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Traffic Engineering

Pakenham East PSP

Traffic Impact Assessment Report
Statement of Evidence





1 Introduction and Scope

Cardinia Shire Council and the VPA have prepared and exhibited Amendment C234 to the Cardinia Planning Scheme. This statement of evidence considers the transport and traffic engineering consequences of the development in accordance with the Amendment, the traffic and transport facilities that are proposed and also considers the Parklea alternative plan.

2 Witness Experience, Project Background and Scope

Witness Name James Donald Higgs

Qualifications Bachelor of Engineering (Civil)

The University of Melbourne

Position Director

TTM Consulting (Vic) Pty Ltd

Suite 9, 70-80 Wellington Street, Collingwood Vic 3066

Experience I have approximately 44 years' experience in Engineering including:

• One year experience at Shire of Mortlake

Three years' experience at Town of Kyabram

Ten years' experience at City of Knox

One year experience Higgs-TTM Pty. Ltd

Twenty years' experience at TTM Consulting Pty Ltd

Ten years' experience at TTM Consulting (Vic) Pty Ltd

Areas of Expertise I have expertise in road and street design and construction, development

traffic impact assessment including traffic and car parking demand generation and parking generation, traffic management and general traffic engineering, road safety and transportation and urban planning with an

engineering focus.

Experience My experience and expertise over the past 44 years includes road design,

project assessment, inter disciplinary urban planning, preparation of movement network design codes including Liveable Neighbourhoods and Clause 56.06 review, determination of pavement design parameters and numerous car parking and traffic generation assessments of a wide range of land use developments. I am therefore well qualified to provide this

assessment in respect of the subject proposal.



Instructions and Existing Relationship

I have been instructed by Minter Ellison, on behalf of Parklea Pty Ltd to provide a statement that includes:

- Review of proposed Amendment C234 with specific references to the Pakenham East Precinct Structure Plan (PSP) in respect of traffic and transport facilities and provisions, primarily concentrating on that part of the PSP located south of Princes Highway.
- Any relevant proposals for improvement of the PSP including alternative FUS plan prepared by Mesh for Parklea.

The instructions also include presentation of evidence before the Panel. The instructions are verbal.

My relationship with the Applicant is of a business nature.

Referenced Material including Facts, Matters and Assumptions

In preparing this statement I have reviewed the following documentation:

- Amendment C234 documentation as exhibited.
- Background Draft report by Traffic Works.
- Pakenham East Precinct Structure Plan, December 2017.
- Clause 56.06 Cardinia Planning Scheme.
- Infrastructure Design Manual.
- Traffic surveys

I have also visited the site and surrounds several times.



3 Existing Conditions about the Site

Of particular relevance to the PSP in respect of transport and traffic issues are the following:

- Princes Highway west of Ryan Road and Princes Highway east of Mt. Ararat Road provide the only external linkages. That may be slightly assisted through some local street linkages into land west of the PSP land on the north side of Princes Highway, but otherwise there are no opportunities for additional connections.
- Access to Princes Highway has limited opportunities due to the Deep Creek, Hancock's Gully and a significant cutting over a length of about 700 metres in the vicinity of the Dore Road intersection.
- Ryan Road along the western PSP boundary south of Princes Highway services about 100 houses, mostly on large 'rural residential" style lots.
- Mt. Ararat Road services a small number of houses at the eastern limit of the PSP area.

Existing traffic volumes on Princes Highway is around 5,300 vehicle movements per day (vpd). Princes Highway has a four-lane divided configuration.

Ryan Road has a sealed carriageway about 7.5 metres wide for a distance of about 1,100 metres south of the Princes Highway, and thereafter an unsealed pavement. Reservation width is 24 metres.

4 The Proposal

Appended to this report are copies of the PSP "Future Urban Structure" Plan, the "Road Network Plan", copied from the exhibition material.

In respect of the land south of Princes Highway the following elements are envisaged by the PSP:

Properties 16-27 11.47ha "developable"Other properties 256.17ha "developable"

The anticipated dwelling yield for south of Princes Highway is:

Standard Density Lots 2,745 no.
 Medium Density Lots 1,863 no.
 Interface Lots 253 no.

It is noted that the above areas and projected yields appear to overestimate the potential dwelling yield, but that will add a layer of conservatism to the traffic estimates.

North of the Princes Highway the stated yield potential is:

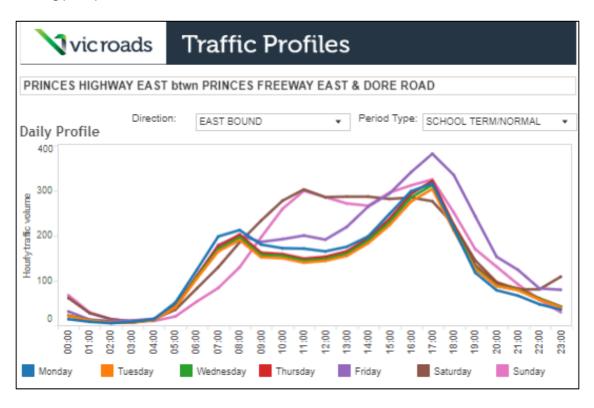
Standard Density Lots 1,825 no.
 Medium Density Lots 300 no.
 Interface Lots 177 no.

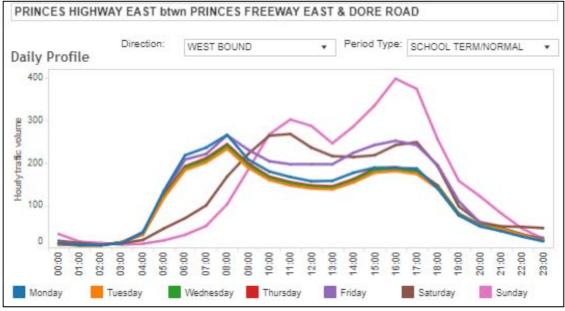


5 Base Traffic Conditions on Princes Highway

Typically a 10 year traffic growth horizon is applied to planning applications, although some of the material exhibited shows a projected Year 2046 scenario. VicRoads data indicates very slow growth over recent years, and consequently I will add 50% to current peak hourly volumes to check intersection design concepts for the Princes Highway. That is a growth rate of about 1.5% per annum, surely conservative.

Existing peak period volumes have been obtained from the VicRoads data as set out below.







Key data from the above is:

•	AM Peak Hour	Eastbound Westbound	200 vph 260 vph
•	PM Peak Hour	Eastbound Westbound	320 vph 200 vph

Factoring up by 50% gives a "Design Value" set of:

•	AM Peak Hour	Eastbound	300 vph
		Westbound	390 vph
•	PM Peak Hour	Eastbound	480 vph
		Westbound	300 vph

It is difficult to determine what values were used in the Council draft TIAR and In the VicRoads/TFV exhibited material.

The above values do not include existing traffic generated out of the Ryan Road precinct, where there are about 110 houses, because the subject segment upon which it is based is east of Ryan Road.



6 Traffic Generation and Directional Distribution

I note the reference in the Draft Pakenham East PSP TIAR for Cardinia Shire that Council and VicRoads have previously agreed to use the following traffic generation rates for assessment of the PSP:

- 0.9 trips/hour and 9/trips per day for standard, interface and interface 2 lots,
- 1.0 trips/hour and 10 trips per day for interface 3 lots,
- 0.5 trips/hour and 5 trips per day for medium density lots.

In my opinion those rates are excessive and do not provide an appropriate basis to model traffic impacts in a very much outer suburban condition.

To test Pakenham I instructed traffic counts at the intersections of Simon Drive and Racecourse Road in Pakenham, on Tuesday and Wednesday May 21-22, 2018. There are 208 dwellings that can only use one or other of the Simon Drive intersections to travel to and from the outside world. The land area occupied is about 17 hectares, indicating a density of 12 dwellings per hectare. The counts showed:

Daily (Tuesday) Trip Generation		1,369 vehicle movements OR 6.6 per household
AM Peak Hour	OUTS	62 vehicles per hour (8:00-9:00)
	INS	36 vehicles per hour (8:00-9:00)
	OR	0.30 vehicles per hour/dwelling OUT
	UN	0.17 vehicles per hour IN
PM Peak Hour	OUTS	43 vehicles per hour (17:00-18:00)
	INS	76 vehicles per hour (17:00-18:00
	OR	0.21 vehicles per hour/dwelling OUT
	UN	0.37 vehicles per hour/dwelling IN

Of interest is that between 5:00am and 9:00am the outbound volumes are close to peak in each hour, and the afternoon inbound traffic is also well spread. There is an obvious "mini-peak" around school start and finish times. Also, daily traffic is about 13 times the average of the peaks.

At 12 dwellings per hectare the sample is not biased towards higher than standard density. There may be some mode shift to the train because the surveyed area is within about 1km of the Pakenham Rail Station, but I do not expect that to be significant.



The following provides assessment of traffic generation at 9 daily vehicle trips at the driveway of dwellings, and peak period generation rates as apparently agreed. For the PSP area that gives:

SOUTH OF PRINCES HIGHWAY							
		AM Peak	AM Peak	AM Peak	AM Peak		
	No.	Rate Out	vph Out	Rate In	vph In	Daily Rate	vpd
Standard Density Lots	2745	0.72	1976	0.18	494	9	24705
Medium Density Lots	1863	0.40	745	0.10	186	5	9315
Interface Lots	253	0.72	182	0.18	46	10	2530
Existing Rural Ryan Rd area Lots	110	0.72	79	0.18	20	10	1100
Totals	4971		2983		746		37650
		PM Peak	PM Peak	PM Peak	PM Peak		
	No.	Rate Out	vph Out	Rate In	vph In	Daily Rate	vpd
Standard Density Lots	2745	0.25	686	0.63	1729	9	24705
Medium Density Lots	1863	0.15	279	0.35	652	5	9315
Interface Lots	253	0.27	68	0.63	159	10	2530
Existing Rural Ryan Rd area Lots	110	0.27	30	0.63	69	10	1100
Totals	4971		1064		2610		37650
NORTH OF PRINCES HIGHWAY							
		AM Peak	AM Peak	AM Peak	AM Peak		
	No.	Rate Out	vph Out	Rate In	vph In	Daily Rate	vpd
Standard Density Lots	2285	0.72	1645	0.18	411	9	20565
Medium Density Lots	300	0.40	120	0.10	30	5	1500
Interface Lots	177	0.72	127	0.18	32	10	1770
Totals	2762		1893		473		23835
		PM Peak	PM Peak	PM Peak	PM Peak		
	No.	Rate Out	vph Out	Rate In	vph In	Daily Rate	vpd
Standard Density Lots	2285	0.25	571	0.63	1440	9	20565
Medium Density Lots	300	0.15	45	0.35	105	5	1500
Interface Lots	177	0.27	48	0.63	112	10	1770
Totals	2762		664		1656		23835

The east-west distributions in the Draft TIAR seem reasonable to me, with the approximate support of data from the Windermere Boulevard intersection.

In my opinion an internalization rate of at least 20% of traffic generated at the driveways is appropriate to account for local trips to and from local shopping, schools, recreation and community facilities, and local jobs. It is also understood that the VPA estimates that internalization of vehicle trips at 25% of the total traffic generated at the driveways.

Using the generation in the table above with the 25% internalization factor applied gives the peak hour movements at the intersections along the Princes Highway as set out in the following diagram.



20 20 20 20 20 20 20 20 20 20 20 20 20 2	STREET A 280 440 440 440 440 440 440 440 440 440 4	STREET B 250 1 000 000 000 000 000 000 000 000 000	STREET C 200 1 004 005 005 005 005 005 005 005 005 005	STREET D 50 - 12 12 12 12 12 12 12 12 12 12 12 12 12
RYAN RD 000 - 10	200 2 370 170 170 170 170 170 170 170 170 170 1	130 - 110 130 - 110 1180 - 110 - 1110 - 200 HOUR	220 - 120 - 120 - 1270 - 170 - 170 - 170	02 L 1090 - 1530 - 40

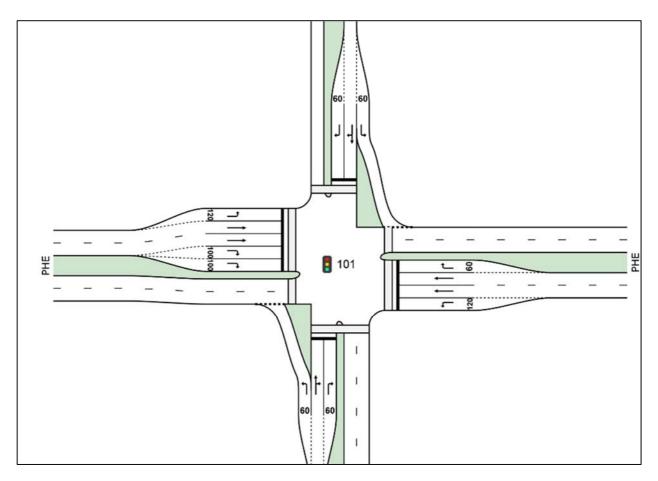


7 Intersections along Princes Highway

The exhibited material provides conceptual layout plans for the intersections along the Princes Highway. The council Draft TIAR proposes some minor changes to those intersections, providing a rationale based on SIDRA analysis of future traffic flows along both the Princes Highway and the intersecting streets.

The council proposal for the intersections is to add a few left turn (generally high angle slip) lanes and to alter a few lane lengths. I agree with adding slip lanes for left turn exit from the streets within the precinct because it will allow through traffic smoother passage during off peak periods and there is no detrimental impact on pedestrian related conditions downstream. I recommend adding left slips at all connecting streets, even if only a very short approach lane length is applied.

To review the validity of the proposals I am applying SIDRA analysis to the intersections, with the traffic loadings being per the diagram at Section 6 above, and the layout being per the diagram below.



The Lane Summary tables from the Sidra analysis are appended to this report and demonstrate adequate performance under the loadings applied. Of course if more realistic loadings were applied there would be a significantly greater margin of freedom in the outputs.



8 Traffic and Street Form for Internal Streets

8.1 Overview

The exhibited material provides no guidance about traffic volumes on any sections of street other than on the approaches to the Princes Highway intersections. Consequently it is unclear as to what the nomination of the proposed street forms in the PSP has been based upon

8.2 Traffic on Major Streets at Princes Highway

On the basis of the estimating rates set out at Section 6 my estimate of the distribution of daily vehicle movements on the major connections from the south is set out below.

6000	0006	7000	9000	

These are less than in the council TIAR and demonstrate that there is no need for the increased cross sections as set out in the TIAR. With more appropriate traffic generation rate estimates the volumes would be much lower, but would not change what is built on the major street linkages.

A street network planning objective should be to limit the extent of street where those traffic volumes will be so high. That is achievable through development of a well-connected movement network, offering multiple route choices for most trips as the network approaches the links to the Princes Highway, and to the main "loop" arterial Connector Boulevard Street from Intersection A to Intersection B.

8.3 Traffic and Street Network Elements within the Neighbourhoods

In the area east of Ryan Road and south of the Primary School site the PSP Plan 7 shows some Access Street Level 2 proposals. There is not enough developable land to create a need for those streets, with Access Street Level 1 being adequate. Additional parking around part of the school site may be warranted.

There will be almost no traffic on the streets that run along the drainage areas, freeway corridor and open space areas. There should be a further street section - Park Edge - with 5.5 metres carriageway in a 12.5 metres reservation, as is contemplated for similar application in Clause 56.06 of the Planning Scheme.

The proposed Boulevard Connector east of Street B can be a Connector Street, and the proposed Connector Street as Street B near the LTC can be Boulevard Connector.

Streets along Hancock's Gully are shown at Access Street Level 2, both sides. Those streets will have housing on only one side, and are not likely to carry more than 1,000 daily vehicle movements. A "Park Edge" form of Access Street Level 1 will be adequate.

My proposed modifications to the street forms are shown in Drawing No. 9931110.

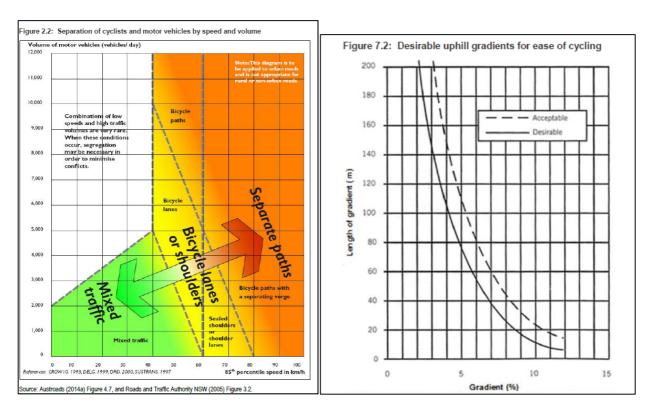
The Conservation Interface Street will have extremely low traffic volumes and the carriageway width needs to be 5.5 metres, not more.

Site: Pakenham East PSP



9 Cycling Trails and On-Street Proposals

The PSP shows a very comprehensive network of trails and cycle paths along some streets. AustRoads provides guidance on separation of cyclists from motor vehicles and also on appropriate grades, as follows.



Whilst the AustRoads Guide may indicate that there is no need for separation of cyclists from motor vehicles on some parts of the network I agree that where a logical route between points of attraction for cyclists will go along a street the separation is appropriate.

A key point relates to gradients. On the proposed Boulevard Connector Street through the central part of the site there are grades of about 3.2% in 250 metres and 4.3% in 230 metres. A longitudinal section of the ground level along the proposed Bvd Connector Street near the High School site is provided in Drawing No. 9931501. That is not to say that the section provides finished levels but responsible design would reduce cuts and fills to limit environmental impact. Given that this is a virtual "greenfield" site I recommend a realignment of the street on which the path is proposed, to achieve grades that meet the "desirable" criteria provided by AustRoads.

A suitable realignment is shown in the Drawing No. 9931310, affecting the PSP proposed High School site. I note the Parklea proposal to relocate the High School to a flatter location further to the north east, within an area likely to be delivered much later in the overall project. The Parklea proposal allows the Connector Street to have cycle-friendly grades, is a better fit with the staging of the development and is also a better transport related solution for a major school.

A further point about cycling facilities is that as far as is possible every street should be cycling-friendly. Where target speeds are 40kph or lower, traffic volumes under about 2,500 vehicles per day will allow that if we accept the AustRoads guidelines.



10 The Parklea Alternative Future Urban Structure

The Parklea Future Urban Structure Plan (FUS) varies from the exhibited FUS in that:

- The Active Open Space has been split into two segments, with one moved east of Hancock's Gully.
- The Indoor Recreation, High School and non-government Primary School have been moved to a relatively flat area east of Hancock's Gully.
- Community facilities adjacent to the LTC have been moved to east of Hancock's Gully.
- A small park east of the southern primary school has been omitted.

Key transport related points about those matters are:

• Access to the High School from the east is significantly improved. I note the secondary school catchment predictions provided by Mr. Panozzo, as follows.

Catchment Areas for Pakenham East Secondary School & Projected 12 - 17 year old population

	2016	2018	2021	2026	2031	2036	2041
Primary Catchment Areas							
Pakenham East Precinct	9	11	10	108	851	1675	1893
Pakenham North East	475	538	580	681	798	802	801
Secondary Catchment Areas							
Bunyip	225	256	303	346	380	391	407
Garfield	150	153	168	208	237	261	282
Nar Nar Goon - Tynong area	139	123	129	174	186	194	199
Northern Rural	361	350	336	310	308	323	326
Total	1,359	1,431	1,526	1,827	2,760	3,646	3,908

From that information it is clear that the eastern area is of significance to the High School population.

- Accessibility from areas west of the PSP is similar to that in the PSP proposed location because of the greater distance of Princes Highway use compared with Connector Street.
- If the Parklea alternative is to be accepted I would alter some of the recommendations shown in Drawing No. 9931310 to provide more street with parking and clear travel paths. Drawing No. 9931311 shows the appropriate concept. The reason for the additional street network including clear travel lanes and additional parking is to enable satisfactory management of the school traffic, clear of parking and with circular travel paths enabled so that U-turns are not prevalent. Under the proposal presented in Drawing No. 9931311 both the non-government primary school and the secondary school have all boundaries along streets, and all except the western boundary of the primary school would be streets with two clear travel lanes plus parallel parking.

Site: Pakenham East PSP

Reference: 9931R7868.DOC 12



11 The Parklea Proposed LTC Plan

Parklea has discussed an alternative town centre concept plan with the VPA and Council. The version assessed by me is appended to this report. I understand that, following a workshop session held in May 2018, modifications may be made to this concept plan. The Parklea LTC plan differs from the exhibited PSP plan for the LTC in respect of the alignment of the streets and the location of key intersections.

The Parklea plan has a design that is sprung from a plan for Intersection B and the Connector Street, with a *de facto* "Main Street" intersection on Connector B about 110 metres south of the Princes Highway southern carriageway. The plan for the connector is shown in the drawing proposed by Cardno and appended to this report.

As a presentation of the LTC the Street B form would be improved with a planted median, consistent with the Boulevard Connector Street form. The cycle path in a less formal response to the typical section may allow better integration of the traffic facilities with the existing trees that are to be retained in that vicinity.

12 Ryan Road

Ryan Road is nominated as a "bus capable" street in the network. The PSP proposal is for a 7 metres carriageway plus 2 x parking/tree lanes, centred on a line offset 9.6 metres off one of the property boundary lines. The existing carriageway of about 7.5 metres width is located to the east of centre, approximately centred on a line about 9.5 metres off the eastern building line. That condition exists to a point about 300 metres south of Canty Lane, from where the pavement is unsealed. There is a narrowing at a drainage crossing north of Canty Lane.



South of the existing sealed carriageway a street carriageway of 7.3 metres will be adequate, with no additional parking needed. AADT will be under about 2,500. The paths can continue south on the PSP proposed offsets.

Therefore Ryan Road will need minimal additional work – the paths can be provided with development and minimal indented car parking to service development as occurring. Any idea of making Ryan Road wider to the southern boundary in case a railway station might go there makes no sense. If a railway station had been proposed a totally different urban structure would be appropriate.

In my opinion there is no need for a roundabout at the intersection of Canty lane and Ryan Road. A simple priority T junction will provide adequately for the movements that are likely to occur.

Site: Pakenham East PSP

Reference: 9931R7868.DOC 13



13 The Boulevard Connector Street as an Arterial Street

The constraints to the arterial road network are such that there is no way of responding truly to the traditional "mile grid" of arterial roads or streets with midway connectors, despite what the VPA explanatory report says.

Typically arterial blocks will encompass about 256 hectares of land, and connections are short and straight where "connector" street standards are warranted.

In this case the area south of Princes Highway is about 370 hectares, or well over a full arterial street block. The Boulevard Connector Street will need to function as an arterial street – the network would fail if it was to be removed, which is a valid test of what constitutes an arterial network element.

14 The Infrastructure Contributions Plan

Key points in respect of traffic facilities included in the Infrastructure Contributions Plan (ICP) are:

- With approach configurations to the Princes Highway per the council TIAR with left slips, and under the traffic volume scenario described above, 3 separate through lanes on the Princes Highway are not necessary and such layouts should not be part of the ICP.
- The roundabout at the intersection of Canty Lane and Ryan Road is not necessary and therefore should be removed from the ICP.
- Ryan Road should not be part of the ICP
- The Boulevard Connector between Intersection A and Intersection B should be included in the ICP

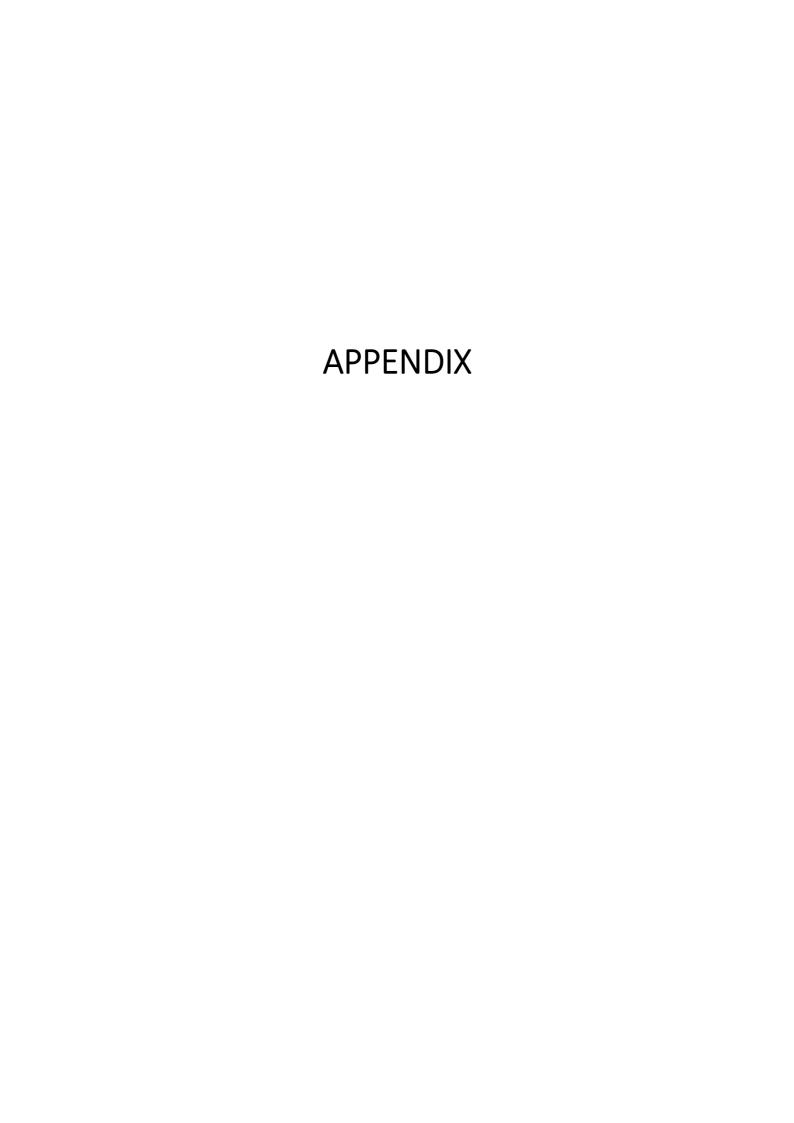
15 Summary and Conclusions

Subject to the recommendation made in the body of this statement I see no traffic or transport related reasons why the proposed Planning Scheme Amendment should not be adopted. Additional work will be needed in respect of the ICP, and I have made my recommendations in that respect in the body of the statement.

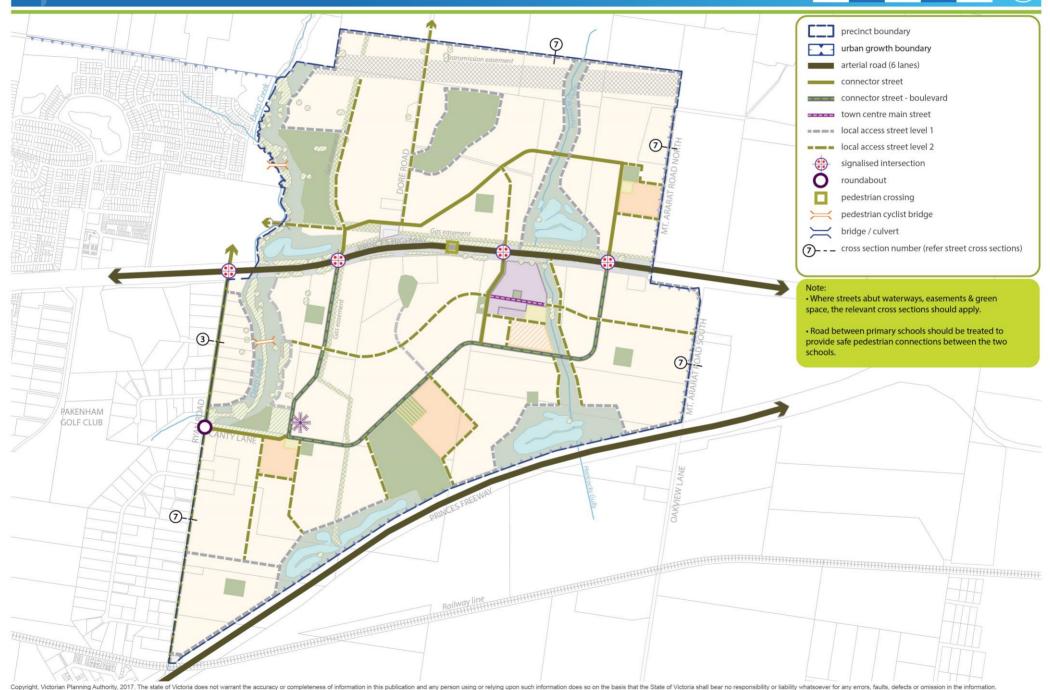
In preparing this statement I have made all of the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

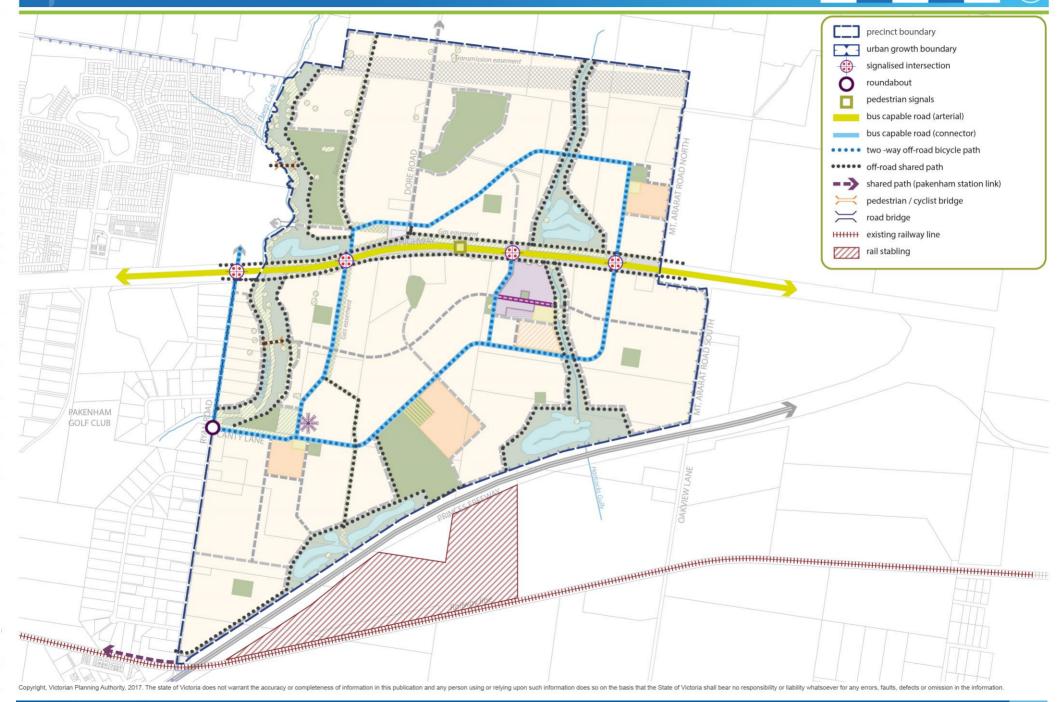
TTM Consulting (Vic) Pty Ltd

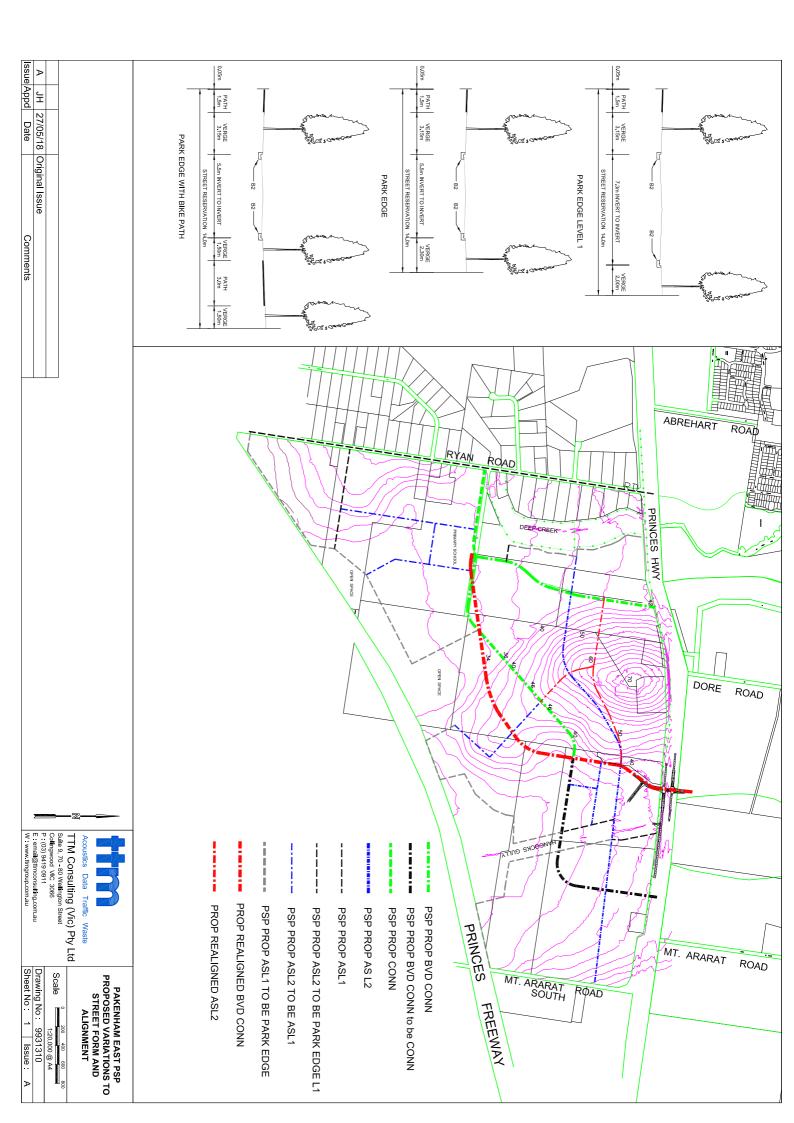
J. D. Higgs

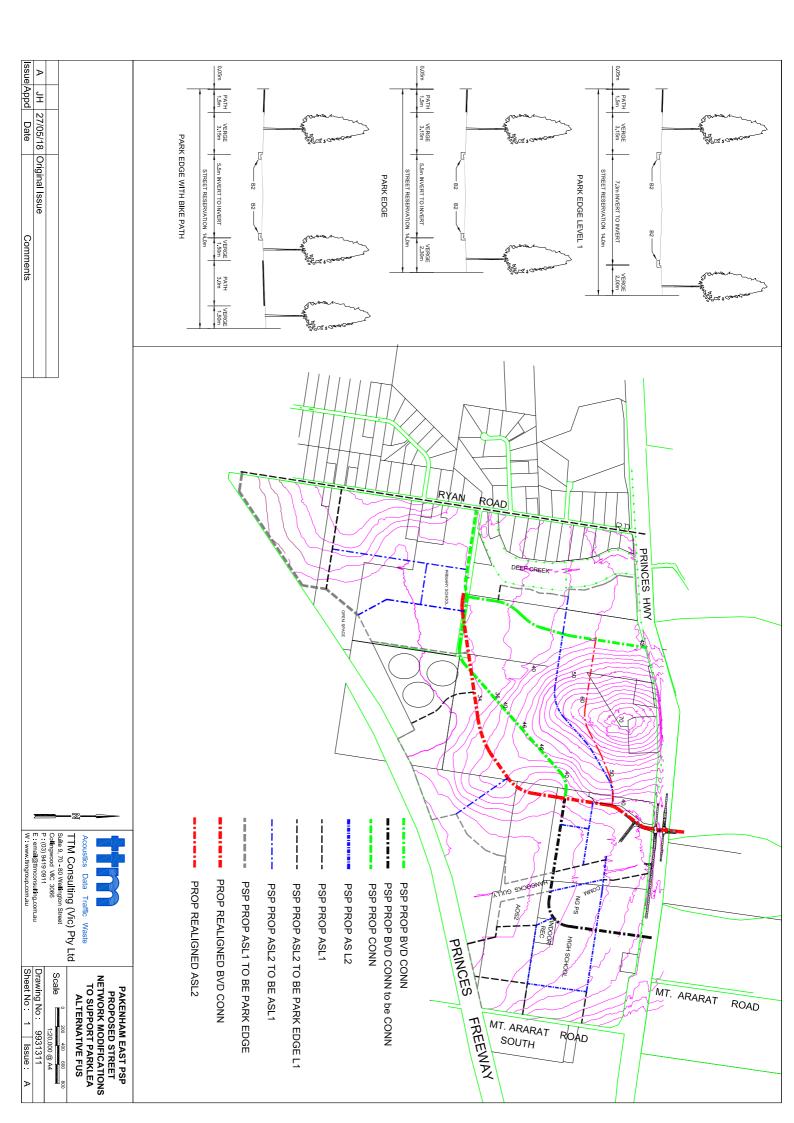


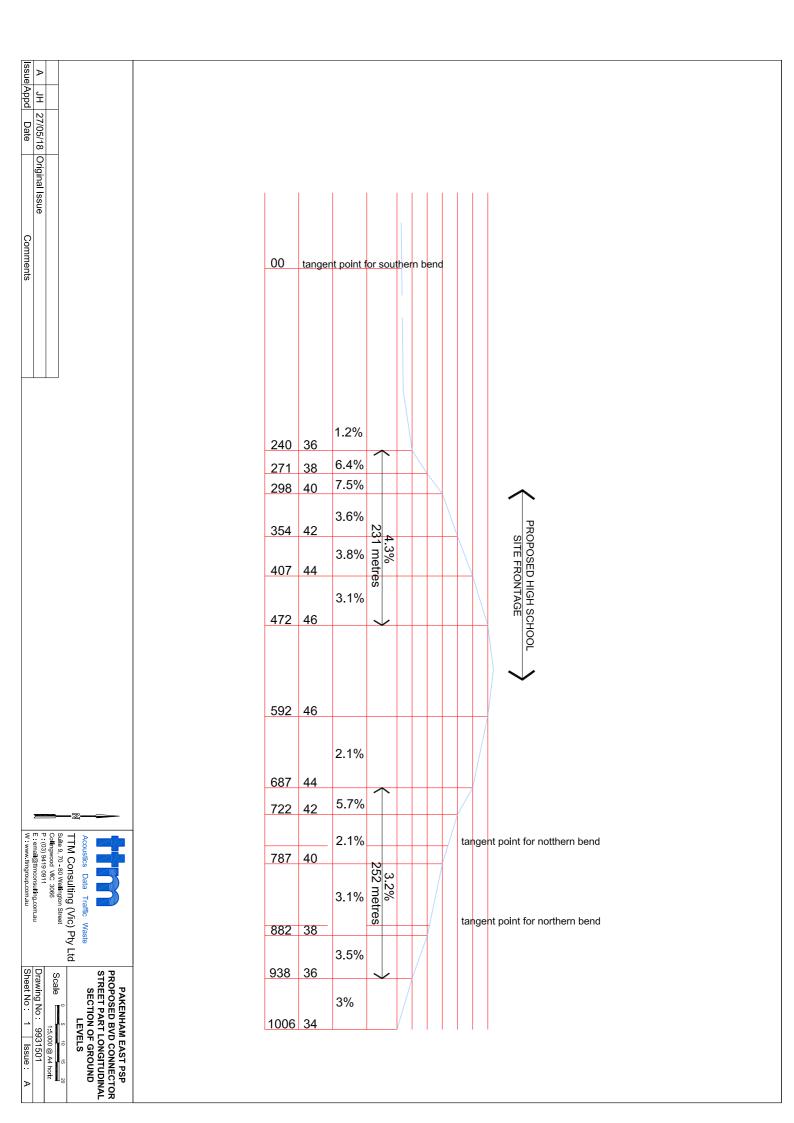


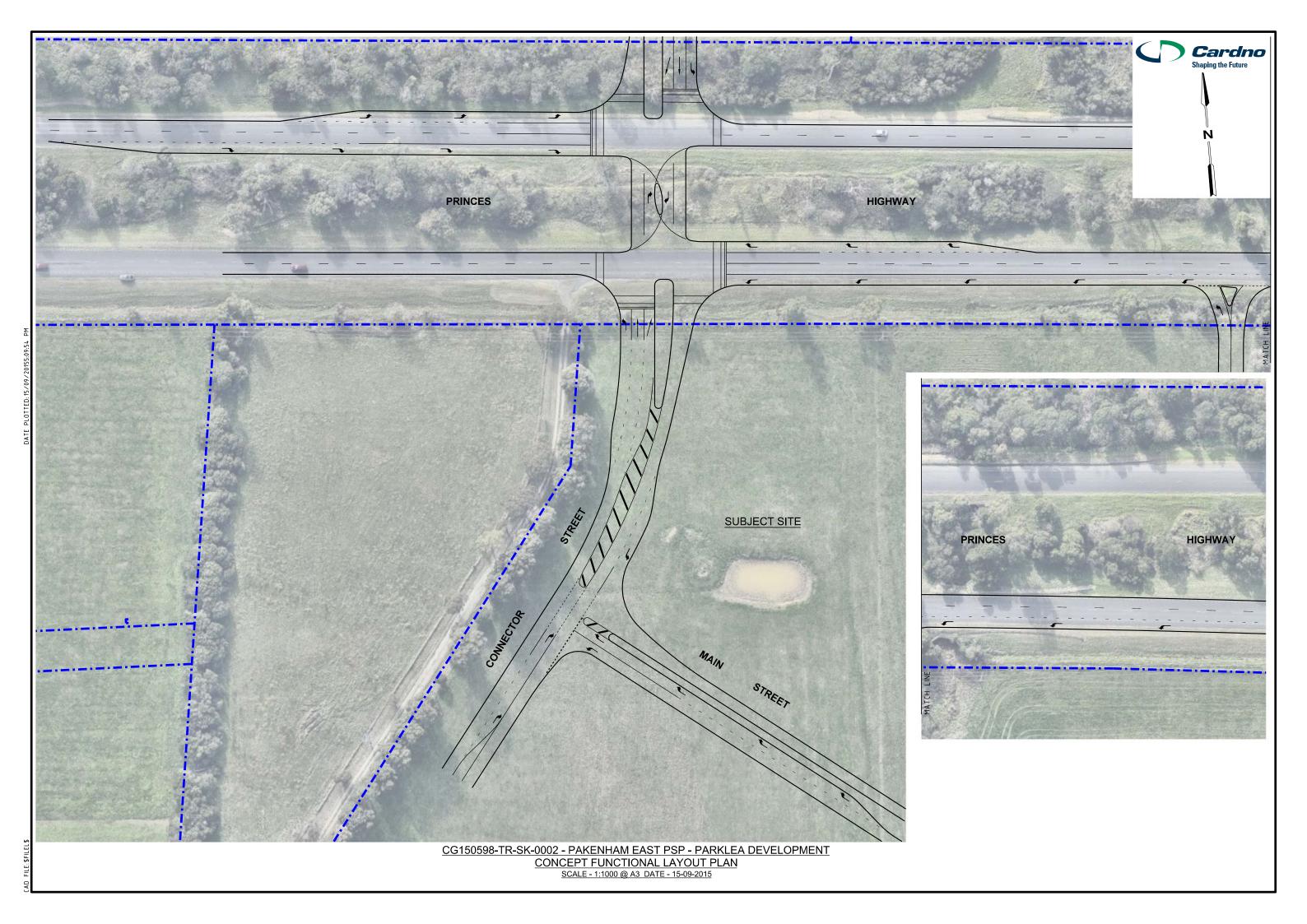








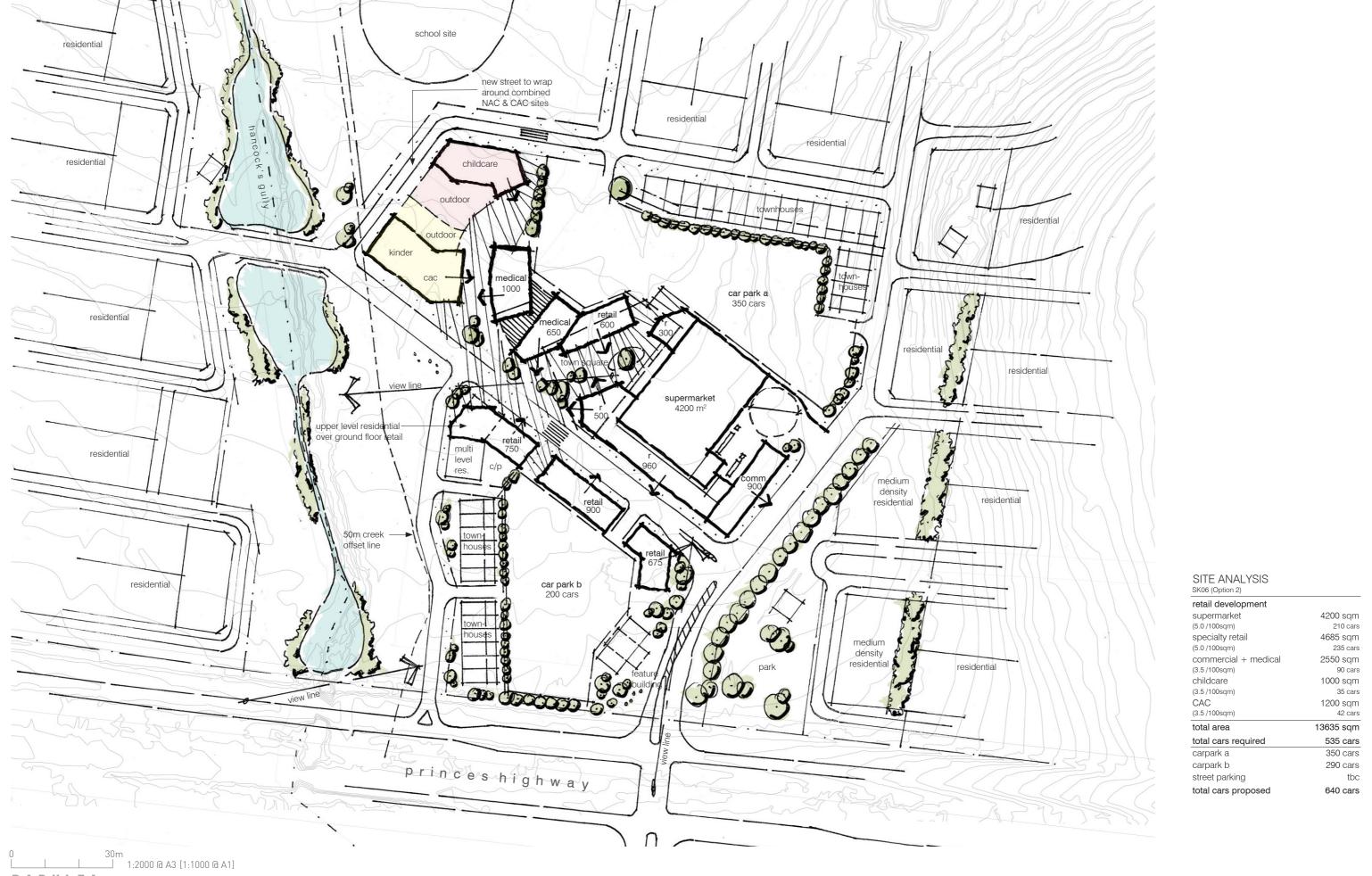








PAKENHAM EAST
Revised VPA FUSP - Option 1
Level 2, 6 Riverside Quay Southbank, VIC 3006
1 9695 3025 f 9695 3001



PAKENHAM EAST

MASTER PLAN OPTION 2
CONCEPT PLANNING

PROJECT 2015-063 SK06.11

DATE 01.10.2015 WO/BJ

MEL SYD PER 1800 422 533 i 2 C . C 0 M . A U

SITE LAYOUT

Site: 101 [INT B PM]

Site: 101 [RYAN PHE AM]

	Demand	Flows		Dea.	Lane	Average	Level of	95% Back of	Queue	Lane	Lane	Cap.	Prob.
	Total veh/h	H∨ %	Cap. veh/h	Satn v/c	Util.	Delay sec	Service	Veh	Dist m	Config	Length m	Adj.	Block.
South: Ryan Rd													
Lane 1	263	5.0	718	0.366	100	27.3	LOS C	9.8	71.3	Short	60	0.0	NA
Lane 2	68	5.0	193	0.354	100	54.9	LOS D	3.8	27.7	Full	500	0.0	0.0
Lane 3	81	5.0	229	0.354	100	54.4	LOS D	4.4	32.0	Short	60	0.0	NA
Approach	413	5.0		0.366		37.2	LOS D	9.8	71.3				
East: PHE													
Lane 1	59	5.0	1106	0.053	100	15.1	LOS B	1.3	9.7	Short	120	0.0	NA
Lane 2	1004	5.0	1135	0.885	100	26.8	LOS C	53.2	388.6	Full	500	0.0	0.0
Lane 3	1011	5.0	1143	0.885	100	26.8	LOS C	53.9	393.2	Full	500	0.0	0.0
Lane 4	23	5.0	90	0.258	100	68.7	LOS E	1.4	10.2	Short	60	0.0	NA
Approach	2098	5.0		0.885		26.9	LOS C	53.9	393.2				
North: Ryan Rd													
Lane 1	74	5.0	754	0.098	100	8.4	LOSA	0.8	5.9	Short	60	0.0	NA
Lane 2	71	5.0	121	0.591	100	66.9	LOS E	4.3	31.7	Full	500	0.0	0.0
Lane 3	71	5.0	120	0.591	100	68.2	LOS E	4.3	31.4	Short	60	0.0	NA
Approach	216	5.0		0.591		47.4	LOS D	4.3	31.7				
West: PHE													
Lane 1	46	5.0	1106	0.042	100	15.1	LOS B	1.0	7.6	Short	120	0.0	NA
Lane 2	472	5.0	1165	0.405	100	12.4	LOS B	13.8	101.0	Full	500	0.0	0.0
Lane 3	472	5.0	1165	0.405	100	12.4	LOS B	13.8	101.0	Full	500	0.0	0.0
Lane 4	45	5.0	90	0.499	100	70.0	LOS E	2.8	20.1	Short	100	0.0	NA
Lane 5	45	5.0	90	0.499	100	70.0	LOS E	2.8	20.1	Short	100	0.0	NA
Approach	1079	5.0		0.499		17.3	LOS B	13.8	101.0				
Intersection	3805	5.0		0.885		26.5	LOS C	53.9	393.2				

Site: 101 [ryan phe PM]

Lane Use and	Performa	nce											
	Demand Total veh/h	Flows H∀ %	Cap.	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back o Veh	f Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Ryan Rd													
Lane 1	134	5.0	1100	0.122	100	11.1	LOS B	2.3	17.0	Short	60	0.0	NA
Lane 2	36	5.0	148	0.245	100	59.5	LOS E	2.2	15.9	Full	500	0.0	0.0
Lane 3	56	5.0	229	0.245	100	53.4	LOS D	3.0	21.7	Short	60	0.0	NA
Approach	226	5.0		0.245		29.4	LOS C	3.0	21.7				
East: PHE													
Lane 1	105	5.0	1046	0.101	100	17.2	LOS B	2.7	19.4	Short	120	0.0	NA
Lane 2	633	5.0	1102	0.575	100	16.6	LOS B	22.9	166.9	Full	500	0.0	0.0
Lane 3	579	5.0	1007 ¹	0.575	100	15.9	LOS B	20.0	146.1	Full	500	0.0	0.0
Lane 4	68	5.0	149	0.458	100	64.8	LOS E	4.0	29.2	Short	60	0.0	NA
Approach	1385	5.0		0.575		18.7	LOS B	22.9	166.9				
North: Ryan Rd													
Lane 1	32	5.0	577	0.055	100	22.5	LOS C	0.9	6.9	Short	60	0.0	NA
Lane 2	35	5.0	122	0.283	100	63.4	LOS E	2.0	14.8	Full	500	0.0	0.0
Lane 3	34	5.0	120	0.283	100	66.1	LOS E	2.0	14.5	Short	60	0.0	NA
Approach	100	5.0		0.283		51.4	LOS D	2.0	14.8				
West: PHE													
Lane 1	116	5.0	1046	0.111	100	17.3	LOS B	3.0	21.5	Short	120	0.0	NA
Lane 2	987	5.0	1042 ¹	0.947	100	48.0	LOS D	67.0	488.8	Full	500	0.0	3.0
Lane 3	961	5.0	1015 ¹	0.947	100	48.1	LOS D	64.2	468.9	Full	500	0.0	0.0
Lane 4	132	5.0	149	0.881	100	75.8	LOS E	8.8	63.9	Short	100	0.0	NA
Lane 5	132	5.0	149	0.881	100	75.8	LOS E	8.8	63.9	Short	100	0.0	NA
Approach	2326	5.0		0.947		49.7	LOS D	67.0	488.8				
Intersection	4038	5.0		0.947		38.0	LOS D	67.0	488.8				

Site: 101 [INT A AM]

	Demand F	Flows			Lane Use and Performance												
	Total HV		De Cap. sa		Lane	Average	Level of	95% Back of		Lane	Lane	Сар.	Prob.				
				Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.				
South: ST A	veh/h	%	veh/h	v/c	%	sec			m		m	%	%				
Lane 1	442	5.0	817 ¹	0.541	100	21.6	LOS C	15.1	110.5	Short	60	0.0	NA				
Lane 2	144	5.0	274	0.525	100	52.7	LOS D	7.5	54.8	Full	500	0.0	0.0				
Lane 3	182	5.0	347	0.525	100	48.7	LOS D	9.5	69.7	Short	60	0.0	NA				
Approach	768	5.0		0.541		33.9	LOS C	15.1	110.5								
East: PHE																	
Lane 1	107	5.0	941	0.114	100	20.8	LOS C	3.1	22.7	Short	120	0.0	NA				
Lane 2	722	5.0	973 ¹	0.742	100	23.3	LOS C	32.1	234.2	Full	500	0.0	0.0				
Lane 3	676	5.0	912	0.742	100	22.4	LOS C	28.9	211.2	Full	500	0.0	0.0				
Lane 4	77	5.0	105	0.735	100	71.6	LOS E	4.9	35.4	Short	60	0.0	NA				
Approach	1582	5.0		0.742		25.1	LOS C	32.1	234.2								
North: ST A																	
Lane 1	189	5.0	750	0.253	100	10.7	LOS B	2.9	21.2	Short	60	0.0	NA				
Lane 2	148	5.0	196	0.754	100	65.1	LOS E	9.1	66.1	Full	500	0.0	0.0				
Lane 3	147	5.0	194	0.754	100	66.3	LOS E	9.0	65.4	Short	60	0.0	NA				
Approach	484	5.0		0.754		44.2	LOS D	9.1	66.1								
West: PHE																	
Lane 1	105	5.0	941	0.112	100	20.8	LOS C	3.0	22.2	Short	120	0.0	NA				
Lane 2	447	5.0	992	0.451	100	18.8	LOS B	16.0	117.1	Full	500	0.0	0.0				
Lane 3	447	5.0	992	0.451	100	18.8	LOS B	16.0	117.1	Full	500	0.0	0.0				
Lane 4	77	5.0	105	0.740	100	71.7	LOS E	4.9	35.7	Short	100	0.0	NA				
Lane 5	77	5.0	105	0.740	100	71.7	LOS E	4.9	35.7	Short	100	0.0	NA				
Approach	1154	5.0		0.740		26.1	LOS C	16.0	117.1								
Intersection	3988	5.0		0.754		29.4	LOS C	32.1	234.2								

Site: 101 [INT A PM]

Lane Use and Performance													
	Demand		Can	Deg.	Lane	Average	Level of	95% Back o		Lane	Lane	Сар.	Prob.
	Total veh/h	H∨ %	Cap. veh/h	Satn v/c	Util. %	Delay sec	Service	Veh	Dist m	Config	Length m	Adj. %	Block. %
South: ST A	veiliii	70	Velilli	VIC	70	301			- "		- "	/0	/0
Lane 1	232	5.0	1093	0.212	100	12.3	LOS B	4.6	33.7	Short	60	0.0	NA
Lane 2	80	5.0	151	0.531	100	66.4	LOS E	4.9	35.6	Full	500	0.0	0.0
Lane 3	120	5.0	225	0.531	100	56.7	LOS E	6.7	48.8	Short	60	0.0	NA
Approach	432	5.0		0.531		34.6	LOS C	6.7	48.8				
East: PHE													
Lane 1	263	5.0	941	0.280	100	22.4	LOS C	8.4	61.6	Short	120	0.0	NA
Lane 2	588	5.0	992	0.593	100	20.9	LOS C	23.4	171.0	Full	500	0.0	0.0
Lane 3	459	5.0	775 ¹	0.593	100	19.0	LOS B	16.6	121.4	Full	500	0.0	0.0
Lane 4	179	5.0	254	0.704	100	61.3	LOS E	10.5	76.5	Short	60	0.0	NA
Approach	1489	5.0		0.704		25.4	LOS C	23.4	171.0				
North: ST A													
Lane 1	105	5.0	655	0.161	100	15.9	LOS B	2.5	18.0	Short	60	0.0	NA
Lane 2	58	5.0	122	0.480	100	65.2	LOS E	3.5	25.5	Full	500	0.0	0.0
Lane 3	57	5.0	120	0.480	100	67.3	LOS E	3.4	25.1	Short	60	0.0	NA
Approach	221	5.0		0.480		42.3	LOS D	3.5	25.5				
West: PHE													
Lane 1	232	5.0	941	0.246	100	22.0	LOS C	7.3	53.1	Short	120	0.0	NA
Lane 2	746	5.0	933 ¹	0.799	100	24.0	LOS C	34.0	248.4	Full	500	0.0	0.0
Lane 3	686	5.0	858 ¹	0.799	100	23.6	LOS C	30.2	220.7	Full	500	0.0	0.0
Lane 4	195	5.0	254	0.767	100	63.4	LOS E	11.8	85.8	Short	100	0.0	NA
Lane 5	195	5.0	254	0.767	100	63.4	LOS E	11.8	85.8	Short	100	0.0	NA
Approach	2053	5.0		0.799		31.1	LOS C	34.0	248.4				
Intersection	4195	5.0		0.799		30.1	LOS C	34.0	248.4				

Site: 101 [INT B AM]

Lane Use and	1 Performa	nce											
	Demand Total veh/h	Flows HV %	Cap.	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: ST B	*51011	- '			,,	333						- 1	
Lane 1	337	5.0	1067	0.316	100	13.3	LOS B	7.5	55.1	Short	60	0.0	NA
Lane 2	134	5.0	311	0.432	100	50.9	LOS D	7.0	51.1	Full	500	0.0	0.0
Lane 3	150	5.0	348	0.432	100	48.7	LOS D	7.8	56.8	Short	60	0.0	NA
Approach	621	5.0		0.432		30.0	LOS C	7.8	56.8				
East: PHE													
Lane 1	82	5.0	927	0.089	100	21.1	LOS C	2.4	17.4	Short	120	0.0	NA
Lane 2	561	5.0	976	0.575	100	21.2	LOS C	22.3	162.6	Full	500	0.0	0.0
Lane 3	527	5.0	917 ¹	0.575	100	20.6	LOS C	20.4	148.8	Full	500	0.0	0.0
Lane 4	44	5.0	120	0.370	100	66.6	LOS E	2.6	19.1	Short	60	0.0	NA
Approach	1214	5.0		0.575		22.6	LOS C	22.3	162.6				
North: ST B													
Lane 1	126	5.0	673	0.188	100	13.0	LOS B	2.4	17.7	Short	60	0.0	NA
Lane 2	101	5.0	168	0.602	100	62.5	LOS E	6.0	43.6	Full	500	0.0	0.0
Lane 3	99	5.0	164	0.602	100	65.0	LOS E	5.9	42.8	Short	60	0.0	NA
Approach	326	5.0		0.602		44.1	LOS D	6.0	43.6				
West: PHE													
Lane 1	56	5.0	927	0.060	100	20.8	LOS C	1.6	11.6	Short	120	0.0	NA
Lane 2	595	5.0	976	0.609	100	21.7	LOS C	24.3	177.0	Full	500	0.0	0.0
Lane 3	595	5.0	976	0.609	100	21.7	LOS C	24.3	177.0	Full	500	0.0	0.0
Lane 4	66	5.0	120	0.555	100	67.8	LOS E	4.0	29.3	Short	100	0.0	NA
Lane 5	66	5.0	120	0.555	100	67.8	LOS E	4.0	29.3	Short	100	0.0	NA
Approach	1378	5.0		0.609		26.1	LOS C	24.3	177.0				
Intersection	3539	5.0		0.609		27.2	LOSC	24.3	177.0				

Site: 101 [INT B PM]

Lane Use and Performance													
	Demand Total veh/h	Flows HV %	Cap.	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: ST B	******	- '											,,
Lane 1	192	5.0	1051	0.182	100	13.2	LOS B	4.0	29.4	Short	60	0.0	NA
Lane 2	65	5.0	136	0.474	100	74.6	LOS E	4.4	32.1	Full	500	0.0	0.0
Lane 3	105	5.0	221	0.474	100	56.4	LOS E	5.8	42.5	Short	60	0.0	NA
Approach	361	5.0		0.474		36.7	LOS D	5.8	42.5				
East: PHE													
Lane 1	211	5.0	971	0.217	100	20.7	LOS C	6.3	45.9	Short	120	0.0	NA
Lane 2	635	5.0	1023	0.621	100	20.2	LOS C	25.3	184.8	Full	500	0.0	0.0
Lane 3	547	5.0	881 ¹	0.621	100	18.8	LOS B	20.4	148.7	Full	500	0.0	0.0
Lane 4	116	5.0	224	0.517	100	60.2	LOS E	6.5	47.8	Short	60	0.0	NA
Approach	1508	5.0		0.621		22.8	LOS C	25.3	184.8				
North: ST B													
Lane 1	53	5.0	690	0.076	100	12.8	LOS B	1.0	7.2	Short	60	0.0	NA
Lane 2	72	5.0	122	0.589	100	66.1	LOS E	4.4	31.8	Full	500	0.0	0.0
Lane 3	70	5.0	120	0.589	100	68.2	LOS E	4.3	31.2	Short	60	0.0	NA
Approach	195	5.0		0.589		52.4	LOS D	4.4	31.8				
West: PHE													
Lane 1	137	5.0	971	0.141	100	20.0	LOS B	3.9	28.4	Short	120	0.0	NA
Lane 2	633	5.0	1023	0.619	100	20.1	LOS C	25.2	184.0	Full	500	0.0	0.0
Lane 3	633	5.0	1023	0.619	100	20.1	LOS C	25.2	184.0	Full	500	0.0	0.0
Lane 4	142	5.0	224	0.634	100	61.5	LOS E	8.2	60.0	Short	100	0.0	NA
Lane 5	142	5.0	224	0.634	100	61.5	LOS E	8.2	60.0	Short	100	0.0	NA
Approach	1687	5.0		0.634		27.1	LOS C	25.2	184.0				
Intersection	3752	5.0		0.634		27.6	LOSC	25.3	184.8				