



Traffic Engineering

Long Forest Estate

Transport Impact Assessment



1 Introduction and Scope

Rescom are the owners of the Long Forest Estate which forms part of the Draft Future Urban Structure (FUS) Plan and the Merrimu Precinct Structure Plan (“PSP”). I have been engaged by Rescom to undertake the following transport review.

I have been requested to review the traffic impacts for Long Forest Estate if it were to be included in the Merrimu PSP as standard conventional density residential as opposed to Low Density Residential.

My assessment will provide the following :

1. An assessment that the proposed ultimate intersection arrangement for Bacchus Marsh Road and Flanagans Drive can accommodate the traffic for the approx. 6,420 dwellings PLUS the 1,000 dwellings (Long Forest Estate). My assessment includes some appropriate assumptions which are detailed in this report.
2. An assessment of the existing Bacchus Marsh Road and Flanagans Drive intersection and confirmation of the number of developed lots that can be accommodated within this intersection, assuming any upgrades required would be contained within the existing road reserve boundary.
3. Impact on the capacity of Flanagans Drive, particularly between Lindsay Avenue and Streeton Drive, and what upgrades would be expected to support the Long Forest Estate at a conventional density e.g. Connection points/Intersections/Road widening.

Record

No.	Author	Description	Date
1.	DJH	Traffic Engineering and Transport Impact Assessment	11/2/2026

2 Transport and Planning Context

2.1 Existing Conditions

Flanagans Drive is currently managed by Moorabool Shire Council (Council). It extends for approximately 2.7km north-south from Bacchus Marsh Road to Bences Road and is currently constructed with a 6.0 metres (approx.) sealed carriageway within a 20 metres (approx.) reservation.

At the northern end of Flanagans Drive, an informal dirt road has been created within the Long Forest Estate site to provide connection to Bences Road for existing locals. This informal dirt road is currently located on private land and is subject to the landowner opting to retain the status quo.

A number of dead-end local streets (Condor Drive (North and South), Davies Court, Drysdale Court and Streeton Drive) either abut or enter the Long Forest Estate Site ("the Site") from Flanagans Drive and are generally constructed with a sealed rural carriageway.

Streeton Drive is located to the south of the Site, with a connection to the Site provided via Condor Drive (South).

The Western Freeway/Bacchus Marsh Road interchange is a half-diamond interchange with off-ramps only for both directions of freeway traffic.

2.2 Bacchus Marsh Eastern Link Road (BMELR)

DTP are currently undertaking a planning study for an eastern link road in Bacchus Marsh to improve north-south connections through the growing township and to divert heavy vehicles away from the Bacchus Marsh Town Centre.

The study considered 6 alternative alignments, which resulted in DTP nominating Option B Alternative as their preferred alignment. It is understood that it will ultimately be a 4-lane arterial road (i.e. 2 lanes in each direction separated by a median).

It is noted the preferred BMELR alignment is still subject to a planning approval process¹, which will ultimately result in land for the future road being reserved by a Public Acquisition Overlay (PAO) via a Planning Scheme Amendment.

The Option B Alternative alignment proposes to upgrade the existing half-diamond freeway interchange at Bacchus Marsh Road to a full diamond rural interchange with roundabouts either side of the freeway. A new arterial road will extend south from the upgraded interchange to connect to Bacchus Marsh – Geelong Road and Parwan – Exford Road.

North of the freeway, a new full diamond rural interchange will be built to the east of the Lerderderg River and extend north through the Draft FUS Plan to connect to Bacchus Marsh – Gisborne Road and Diggers Rest – Coimadaí Road.

¹ DTP are currently determining if an Environmental Effects Statement (EES) is required based on the outcomes of field surveys to identify populations of the recently rediscovered Victorian Grassland Earless Dragon.

It is understood the section of land between the BMELR and Gisborne Road is largely undevelopable due to the terrain associated with the escarpment, as well as the need to provide a buffer from the quarry. As such, the BMELR will effectively act as the western boundary of the developable part of the Draft FUS Plan. Some minor refinement to the road network shown on the draft PSP Future Urban Structure (FUS) plan may be required to integrate DTP's preferred Option B Alternative alignment for the BMELR.

Delivery timeframes and funding for the BMELR are currently unclear. It is noted the northern and southern sections may also be delivered separately, as well as the staging of interim (single carriageway) and ultimate (dual carriageway) based on traffic demand.

Of relevance to the site, the upgraded interchange may result in additional development traffic using Flanagans Drive to access the Western Freeway, which may result in the need to reclassify it from a connector street as currently shown on the draft FUS plan (page 4).

The Option B Alternative alignment is shown below.

Bacchus Marsh Eastern Link Road

Preferred alignment: Option B Alternative – 2023



DTP0317/23



Department of Transport and Planning

regionalroads.vic.gov.au

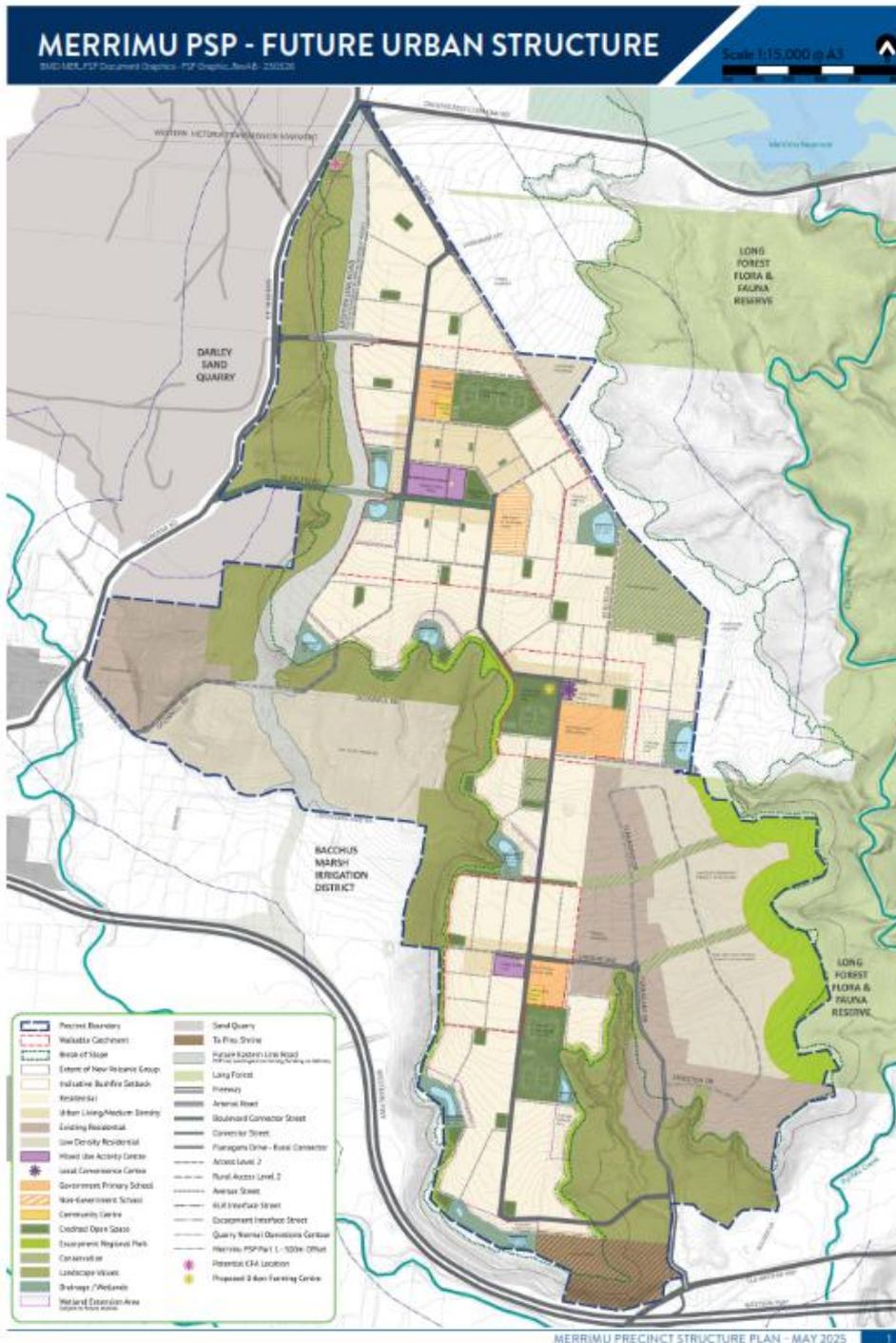


Authorised by the Department of Transport and Planning, 1 Spring Street, Melbourne

Bacchus Marsh Eastern Link Road – Option B Alternative Alignment (source: DTP)

3 Draft Future Urban Structure Plan

Below is the Draft Future Urban Structure Plan (FUS Plan) prepared by Bacchus Marsh Developments Pty Ltd (“BMD”) in May 2025.



Draft FUS Plan prepared by Bacchus Marsh Developments Pty Ltd²

² The draft FUS plan depicted above is out of date and incorrectly depicts the Site as low density residential.

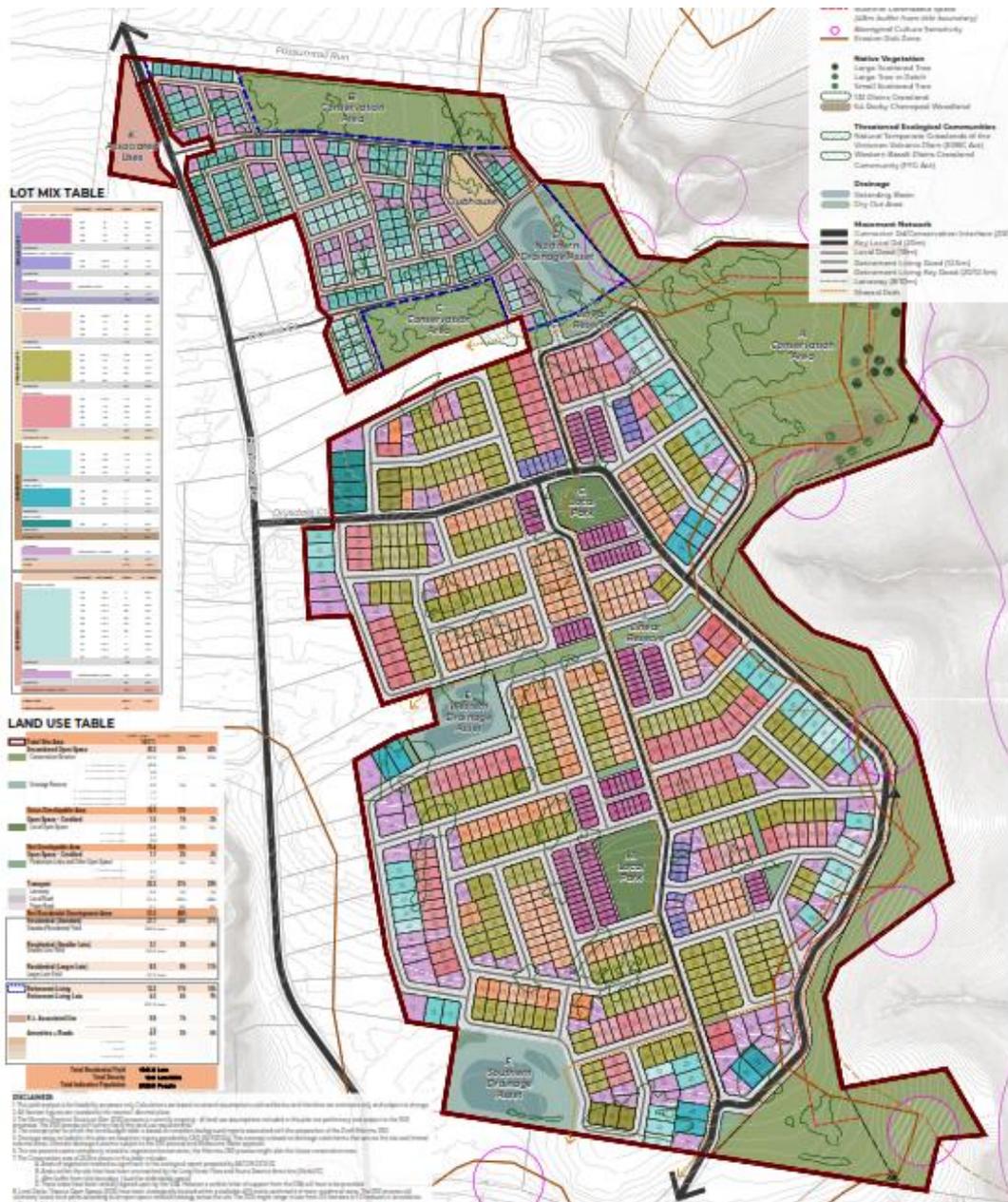
4 The Proposed Development Plan

4.1 Long Forest Estate Development Plan

The Site is located in the south eastern part of the Draft FUS Plan.

A concept plan for the subdivision of the site has been prepared by Mesh that shows a yield of 1,041 lots, which includes 231 retirement village lots with associated clubhouse in the northern part of the site.

A copy of the concept plan is shown below.



Subject Site – Concept Plan prepared by Mesh

4.2 Draft FUS Plan and Mesh Road Network Variations

The Draft FUS Plan shows Flanagans Drive as a connector street from the Western Freeway interchange to Lindsay Avenue, with the connector street then continuing across Lindsay Avenue and up Bences Road.

By comparison, the Mesh concept plan continues Flanagans Drive as connector street beyond Lindsay Avenue continuing up Flanagans Drive to Possumtail Run/Bences Road intersection.

5 Existing Traffic Volumes

In the absence of existing traffic count data and modelling, the following estimation of Average Annual Daily Traffic (AADT) undertaken for this assessment is as follows:

- Bacchus Marsh Road – 15,000 vehicles per day at the Flanagans Drive intersection
- Freeway Exit Ramp (from Ballarat) – 1,500 vehicles per day

For these intersections peak hours volumes are assumed to be 10% of daily volumes.

6 Estimated Traffic Generation and Distribution

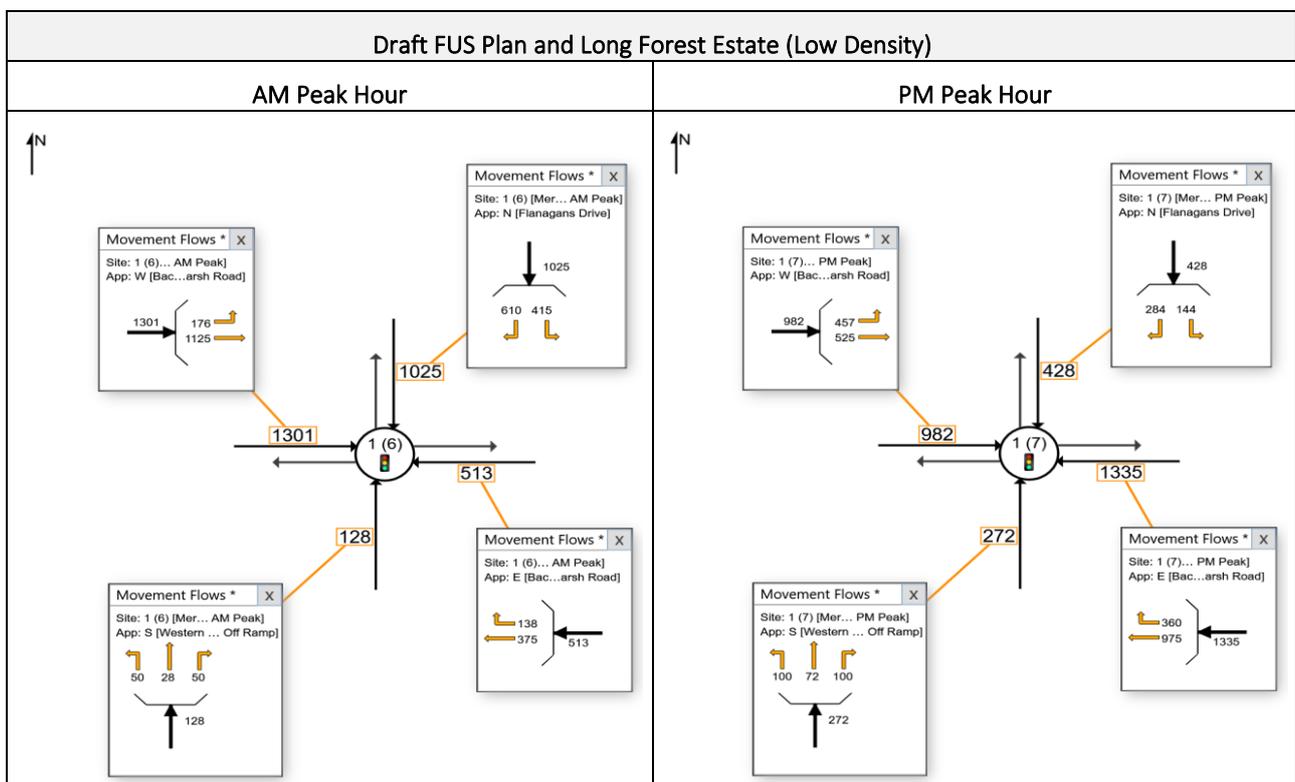
The following estimation of Average Annual Daily Traffic (AADT) and distribution from the Draft FUS Plan area is made on the following set of assumptions:

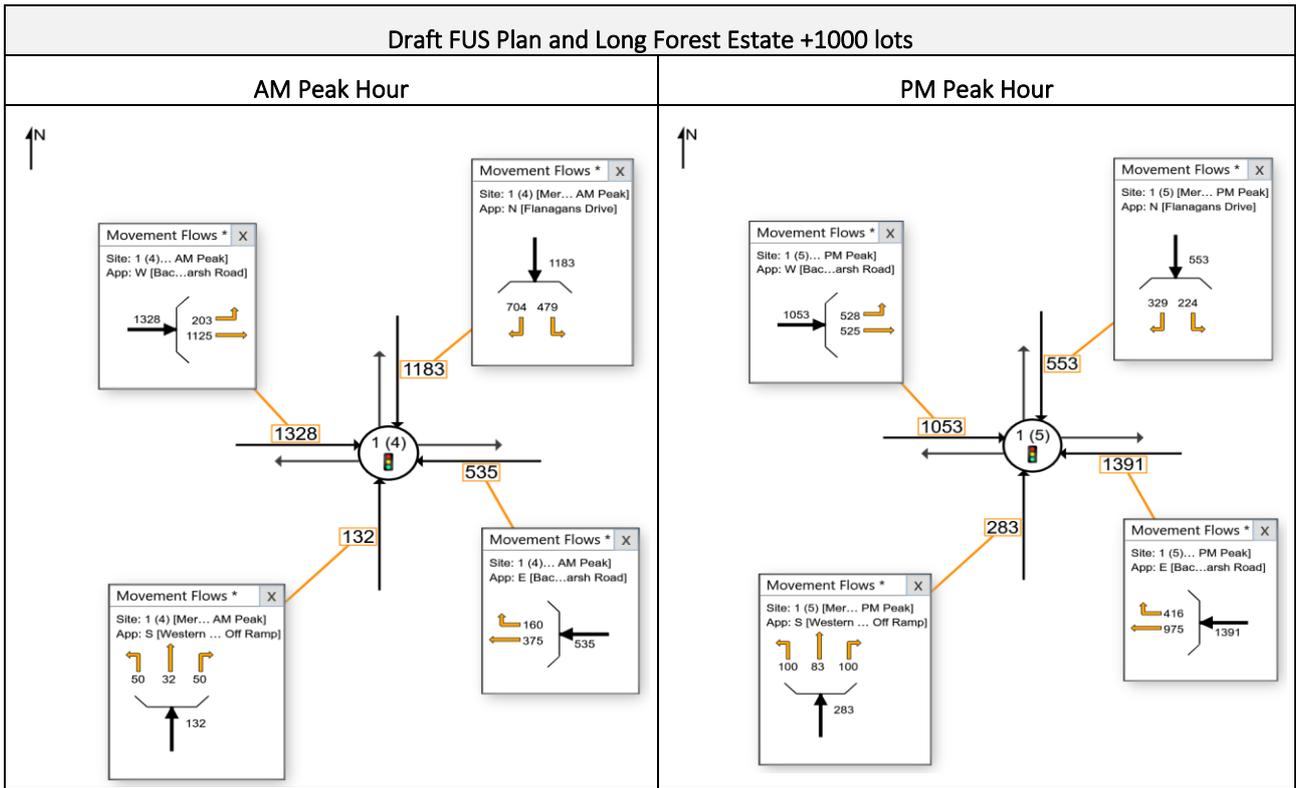
My assessment is based on the following assumptions:

- Population forecasts
 - Draft FUS Plan – 20,500 people (6,420 dwellings) (Source: VPA)
 - Long Forest Estate – 1,000 dwellings
- Trip generation
 - Daily – 8 trips per dwelling per day
- Trip purpose (Source: VISTA data for Geelong, 2018 in lieu of available data for Bacchus Marsh) – Daily
 - Work related – 35%
 - Social/Recreational – 25%
 - Shopping – 22%
 - Education – 11%
 - Personal Business – 8%
- Work trip distribution (Source: ABS 2021 Census for Moorabool Shire Council) –
 - 35% within Bacchus Marsh and surrounds, assume:
 - 5% within Draft FUS Plan
 - 5% to the north (sand quarries, etc.)
 - 10% to the south-west (Bacchus Marsh Town Centre)
 - 15% to the south (Parwan Station Precinct and Parwan Employment Precinct)
 - 65% outside of Bacchus Marsh and surrounds, assume:
 - 11% to the west (Ballarat)
 - 54% to the east (Melbourne and Melton)
- Education trip distribution (Source: ABS 2021 Census for Moorabool Shire Council) –
 - 10% for pre-school, assume:
 - 5% within Draft FUS Plan
 - 2.5% to the south-west (Bacchus Marsh Town Centre)
 - 2.5% to the south (Parwon Station Precinct)
 - 39% for primary school, assume:
 - 26% within Draft FUS Plan
 - 9% to the south-west (Bacchus Marsh Town Centre)
 - 4% to the south (Parwon Station Precinct)
 - 29% for secondary school, assume:
 - 23% to the south-west (Bacchus Marsh Collage and Bacchus Marsh Grammar)
 - 6% to the east (Melbourne and Melton)

- 22% for TAFE/University, assume:
 - o 4% to the west (Ballarat)
 - o 18% to the east (Melbourne and Melton)
- Social/Recreational, Shopping and Personal Business trips, assume:
 - 40% within Draft FUS Plan
 - 50% to the south-west (Bacchus Marsh Town Centre)
 - 10% to the south (Parwon Station Precinct)
- Trips to be distributed to Flanagans Drive, assume:
 - 20% of trips to the south-west (Bacchus Marsh Town Centre)
 - 60% of trips to the south (Parwan Station Precinct and Parwan Employment Precinct)
 - 50% of trips to the east (Melbourne and Melton)
 - 50% of trips to the west (Ballarat)
- Peak Period flows and directional split
 - 10% of daily movements in the peak hour,
 - AM Peak - 25% inbound and 75% outbound,
 - PM Peak - 65% inbound and 35% outbound.

Based upon the assumptions above the peak hour volumes for assessment purposes are depicted in the following images with the full distribution summarised in Appendix A.



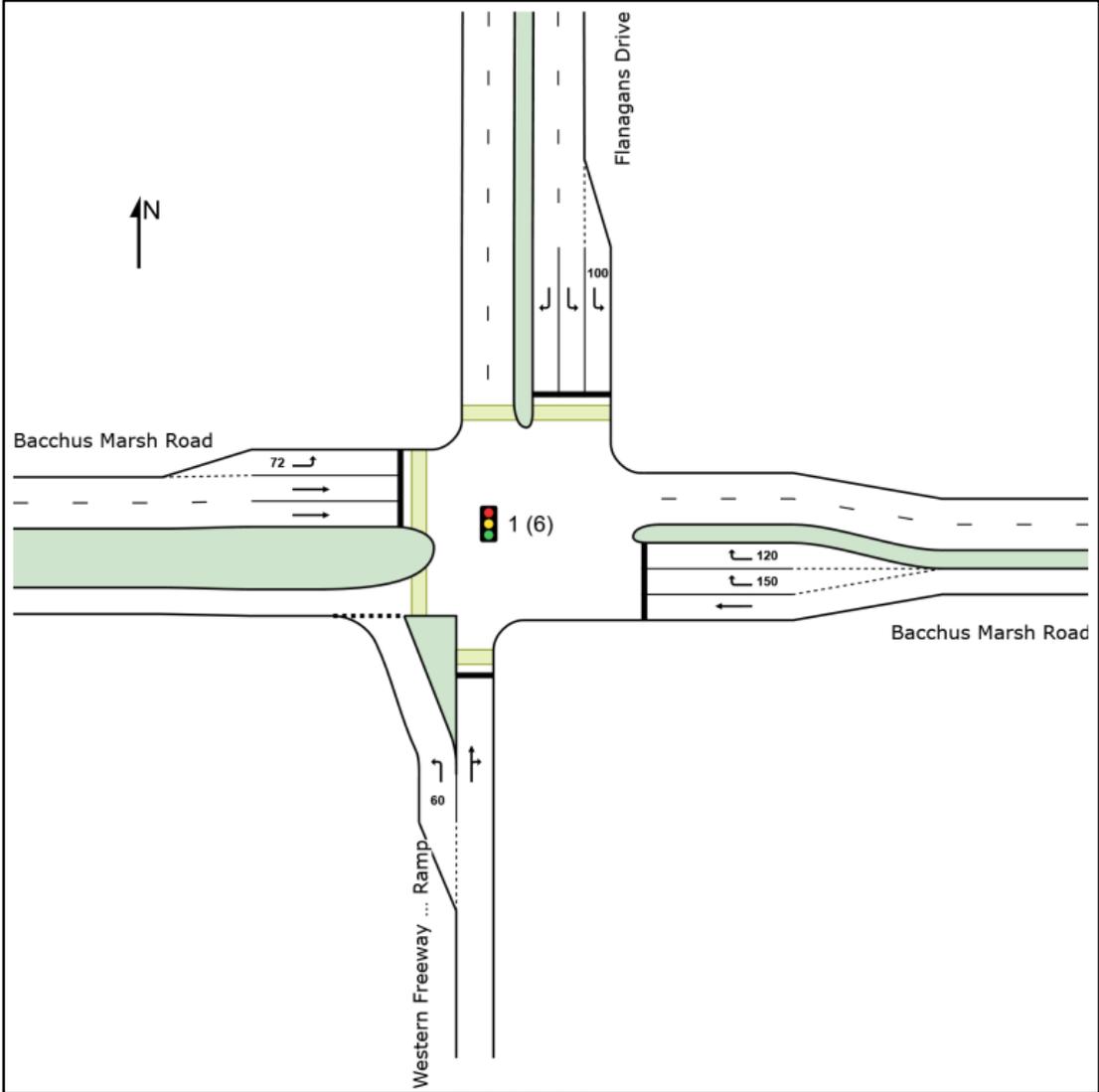


7 Assessment of Intersection Performance

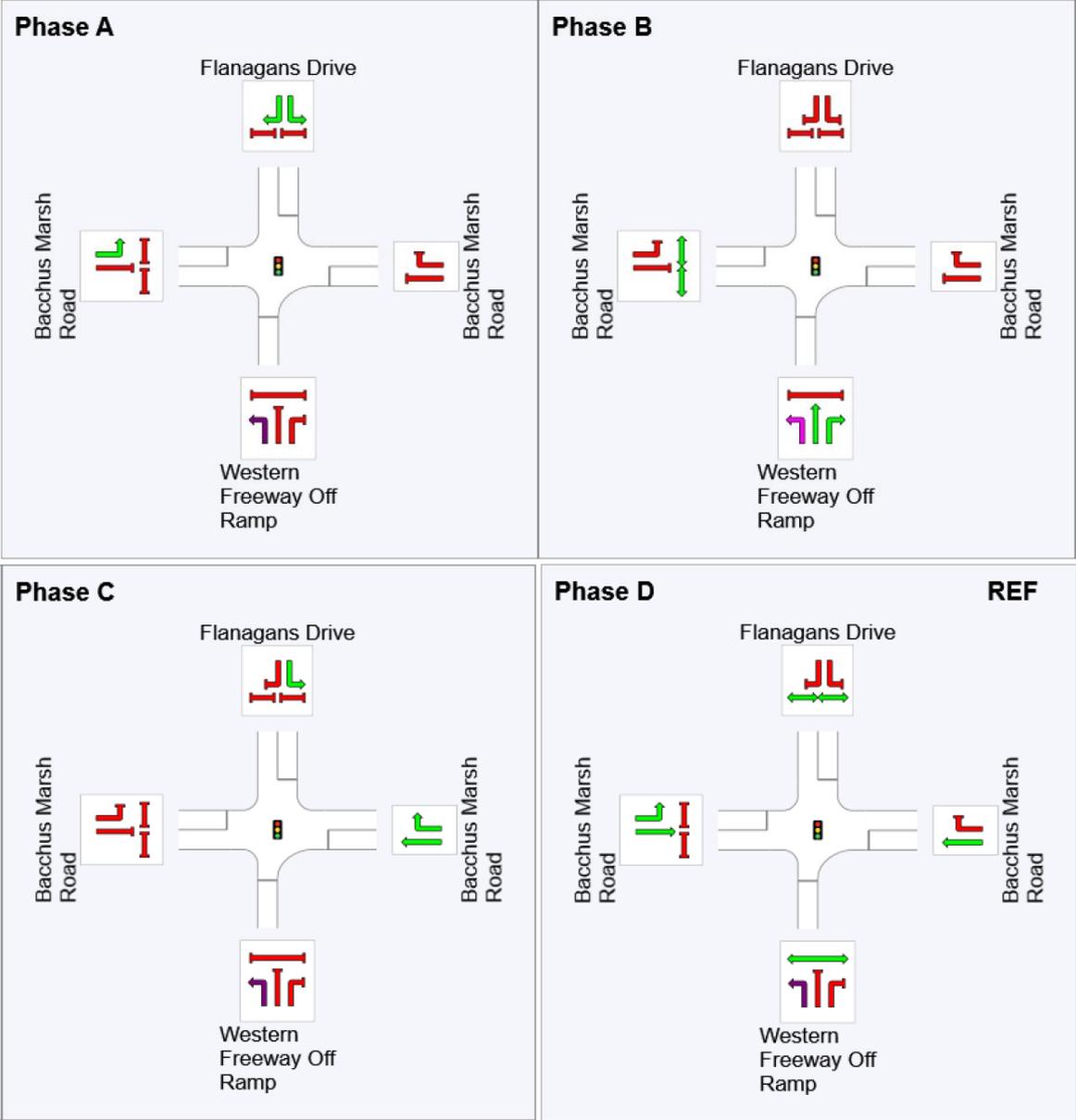
SIDRA v10 has been used to assess the performance of the Bacchus Marsh Road and Flanagans Drive intersection based upon the assumptions above.

The intersection layout adopted as the basis of the assessment is consistent with ultimate intersection layout prepared by Traffix Group (Dwg No. G23398-20-09B).

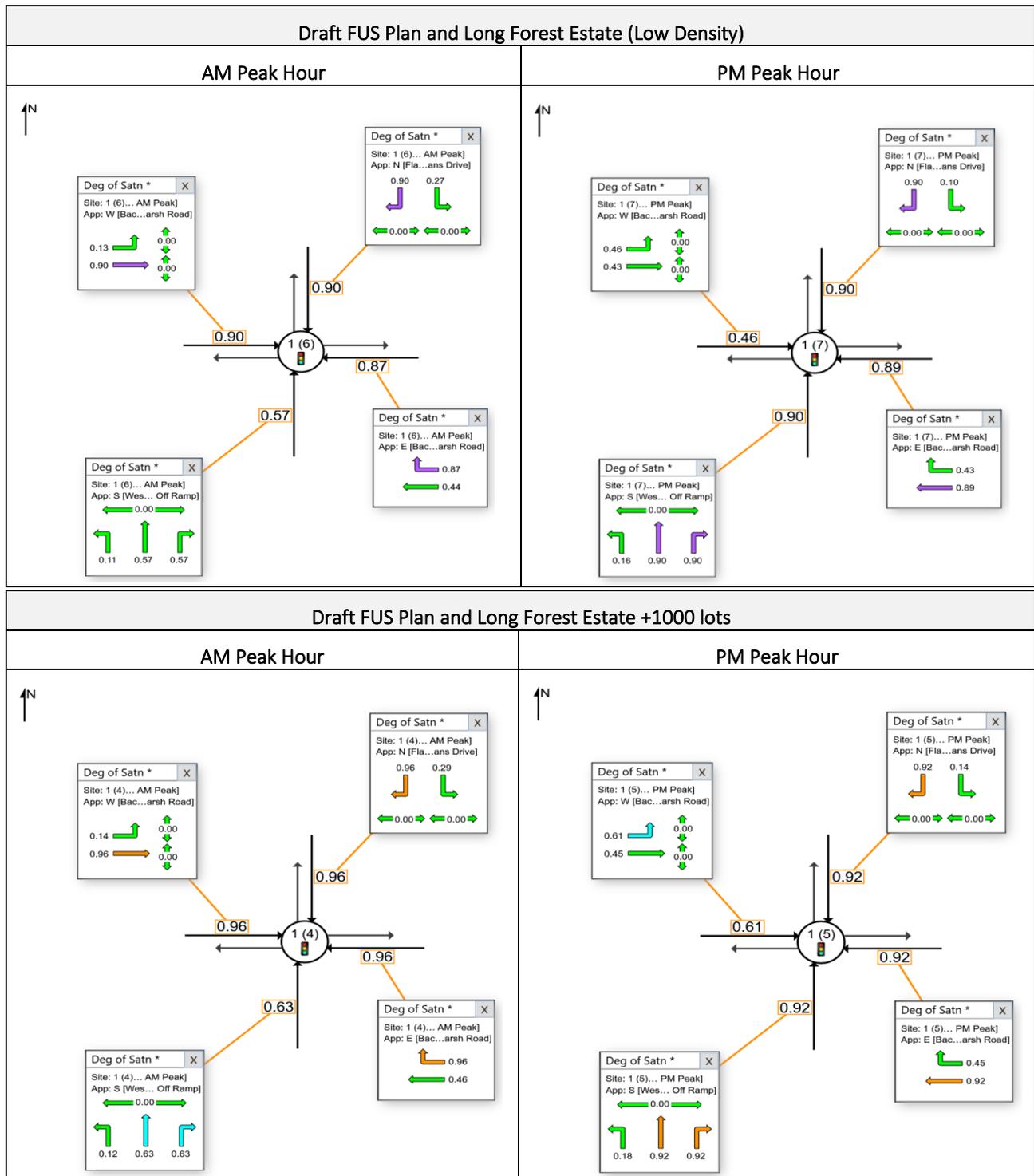
Ultimate Intersection Layout – Bacchus Marsh Road and Flanagans Drive



To ensure consistency between the two scenario's signal phasing was based upon the following layout.



The following table provides the degree of saturation for each scenario during the AM and PM peak periods.



The intersection analysis confirms that the additional 1,000 lots increases the intersection degree of saturation by about 6% and that the peak of 0.96 during the AM Peak period does not render the intersection inoperable rather it will add a few seconds to total travel times during commuter peak periods.

The intersection degree of saturation during the PM Peak period, increases by about 2%, to 0.92, which once again is appropriate. A full copy of the SIDRA output is attached in Appendix B.

8 Interim Assessment

An assessment of the interim intersection arrangement at Bacchus Marsh Road and Flanagans Drive with any road upgrades contained within the existing road reserve boundary has been undertaken to understand the interim development potential.

In determining the available capacity at the Bacchus Marsh Road and Flanagans Drive intersection, early stages have been assumed as follows :-

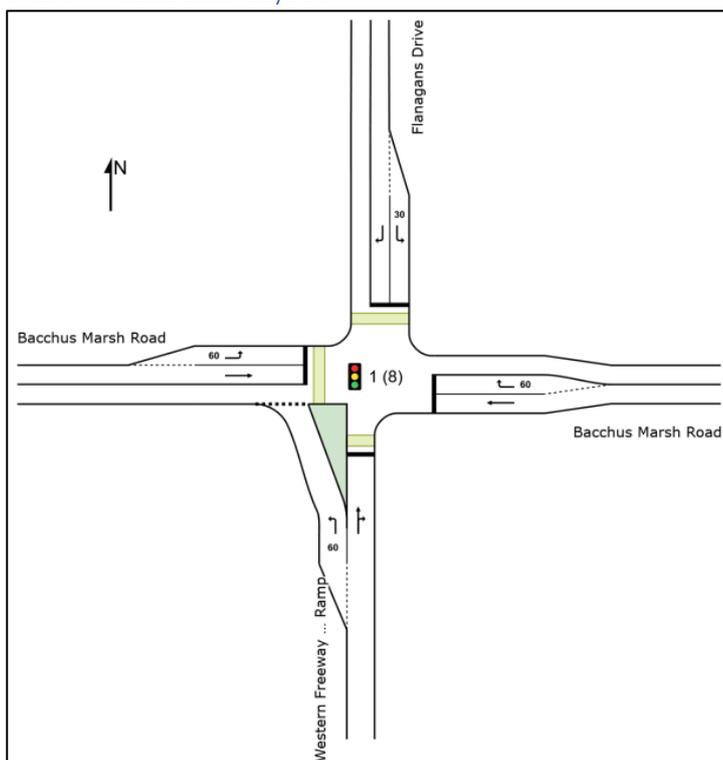
- Development of lots are south of the Possumtail/Bences Road intersection as Bences Road north of this intersection is unsealed for 1-2 kms,
- Earlier lots constructed in northern section of the Draft FUS Plan, would be north of Buckleys Road with all traffic movements to/from Gisborne Road and no movements generated onto the Bacchus Marsh Road and Flanagans Drive intersection.
- Existing Bences Road (South) access to Flanagans Drive north is currently directly through the Long Forest Estate site.

Accordingly, the same generation rate and distribution was adopted as outlined in Section 6, however varied as follows:

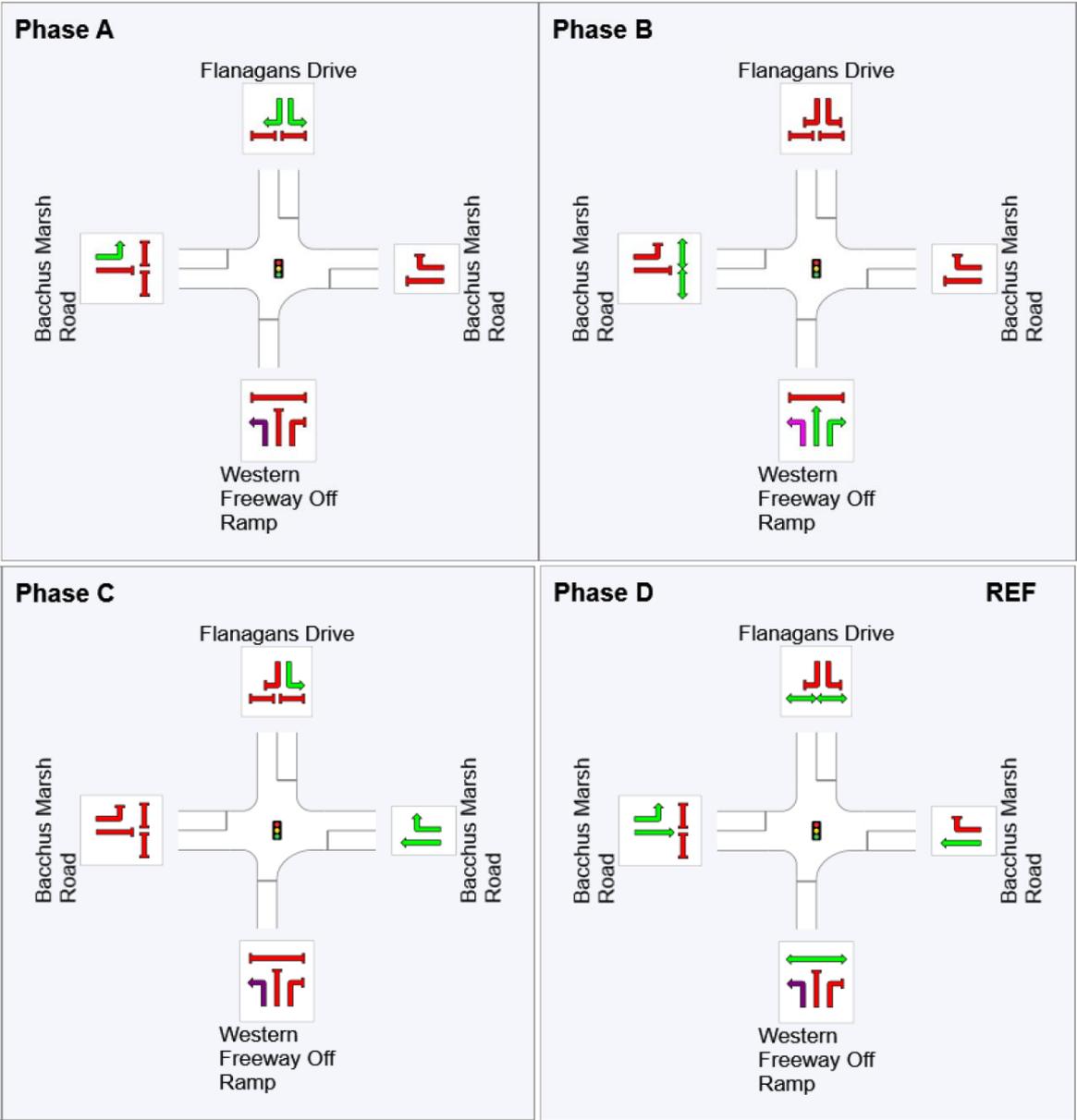
- The assessment assumes no internal trips, that is all the demand generators are external to the site,
- Distribution was varied such that all vehicle movements passed through the Bacchus Marsh Road and Flanagans Drive intersection as the current road connections and conditions to the north are substandard,

The SIDRA 10 inputs and outputs are summarised in the following figures with the full output in Appendix C.

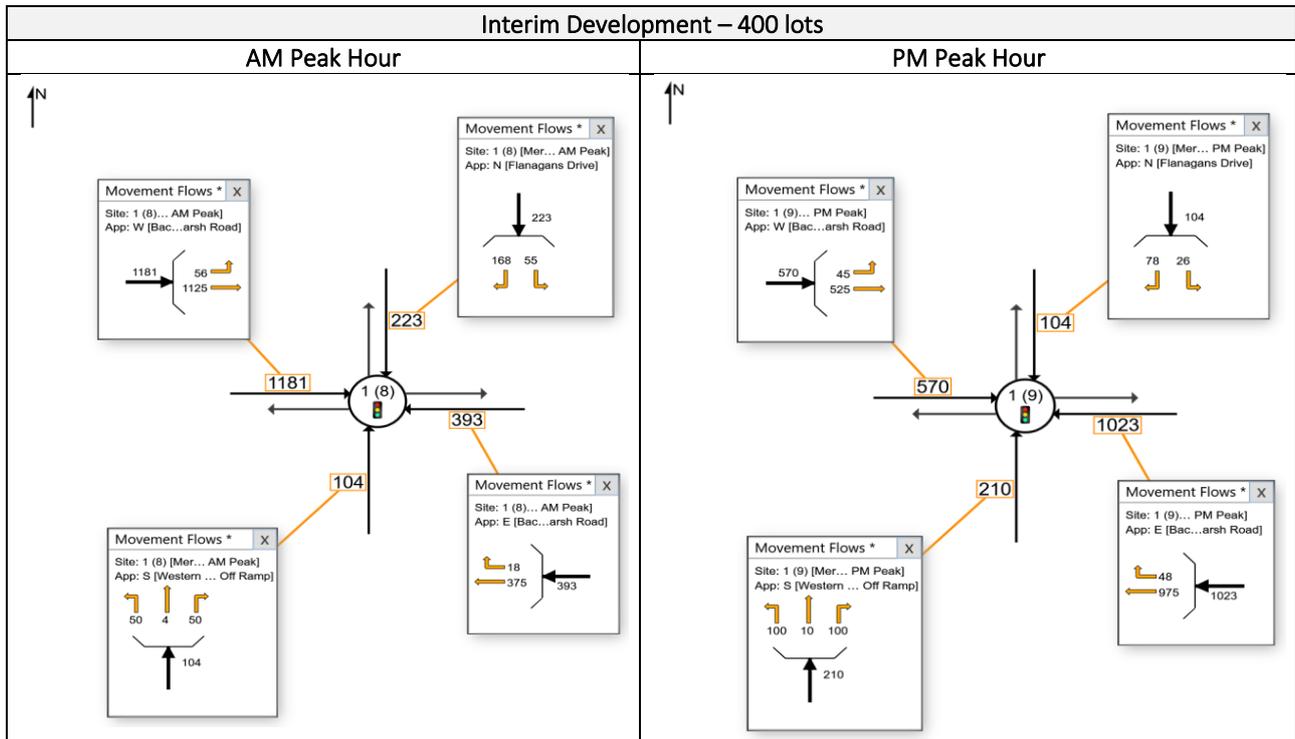
Interim Intersection Layout



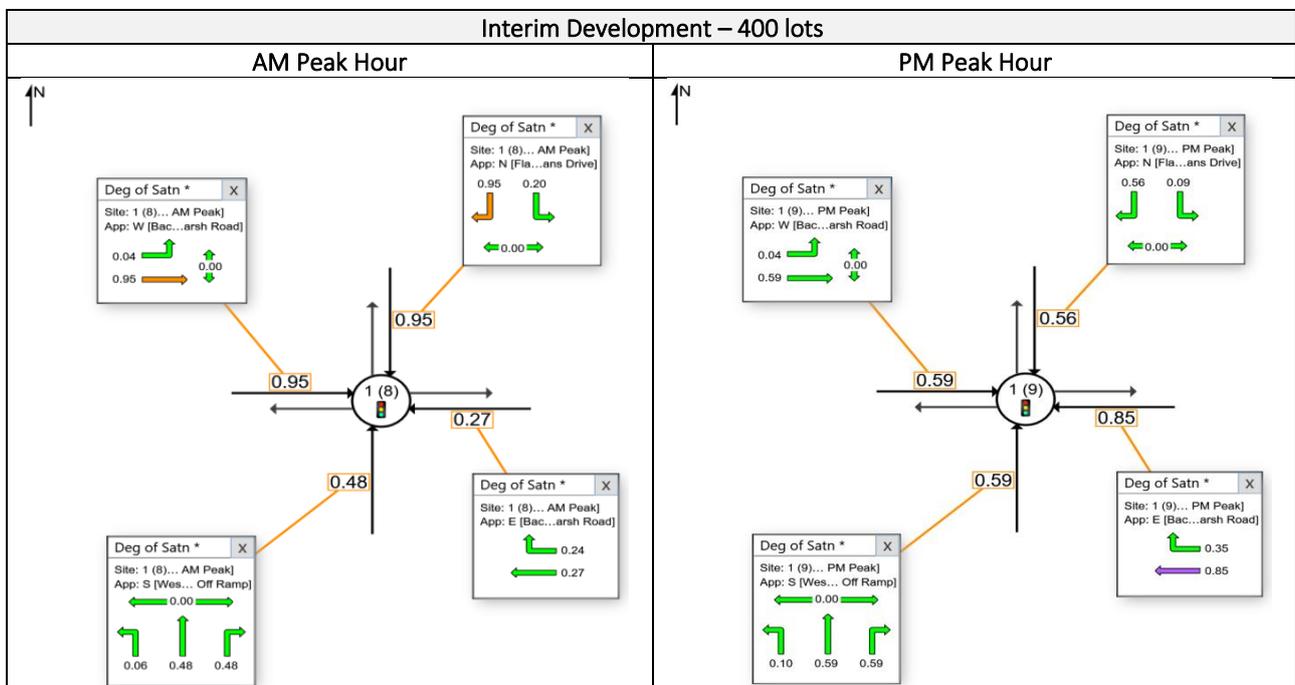
Once again to ensure consistency between the two scenario's signal phasing was based upon the following layout.



Peak Hour volumes are depicted in the following image.



The following table provides the degree of saturation for each scenario during the AM and PM peak periods.



My interim assessment confirms that a lot yield of 400 dwellings can be accommodated within an interim arrangement at the Bacchus Marsh Road and Flanagans Drive intersection based upon the daily volume estimate for Bacchus Marsh Road of 15,000 vehicles per day.

9 Assessment of Flanagans Drive

9.1 Estimated Daily Volumes

In the absence of publicly available transport modelling for the Draft FUS Plan or broader growth area, I have used first principles assumptions to estimate the ultimate traffic volume on Flanagans Drive when the broader growth area has been fully built out.

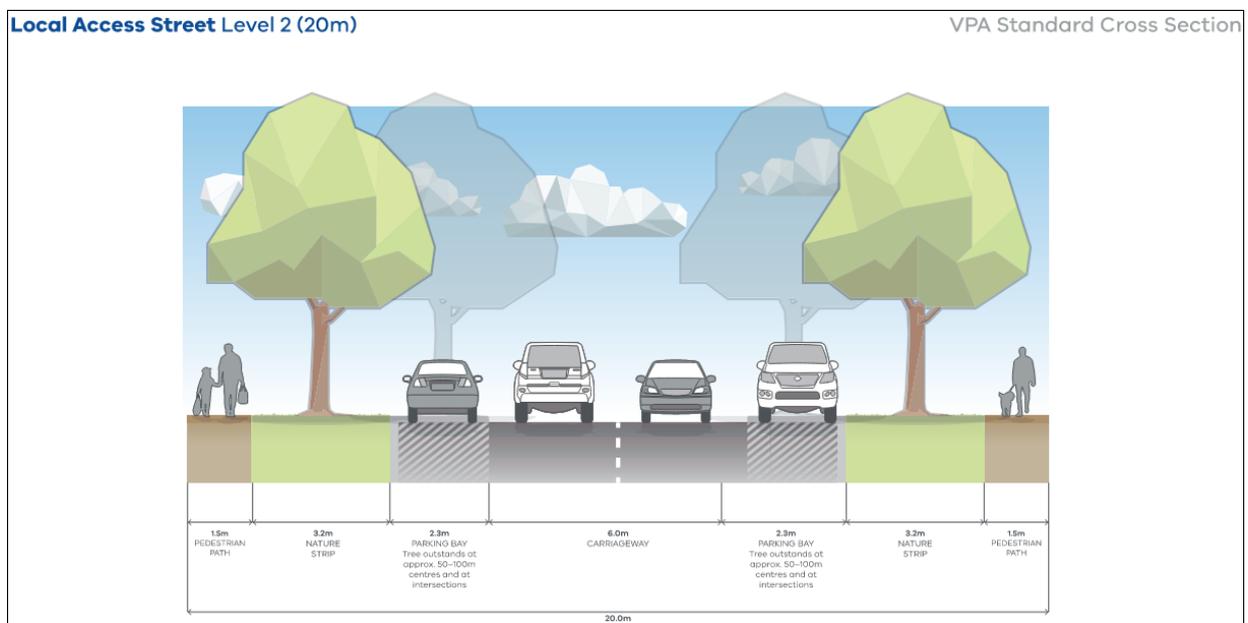
From the generation and distribution contained in Section 6 above the daily traffic volumes at the southern end of Flanagans Drive is summarised in the following table.

Development Scenario	Total Dwellings	AADT (VPD)
Draft FUS Plan and Long Forest Estate (Low Density)	6,420	13,700
Draft FUS Plan and Long Forest Estate +1000 lots	7,420	15,800
400 Lots	400	3,150

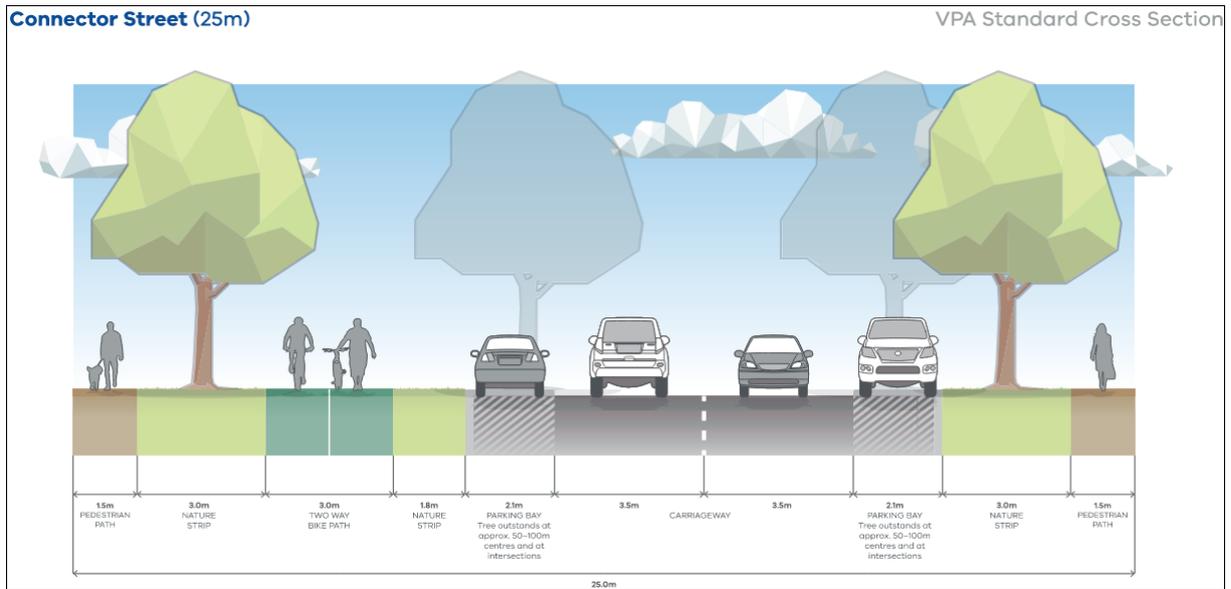
9.2 Typical VPA Cross Sections

The VPA Engineering Design and Construction Manual (EDCM) provides the following traffic volume ranges and cross.

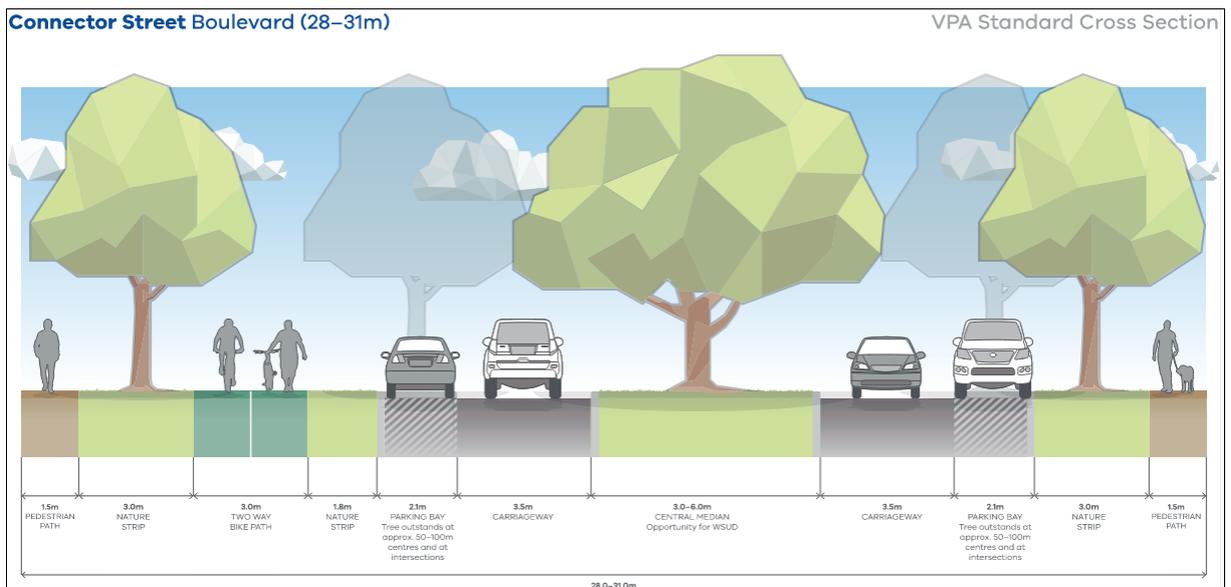
- Local Access Street Level 2 2,000 – 3,000 vpd



- **Connector Street** 3,000 – 7,000 vpd



- **Trunk Connector** 7,000 – 12,000 vpd



- **Arterial** 12,000 – 60,000 vpd

Similar Trunk Connector section above however the parking lane is replaced with an additional travel lane.

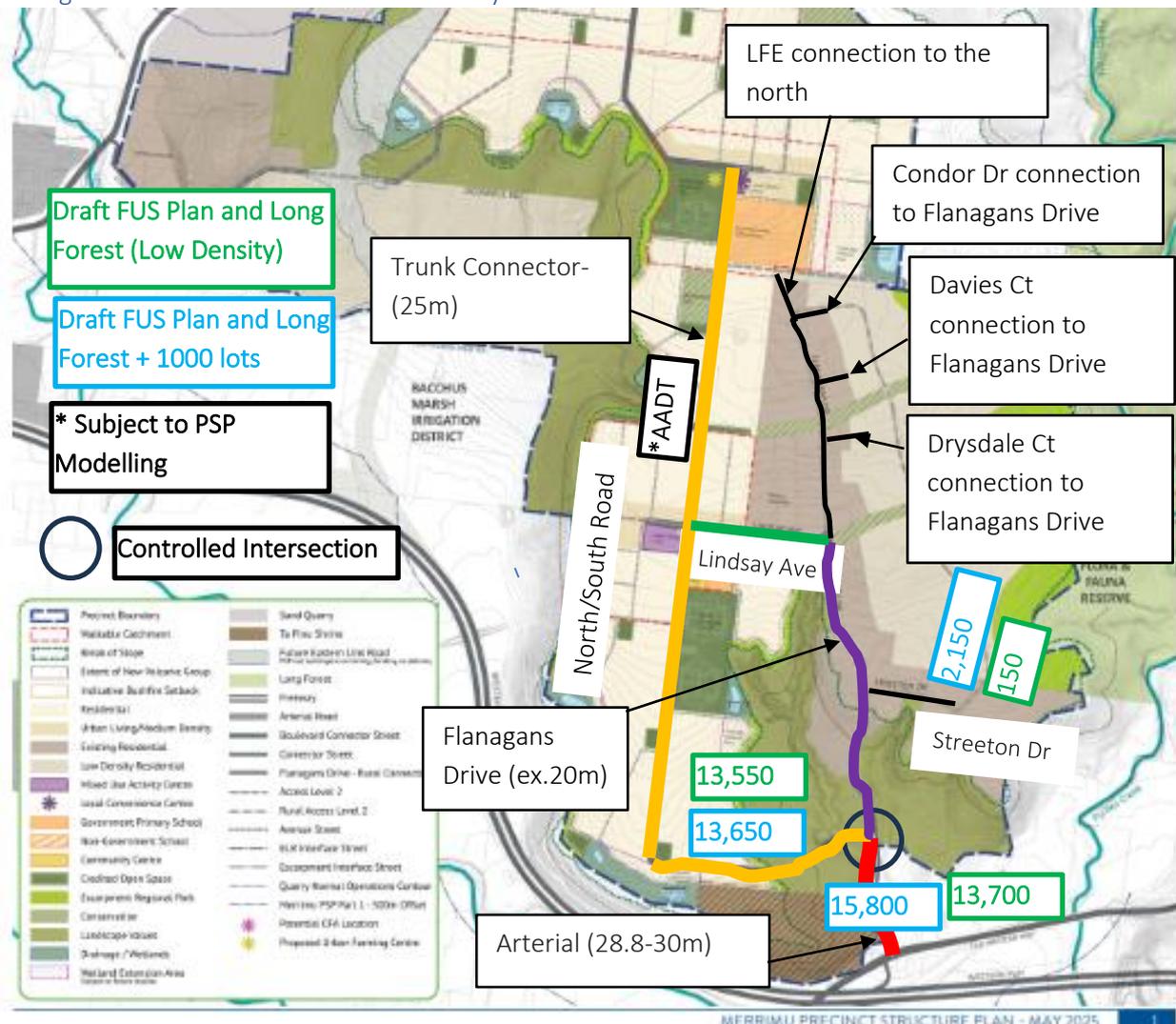
9.3 Flanagans Drive Cross Section

The Draft Future Urban Structure Plan (FUS Plan) prepared by Bacchus Marsh Developments Pty Ltd in May 2025 proposes a single connection to the Bacchus Marsh Road/Flanagans Drive intersection.

Within the Draft FUS Plan, the road layout proposes an east-west connector from Flanagans Drive to a new North/South Road that runs parallel to Bences Road. The road hierarchy legend in the Draft FUS Plan indicates that North/South Road – East-West Road connection to Flanagans Road will be a higher order Boulevard Connector Street and that Flanagans Road north of the East-West road will be a lower order road.

Based upon the assumptions outlined above the following image provides a summary of the estimated AADT for the different scenarios outlined.

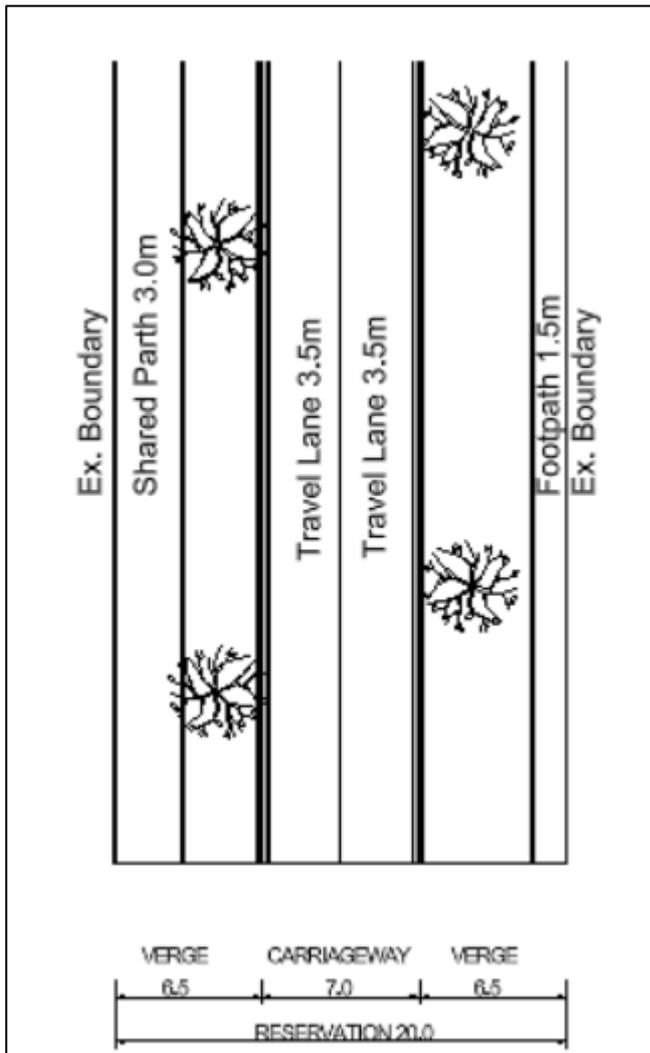
Flanagans Drive – Indicative Street Hierarchy and AADT



The typical VPA cross sections are designed to be accommodated within an unconstrained environment and are consistent with overarching urban design principles.

I understand the existing environmental constraints on Flanagans Drive between Lindsay Avenue and the new East-West Road make it impractical to widen the existing 20 metre wide reservation. Thus, the Draft FUS Plan directs vehicle access to/from Bacchus Marsh Road via the new North/South Road and East-West Road to Flanagans Drive.

An appropriate Flanagans Drive cross section that could be retained within the existing 20 metre reservation width is depicted below.



With no provision for kerbside parking and minimal accesses along this section of Flanagans Drive, traffic volumes upto 20,000 vehicles per day could be supported.

My assessment confirms the addition of 1000 lots for Long Forest Estate will generate 2,150 daily movements on Flanagans Drive to the south of Lindsay Avenue. When these volumes are added to those generated by the broader Merrimu PSP, combined volumes will not exceed 20,000 vehicle movements per day on Flanagans Drive.

10 Summary and Conclusion

The inclusion of 1,000 residential lots for the Long Forest Estate in accordance with the Development Plan prepared by Mesh is an appropriate inclusion within the Draft FUS Plan.

My assessment confirms the following:

- Provision for the traffic generated by the additional 1000 lots can be adequately accommodated within the Draft FUS Plan ultimate intersection arrangement for Bacchus Marsh Road and Flanagans Drive,
- The existing 20 metre reservation width and operational conditions for Flanagans Drive between Lindsay Avenue and the new East-West Road has adequate cross section width to accommodate upto 20,000 vehicle movements per day. This ensures there is adequate capacity for the additional 1000 lots that form part of Long Forest Estate.

My assessment of an interim intersection arrangement at Bacchus Marsh Road and Flanagans Drive that is contained within the existing road reservation can support the development of 400 residential lots south of the Possumtail/Bences Road intersection as Bences Road north of this intersection is unsealed for 2-3 kms and needs to traverse through the site to access Flanagans Drive (North).

Colliers International Engineering & Design (TTMC) Pty Limited



Damien Hancox
Director, Transport

Disclaimer

This report has been prepared by Colliers for the exclusive use of the client for the specific purpose stated within. The findings, conclusions, and recommendations presented in this report are based on the information available, assumptions made, and methodologies applied at the time of analysis.

Colliers shall not be held liable for any losses, damages, or reliance placed on this report beyond the scope of the agreed-upon engagement. Any reproduction or distribution of this report without Colliers' consent is prohibited.

APPENDIX A

Merrimu and Long (Low Density)

		Trip Reason		
		Work	Education	Shopping/Recreation/Personal
Daily		35.0%	11.0%	54.0%
	Within Merrimu PSP	5.0%	31.0%	40.0%
Local	North	5.0%	0.0%	0.0%
	South-West (Bacchus Marsh TC)	10.0%	34.5%	50.0%
	South (Parwon Precinct)	15.0%	6.5%	10.0%
External	West (Ballarat)	11.0%	4.0%	0.0%
	East (Melton, Melbourne)	54.0%	24.0%	0.0%

Dwellings **6420**

Trips per day 8

		Trip Reason				Daily		Peak Hour		Proportion				Flanagan	
		Work	Education	Shopping/Recreation/Personal	Total	Total	Total	Total	Flanagan	AM-In	AM-Out	PM-In	PM-Out	Drive (VPD)	
										25%	75%	65%	35%		
Daily		17,976	5,650	27,734	51,360	5,136									
	Within Merrimu PSP	899	1,751	11,094	13,744	1,374	0%	-	-	-	-	-	-		
Local	North	899	-	-	899	90	0%	-	-	-	-	-	-		
	South-West (Bacchus Marsh TC)	1,798	1,949	13,867	17,614	1,761	20%	88	264	229	123	123	123	3,522.78	
	South (Parwon Precinct)	2,696	367	2,773	5,837	584	60%	88	263	228	123	123	123	3,502.24	
External	West (Ballarat)	1,977	226	-	2,203	220	50%	28	83	72	39	39	39	1,101.67	
	East (Melton, Melbourne)	9,707	1,356	-	11,063	1,106	50%	138	415	360	194	194	194	5,531.47	
13,658.16															
					Bacchus Marsh Road @ Flan	15000	1,500			375	1,125	975	525		
									AM-Left	AM-Right	PM-Left	PM-Right			
									50%	50%	50%	50%			
					Freeway Exit Ramp - from Ballarat	2000	200					100	100		
							1000	100		50	50				

Merrimu and Long (+1000 lots)

		Trip Reason		
		Work	Education	Shopping/Recreation/Personal
Daily		35.0%	11.0%	54.0%
	Within Merrimu PSP	5.0%	31.0%	40.0%
Local	North	5.0%	0.0%	0.0%
	South-West (Bacchus Marsh TC)	10.0%	34.5%	50.0%
	South (Parwon Precinct)	15.0%	6.5%	10.0%
External	West (Ballarat)	11.0%	4.0%	0.0%
	East (Melton, Melbourne)	54.0%	24.0%	0.0%

Dwellings **7420**

Trips per day 8

		Trip Reason				Daily		Peak Hour		Proportion				Flanagan
		Work	Education	Shopping/Recreation/Personal	Total	Total	Total	Flanagan	AM-In	AM-Out	PM-In	PM-Out	Drive (VPD)	
								25%	75%	65%	35%			
Daily		20,776	6,530	32,054	59,360	5,936								
	Within Merrimu PSP	1,039	2,024	12,822	15,885	1,588	0%	-	-	-	-			
Local	North	1,039	-	-	1,039	104	0%	-	-	-	-			
	South-West (Bacchus Marsh TC)	2,078	2,253	16,027	20,358	2,036	20%	102	305	265	143	4,071.50		
	South (Parwon Precinct)	3,116	424	3,205	6,746	675	60%	101	304	263	142	4,047.76		
External	West (Ballarat)	2,285	261	-	2,547	255	50%	32	95	83	45	1,273.27		
	East (Melton, Melbourne)	11,219	1,567	-	12,786	1,279	50%	160	479	416	224	6,393.07		
													15,785.60	
					Bacchus Marsh Road @ Flan	15000	1,500		375	1,125	975	525		
								AM-Left	AM-Right	PM-Left	PM-Right			
								50%	50%	50%	50%			
					Freeway Exit Ramp - from Ballarat	2000	200				100	100		
							1000	100	50	50				

APPENDIX B

MOVEMENT SUMMARY

 **Site: [1 (6)] Merrimu + Long Forest Low Resi AM Peak (SIDRA)**

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140.0 seconds (Site Practical Cycle Time)

Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop Rate	Number of Cycles to Depart	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	50	2.0	50	2.0	0.107	18.9	LOS B	1.8	12.9	0.56	0.95	0.56	25.9
2	T1	All MCs	28	2.0	28	2.0	*0.568	71.2	LOS E	5.4	38.5	1.00	0.78	1.01	21.4
3	R2	All MCs	50	2.0	50	2.0	0.568	73.0	LOS E	5.4	38.5	1.00	0.78	1.01	21.9
Approach			128	2.0	128	2.0	0.568	51.5	LOS D	5.4	38.5	0.83	0.85	0.83	23.2
East: Bacchus Marsh Road															
5	T1	All MCs	375	2.0	375	2.0	0.442	29.2	LOS C	17.6	125.4	0.75	0.65	0.75	40.7
6	R2	All MCs	138	2.0	138	2.0	*0.870	89.1	LOS F	5.3	37.9	1.00	0.96	1.47	23.3
Approach			513	2.0	513	2.0	0.870	45.3	LOS D	17.6	125.4	0.82	0.74	0.94	33.9
North: Flanagans Drive															
7	L2	All MCs	415	2.0	415	2.0	0.273	22.4	LOS C	6.8	48.8	0.71	1.16	0.71	27.9
9	R2	All MCs	610	2.0	610	2.0	*0.897	61.3	LOS E	44.8	319.1	1.00	1.00	1.15	28.2
Approach			1025	2.0	1025	2.0	0.897	45.5	LOS D	44.8	319.1	0.88	1.06	0.97	28.1
West: Bacchus Marsh Road															
10	L2	All MCs	176	2.0	176	2.0	0.125	28.6	LOS C	3.1	21.9	0.28	0.65	0.28	46.3
11	T1	All MCs	1125	2.0	1125	2.0	*0.896	67.5	LOS E	44.8	318.7	1.00	1.04	1.16	30.6
Approach			1301	2.0	1301	2.0	0.896	62.2	LOS E	44.8	318.7	0.90	0.99	1.04	29.5
All Vehicles			2967	2.0	2967	2.0	0.897	53.1	LOS D	44.8	319.1	0.88	0.96	0.99	29.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

 Site: [1 (4)] Merrimu + Long Forest Standard Resi AM Peak (SIDRA)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150.0 seconds (Site Practical Cycle Time)

Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop of Cycles	Number of Cycles to Depart	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]		Rate	Rate	km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	50	2.0	50	2.0	0.120	26.4	LOS C	2.1	14.8	0.61	1.11	0.61	24.1
2	T1	All MCs	32	2.0	32	2.0	*0.628	77.3	LOS E	6.1	43.7	1.00	0.82	1.04	20.7
3	R2	All MCs	50	2.0	50	2.0	0.628	79.1	LOS E	6.1	43.7	1.00	0.82	1.04	21.2
Approach			132	2.0	132	2.0	0.628	58.7	LOS E	6.1	43.7	0.85	0.93	0.88	22.1
East: Bacchus Marsh Road															
5	T1	All MCs	375	2.0	375	2.0	0.461	33.3	LOS C	19.5	138.5	0.77	0.68	0.77	38.9
6	R2	All MCs	160	2.0	160	2.0	*0.957	109.1	LOS F	7.2	51.2	1.00	1.09	1.76	20.7
Approach			535	2.0	535	2.0	0.957	55.9	LOS E	19.5	138.5	0.84	0.80	1.07	30.8
North: Flanagans Drive															
7	L2	All MCs	479	2.0	479	2.0	0.292	22.0	LOS C	8.2	58.1	0.68	1.17	0.68	28.1
9	R2	All MCs	704	2.0	704	2.0	*0.957	83.4	LOS F	64.8	461.2	1.00	1.12	1.28	24.1
Approach			1183	2.0	1183	2.0	0.957	58.6	LOS E	64.8	461.2	0.87	1.14	1.04	25.6
West: Bacchus Marsh Road															
10	L2	All MCs	203	2.0	203	2.0	0.142	33.0	LOS C	3.7	26.4	0.28	0.65	0.28	46.3
11	T1	All MCs	1125	2.0	1125	2.0	*0.957	97.0	LOS F	57.2	407.5	1.00	1.21	1.34	24.9
Approach			1328	2.0	1328	2.0	0.957	87.3	LOS F	57.2	407.5	0.89	1.13	1.18	24.6
All Vehicles			3178	2.0	3178	2.0	0.957	70.1	LOS E	64.8	461.2	0.87	1.07	1.10	25.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

 **Site: [1 (7)] Merrimu + Long Forest Low Resi PM Peak (SIDRA)**

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120.0 seconds (Site Practical Cycle Time)

Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop of Cycles	Number of Cycles to Depart	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]		Rate	Rate	km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	100	2.0	100	2.0	0.157	29.0	LOS C	3.9	27.7	0.73	1.17	0.73	24.3
2	T1	All MCs	72	2.0	72	2.0	* 0.895	70.2	LOS E	11.5	82.0	1.00	1.17	1.43	21.5
3	R2	All MCs	100	2.0	100	2.0	0.895	72.0	LOS E	11.5	82.0	1.00	1.17	1.43	22.1
Approach			272	2.0	272	2.0	0.895	55.7	LOS E	11.5	82.0	0.90	1.17	1.17	22.7
East: Bacchus Marsh Road															
5	T1	All MCs	975	2.0	975	2.0	* 0.895	36.8	LOS D	56.1	399.2	0.95	0.94	1.04	39.5
6	R2	All MCs	360	2.0	360	2.0	0.435	51.5	LOS D	9.1	65.1	0.91	0.80	0.91	31.2
Approach			1335	2.0	1335	2.0	0.895	40.8	LOS D	56.1	399.2	0.94	0.90	1.00	35.4
North: Flanagans Drive															
7	L2	All MCs	144	2.0	144	2.0	0.098	18.2	LOS B	1.8	12.6	0.66	1.17	0.66	32.1
9	R2	All MCs	284	2.0	284	2.0	* 0.895	70.5	LOS E	19.1	136.2	1.00	1.07	1.34	26.3
Approach			428	2.0	428	2.0	0.895	52.9	LOS D	19.1	136.2	0.89	1.10	1.11	28.0
West: Bacchus Marsh Road															
10	L2	All MCs	457	2.0	457	2.0	0.464	24.1	LOS C	16.4	116.7	0.67	0.78	0.67	39.4
11	T1	All MCs	525	2.0	525	2.0	0.435	35.4	LOS D	12.2	87.0	0.85	0.72	0.85	38.1
Approach			982	2.0	982	2.0	0.464	30.1	LOS C	16.4	116.7	0.76	0.75	0.76	38.6
All Vehicles			3017	2.0	3017	2.0	0.895	40.4	LOS D	56.1	399.2	0.87	0.91	0.95	33.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

 Site: [1 (5)] Merrimu + Long Forest Standard Resi PM Peak (SIDRA)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150.0 seconds (Site Practical Cycle Time)

Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop of Cycles	Number of Cycles	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]		Rate to Depart		km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	100	2.0	100	2.0	0.183	42.2	LOS D	5.2	36.7	0.78	1.24	0.78	22.2
2	T1	All MCs	83	2.0	83	2.0	*0.921	89.5	LOS F	15.5	110.2	1.00	1.18	1.43	19.4
3	R2	All MCs	100	2.0	100	2.0	0.921	91.3	LOS F	15.5	110.2	1.00	1.18	1.43	19.8
Approach			283	2.0	283	2.0	0.921	73.4	LOS E	15.5	110.2	0.92	1.20	1.20	20.4
East: Bacchus Marsh Road															
5	T1	All MCs	975	2.0	975	2.0	*0.921	51.9	LOS D	72.3	514.8	0.98	0.97	1.07	35.8
6	R2	All MCs	416	2.0	416	2.0	0.450	61.8	LOS E	12.8	91.4	0.90	0.81	0.90	29.3
Approach			1391	2.0	1391	2.0	0.921	54.8	LOS D	72.3	514.8	0.95	0.92	1.02	31.1
North: Flanagans Drive															
7	L2	All MCs	224	2.0	224	2.0	0.137	19.3	LOS B	3.2	23.1	0.63	1.17	0.63	32.2
9	R2	All MCs	329	2.0	329	2.0	*0.921	87.7	LOS F	28.1	200.3	1.00	1.08	1.32	23.5
Approach			553	2.0	553	2.0	0.921	60.0	LOS E	28.1	200.3	0.85	1.12	1.04	26.3
West: Bacchus Marsh Road															
10	L2	All MCs	528	2.0	528	2.0	0.609	38.4	LOS D	26.3	187.4	0.75	0.82	0.75	36.5
11	T1	All MCs	525	2.0	525	2.0	0.450	48.9	LOS D	15.4	109.7	0.86	0.73	0.86	34.5
Approach			1053	2.0	1053	2.0	0.609	43.7	LOS D	26.3	187.4	0.80	0.78	0.80	33.7
All Vehicles			3280	2.0	3280	2.0	0.921	53.7	LOS D	72.3	514.8	0.89	0.93	0.97	29.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

APPENDIX C

MOVEMENT SUMMARY

 Site: [1 (8)] Merrimu + Long Forest 400 Lots AM Peak (SIDRA)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150.0 seconds (Site Practical Cycle Time)

Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop of Cycles	Number of Cycles	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]		Rate to Depart		km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	50	2.0	50	2.0	0.060	3.7	LOS A	0.6	4.6	0.19	0.79	0.19	25.0
2	T1	All MCs	4	2.0	4	2.0	*0.477	77.4	LOS E	4.0	28.6	1.00	0.75	1.00	20.5
3	R2	All MCs	50	2.0	50	2.0	0.477	79.6	LOS E	4.0	28.6	1.00	0.75	1.00	21.0
Approach			104	2.0	104	2.0	0.477	43.0	LOS D	4.0	28.6	0.61	0.77	0.61	22.7
East: Bacchus Marsh Road															
5	T1	All MCs	375	2.0	375	2.0	0.270	7.9	LOS A	9.4	66.9	0.38	0.34	0.38	53.1
6	R2	All MCs	18	2.0	18	2.0	*0.243	85.3	LOS F	1.4	9.7	1.00	0.70	1.00	23.7
Approach			393	2.0	393	2.0	0.270	11.4	LOS B	9.4	66.9	0.41	0.35	0.41	50.3
North: Flanagans Drive															
7	L2	All MCs	55	2.0	55	2.0	0.201	74.7	LOS E	3.0	21.3	0.92	1.04	0.92	23.4
9	R2	All MCs	168	2.0	168	2.0	*0.948	130.7	LOS F	15.3	109.2	1.00	1.11	1.57	20.9
Approach			223	2.0	223	2.0	0.948	116.9	LOS F	15.3	109.2	0.98	1.10	1.41	18.6
West: Bacchus Marsh Road															
10	L2	All MCs	56	2.0	56	2.0	0.039	29.2	LOS C	0.9	6.3	0.24	0.63	0.24	46.8
11	T1	All MCs	1125	2.0	1125	2.0	*0.949	66.1	LOS E	90.0	640.8	1.00	1.02	1.13	34.1
Approach			1181	2.0	1181	2.0	0.949	64.3	LOS E	90.0	640.8	0.96	1.00	1.09	29.1
All Vehicles			1901	2.0	1901	2.0	0.949	58.4	LOS E	90.0	640.8	0.83	0.87	0.96	29.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

 **Site: [1 (9)] Merrimu + Long Forest 400 Lots PM Peak (SIDRA)**
 Output produced by SIDRA INTERSECTION Version: 10.0.5.217

New Site
 Site Category: (None)
 Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80.0 seconds (Site Practical Cycle Time)
Site Scenario: 1 | Local Volumes

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Qued	Eff. Stop Rate	Number of Cycles to Depart	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h	%	veh/h	%				veh	m				
South: Western Freeway Off Ramp															
1	L2	All MCs	100	2.0	100	2.0	0.105	10.4	LOS B	1.9	13.2	0.50	0.85	0.50	27.8
2	T1	All MCs	10	2.0	10	2.0	* 0.593	40.2	LOS D	4.4	31.5	1.00	0.81	1.05	25.9
3	R2	All MCs	100	2.0	100	2.0	0.593	42.4	LOS D	4.4	31.5	1.00	0.81	1.05	26.7
Approach			210	2.0	210	2.0	0.593	27.1	LOS C	4.4	31.5	0.76	0.83	0.79	27.2
East: Bacchus Marsh Road															
5	T1	All MCs	975	2.0	975	2.0	* 0.847	25.1	LOS C	34.9	248.3	0.88	0.88	0.96	45.9
6	R2	All MCs	48	2.0	48	2.0	0.346	52.7	LOS D	1.9	13.6	0.99	0.74	0.99	31.7
Approach			1023	2.0	1023	2.0	0.847	26.4	LOS C	34.9	248.3	0.88	0.87	0.96	41.7
North: Flanagans Drive															
7	L2	All MCs	26	2.0	26	2.0	0.094	23.8	LOS C	0.6	4.6	0.89	1.06	0.89	28.2
9	R2	All MCs	78	2.0	78	2.0	* 0.562	46.4	LOS D	3.2	22.8	1.00	0.79	1.05	31.4
Approach			104	2.0	104	2.0	0.562	40.8	LOS D	3.2	22.8	0.97	0.85	1.01	30.5
West: Bacchus Marsh Road															
10	L2	All MCs	45	2.0	45	2.0	0.040	12.7	LOS B	0.7	4.9	0.42	0.66	0.42	45.1
11	T1	All MCs	525	2.0	525	2.0	0.592	17.9	LOS B	15.3	108.8	0.80	0.70	0.80	46.6
Approach			570	2.0	570	2.0	0.592	17.5	LOS B	15.3	108.8	0.77	0.70	0.77	46.2
All Vehicles			1907	2.0	1907	2.0	0.847	24.6	LOS C	34.9	248.3	0.84	0.81	0.89	39.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)