	9%	28%
Johnston St	Nicholson St	Brunswick St	4,580	23,980	2,630	3,400	20,540	2,520	-26%	-14%	-4%	3,220	20,200	2,540	-30%	-16%	-3%
Johnston St	Smith St	Wellington St	4,800	21,840	2,160	3,200	18,380	2,170	-33%	-16%	0%	3,020	18,080	2,130	-37%	-17%	-1%
Johnston St	Wellington St	Hoddle St	4,120	20,920	1,970	3,420	20,320	2,310	-17%	-3%	17%	3,320	20,160	2,270	-19%	-4%	15%
Lygon St	Elgin St	Grattan St	2,820	16,080	2,270	3,440	20,720	3,360	22%	29%	48%	3,040	19,940	3,390	8%	24%	49%
Lygon St	Elgin St	Princes St	4,140	24,300	3,370	4,700	27,980	4,410	14%	15%	31%	4,540	27,600	4,440	10%	14%	32%
Lygon St	Grattan St	Queensberry St	2,160	12,180	1,910	3,480	21,280	3,460	61%	75%	81%	3,140	20,640	3,500	45%	69%	83%
Lygon St	Princes St	Brunswick Rd	5,100	30,160	4,150	5,760	35,500	5,260	13%	18%	27%	5,500	34,940	5,270	8%	16%	27%
Lygon St	Queensberry St	Victoria St	3,860	21,480	3,280	4,420	26,700	4,380	15%	24%	34%	3,980	25,860	4,420	3%	20%	35%
Macarthur Rd	Elliot Ave	Royal Pde	4,840	29,460	2,750	6,180	37,700	4,280	28%	28%	56%	6,060	37,400	4,220	25%	27%	53%
Macaulay Rd	Boundary Rd	City Link	3,120	18,800	2,380	2,520	15,380	2,550	-19%	-18%	7%	2,300	14,920	2,550	-26%	-21%	7%
Macaulay Rd	Haines St	Arden St	4,360	26,880	3,710	4,380	27,360	4,710	0%	2%	27%	4,100	26,580	4,700	-6%	-1%	27%
Macaulay Rd	Haines St	Boundary Rd	4,880	30,480	4,060	5,060	31,760	5,250	4%	4%	29%	4,720	30,960	5,240	-3%	2%	29%
Nicholson St	Alexandra Pde	Johnston St	5,620	32,860	5,060	6,220	39,600	6,820	11%	21%	35%	6,000	38,860	6,900	7%	18%	36%
Nicholson St	Alexandra Pde	Newry St	5,440	31,540	4,120	6,120	37,180	4,210	13%	18%	2%	6,000	36,900	4,220	10%	17%	2%
Nicholson St	Johnston St	Victoria St	5,560	30,960	5,100	6,060	36,500	6,650	9%	18%	30%	5,520	35,540	6,760	-1%	15%	33%
Nicholson St	Newry St	Brunswick Rd	5,200	30,040	3,030	6,040	36,680	4,060	16%	22%	34%	5,940	36,420	4,070	14%	21%	34%
Peel St	Flemington Rd	Victoria St	5,120	30,620	5,110	6,180	38,220	7,280	21%	25%	42%	5,760	37,440	7,380	13%	22%	44%
Princes St	Nicholson St	Rathdowne St	11,340	64,780	8,310	12,220	66,420	9,540	8%	3%	15%	11,900	65,760	9,600	5%	2%	16%
Princes St	Rathdowne St	Lygon St	8,920	45,860	5,240	10,160	57,280	7,710	14%	25%	47%	10,160	56,940	7,630	14%	24%	46%
Queens Pde	Alexandra Pde	Heidelberg Rd	7,420	43,660	6,640	6,980	43,300	7,120	-6%	-1%	7%	6,660	42,520	7,200	-10%	-3%	8%
Queens Pde	Heidelberg Rd	High St	5,600	33,440	4,180	5,980	36,580	4,500	7%	9%	8%	5,840	36,160	4,460	4%	8%	7%
Queensberry St	Lygon St	Rathdowne St	2,360	11,180	1,940	80	300	30	-97%	-97%	-98%	20	120	20	-99%	-99%	-99%
Queensberry St	Lygon St	Swanston St	1,960	12,020	2,270	40	320	50	-98%	-97%	-98%	20	280	50	-99%	-98%	-98%
Queensberry St	Swanston St	Peel St	2,280	13,580	2,030	0	40	10	-100%	-100%	-100%	0	40	10	-100%	-100%	-100%
Racecourse Rd	Flemington Rd	Stubbs St	5,240	29,200	3,080	7,220	42,580	5,500	38%	46%	79%	6,700	41,480	5,440	28%	42%	77%
Rathdowne St	Princes St	Newry St	2,440	13,720	1,680	2,120	13,480	1,790	-13%	-2%	7%	1,960	13,160	1,780	-20%	-4%	6%
Rathdowne St	Princes St	Victoria St	5,880	34,000	5,760	6,180	37,680	6,470	5%	11%	12%	5,540	36,300	6,600	-6%	7%	15%
Royal Pde	Gatehouse St	Brunswick Rd	6,880	39,560	5,810	7,000	41,980	6,790	2%	6%	17%	6,740	41,440	6,840	-2%	5%	18%
Royal Pde	Gatehouse St	Grattan St	5,960	34,820	5,600	7,040	44,400	7,900	18%	28%	41%	6,740	43,560	7,940	13%	25%	42%
Smith St	Alexandra Pde	Queens Pde	1,380	6,280	710	620	3,960	440	-55%	-37%	-38%	500	3,300	380	-64%	-47%	-46%
Smith St	Johnston St	Keele St	2,460	15,560	1,950	460	3,180	400	-81%	-80%	-79%	440	3,120	400	-82%	-80%	-79%
Smith St	Keele St	Alexandra Pde	2,300	15,360	1,800	480	3,020	300	-79%	-80%	-83%	400	2,840	290	-83%	-82%	-84%
Smith St	Victoria Pde	Johnston St	2,280	12,340	1,780	340	2,340	360	-85%	-81%	-80%	320	2,300	350	-86%	-81%	-80%
St Georges Rd	Brunswick St	Holden St	3,660	17,580	2,450	3,540	17,440	2,280	-3%	-1%	-7%	3,420	17,100	2,280	-7%	-3%	-7%
Swanston St	Cemetery Rd W	Elgin St	1,960	12,780	1,670	2,600	16,760	2,700	33%	31%	62%	2,620	16,640	2,660	34%	30%	59%
Swanston St	Grattan St	Elgin St	2,740	15,300	2,410	2,600	16,320	3,410	-5%	7%	41%	2,200	15,540	3,330	-20%	2%	38%
Swanston St	Victoria St	Grattan St	2,320	13,300	2,820	3,100	19,520	4,170	34%	47%	48%	2,920	18,840	4,080	26%	42%	45%
Victoria Pde	Brunswick St	Nicholson St	8,660	52,300	8,810	9,080	57,820	9,920	5%	11%	13%	8,120	55,340	9,820	-6%	6%	11%
Victoria Pde	Hoddle St	Rokeby St	8,920	54,860	8,960	9,940	62,740	11,200	11%	14%	25%	9,540	61,460	11,360	7%	12%	27%
Victoria Pde	Rokeby St	Cambridge St	8,760	53,600	9,100	9,700	61,400	11,340	11%	15%	25%	9,320	60,060	11,510	6%	12%	26%
Victoria St	Chetwynd St	Elizabeth St	4,020	23,520	4,680	4,520	28,660	6,000	12%	22%	28%	4,400	28,540	6,000	9%	21%	28%
Victoria St	Curzon St	Dryburgh St	2,880	18,840	3,300	4,240	27,560	5,590	47%	46%	69%	4,120	26,880	5,640	43%	43%	71%
Victoria St	Elizabeth St	Rathdowne St	8,440	50,800	8,840	9,040	57,420	10,490	7%	13%	19%	8,860	56,560	10,490	5%	11%	19%
Victoria St	Hawke St	Chetwynd St	3,740	20,800	3,750	4,020	24,740	5,200	7%	19%	39%	3,880	24,480	5,220	4%	18%	39%
Victoria St	Hoddle St	Lithgow St	3,360	19,340	3,140	4,000	25,960	4,070	19%	34%	30%	3,640	25,360	4,060	8%	31%	29%
Victoria St	Nicholson St	Rathdowne St	8,280	48,560	8,120	8,420	54,680	9,910	2%	13%	22%	7,440	52,320	9,830	-10%	8%	21%
Wellington St	Johnston St	Alexandra Pde	2,920	18,640	2,290	300	1,460	120	-90%	-92%	-95%	200	1,280	110	-93%	-93%	-95%
Wellington St	Victoria Pde	Johnston St	2,580	16,480	2,410	200	720	60	-92%	-96%	-98%	120	640	60	-95%	-96%	-98%
Wreckyn St	Courtney St	Flemington Rd	2,320	13,200	1,940	460	2,720	490	-80%	-79%	-75%	540	2,860	500	-77%	-78%	-74%
E-W Tunnel	Eastern Fwy	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Eastern Fwy	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Royal Pde	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Flemington Rd	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Flemington Rd	Royal Pde	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Eastern Fwy	Albert St	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Albert St	Eastern Fwy	0	0	0	0	0	0				0	0	0			

Northern Central City Corridor Study

Modelled traffic volumes on selected roads

Summary of Zenith model outputs (CV = commercial vehicles) - indicative only

Road	From	To	2001 Calibrated model			2021 Strategy F - DART (light rail)						2021 Strategy F1 - DART (light rail + toll)					
			AM pk	Daily		AM pk	Daily		Diff from 2001			AM pk	Daily		Diff from 2001		
			All veh	All veh	CV	All veh	All veh	CV	All veh		CV	All veh	All veh	CV	All veh		CV
			Total	Total	Total	Total	Total	Total	AM pk	Daily	Daily	Total	Total	Total	AM pk	Daily	Daily
Abbotsford St	Arden St	Haines St	2,040	8,700	1,250	100	760	180	-95%	-91%	-86%	100	740	170	-95%	-91%	-86%
Abbotsford St	Haines St	Flemington Rd	1,240	5,340	740	60	640	160	-95%	-88%	-78%	60	640	150	-95%	-88%	-80%
Abbotsford St	Victoria St	Arden St	1,400	6,760	950	0	0	0	-100%	-100%	-100%	0	0	0	-100%	-100%	-100%
Alexandra Pde	Brunswick St	Nicholson St	15,780	91,000	11,830	15,600	92,680	13,460	-1%	2%	14%	15,800	93,820	13,760	0%	3%	16%
Alexandra Pde	Gold St	Smith St	12,520	70,320	7,800	10,940	64,280	7,760	-13%	-9%	-1%	10,780	62,980	7,590	-14%	-10%	-3%
Alexandra Pde	Smith St	Brunswick St	11,360	64,940	7,190	10,880	64,760	8,020	-4%	0%	12%	10,540	62,200	7,530	-7%	-4%	5%
Arden St	Citylink	Macaulay Rd	2,520	14,860	2,540	40	1,340	510	-98%	-91%	-80%	20	1,540	580	-99%	-90%	-77%
Arden St	Curzon St	Courtney St	2,020	11,540	1,650	120	1,040	190	-94%	-91%	-88%	120	1,000	170	-94%	-91%	-90%
Arden St	Macaulay Rd	Curzon St	3,020	16,720	2,310	60	600	70	-98%	-96%	-97%	60	640	70	-98%	-96%	-97%
Boundary Rd	Macaulay Rd	Racecourse Rd	1,900	12,020	1,710	2,460	16,460	2,470	29%	37%	44%	2,520	16,440	2,450	33%	37%	43%
Brunswick Rd	CityLink	Grantham St	5,120	25,340	1,700	5,340	27,340	2,360	4%	8%	39%	5,280	27,060	2,310	3%	7%	36%
Brunswick Rd	Grantham St	Sydney Rd	4,060	20,840	1,620	5,140	27,320	2,600	27%	31%	60%	5,060	27,300	2,550	25%	31%	57%
Brunswick Rd	Lygon St	Nicholson St	4,260	23,980	1,910	5,080	31,900	3,300	19%	33%	73%	5,220	32,080	3,390	23%	34%	77%
Brunswick Rd	Sydney Rd	Lygon St	4,740	27,020	2,340	5,680	34,360	3,670	20%	27%	57%	5,840	33,520	3,530	23%	24%	51%
Brunswick St	Alexandra Pde	St Georges Rd	2,820	12,460	1,630	3,600	17,040	2,490	28%	37%	53%	3,460	16,700	2,330	23%	34%	43%
Brunswick St	Gertrude St	Moor St	2,560	13,040	2,050	3,000	18,280	2,860	17%	40%	40%	3,080	17,840	2,740	20%	37%	34%
Brunswick St	Johnston St	Alexandra Pde	3,620	16,260	2,040	3,980	20,060	2,690	10%	23%	32%	3,860	20,720	2,850	7%	27%	40%
Brunswick St	Moor St	Johnston St	2,620	13,460	1,830	3,000	17,720	2,620	15%	32%	43%	3,080	17,500	2,550	18%	30%	39%
Brunswick St	Victoria Pde	Gertrude St	3,400	15,200	2,330	3,420	20,820	3,230	1%	37%	39%	3,500	20,280	3,120	3%	33%	34%
Cemetery Rd E	Lygon St	Swanston St	7,320	40,960	4,850	7,280	44,480	6,280	-1%	9%	29%	7,160	44,560	6,270	-2%	9%	29%
Cemetery Rd W	Swanston St	Royal Pde	5,000	30,980	2,930	5,720	34,920	3,890	14%	13%	33%	5,760	34,780	3,770	15%	12%	29%
Citylink	Brunswick Rd	Dynon St	8,960	39,500	3,700	9,060	48,460	4,860	1%	23%	31%	9,040	48,580	4,950	1%	23%	34%
Citylink	Dynon St	Brunswick Rd	3,660	35,140	3,100	4,260	43,100	4,550	16%	23%	47%	4,340	43,800	4,720	19%	25%	52%
Curzon St	Victoria St	Haines St	2,880	15,940	2,390	3,680	21,560	3,900	28%	35%	63%	3,720	21,940	3,810	29%	38%	59%
Dryburgh St	Victoria St	Arden St	3,240	20,300	3,150	4,160	26,800	4,550	28%	32%	44%	4,120	26,760	4,570	27%	32%	45%
Eastern Fwy	Gold St	Yarra Bend	7,240	68,640	7,700	8,820	67,360	9,100	22%	-2%	18%	8,300	64,280	8,500	15%	-6%	10%
Eastern Fwy	Yarra Bend	Gold St	16,220	67,040	7,430	13,900	68,460	9,100	-14%	2%	22%	13,560	65,840	8,720	-16%	-2%	17%
Elgin St	Swanston St	Nicholson St	3,920	25,680	3,160	2,920	19,080	2,590	-26%	-26%	-18%	2,960	19,060	2,620	-24%	-26%	-17%
Elizabeth St	Flemington Rd	Victoria St	6,420	39,100	6,320	6,860	45,320	7,780	7%	16%	23%	6,900	45,180	7,800	7%	16%	23%
Elizabeth St	Grattan St	Flemington Rd	5,640	33,860	5,760	7,320	46,260	9,370	30%	37%	63%	7,160	45,960	9,350	27%	36%	62%
Elliott Ave	Flemington Rd	Macarthur Rd	5,080	31,200	2,910	6,240	38,640	4,430	23%	24%	52%	6,180	38,340	4,320	22%	23%	48%
Errol St	Arden St	Victoria St	600	2,880	490	0	120	40	-100%	-96%	-92%	0	140	40	-100%	-95%	-92%
Flemington Rd	Abbotsford St	Elliott Ave	9,460	55,240	7,100	9,820	60,220	8,980	4%	9%	26%	9,820	60,080	8,880	4%	9%	25%
Flemington Rd	Elizabeth St	Grattan St	6,500	40,520	6,050	8,040	52,220	8,680	24%	29%	43%	8,200	51,840	8,670	26%	28%	43%
Flemington Rd	Gatehouse St	Abbotsford St	8,400	52,260	7,090	10,160	61,860	9,590	21%	18%	35%	10,200	61,800	9,520	21%	18%	34%
Flemington Rd	Grattan St	Gatehouse St	7,180	45,420	6,480	7,500	49,520	8,080	4%	9%	25%	7,640	49,100	8,070	6%	8%	25%
Gatehouse St	Bayles St	Flemington Rd	2,040	12,420	2,010	0	160	30	-100%	-99%	-99%	0	140	30	-100%	-99%	-99%
Gatehouse St	Bayles St	Royal Pde	2,040	12,420	2,010	0	160	30	-100%	-99%	-99%	0	140	30	-100%	-99%	-99%
Gatehouse St	Royal Pde	College Cr	2,180	12,200	1,800	1,020	8,900	1,400	-53%	-27%	-22%	840	8,960	1,410	-61%	-27%	-22%
Gertrude St	Brunswick St	Smith St	840	2,940	340	520	3,420	450	-38%	16%	32%	480	3,340	450	-43%	14%	32%
Gertrude St	Nicholson St	Brunswick St	500	2,380	260	40	600	70	-92%	-75%	-73%	40	440	50	-92%	-82%	-81%
Grattan St	Elizabeth St	Flemington Rd	2,940	17,800	2,410	20	400	80	-99%	-98%	-97%	20	400	80	-99%	-98%	-97%
Grattan St	Rathdowne St	Swanston St	2,360	12,920	1,380	40	100	10	-98%	-99%	-99%	0	200	20	-100%	-98%	-99%
Grattan St	Swanston St	Royal Pde	3,220	19,360	2,530	0	240	40	-100%	-99%	-98%	0	260	40	-100%	-99%	-98%
Harker St	Haines St	Flemington Rd	3,520	18,820	2,660	3,600	20,640	3,480	2%	10%	31%	3,640	20,980	3,420	3%	11%	29%
High St	Queens Pde	Westgarth St	5,340	31,680	4,010	5,600	34,120	4,160	5%	8%	4%	5,500	33,760	4,140	3%	7%	3%
Hoddle St	Johnston St	Langridge St	13,820	85,260	10,740	16,080	101,420	15,110	16%	19%	41%	15,940	100,260	15,000	15%	18%	40%
Hoddle St	Langridge St	Victoria St	12,740	81,280	10,690	16,340	101,420	15,440	28%	25%	44%	16,160	100,260	15,320	27%	23%	43%
Hoddle St	Queens Pde	Alexandra Pde	8,640	48,820	4,960	8,160	48,980	6,080	-6%	0%	23%	8,180	49,420	6,150	-5%	1%	24%
Holden St	Nicholson St	St Georges Rd	2,240	13,180	1,290	3,120	17,780	2,540	39%	35%	97%	2,980	17,240	2,340	33%	31%	81%
Johnston St	Brunswick St	Smith St	4,060	21,320	2,200	3,400	20,720	2,590	-16%	-3%	18%	3,460	20,360	2,300	-15%	-5%	5%
Johnston St	Hoddle St	Masons Lane	3,840	22,360	2,290	3,860	24,320	2,860	1%	9%	25%	3,920	24,500	2,950	2%	10%	29%
Johnston St	Nicholson St	Brunswick St	4,580	23,980	2,630	3,340	20,980	2,690	-27%	-13%	2%	3,380	21,440	2,600	-26%	-11%	-1%
Johnston St	Smith St	Wellington St	4,800	21,840	2,160	3,200	19,420	2,370	-33%	-11%	10%	3,240	19,140	2,090	-33%	-12%	-3%
Johnston St	Wellington St	Hoddle St	4,120	20,920	1,970	3,520	21,320	2,470	-15%	2%	25%	3,520	21,040	2,200	-15%	1%	12%
Lygon St	Elgin St	Grattan St	2,820	16,080	2,270	2,920	19,460	3,320	4%	21%	46%	2,880	19,140	3,300	2%	19%	45%
Lygon St	Elgin St	Princes St	4,140	24,300	3,370	4,240	26,020	4,140	2%	7%	23%	4,200	26,060	4,260	1%	7%	26%
Lygon St	Grattan St	Queensberry St	2,160	12,180	1,910	3,020	20,180	3,440	40%	66%	80%	3,000	19,740	3,400	39%	62%	78%
Lygon St	Princes St	Brunswick Rd	5,100	30,160	4,150	5,460	35,020	5,230	7%	16%	26%	5,520	34,860	5,320	8%	16%	28%
Lygon St	Queensberry St	Victoria St	3,860	21,480	3,280	3,940	25,840	4,390	2%	20%	34%	3,940	25,580	4,370	2%	19%	33%
Macarthur Rd	Elliot Ave	Royal Pde	4,840	29,460	2,750	5,980	36,900	4,260	24%	25%	55%	5,920	36,700	4,140	22%	25%	51%
Macaulay Rd	Boundary Rd	City Link	3,120	18,800	2,380	2,360	14,780	2,500	-24%	-21%	5%	2,220	14,740	2,530	-29%	-22%	6%
Macaulay Rd	Haines St	Arden St	4,360	26,880	3,710	4,100	26,720	4,410	-6%	-1%	19%	4,060	26,600	4,420	-7%	-1%	19%
Macaulay Rd	Haines St	Boundary Rd	4,880	30,480	4,060	4,820	31,200	4,960	-1%	2%	22%	4,740	31,180	4,980	-3%	2%	23%
Nicholson St	Alexandra Pde	Johnston St	5,620	32,860	5,060	5,840	37,020	6,490	4%	13%	28%	5,700	36,760	6,570	1%	12%	30%
Nicholson St	Alexandra Pde	Newry St	5,440	31,540	4,120	5,860	36,320	4,420	8%	15%	7%	5,880	36,460	4,540	8%	16%	10%
Nicholson St	Johnston St	Victoria St	5,560	30,960	5,100	5,320	35,120	6,650	-4%	13%	30%	5,380	34,700	6,580	-3%	12%	29%
Nicholson St	Newry St	Brunswick Rd	5,200	30,040	3,030	5,780	35,780	4,270	11%	19%	41%	5,780	35,800	4,360	11%	19%	44%
Peel St	Flemington Rd	Victoria St	5,120	30,620	5,110	5,860	37,500	7,390	14%	22%	45%	5,900	37,540	7,370	15%	23%	44%
Princes St	Nicholson St	Rathdowne St	11,340	64,780	8,310	11,200	61,560	8,970	-1%	-5%	8%	11,120	60,900	8,800	-2%	-6%	6%
Princes St	Rathdowne St	Lygon St	8,920	45,860	5,240	9,420	54,820	7,510	6%	20%	43%	9,260	54,500	7,410	4%	19%	41%
Queens Pde	Alexandra Pde	Heidelberg Rd	7,420	43,660	6,640	6,580	40,900	6,900	-11%	-6%	4%	6,640	40,260	6,940	-11%	-8%	5%
Queens Pde	Heidelberg Rd	High St	5,600	33,440	4,180	5,860	35,960	4,380	5%	8%	5%	5,820	35,660	4,360	4%	7%	4%
Queensberry St	Lygon St	Rathdowne St	2,360	11,180	1,940	20	180	20	-99%	-98%	-99%	20	100	10	-99%	-99%	-99%
Queensberry St	Lygon St	Swanston St	1,960	12,020	2,270	0	280	50	-100%	-98%	-98%	20	360	70	-99%	-97%	-97%
Queensberry St	Swanston St	Peel St	2,280	13,580	2,030	0	40	10	-100%	-100%	-100%	0	40	10	-100%	-100%	-100%
Racecourse Rd	Flemington Rd	Stubbs St	5,240	29,200	3,080	6,580	40,920	5,450	26%	40%	77%	6,420	41,400	5,580	23%	42%	81%
Rathdowne St	Princes St	Newry St	2,440	13,720	1,680	1,980	13,020	1,760	-19%	-5%	5%	1,900	12,300	1,640	-22%	-10%	-2%
Rathdowne St	Princes St	Victoria St	5,880	34,000	5,760	5,380	35,260	6,320	-9%	4%	10%	5,280	35,360	6,260	-10%	4%	9%
Royal Pde	Gatehouse St	Brunswick Rd	6,880	39,560	5,810	6,640	41,420	6,830	-3%	5%	18%	6,680	41,500	6,870	-3%	5%	18%
Royal Pde	Gatehouse St	Grattan St	5,960	34,820	5,600	6,700	43,080	7,790	12%	24%	39%	6,580	42,540	7,750	10%	22%	38%
Smith St	Alexandra Pde	Queens Pde	1,380	6,280	710	460	4,340	620	-67%	-31%	-13%	380	3,220	320	-72%	-49%	-55%
Smith St	Johnston St	Keele St	2,460	15,560	1,950	520	3,680	460	-79%	-76%	-76%	480	3,300	420	-80%	-79%	-78%
Smith St	Keele St	Alexandra Pde	2,300	15,360	1,800	440	3,380	350	-81%	-78%	-81%	440	2,980	300	-81%	-81%	-83%
Smith St	Victoria Pde	Johnston St	2,280	12,340	1,780	340	2,420	360	-85%	-80%	-80%	340	2,440	360	-85%	-80%	-80%
St Georges Rd	Brunswick St	Holden St	3,660	17,580	2,450	3,380	16,640	2,330	-8%	-5%	-5%	3,320	16,400	2,190	-9%	-7%	-11%
Swanston St	Cemetery Rd W	Elgin St	1,960	12,780	1,670	2,480	18,080	2,960	27%	41%	77%	2,780	17,760	2,810	42%	39%	68%
Swanston St	Grattan St	Elgin St	2,740	15,300	2,410	2,160	15,200	3,220	-21%	-1%	34%	2,220	15,340	3,300	-19%	0%	37%
Swanston St	Victoria St	Grattan St	2,320	13,300	2,820	2,800	18,460	3,980	21%	39%	41%	2,760	18,440	4,060	19%	39%	44%
Victoria Pde	Brunswick St	Nicholson St	8,660	52,300	8,810	8,720	59,140	10,590	1%	13%	20%	8,180	57,660	10,200	-6%	10%	16%
Victoria Pde	Hoddle St	Rokeby St	8,920	54,860	8,960	10,100	64,660	12,060	13%	18%	35%	9,980	64,060	12,010	12%	17%	34%
Victoria Pde	Rokeby St	Cambridge St	8,760	53,600	9,100	9,900	63,380	12,210	13%	18%	34%	9,780	62,820	12,190	12%	17%	34%
Victoria St	Chetwynd St	Elizabeth St	4,020	23,520	4,680	4,320	28,340	6,060	7%	20%	29%	4,440	27,880	5,850	10%	19%	25%
Victoria St	Curzon St	Dryburgh St	2,880	18,840	3,300	3,900	27,320	5,440	35%	45%	65%	3,960	26,480	5,270	38%	41%	60%
Victoria St	Elizabeth St	Rathdowne St	8,440	50,800	8,840	8,820	56,620	10,720	5%	11%	21%	8,700	56,600	10,500	3%	11%	19%
Victoria St	Hawke St	Chetwynd St	3,740	20,800	3,750	3,860	24,260	5,170	3%	17%	38%	3,900	24,180	5,090	4%	16%	36%
Victoria St	Hoddle St	Lithgow St	3,360	19,340	3,140	3,760	25,440	4,060	12%	32%	29%	3,880	25,780	4,180	15%	33%	33%
Victoria St	Nicholson St	Rathdowne St	8,280	48,560	8,120	8,060	53,500	10,120	-3%	10%	25%	7,420	51,440	9,660	-10%	6%	19%
Wellington St	Johnston St	Alexandra Pde	2,920	18,640	2,290	260	1,780	190	-91%	-90%	-92%	280	1,680	170	-90%	-91%	-93%
Wellington St	Victoria Pde	Johnston St	2,580	16,480	2,410	140	720	70	-95%	-96%	-97%	160	620	50	-94%	-96%	-98%
Wreckyn St	Courtney St	Flemington Rd	2,320	13,200	1,940	500	2,800	490	-78%	-79%	-75%	540	2,880	510	-77%	-78%	-74%
E-W Tunnel	Eastern Fwy	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Eastern Fwy	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Nicholson St	Royal Pde	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Nicholson St	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Royal Pde	Flemington Rd	0	0	0	0	0	0				0	0	0			
E-W Tunnel	Flemington Rd	Royal Pde	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Eastern Fwy	Albert St	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Albert St	Eastern Fwy	0	0	0	0	0	0				0	0	0			

Northern Central City Corridor Study

Modelled traffic volumes on selected roads

Summary of Zenith model outputs (CV = commercial vehicles) - indicative only

Road	From	To	2001 Calibrated model			2021 Strategy F2 - DART (heavy rail)						2021 Strategy G - E-W tunnel					
			AM pk	Daily		AM pk	Daily		Diff from 2001			AM pk	Daily		Diff from 2001		
			All veh	All veh	CV	All veh	All veh	CV	All veh		CV	All veh	All veh	CV	All veh		CV
			Total	Total	Total	Total	Total	Total	AM pk	Daily	Daily	Total	Total	Total	AM pk	Daily	Daily
Abbotsford St	Arden St	Haines St	2,040	8,700	1,250	100	720	170	-95%	-92%	-86%	80	640	150	-96%	-93%	-88%
Abbotsford St	Haines St	Flemington Rd	1,240	5,340	740	80	600	150	-94%	-89%	-80%	60	480	120	-95%	-91%	-84%
Abbotsford St	Victoria St	Arden St	1,400	6,760	950	0	0	0	-100%	-100%	-100%	0	0	0	-100%	-100%	-100%
Alexandra Pde	Brunswick St	Nicholson St	15,780	91,000	11,830	18,260	109,020	15,980	16%	20%	35%	8,780	54,640	9,240	-44%	-40%	-22%
Alexandra Pde	Gold St	Smith St	12,520	70,320	7,800	13,600	81,180	10,020	9%	15%	28%	3,520	24,460	3,300	-72%	-65%	-58%
Alexandra Pde	Smith St	Brunswick St	11,360	64,940	7,190	13,720	80,880	10,040	21%	25%	40%	4,000	25,180	3,540	-65%	-61%	-51%
Arden St	Citylink	Macaulay Rd	2,520	14,860	2,540	20	1,740	650	-99%	-88%	-74%	40	1,600	590	-98%	-89%	-77%
Arden St	Curzon St	Courtney St	2,020	11,540	1,650	120	1,040	180	-94%	-91%	-89%	120	1,000	180	-94%	-91%	-89%
Arden St	Macaulay Rd	Curzon St	3,020	16,720	2,310	80	740	90	-97%	-96%	-96%	60	480	40	-98%	-97%	-98%
Boundary Rd	Macaulay Rd	Racecourse Rd	1,900	12,020	1,710	2,620	16,240	2,470	38%	35%	44%	2,040	14,220	2,250	7%	18%	32%
Brunswick Rd	CityLink	Grantham St	5,120	25,340	1,700	5,400	27,640	2,320	5%	9%	36%	4,520	23,600	2,080	-12%	-7%	22%
Brunswick Rd	Grantham St	Sydney Rd	4,060	20,840	1,620	5,180	27,700	2,560	28%	33%	58%	4,680	25,540	2,580	15%	23%	59%
Brunswick Rd	Lygon St	Nicholson St	4,260	23,980	1,910	5,300	34,340	3,660	24%	43%	92%	3,080	19,160	2,010	-28%	-20%	5%
Brunswick Rd	Sydney Rd	Lygon St	4,740	27,020	2,340	5,980	34,400	3,610	26%	27%	54%	3,820	22,680	2,460	-19%	-16%	5%
Brunswick St	Alexandra Pde	St Georges Rd	2,820	12,460	1,630	3,560	17,800	2,460	26%	43%	51%	3,180	14,600	1,810	13%	17%	11%
Brunswick St	Gertrude St	Moor St	2,560	13,040	2,050	3,240	18,580	2,930	27%	42%	43%	3,000	18,100	2,970	17%	39%	45%
Brunswick St	Johnston St	Alexandra Pde	3,620	16,260	2,040	3,860	20,360	2,790	7%	25%	37%	4,100	21,840	3,240	13%	34%	59%
Brunswick St	Moor St	Johnston St	2,620	13,460	1,830	3,180	18,460	2,800	21%	37%	53%	3,000	17,660	2,760	15%	31%	51%
Brunswick St	Victoria Pde	Gertrude St	3,400	15,200	2,330	3,620	20,720	3,270	6%	36%	40%	3,400	20,340	3,320	0%	34%	42%
Cemetery Rd E	Lygon St	Swanston St	7,320	40,960	4,850	7,480	45,960	6,460	2%	12%	33%	3,220	21,480	4,240	-56%	-48%	-13%
Cemetery Rd W	Swanston St	Royal Pde	5,000	30,980	2,930	5,760	35,260	3,840	15%	14%	31%	3,900	20,960	2,980	-22%	-32%	2%
Citylink	Brunswick Rd	Dynon St	8,960	39,500	3,700	8,940	47,980	4,800	0%	21%	30%	9,380	50,040	5,030	5%	27%	36%
Citylink	Dynon St	Brunswick Rd	3,660	35,140	3,100	4,320	43,680	4,520	18%	24%	46%	4,540	43,200	4,650	24%	23%	50%
Curzon St	Victoria St	Haines St	2,880	15,940	2,390	3,720	21,780	3,950	29%	37%	65%	3,640	21,320	3,830	26%	34%	60%
Dryburgh St	Victoria St	Arden St	3,240	20,300	3,150	4,200	26,540	4,600	30%	31%	46%	3,360	22,920	4,010	4%	13%	27%
Eastern Fwy	Gold St	Yarra Bend	7,240	68,640	7,700	9,120	70,680	9,450	26%	3%	23%	10,420	78,700	10,210	44%	15%	33%
Eastern Fwy	Yarra Bend	Gold St	16,220	67,040	7,430	14,400	71,260	9,400	-11%	6%	27%	15,680	80,040	10,120	-3%	19%	36%
Elgin St	Swanston St	Nicholson St	3,920	25,680	3,160	3,160	20,160	2,860	-19%	-21%	-9%	2,140	15,660	2,340	-45%	-39%	-26%
Elizabeth St	Flemington Rd	Victoria St	6,420	39,100	6,320	6,860	44,880	7,900	7%	15%	25%	6,380	41,820	7,880	-1%	7%	25%
Elizabeth St	Grattan St	Flemington Rd	5,640	33,860	5,760	7,260	46,740	9,570	29%	38%	66%	7,480	47,560	9,830	33%	40%	71%
Elliott Ave	Flemington Rd	Macarthur Rd	5,080	31,200	2,910	6,260	38,980	4,400	23%	25%	51%	620	4,680	550	-88%	-85%	-81%
Errol St	Arden St	Victoria St	600	2,880	490	0	140	40	-100%	-95%	-92%	0	140	40	-100%	-95%	-92%
Flemington Rd	Abbotsford St	Elliott Ave	9,460	55,240	7,100	9,780	59,980	9,110	3%	9%	28%	8,780	53,540	8,280	-7%	-3%	17%
Flemington Rd	Elizabeth St	Grattan St	6,500	40,520	6,050	8,140	52,060	8,820	25%	28%	46%	7,600	48,600	8,660	17%	20%	43%
Flemington Rd	Gatehouse St	Abbotsford St	8,400	52,260	7,090	10,180	61,640	9,730	21%	18%	37%	9,200	55,420	8,950	10%	6%	26%
Flemington Rd	Grattan St	Gatehouse St	7,180	45,420	6,480	7,620	49,420	8,230	6%	9%	27%	6,980	45,620	8,020	-3%	0%	24%
Gatehouse St	Bayles St	Flemington Rd	2,040	12,420	2,010	0	80	20	-100%	-99%	-99%	0	40	10	-100%	-100%	-100%
Gatehouse St	Bayles St	Royal Pde	2,040	12,420	2,010	0	80	20	-100%	-99%	-99%	0	40	10	-100%	-100%	-100%
Gatehouse St	Royal Pde	College Cr	2,180	12,200	1,800	980	9,100	1,410	-55%	-25%	-22%	980	8,300	1,280	-55%	-32%	-29%
Gertrude St	Brunswick St	Smith St	840	2,940	340	480	3,060	410	-43%	4%	21%	480	3,280	430	-43%	12%	26%
Gertrude St	Nicholson St	Brunswick St	500	2,380	260	60	400	40	-88%	-83%	-85%	60	740	80	-88%	-69%	-69%
Grattan St	Elizabeth St	Flemington Rd	2,940	17,800	2,410	20	380	70	-99%	-98%	-97%	0	320	70	-100%	-98%	-97%
Grattan St	Rathdowne St	Swanston St	2,360	12,920	1,380	0	100	10	-100%	-99%	-99%	60	200	10	-97%	-98%	-99%
Grattan St	Swanston St	Royal Pde	3,220	19,360	2,530	0	200	30	-100%	-99%	-99%	0	360	50	-100%	-98%	-98%
Harker St	Haines St	Flemington Rd	3,520	18,820	2,660	3,680	21,120	3,580	5%	12%	35%	3,620	20,700	3,530	3%	10%	33%
High St	Queens Pde	Westgarth St	5,340	31,680	4,010	5,480	34,360	4,260	3%	8%	6%	5,360	33,580	4,280	0%	6%	7%
Hoddle St	Johnston St	Langridge St	13,820	85,260	10,740	15,620	98,380	14,430	13%	15%	34%	14,800	93,480	13,510	7%	10%	26%
Hoddle St	Langridge St	Victoria St	12,740	81,280	10,690	15,800	98,160	14,740	24%	21%	38%	14,980	93,540	13,860	18%	15%	30%
Hoddle St	Queens Pde	Alexandra Pde	8,640	48,820	4,960	8,040	48,280	6,070	-7%	-1%	22%	7,880	48,460	6,250	-9%	-1%	26%
Holden St	Nicholson St	St Georges Rd	2,240	13,180	1,290	2,680	17,700	2,340	20%	34%	81%	3,080	17,920	2,610	38%	36%	102%
Johnston St	Brunswick St	Smith St	4,060	21,320	2,200	3,240	19,520	2,400	-20%	-8%	9%	2,960	17,560	2,080	-27%	-18%	-5%
Johnston St	Hoddle St	Masons Lane	3,840	22,360	2,290	3,820	24,060	2,930	-1%	8%	28%	3,860	24,080	2,880	1%	8%	26%
Johnston St	Nicholson St	Brunswick St	4,580	23,980	2,630	3,160	19,780	2,470	-31%	-18%	-6%	3,340	20,440	2,580	-27%	-15%	-2%
Johnston St	Smith St	Wellington St	4,800	21,840	2,160	3,000	18,180	2,160	-38%	-17%	0%	2,760	16,400	1,870	-43%	-25%	-13%
Johnston St	Wellington St	Hoddle St	4,120	20,920	1,970	3,320	20,240	2,310	-19%	-3%	17%	3,160	19,240	2,100	-23%	-8%	7%
Lygon St	Elgin St	Grattan St	2,820	16,080	2,270	2,960	19,680	3,370	5%	22%	48%	2,740	18,620	3,240	-3%	16%	43%
Lygon St	Elgin St	Princes St	4,140	24,300	3,370	4,400	26,740	4,290	6%	10%	27%	3,320	22,440	3,450	-20%	-8%	2%
Lygon St	Grattan St	Queensberry St	2,160	12,180	1,910	3,100	20,420	3,490	44%	68%	83%	2,820	19,260	3,350	31%	58%	75%
Lygon St	Princes St	Brunswick Rd	5,100	30,160	4,150	5,460	34,680	5,220	7%	15%	26%	5,540	35,120	5,220	9%	16%	26%
Lygon St	Queensberry St	Victoria St	3,860	21,480	3,280	4,000	25,860	4,440	4%	20%	35%	3,860	25,700	4,410	0%	20%	34%
Macarthur Rd	Elliot Ave	Royal Pde	4,840	29,460	2,750	5,980	37,240	4,220	24%	26%	53%	200	2,260	290	-96%	-92%	-89%
Macaulay Rd	Boundary Rd	City Link	3,120	18,800	2,380	2,320	14,820	2,550	-26%	-21%	7%	2,280	15,680	2,630	-27%	-17%	11%
Macaulay Rd	Haines St	Arden St	4,360	26,880	3,710	4,160	26,480	4,460	-5%	-1%	20%	3,280	22,940	3,900	-25%	-15%	5%
Macaulay Rd	Haines St	Boundary Rd	4,880	30,480	4,060	4,820	30,860	5,000	-1%	1%	23%	4,120	28,200	4,610	-16%	-7%	14%
Nicholson St	Alexandra Pde	Johnston St	5,620	32,860	5,060	5,960	39,080	6,970	6%	19%	38%	5,800	37,640	6,560	3%	15%	30%
Nicholson St	Alexandra Pde	Newry St	5,440	31,540	4,120	6,040	36,960	4,350	11%	17%	6%	5,200	33,680	5,270	-4%	7%	28%
Nicholson St	Johnston St	Victoria St	5,560	30,960	5,100	5,440	35,340	6,730	-2%	14%	32%	5,280	34,180	6,530	-5%	10%	28%
Nicholson St	Newry St	Brunswick Rd	5,200	30,040	3,030	5,980	36,500	4,200	15%	22%	39%	5,080	32,480	5,050	-2%	8%	67%
Peel St	Flemington Rd	Victoria St	5,120	30,620	5,110	5,860	37,740	7,430	14%	23%	45%	5,940	37,860	7,390	16%	24%	45%
Princes St	Nicholson St	Rathdowne St	11,340	64,780	8,310	11,840	66,560	9,840	4%	3%	18%	5,260	36,120	6,490	-54%	-44%	-22%
Princes St	Rathdowne St	Lygon St	8,920	45,860	5,240	10,360	57,200	7,810	16%	25%	49%	4,240	28,640	4,770	-52%	-38%	-9%
Queens Pde	Alexandra Pde	Heidelberg Rd	7,420	43,660	6,640	6,620	42,480	7,270	-11%	-3%	9%	6,660	41,980	7,090	-10%	-4%	7%
Queens Pde	Heidelberg Rd	High St	5,600	33,440	4,180	5,800	36,200	4,490	4%	8%	7%	5,660	35,500	4,520	1%	6%	8%
Queensberry St	Lygon St	Rathdowne St	2,360	11,180	1,940	40	120	10	-98%	-99%	-99%	0	80	10	-100%	-99%	-99%
Queensberry St	Lygon St	Swanston St	1,960	12,020	2,270	20	280	40	-99%	-98%	-98%	20	260	40	-99%	-98%	-98%
Queensberry St	Swanston St	Peel St	2,280	13,580	2,030	0	40	10	-100%	-100%	-100%	0	40	0	-100%	-100%	-100%
Racecourse Rd	Flemington Rd	Stubbs St	5,240	29,200	3,080	6,660	41,480	5,490	27%	42%	78%	7,420	44,660	5,840	42%	53%	90%
Rathdowne St	Princes St	Newry St	2,440	13,720	1,680	1,880	12,680	1,670	-23%	-8%	-1%	1,920	12,060	1,480	-21%	-12%	-12%
Rathdowne St	Princes St	Victoria St	5,880	34,000	5,760	5,480	36,180	6,590	-7%	6%	14%	5,220	35,380	6,320	-11%	4%	10%
Royal Pde	Gatehouse St	Brunswick Rd	6,880	39,560	5,810	6,680	41,460	6,850	-3%	5%	18%	7,100	43,000	6,580	3%	9%	13%
Royal Pde	Gatehouse St	Grattan St	5,960	34,820	5,600	6,720	43,360	7,930	13%	25%	42%	6,860	44,080	8,150	15%	27%	46%
Smith St	Alexandra Pde	Queens Pde	1,380	6,280	710	500	2,940	360	-64%	-53%	-49%	840	4,000	550	-39%	-36%	-23%
Smith St	Johnston St	Keele St	2,460	15,560	1,950	420	3,080	410	-83%	-80%	-79%	400	3,040	380	-84%	-80%	-81%
Smith St	Keele St	Alexandra Pde	2,300	15,360	1,800	400	2,820	290	-83%	-82%	-84%	460	3,440	370	-80%	-78%	-79%
Smith St	Victoria Pde	Johnston St	2,280	12,340	1,780	320	2,280	350	-86%	-82%	-80%	300	2,280	350	-87%	-82%	-80%
St Georges Rd	Brunswick St	Holden St	3,660	17,580	2,450	3,380	17,380	2,290	-8%	-1%	-7%	2,960	13,440	1,570	-19%	-24%	-36%
Swanston St	Cemetery Rd W	Elgin St	1,960	12,780	1,670	2,720	17,320	2,800	39%	36%	68%	2,680	19,560	3,510	37%	53%	110%
Swanston St	Grattan St	Elgin St	2,740	15,300	2,410	2,280	15,640	3,400	-17%	2%	41%	2,280	16,080	3,280	-17%	5%	36%
Swanston St	Victoria St	Grattan St	2,320	13,300	2,820	2,860	18,660	4,100	23%	40%	45%	2,820	18,800	3,920	22%	41%	39%
Victoria Pde	Brunswick St	Nicholson St	8,660	52,300	8,810	7,980	55,240	9,980	-8%	6%	13%	7,080	51,080	9,340	-18%	-2%	6%
Victoria Pde	Hoddle St	Rokeby St	8,920	54,860	8,960	9,400	61,240	11,430	5%	12%	28%	8,060	54,260	10,260	-10%	-1%	15%
Victoria Pde	Rokeby St	Cambridge St	8,760	53,600	9,100	9,100	59,800	11,550	4%	12%	27%	7,740	52,740	10,400	-12%	-2%	14%
Victoria St	Chetwynd St	Elizabeth St	4,020	23,520	4,680	4,420	29,220	6,070	10%	24%	30%	3,660	25,580	5,550	-9%	9%	19%
Victoria St	Curzon St	Dryburgh St	2,880	18,840	3,300	4,060	26,940	5,440	41%	43%	65%	3,720	25,140	5,060	29%	33%	53%
Victoria St	Elizabeth St	Rathdowne St	8,440	50,800	8,840	8,780	56,500	10,580	4%	11%	20%	8,000	52,060	10,370	-5%	2%	17%
Victoria St	Hawke St	Chetwynd St	3,740	20,800	3,750	3,840	24,240	5,080	3%	17%	35%	3,820	23,780	5,130	2%	14%	37%
Victoria St	Hoddle St	Lithgow St	3,360	19,340	3,140	3,600	25,320	4,080	7%	31%	30%	3,700	24,700	3,940	10%	28%	25%
Victoria St	Nicholson St	Rathdowne St	8,280	48,560	8,120	7,380	51,080	9,740	-11%	5%	20%	6,280	45,620	8,840	-24%	-6%	9%
Wellington St	Johnston St	Alexandra Pde	2,920	18,640	2,290	180	1,240	110	-94%	-93%	-95%	140	980	80	-95%	-95%	-97%
Wellington St	Victoria Pde	Johnston St	2,580	16,480	2,410	120	620	50	-95%	-96%	-98%	80	400	20	-97%	-98%	-99%
Wreckyn St	Courtney St	Flemington Rd	2,320	13,200	1,940	540	2,860	500	-77%	-78%	-74%	540	3,000	520	-77%	-77%	-73%
E-W Tunnel	Eastern Fwy	Nicholson St	0	0	0	0	0	0				8,520	47,060	5,290			
E-W Tunnel	Nicholson St	Eastern Fwy	0	0	0	0	0	0				7,100	47,660	5,840			
E-W Tunnel	Nicholson St	Royal Pde	0	0	0	0	0	0				9,220	51,340	5,830			
E-W Tunnel	Royal Pde	Nicholson St	0	0	0	0	0	0				8,140	50,600	5,680			
E-W Tunnel	Royal Pde	Flemington Rd	0	0	0	0	0	0				7,000	41,280	4,310			
E-W Tunnel	Flemington Rd	Royal Pde	0	0	0	0	0	0				6,460	39,580	4,200			
CBD Tunnel	Eastern Fwy	Albert St	0	0	0	0	0	0				0	0	0			
CBD Tunnel	Albert St	Eastern Fwy	0	0	0	0	0	0				0	0	0			

Northern Central City Corridor Study

Modelled traffic volumes on selected roads

Summary of Zenith model outputs (CV = commercial vehicles) - indicative only

Road	From	To	2001 Calibrated model			2021 Strategy G1 - E-W tunnel no ramps						2021 Strategy G2 - CBD tunnel					
			AM pk	Daily		AM pk	Daily		Diff from 2001			AM pk	Daily		Diff from 2001		
			All veh	All veh	CV	All veh	All veh	CV	All veh		CV	All veh	All veh	CV	All veh		CV
			Total	Total	Total	Total	Total	Total	AM pk	Daily	Daily	Total	Total	Total	AM pk	Daily	Daily
Abbotsford St	Arden St	Haines St	2,040	8,700	1,250	80	680	160	-96%	-92%	-87%	100	760	180	-95%	-91%	-86%
Abbotsford St	Haines St	Flemington Rd	1,240	5,340	740	60	500	130	-95%	-91%	-82%	60	720	170	-95%	-87%	-77%
Abbotsford St	Victoria St	Arden St	1,400	6,760	950	0	0	0	-100%	-100%	-100%	0	0	0	-100%	-100%	-100%
Alexandra Pde	Brunswick St	Nicholson St	15,780	91,000	11,830	8,860	55,100	9,260	-44%	-39%	-22%	9,600	56,960	7,890	-39%	-37%	-33%
Alexandra Pde	Gold St	Smith St	12,520	70,320	7,800	5,360	35,500	4,940	-57%	-50%	-37%	6,880	43,600	4,510	-45%	-38%	-42%
Alexandra Pde	Smith St	Brunswick St	11,360	64,940	7,190	5,580	34,740	4,870	-51%	-47%	-32%	6,780	42,420	4,400	-40%	-35%	-39%
Arden St	Citylink	Macaulay Rd	2,520	14,860	2,540	20	1,180	450	-99%	-92%	-82%	140	2,220	770	-94%	-85%	-70%
Arden St	Curzon St	Courtney St	2,020	11,540	1,650	120	1,080	190	-94%	-91%	-88%	140	1,120	190	-93%	-90%	-88%
Arden St	Macaulay Rd	Curzon St	3,020	16,720	2,310	60	480	50	-98%	-97%	-98%	80	620	70	-97%	-96%	-97%
Boundary Rd	Macaulay Rd	Racecourse Rd	1,900	12,020	1,710	1,880	13,960	2,250	-1%	16%	32%	2,720	17,080	2,600	43%	42%	52%
Brunswick Rd	CityLink	Grantham St	5,120	25,340	1,700	4,500	23,980	2,150	-12%	-5%	26%	5,540	28,040	2,440	8%	11%	44%
Brunswick Rd	Grantham St	Sydney Rd	4,060	20,840	1,620	4,500	25,180	2,610	11%	21%	61%	5,280	28,240	2,750	30%	36%	70%
Brunswick Rd	Lygon St	Nicholson St	4,260	23,980	1,910	3,800	23,720	2,670	-11%	-1%	40%	5,180	31,240	3,410	22%	30%	79%
Brunswick Rd	Sydney Rd	Lygon St	4,740	27,020	2,340	4,020	25,420	2,820	-15%	-6%	21%	5,560	32,480	3,460	17%	20%	48%
Brunswick St	Alexandra Pde	St Georges Rd	2,820	12,460	1,630	3,140	14,000	1,670	11%	12%	2%	3,360	16,360	2,260	19%	31%	39%
Brunswick St	Gertrude St	Moor St	2,560	13,040	2,050	3,060	18,340	2,910	20%	41%	42%	3,040	16,860	2,550	19%	29%	24%
Brunswick St	Johnston St	Alexandra Pde	3,620	16,260	2,040	3,900	20,880	3,020	8%	28%	48%	3,940	20,580	2,880	9%	27%	41%
Brunswick St	Moor St	Johnston St	2,620	13,460	1,830	2,980	17,460	2,650	14%	30%	45%	2,900	15,760	2,250	11%	17%	23%
Brunswick St	Victoria Pde	Gertrude St	3,400	15,200	2,330	3,420	20,660	3,260	1%	36%	40%	3,520	19,280	2,900	4%	27%	24%
Cemetery Rd E	Lygon St	Swanston St	7,320	40,960	4,850	4,440	29,220	5,060	-39%	-29%	4%	5,360	33,280	4,980	-27%	-19%	3%
Cemetery Rd W	Swanston St	Royal Pde	5,000	30,980	2,930	3,100	19,280	2,300	-38%	-38%	-22%	4,620	27,780	3,230	-8%	-10%	10%
Citylink	Brunswick Rd	Dynon St	8,960	39,500	3,700	9,460	49,540	5,080	6%	25%	37%	9,260	49,120	4,960	3%	24%	34%
Citylink	Dynon St	Brunswick Rd	3,660	35,140	3,100	4,460	42,940	4,630	22%	22%	49%	4,540	44,040	4,650	24%	25%	50%
Curzon St	Victoria St	Haines St	2,880	15,940	2,390	3,800	21,220	3,730	32%	33%	56%	3,660	20,380	3,710	27%	28%	55%
Dryburgh St	Victoria St	Arden St	3,240	20,300	3,150	3,340	22,100	3,850	3%	9%	22%	4,500	28,080	4,820	39%	38%	53%
Eastern Fwy	Gold St	Yarra Bend	7,240	68,640	7,700	10,580	79,420	10,080	46%	16%	31%	9,640	75,740	10,820	33%	10%	41%
Eastern Fwy	Yarra Bend	Gold St	16,220	67,040	7,430	15,860	81,780	10,270	-2%	22%	38%	15,360	76,660	10,660	-5%	14%	43%
Elgin St	Swanston St	Nicholson St	3,920	25,680	3,160	2,920	18,000	2,410	-26%	-30%	-24%	3,200	19,960	2,800	-18%	-22%	-11%
Elizabeth St	Flemington Rd	Victoria St	6,420	39,100	6,320	6,140	41,040	7,620	-4%	5%	21%	7,000	45,740	7,570	9%	17%	20%
Elizabeth St	Grattan St	Flemington Rd	5,640	33,860	5,760	7,140	45,520	9,200	27%	34%	60%	6,700	44,040	8,840	19%	30%	53%
Elliott Ave	Flemington Rd	Macarthur Rd	5,080	31,200	2,910	2,360	15,160	1,760	-54%	-51%	-40%	3,680	22,880	2,620	-28%	-27%	-10%
Errol St	Arden St	Victoria St	600	2,880	490	0	160	40	-100%	-94%	-92%	0	120	30	-100%	-96%	-94%
Flemington Rd	Abbotsford St	Elliott Ave	9,460	55,240	7,100	8,500	52,660	8,130	-10%	-5%	15%	10,260	63,080	9,210	8%	14%	30%
Flemington Rd	Elizabeth St	Grattan St	6,500	40,520	6,050	6,960	46,360	8,220	7%	14%	36%	8,640	55,380	8,890	33%	37%	47%
Flemington Rd	Gatehouse St	Abbotsford St	8,400	52,260	7,090	8,880	54,180	8,720	6%	4%	23%	10,580	64,100	9,710	26%	23%	37%
Flemington Rd	Grattan St	Gatehouse St	7,180	45,420	6,480	6,360	43,520	7,600	-11%	-4%	17%	8,080	52,660	8,290	13%	16%	28%
Gatehouse St	Bayles St	Flemington Rd	2,040	12,420	2,010	0	40	10	-100%	-100%	-100%	0	160	30	-100%	-99%	-99%
Gatehouse St	Bayles St	Royal Pde	2,040	12,420	2,010	0	40	10	-100%	-100%	-100%	0	160	30	-100%	-99%	-99%
Gatehouse St	Royal Pde	College Cr	2,180	12,200	1,800	660	6,760	1,110	-70%	-45%	-38%	720	6,720	1,050	-67%	-45%	-42%
Gertrude St	Brunswick St	Smith St	840	2,940	340	480	3,240	430	-43%	10%	26%	520	3,340	440	-38%	14%	29%
Gertrude St	Nicholson St	Brunswick St	500	2,380	260	100	700	70	-80%	-71%	-73%	20	780	80	-96%	-67%	-69%
Grattan St	Elizabeth St	Flemington Rd	2,940	17,800	2,410	0	280	60	-100%	-98%	-98%	20	540	110	-99%	-97%	-95%
Grattan St	Rathdowne St	Swanston St	2,360	12,920	1,380	0	100	10	-100%	-99%	-99%	0	20	0	-100%	-100%	-100%
Grattan St	Swanston St	Royal Pde	3,220	19,360	2,530	0	100	10	-100%	-99%	-100%	0	140	20	-100%	-99%	-99%
Harker St	Haines St	Flemington Rd	3,520	18,820	2,660	3,700	20,380	3,400	5%	8%	28%	3,460	19,000	3,200	-2%	1%	20%
High St	Queens Pde	Westgarth St	5,340	31,680	4,010	5,340	33,180	4,110	0%	5%	2%	5,580	34,220	3,990	4%	8%	0%
Hoddle St	Johnston St	Langridge St	13,820	85,260	10,740	14,780	94,560	14,090	7%	11%	31%	13,500	84,960	10,860	-2%	0%	1%
Hoddle St	Langridge St	Victoria St	12,740	81,280	10,690	15,040	94,740	14,450	18%	17%	35%	13,860	85,460	11,270	9%	5%	5%
Hoddle St	Queens Pde	Alexandra Pde	8,640	48,820	4,960	7,980	48,580	6,170	-8%	0%	24%	8,540	51,240	6,240	-1%	5%	26%
Holden St	Nicholson St	St Georges Rd	2,240	13,180	1,290	3,240	18,680	2,710	45%	42%	110%	3,080	18,460	2,520	38%	40%	95%
Johnston St	Brunswick St	Smith St	4,060	21,320	2,200	3,160	18,620	2,210	-22%	-13%	0%	3,140	18,720	2,110	-23%	-12%	-4%
Johnston St	Hoddle St	Masons Lane	3,840	22,360	2,290	3,780	24,080	2,870	-2%	8%	25%	3,920	24,620	2,870	2%	10%	25%
Johnston St	Nicholson St	Brunswick St	4,580	23,980	2,630	3,340	20,700	2,650	-27%	-14%	1%	3,660	22,200	2,740	-20%	-7%	4%
Johnston St	Smith St	Wellington St	4,800	21,840	2,160	2,860	17,160	1,970	-40%	-21%	-9%	3,000	17,600	1,910	-38%	-19%	-12%
Johnston St	Wellington St	Hoddle St	4,120	20,920	1,970	3,200	19,540	2,130	-22%	-7%	8%	3,480	20,860	2,180	-16%	0%	11%
Lygon St	Elgin St	Grattan St	2,820	16,080	2,270	2,800	19,040	3,180	-1%	18%	40%	2,440	15,880	2,650	-13%	-1%	17%
Lygon St	Elgin St	Princes St	4,140	24,300	3,370	3,260	23,860	3,540	-21%	-2%	5%	3,480	21,360	3,250	-16%	-12%	-4%
Lygon St	Grattan St	Queensberry St	2,160	12,180	1,910	2,920	19,780	3,290	35%	62%	72%	2,540	16,580	2,760	18%	36%	45%
Lygon St	Princes St	Brunswick Rd	5,100	30,160	4,150	5,080	33,580	5,040	0%	11%	21%	5,500	35,040	5,150	8%	16%	24%
Lygon St	Queensberry St	Victoria St	3,860	21,480	3,280	3,940	25,760	4,280	2%	20%	30%	3,700	23,480	3,820	-4%	9%	16%
Macarthur Rd	Elliot Ave	Royal Pde	4,840	29,460	2,750	2,100	13,700	1,630	-57%	-53%	-41%	3,500	22,000	2,560	-28%	-25%	-7%
Macaulay Rd	Boundary Rd	City Link	3,120	18,800	2,380	2,300	15,920	2,610	-26%	-15%	10%	2,380	15,220	2,640	-24%	-19%	11%
Macaulay Rd	Haines St	Arden St	4,360	26,880	3,710	3,300	22,240	3,760	-24%	-17%	1%	4,440	28,000	4,690	2%	4%	26%
Macaulay Rd	Haines St	Boundary Rd	4,880	30,480	4,060	4,160	27,500	4,460	-15%	-10%	10%	5,100	32,200	5,220	5%	6%	29%
Nicholson St	Alexandra Pde	Johnston St	5,620	32,860	5,060	5,560	35,720	6,240	-1%	9%	23%	4,680	31,700	5,060	-17%	-4%	0%
Nicholson St	Alexandra Pde	Newry St	5,440	31,540	4,120	5,260	33,440	5,120	-3%	6%	24%	5,980	36,700	4,780	10%	16%	16%
Nicholson St	Johnston St	Victoria St	5,560	30,960	5,100	5,280	34,180	6,490	-5%	10%	27%	4,620	29,700	5,230	-17%	-4%	3%
Nicholson St	Newry St	Brunswick Rd	5,200	30,040	3,030	5,180	32,740	4,940	0%	9%	63%	5,880	35,900	4,590	13%	20%	51%
Peel St	Flemington Rd	Victoria St	5,120	30,620	5,110	5,800	36,920	7,180	13%	21%	41%	5,880	37,500	7,430	15%	22%	45%
Princes St	Nicholson St	Rathdowne St	11,340	64,780	8,310	6,300	40,480	6,880	-44%	-38%	-17%	6,780	41,180	5,720	-40%	-36%	-31%
Princes St	Rathdowne St	Lygon St	8,920	45,860	5,240	5,300	35,880	5,610	-41%	-22%	7%	6,660	41,220	5,540	-25%	-10%	6%
Queens Pde	Alexandra Pde	Heidelberg Rd	7,420	43,660	6,640	6,420	40,360	6,840	-13%	-8%	3%	5,980	38,460	5,940	-19%	-12%	-11%
Queens Pde	Heidelberg Rd	High St	5,600	33,440	4,180	5,640	35,100	4,340	1%	5%	4%	5,860	36,180	4,220	5%	8%	1%
Queensberry St	Lygon St	Rathdowne St	2,360	11,180	1,940	20	140	20	-99%	-99%	-99%	0	60	10	-100%	-99%	-99%
Queensberry St	Lygon St	Swanston St	1,960	12,020	2,270	0	260	50	-100%	-98%	-98%	40	300	50	-98%	-98%	-98%
Queensberry St	Swanston St	Peel St	2,280	13,580	2,030	0	20	0	-100%	-100%	-100%	0	40	10	-100%	-100%	-100%
Racecourse Rd	Flemington Rd	Stubbs St	5,240	29,200	3,080	7,400	43,900	5,680	41%	50%	84%	5,780	38,000	5,310	10%	30%	72%
Rathdowne St	Princes St	Newry St	2,440	13,720	1,680	1,880	11,840	1,510	-23%	-14%	-10%	2,020	12,460	1,650	-17%	-9%	-2%
Rathdowne St	Princes St	Victoria St	5,880	34,000	5,760	5,320	34,900	6,210	-10%	3%	8%	4,680	30,760	5,420	-20%	-10%	-6%
Royal Pde	Gatehouse St	Brunswick Rd	6,880	39,560	5,810	6,840	42,560	6,940	-1%	8%	19%	6,880	42,040	6,800	0%	6%	17%
Royal Pde	Gatehouse St	Grattan St	5,960	34,820	5,600	6,560	42,340	7,640	10%	22%	36%	6,120	40,600	7,200	3%	17%	29%
Smith St	Alexandra Pde	Queens Pde	1,380	6,280	710	680	2,740	270	-51%	-56%	-62%	400	2,580	250	-71%	-59%	-65%
Smith St	Johnston St	Keele St	2,460	15,560	1,950	440	3,260	410	-82%	-79%	-79%	440	3,160	410	-82%	-80%	-79%
Smith St	Keele St	Alexandra Pde	2,300	15,360	1,800	480	3,060	310	-79%	-80%	-83%	400	2,940	300	-83%	-81%	-83%
Smith St	Victoria Pde	Johnston St	2,280	12,340	1,780	300	2,400	360	-87%	-81%	-80%	300	2,380	360	-87%	-81%	-80%
St Georges Rd	Brunswick St	Holden St	3,660	17,580	2,450	2,980	13,160	1,470	-19%	-25%	-40%	3,220	15,820	2,080	-12%	-10%	-15%
Swanston St	Cemetery Rd W	Elgin St	1,960	12,780	1,670	3,540	21,900	3,620	81%	71%	117%	2,880	19,320	3,220	47%	51%	93%
Swanston St	Grattan St	Elgin St	2,740	15,300	2,410	2,280	16,020	3,360	-17%	5%	39%	1,880	13,280	2,950	-31%	-13%	22%
Swanston St	Victoria St	Grattan St	2,320	13,300	2,820	2,580	18,160	4,020	11%	37%	43%	2,740	18,120	3,940	18%	36%	40%
Victoria Pde	Brunswick St	Nicholson St	8,660	52,300	8,810	7,400	53,280	9,840	-15%	2%	12%	9,640	63,380	10,620	11%	21%	21%
Victoria Pde	Hoddle St	Rokeby St	8,920	54,860	8,960	8,420	56,780	10,890	-6%	3%	22%	7,640	49,240	8,180	-14%	-10%	-9%
Victoria Pde	Rokeby St	Cambridge St	8,760	53,600	9,100	8,120	55,420	11,080	-7%	3%	22%	7,340	48,140	8,410	-16%	-10%	-8%
Victoria St	Chetwynd St	Elizabeth St	4,020	23,520	4,680	3,940	25,940	5,640	-2%	10%	21%	4,500	29,460	6,280	12%	25%	34%
Victoria St	Curzon St	Dryburgh St	2,880	18,840	3,300	3,380	24,700	5,000	17%	31%	52%	4,460	29,000	5,440	55%	54%	65%
Victoria St	Elizabeth St	Rathdowne St	8,440	50,800	8,840	8,180	53,420	10,700	-3%	5%	21%	9,120	59,020	10,840	8%	16%	23%
Victoria St	Hawke St	Chetwynd St	3,740	20,800	3,750	3,760	23,500	5,070	1%	13%	35%	4,020	24,840	5,120	7%	19%	37%
Victoria St	Hoddle St	Lithgow St	3,360	19,340	3,140	3,640	24,720	3,920	8%	28%	25%	3,820	26,000	4,020	14%	34%	28%
Victoria St	Nicholson St	Rathdowne St	8,280	48,560	8,120	6,140	45,680	8,920	-26%	-6%	10%	9,200	59,540	10,900	11%	23%	34%
Wellington St	Johnston St	Alexandra Pde	2,920	18,640	2,290	200	1,100	100	-93%	-94%	-96%	140	820	70	-95%	-96%	-97%
Wellington St	Victoria Pde	Johnston St	2,580	16,480	2,410	80	520	40	-97%	-97%	-98%	80	380	20	-97%	-98%	-99%
Wreckyn St	Courtney St	Flemington Rd	2,320	13,200	1,940	540	2,940	520	-77%	-78%	-73%	500	2,840	490	-78%	-78%	-75%
E-W Tunnel	Eastern Fwy	Nicholson St	0	0	0	7,200	40,020	4,120				0	0	0			
E-W Tunnel	Nicholson St	Eastern Fwy	0	0	0	5,940	38,460	3,960				0	0	0			
E-W Tunnel	Nicholson St	Royal Pde	0	0	0	7,200	40,020	4,120				0	0	0			
E-W Tunnel	Royal Pde	Nicholson St	0	0	0	5,940	38,460	3,960				0	0	0			
E-W Tunnel	Royal Pde	Flemington Rd	0	0	0	7,200	40,020	4,120				0	0	0			
E-W Tunnel	Flemington Rd	Royal Pde	0	0	0	5,940	38,460	3,960				0	0	0			
CBD Tunnel	Eastern Fwy	Albert St	0	0	0	0	0	0				6,880	35,220	6,210			
CBD Tunnel	Albert St	Eastern Fwy	0	0	0	0	0	0				4,420	35,640	6,570			