

# Traffic Impact Statement

<b>Title</b>	West Mundijong Structure Plan Strategic Traffic Advice		
<b>Client</b>	TME Town Planning Management Engineering Pty Ltd	<b>Project No</b>	CEP02161
<b>Date</b>	07/11/2012	<b>Status</b>	Version 1
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## 1 Introduction

TME Town Planning Management Engineering Pty Ltd commissioned Cardno to prepare a Strategic Traffic Advice Note for the West Mundijong Structure Plan. The area is located in the Shire of Serpentine-Jarrahdale and is bounded by Bishop Road to the north, the proposed Tonkin Highway extension to the east, Mundijong Road to the south, and Kargotich Road to the west. The following tasks were undertaken:

- > Comparison of the proposed land uses to existing land use and ROM data
- > Update of traffic projections including generation, distribution and assignment to the network
- > SIDRA analysis of critical intersections for the two options provided (Option 1 and Option 3)
- > Determine intersection control and road reserve requirements (Geometric Design)

Two options provided for assessment, with the following characteristics:

1. Option 1
  - > Intermodal facility located adjacent to the proposed Tonkin Highway;
  - > A spine road runs along the centre of the West Mundijong from Bishop Road to Mundijong Road;
  - > Scott Road, Sparkman Road and a new road connect with the spine road to Kargotich Road.
2. Option 3
  - > Intermodal facility is located adjacent to Kargotich Road;
  - > A major internal road runs beside the intermodal facility from Bishop Road to Sparkman Road;
  - > Scott Road and Sparkman Road connect as a loop road;
  - > Only Sparkman Road connects with Kargotich Road as the western end of Scott Road becomes the intermodal facility.

It has been assumed by the Department of Transport that the intermodal facility will handle approximately 250,000 TEU (Twenty feet Equivalent container) per year.

Layouts of the two options are included at **Appendix A**.

**Figures 1 and 2** show the existing configuration of the critical intersections assessed.

Figure 1 Existing Mundijong Road/Kargotich Road Intersection Layout



Figure 2 Existing Kargotich Road/Bishop Road Intersection Layout

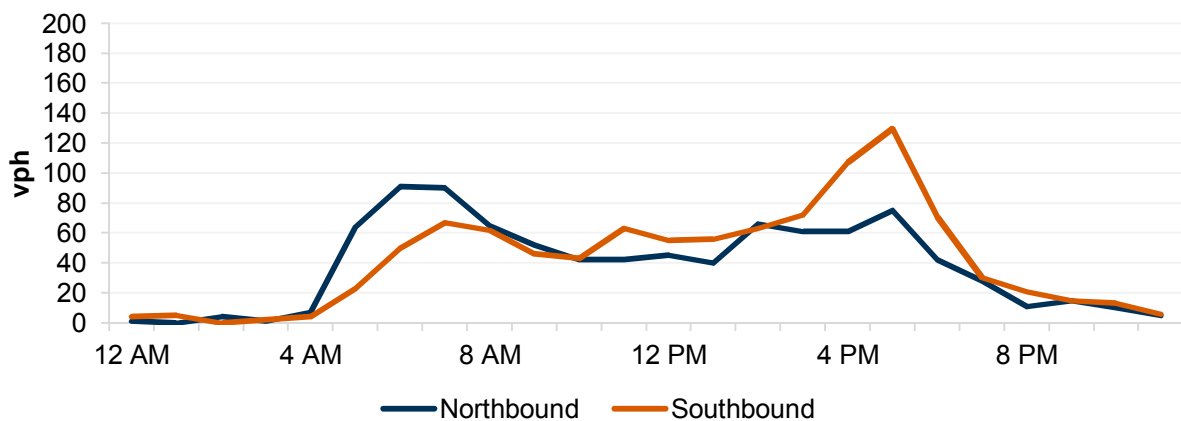


## 2 Traffic Data

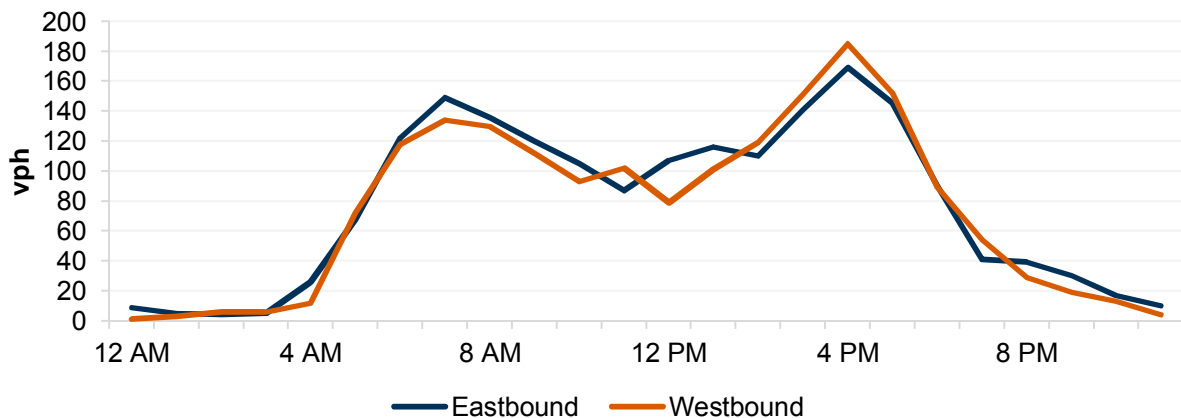
### 2.1 Link Count Data

Main Roads Western Australia (MRWA) conducted link count surveys of Kargotich Road and Mundijong Road, in November 2008. These data have been analysed for the AM and PM peak periods. **Figure 3 and 4** show the average hourly volumes across the surveyed weekday period. The raw data are included in **Appendix B**.

**Figure 3** Kargotich Road Average Weekday Hourly Volumes



**Figure 4** Mundijong Road Average Weekday Hourly Volumes



**Table 2** summarises the average traffic volumes data.

**Table 2** Average Traffic Volumes

Average Traffic Volumes	Kargotich Road	Mundijong Road
AM Peak Hour	157 vph (7am-8am)	283 vph (7am-8am)
PM Peak Hour	205 vph (5pm-6pm)	354 vph (4pm-5pm)
Daily	1926 vph	3635 vph
% of AM Peak to Daily	8.2%	7.8%
% of PM Peak to Daily	10.6%	9.7%
Directional split	North 48%/South 52%	East 51%/West 49%

## 2.2 2031 Modelling Data

MRWA has undertaken regional traffic modelling for the Shire of Serpentine-Jarrahdale as part of the Regional operations Model (ROM). This model includes the anticipated traffic for full build out of the Byford-Mundijong area by 2031, with assumptions regarding land use mix and lot yields as obtained from developers. However, this modelling is not consistent with the proposed industrial land uses within the proposed West Mundijong cell. Therefore, for the purpose of this strategic advice, the ROM output is assumed to represent the ultimate (2031) background traffic volumes in the vicinity of the development.

**Figure 5** shows the daily link volumes extracted from the MRWA 2031 model data in the vicinity of the study area. The entire map is included in **Appendix B**.

**Figure 5** Extract from MRWA 2031 Model



## 2.3 Background Traffic Volumes

In determining the 2031 Background traffic volumes for the surrounding road network, the MRWA link count and modelling data were considered. The data for Kargotich Road does not show sufficient evidence for a growth of traffic volumes, therefore a conservative linear growth rate of 2% has been assumed. The data for Mundijong Road indicates a linear growth rate of 28% and is considered to be appropriate as it is expected that there will be a lot of residential, commercial and industrial developments in the Byford-Mundijong region over the next 20 years.

## 2.4 Development Trip Generation

Trip generation for the proposed land uses has been estimated generally in accordance with *The Institute of Transportation Engineers (ITE): Trip Generation 7<sup>th</sup> Edition*.

For the purpose of determining potential trip generation demand rates, the proposed land uses has been classified as per the following ITE classifications:

**Table 3 ITE Classification**

ITE Land Use	ITE Classification	ITE Classification Code
Intermodal Facility	Truck Terminal	030
Light Industry	General Light Industrial	110
General Industry	General Heavy Industrial	120

*\*Note that the closest description of activities from ITE classification have been used for the proposed land uses.*

**Table 4** summarises the trip generation rates for each peak and daily time period.

**Table 4 ITE Trip Generation Rates**

ITE Land Use	ITE Land Use Code	Trip Generation Rates	
		AM Peak Hour	PM Peak Hour
Truck Terminal	030	0.66 trips/employee	0.62 trips/employee
General Light Industrial	110	0.48 trips/employee	0.51 trips/employee
General Heavy Industrial	120	0.40 trips/employee	0.40 trips/employee

Additionally, entry and exit distribution for the proposed land uses are expected be as follows.

**Table 5 ITE Directionality Rates**

ITE Land Use	AM Peak Hour		PM Peak Hour	
	IN	OUT	IN	OUT
Truck Terminal	40%	60%	47%	53%
General Light Industrial	87%	13%	29%	71%
General Heavy Industrial	85%	15%	30%	70%

**Table 6 and 7** summarise the expected trip generation of each option for the proposed land uses by applying the above trip rates and entry/exit distributions.

**Table 6 Trip Generation – Option 1**

Land Use	Development Yields	AM Peak Hour		PM Peak Hour		Daily Volumes
		IN	OUT	IN	OUT	
Truck Terminal	805 employees	213 trips	319 trips	235 trips	265 trips	5,627 trips
General Light Industrial	1,448 employees	605 trips	90 trips	214 trips	524 trips	4,373 trips
General Heavy Industrial	2,278 employees	775 trips	137 trips	273 trips	638 trips	1,868 trips
<b>Total</b>		<b>1,592 trips</b>	<b>546 trips</b>	<b>722 trips</b>	<b>1,427 trips</b>	<b>11,868 trips</b>

As estimated above, the proposed land uses for Option 1 are expected to generate **2,138 trips during AM peak hour** and **2,149 trips during PM peak hour**.

**Table 7 Trip Generation – Option 3**

Land Use	Development Yields	AM Peak Hour		PM Peak Hour		Daily Volumes
		IN	OUT	IN	OUT	
Truck Terminal	950 employees	251 trips	376 trips	277 trips	312 trips	6,641 trips
General Light Industrial	2,309 employees	964 trips	144 trips	342 trips	836 trips	6,974 trips
General Heavy Industrial	1,417 employees	482 trips	85 trips	170 trips	397 trips	1,162 trips
<b>Total</b>		<b>1,697 trips</b>	<b>605 trips</b>	<b>788 trips</b>	<b>1,545 trips</b>	<b>14,777 trips</b>

As estimated above, the proposed land uses for Option 3 are expected to generate **2,302 trips during AM peak hour** and **2,334 trips during PM peak hour**.

It is expected that vehicle demand for the proposed land uses will consist private vehicles, delivery and service vehicles and semi-trailer trucks. The percentage of heavy vehicles has been calculated as 15% of the total traffic volumes.

## 2.5 Traffic Distribution

Based on the location of key attractions and generators, proposed land uses trips have been generated, distributed and assigned to the external network.

The distributed proposed land uses AM and PM peak hour traffic volumes for the two options are included in **Appendix C**.

## 2.6 SIDRA Analysis

Analysis of the traffic impacts of the proposed development has been carried out for the following intersections under these initial conditions.

- > Mundijong Road/Kargotich Road – assessed with existing four-way Stop controlled configuration
- > Mundijong Road/Spine Road – assessed with three-way Stop controlled configuration (Option 1 only)
- > Kargotich Road/Spine Road – assessed with three-way Stop controlled with channelised right turn treatment configuration (Option 3 only)
- > Kargotich Road/Bishop Road – assessed with three-way Stop controlled with channelised right turn treatment configuration
- > Bishop Road/Spine Road – assessed with three-way Stop controlled configuration

The five identified intersections have been analysed for the year 2031 using the SIDRA v5.1 analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. The Degree of Saturation (DOS), Average Delay and 95th Percentile Queue operational measures can be evaluated as follows:

- > **Degree of Saturation (DOS):** is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity. The generally accepted upper limits for the DOS (where it is considered that the operation of the intersection is constrained) are:
  - 0.80 for un-signalised intersections
  - 0.85 for roundabouts
  - 0.95 for signalised intersections
- > **Level of Service (LOS):** is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of services, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- > **Average Delay:** is the average of all travel time delays for vehicles through the intersection. An un-signalised intersection can be considered to be operated at capacity where the average delay exceeds 40 seconds for any movement;
- > **95% Queue:** is the queue length below which 95% of all observed queue lengths fall.

***Intersections that fail to meet the above operational measures are assessed with signalised configuration and adjustments made to the geometry layout.***

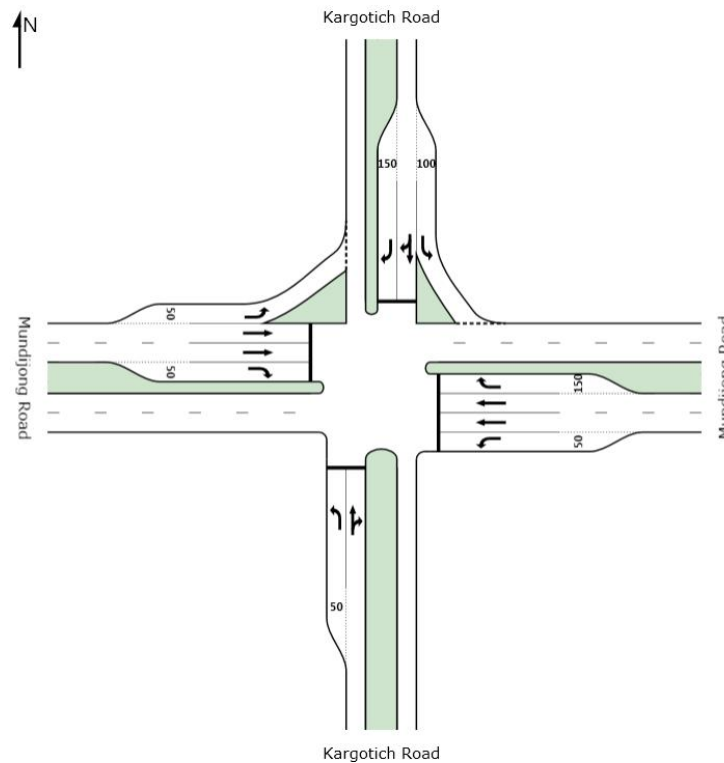
All SIDRA outputs referenced herein are included at **Appendix D**.

### 2.6.1 Mundijong Road/Kargotich Road Intersection

Cardno analysed the Mundijong Road/Kargotich Road intersection for the year 2031 with the existing four-way Stop controlled configuration. The results indicate that this intersection will operate over acceptable capacity limits by 2031 under both Option 1 and 3. Therefore upgrade works are required to cater for the future traffic demand.

The assessment below analyses the Mundijong Road/Kargotich Road intersection for the year 2031 with a potential signalised configuration. **Figure 6** is a SIDRA layout representation of the intersection at this location.

**Figure 6 Mundijong Road/Kargotich Road Intersection Layout – Signalised Configuration**



The results of the SIDRA analysis for this intersection is summarised below.

**Table 8 Mundijong Road/Kargotich Road Intersection 2031 Performance – Signalised Configuration – Option 1**

Intersection Approach	2031 AM Peak				2031PM Peak				
	DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)	
Kargotich Rd - S	L	0.007	46.5	D	0.3	0.006	45.3	D	0.2
	T	0.793	39.9	D	35.7	0.770	38.6	D	37.6
	R	0.793	54.0	D	35.7	0.770	52.7	D	37.6
Mundijong Rd - E	L	0.348	49.1	D	13.8	0.480	49.7	D	19.4
	T	0.458	9.4	A	73.1	0.692	12.1	B	134.0
	R	0.239	36.8	D	22.6	0.204	36.5	D	19.1
Kargotich Rd - N	L	0.031	20.8	C	2.6	0.069	20.6	C	6.0
	T	0.354	35.2	D	14.3	0.745	37.8	D	37.6
	R	0.354	49.3	D	14.7	0.745	51.9	D	38.2
Mundijong Rd - W	L	0.224	15.3	B	8.3	0.068	15.1	B	2.1
	T	0.861	29.9	C	186.8	0.875	32.4	C	190.5
	R	0.007	46.6	D	0.3	0.007	46.6	D	0.3

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 for Option 1. Therefore it is recommended that the intersection to be upgraded to a signalised intersection.



**Table 9 Mundijong Road/Kargotich Road Intersection 2031 Performance – Signalised Configuration – Option 3**

Intersection Approach	2031 AM Peak				2031 PM Peak				
	DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)	
Kargotich Rd - S	L	0.007	46.5	D	0.3	0.004	44.1	D	0.3
	T	0.793	40.0	D	35.8	0.534	34.9	C	37.4
	R	0.793	54.1	D	35.8	0.534	49.0	D	37.4
Mundijong Rd - E	L	0.190	42.7	D	12.2	0.548	56.0	E	22.5
	T	0.442	9.3	A	69.5	0.649	14.2	B	135.9
	R	0.809	42.7	D	126.8	0.617	45.2	D	67.0
Kargotich Rd - N	L	0.151	19.2	B	12.2	0.529	22.3	C	57.9
	T	0.510	35.9	D	21.1	0.816	42.0	D	69.1
	R	0.510	50.0	D	21.6	0.816	56.1	E	69.1
Mundijong Rd - W	L	0.702	22.2	C	53.7	0.206	16.5	B	9.9
	T	0.839	30.7	C	145.6	0.801	27.5	C	167.2
	R	0.007	46.6	D	0.3	0.008	52.1	D	0.3

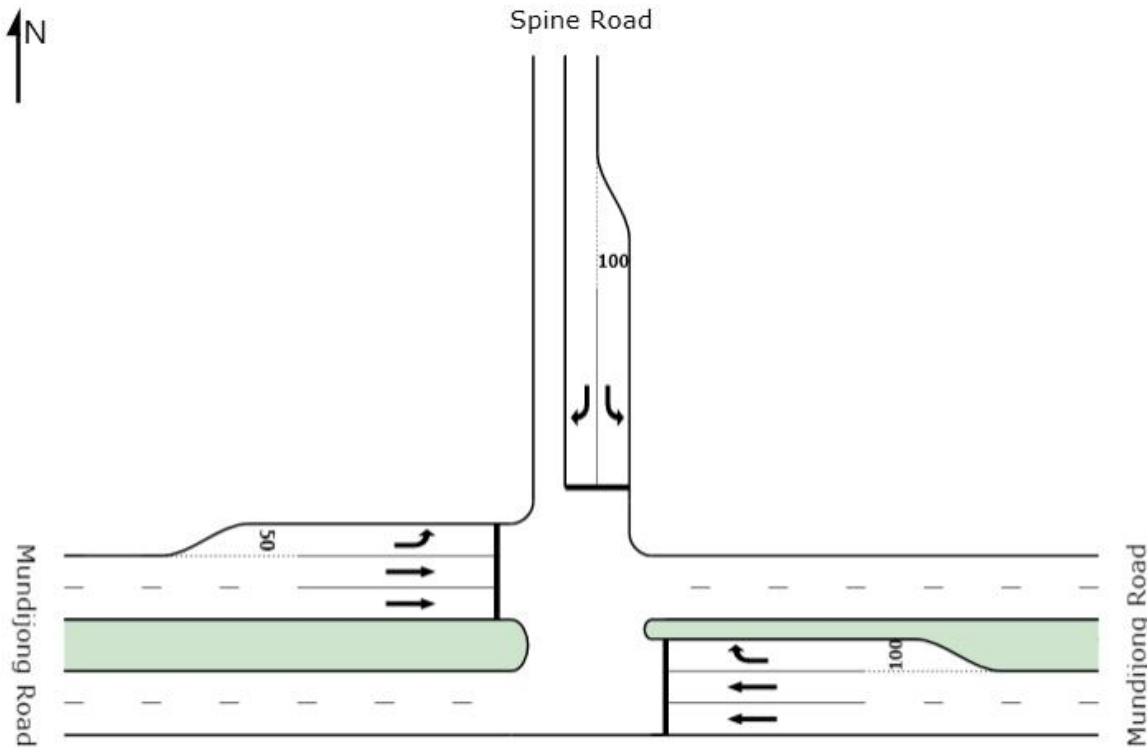
From above it is noted that this intersection will operate within acceptable capacity limits in 2031 for Option 3. Therefore it is recommended that the intersection to be upgraded to a signalised intersection.

2.6.2 Mundijong Road/Spine Road Intersection(for Option 1 only)

Cardno analysed the Mundijong Road/Spine Road intersection for the year 2031 with a three-way Stop controlled configuration. The results indicate that this intersection will operate over acceptable capacity limits in 2031. Therefore upgrade works are required to cater for the future traffic demand.

The assessment below analyses the Mundijong Road/Spine Road intersection for the year 2031 with the signalised configuration. **Figure 7** is a SIDRA layout representation of the intersection at this location.

Figure 7 Mundijong Road/Spine Road Intersection Layout – Signalised Configuration



The results of the SIDRA analysis for this intersection is summarised below.

Table 10 Mundijong Road/Spine Road Intersection 2031 Performance – Signalised Configuration – Option 1

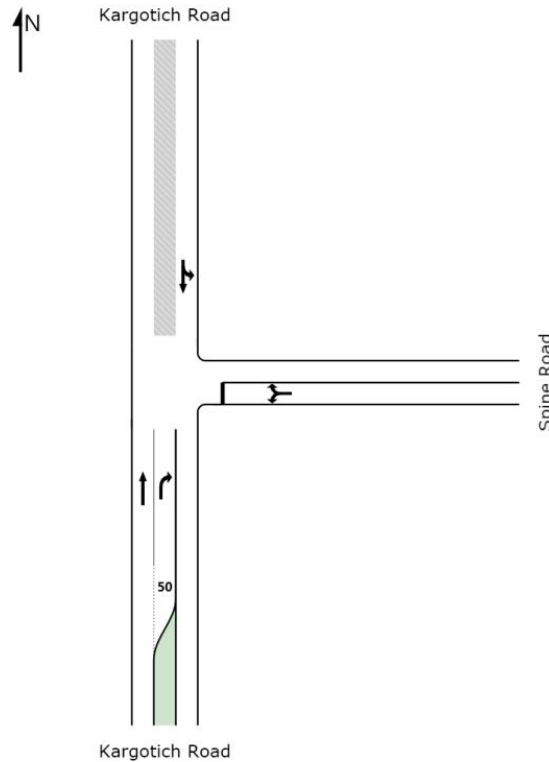
Intersection Approach		2031 AM Peak				2031 PM Peak			
		DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)
Mundijong Rd - E	T	0.396	3.6	A	54.1	0.666	14.1	B	171.5
	R	0.820	47.7	D	120.2	0.819	65.7	E	64.4
Spine Rd - N	L	0.786	49.8	D	39.8	0.885	48.8	D	163.2
	R	0.217	44.1	D	9.7	0.275	36.7	D	37.6
Mundijong Rd - W	L	0.685	34.1	C	54.7	0.310	33.0	C	21.9
	T	0.809	26.8	C	161.6	0.872	37.8	D	254.7

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 with Option 1. Therefore it is recommended that the intersection to be upgraded to a signalised intersection.

2.6.3 Kargotich Road/Spine Road Intersection

The assessment below analyses the Kargotich Road/Spine Road intersection for the year 2031 with the three-way Stop controlled with channelised right turn treatment configuration (Option 3 only). **Figure 8** is a SIDRA layout representation of the intersection at this location. The diagram below is considered a conservative representation, as it is likely that two (2) cars egressing from the Spine Road would be capable to stage at the stop line (for left and right turning movements respectively)

Figure 8 Kargotich Road/Spine Road Intersection Layout – Stop Controlled Configuration



The results of the SIDRA analysis for this intersection is summarised below.

Table 11 Kargotich Road/Spine Road Intersection 2031 Performance – Stop Controlled Configuration – Option 3

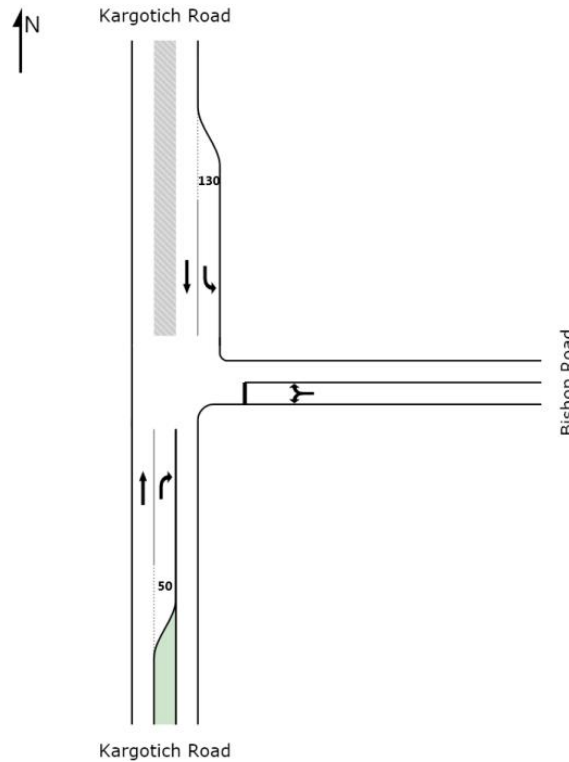
Intersection Approach		2031 AM Peak				2031 PM Peak			
		DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)
Kargotich Rd - S	T	0.108	0.0	A	0.0	0.084	0.0	A	0.0
	R	0.627	16.8	C	48.8	0.220	15.7	C	7.8
Spine Rd - E	L	0.213	13.3	B	6.6	0.719	17.2	C	77.6
	R	0.213	12.8	B	6.6	0.719	16.7	C	77.6
Kargotich Rd - N	L	0.072	14.3	B	0.0	0.107	14.3	B	0.0
	T	0.072	0.0	A	0.0	0.107	0.0	A	0.0

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 with Option 3. No upgrade works are required to cater for the future traffic demand. The requirements for the channelized right turn are a result of the relatively high speeds and proportion of heavy vehicles likely along Kargotich Road.

2.6.4 Kargotich Road/Bishop Road Intersection

The assessment below analyses the Kargotich Road/Bishop Road intersection for the year 2031 with the three-way Stop controlled with channelised right turn treatment configuration. **Figure 9** is a SIDRA layout representation of the intersection at this location. The diagram below is considered a conservative representation, as it is likely that two (2) cars egressing from the Spine Road would be capable to stage at the stop line (for left and right turning movements respectively)

Figure 9 Kargotich Road/Bishop Road Intersection Layout – Stop Controlled Configuration



The results of the SIDRA analysis for this intersection is summarised below.

Table 12 Kargotich Road/Bishop Road Intersection 2031 Performance – Stop Controlled Configuration – Option 1

Intersection Approach		2031 AM Peak				2031 PM Peak			
		DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)
Kargotich Rd - S	T	0.082	0.0	A	0.0	0.053	0.0	A	0.0
	R	0.013	14.5	B	0.3	0.061	14.6	B	1.6
Bishop Rd - E	L	0.117	11.8	B	3.6	0.042	11.9	B	1.2
	R	0.117	11.6	B	3.6	0.042	11.7	B	1.2
Kargotich Rd - N	L	0.003	14.3	B	0.0	0.013	14.3	B	0.0
	T	0.001	0.0	A	0.0	0.006	0.0	A	0.0

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 with Option 1. No upgrade works are required to cater for the future traffic demand. The requirements for the channelized right turn are a result of the relatively high speeds and proportion of heavy vehicles likely along Kargotich Road.

**Table 13 Kargotich Road/Bishop Road Intersection 2031 Performance – Stop Controlled Configuration – Option 3**

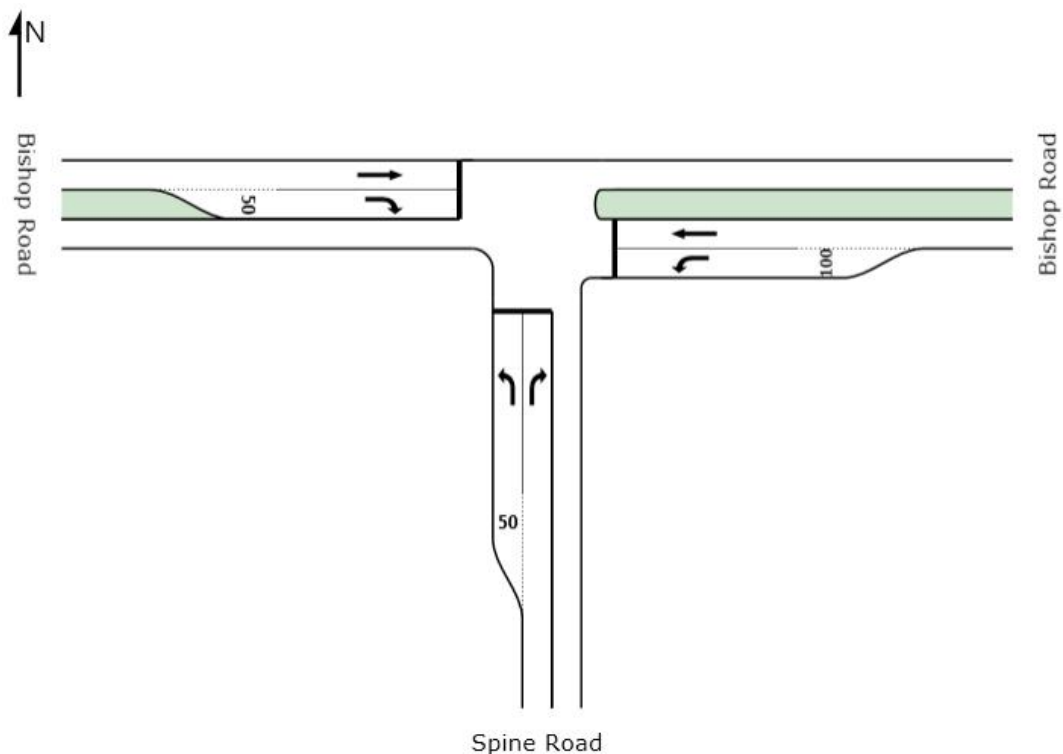
Intersection Approach		2031 AM Peak				2031 PM Peak			
		DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)
Kargotich Rd - S	T	0.080	0.0	A	0.0	0.053	0.1	A	0.0
	R	0.287	14.7	B	9.2	0.238	14.6	B	7.2
Bishop Rd - E	L	0.237	12.1	B	8.1	0.220	11.4	B	7.5
	R	0.237	11.9	B	8.1	0.220	11.2	B	7.5
Kargotich Rd - N	L	0.019	14.3	B	0.0	0.008	14.3	B	0.0
	T	0.001	0.0	A	0.0	0.003	0.0	A	0.0

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 with Option 3. No upgrade works are required to cater for the future traffic demand.

**2.6.5 Bishop Road/Spine Road Intersection**

The assessment below analyses the Bishop Road/Spine Road intersection for the year 2031 with the three-way Stop controlled configuration. **Figure 10** is a SIDRA layout representation of the intersection at this location.

**Figure 10 Bishop Road/Spine Road Intersection Layout – Stop Controlled Configuration**



The results of the SIDRA analysis for this intersection is summarised below.

**Table 14 Bishop Road/Spine Road Intersection 2031 Performance – Stop Controlled Configuration – Option 1**

Intersection Approach	2031 AM Peak				2031 PM Peak				
	DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)	
Spine Rd - S	L	0.008	13.4	B	0.2	0.006	11.4	B	0.2
	R	0.576	17.9	C	32.2	0.863	24.0	C	134.0
Bishop Rd - E	L	0.404	6.8	A	0.0	0.219	6.8	A	0.0
	T	0.060	0.0	A	0.0	0.021	0.0	A	0.0
Bishop Rd - W	T	0.010	0.0	A	0.0	0.048	0.0	A	0.0
	R	0.008	11.8	B	0.2	0.005	8.7	A	0.2

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 with Option 1. No upgrade works are required to cater for the future traffic demand.

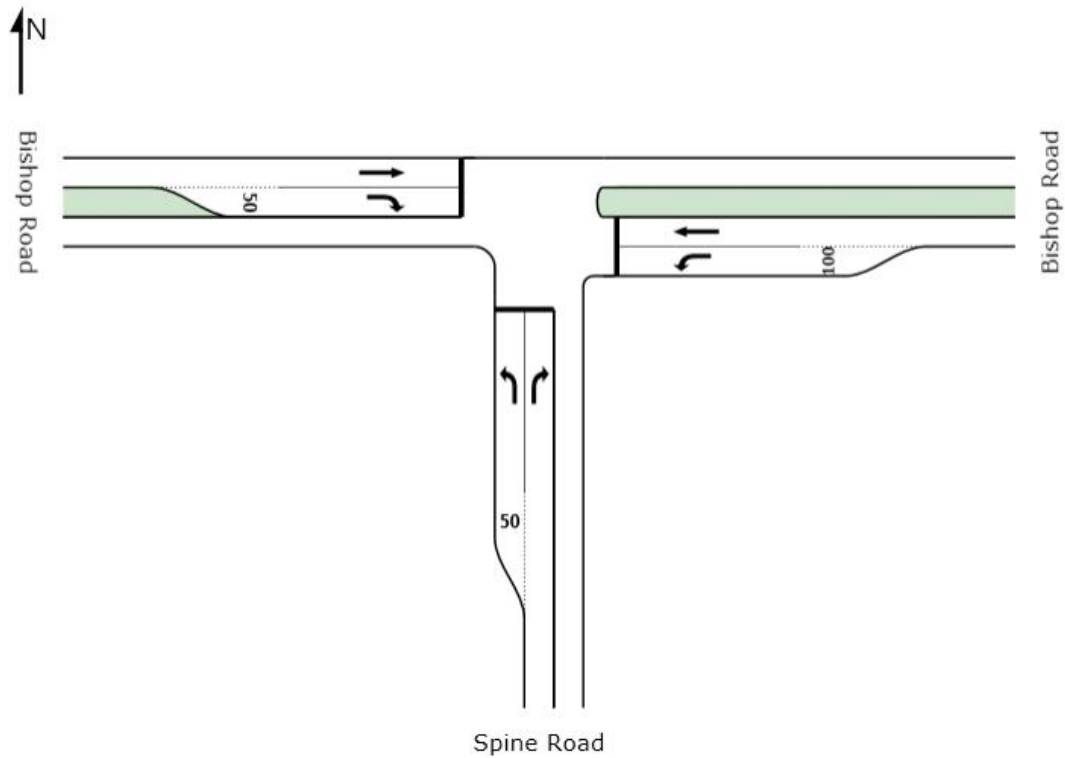
**Table 15 Bishop Road/Spine Road Intersection 2031 Performance – Stop Controlled Configuration – Option 3**

Intersection Approach	2031 AM Peak				2031 PM Peak				
	DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)	
Spine Rd - S	L	0.011	15.3	C	0.3	0.007	12.5	B	0.2
	R	0.417	25.0	D	13.9	1.417	777.4	F	1992.2
Bishop Rd - E	L	0.460	6.8	A	0.0	0.163	6.8	A	0.0
	T	0.122	0.0	A	0.0	0.128	0.0	A	0.0
Bishop Rd - W	T	0.171	0.0	A	0.0	0.149	0.0	A	0.0
	R	0.011	14.5	B	0.3	0.005	9.3	A	0.2

From above it is noted that this intersection will operate well over acceptable capacity limits for the 2031 PM peak scenario under Option 3. Upgrade works are required to cater for the future traffic demand. This is a result of the projected volumes of right-turning egress movements onto Bishop Road headed towards Tonkin Highway.

The assessment below analyses the Bishop Road/Spine Road intersection for the year 2031 with a possible signalised configuration. **Figure 11** is a SIDRA layout representation of the intersection at this location.

Figure 11 Bishop Road/Spine Road Intersection Layout – Signalised Configuration



The results of the SIDRA analysis for this intersection is summarised below.

Table 16 Bishop Road/Spine Road Intersection 2031 Performance – Signalised Configuration – Option 1

Intersection Approach	2031 AM Peak				2031 PM Peak				
	DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)	
Spine Rd - S	L	0.015	28.6	C	1.0	0.014	20.7	C	0.9
	R	0.944	59.0	E	127.4	0.799	32.6	C	210.5
Bishop Rd - E	L	0.973	27.4	C	170.8	0.799	46.3	D	137.6
	T	0.144	12.8	B	16.6	0.076	27.5	C	10.0
Bishop Rd - W	T	0.017	5.6	A	1.8	0.121	19.2	B	19.7
	R	0.032	37.4	D	1.2	0.047	54.4	D	1.8

From above it is noted that this intersection will operate within acceptable capacity limits during the 2031 PM peak scenario under Option 1, though it operates close to capacity during the 2031 A M peak hour . Therefore it is recommended that the intersection to have a Stop controlled configuration under Option 1.

**Table 17 Bishop Road/Spine Road Intersection 2031 Performance – Signalised Configuration – Option 3**

Intersection Approach		2031 AM Peak				2031 PM Peak			
		DOS	Delay(s)	LOS	95% Queue(m)	DOS	Delay(s)	LOS	95% Queue(m)
Spine Rd - S	L	0.030	34.4	C	1.1	0.012	17.9	B	0.8
	R	0.733	39.6	D	31.6	0.802	29.2	C	188.2
Bishop Rd - E	L	1.000*	21.8	C	163.2	0.766	42.9	D	87.3
	T	0.259	9.3	A	30.7	0.601	31.6	C	65.3
Bishop Rd - W	T	0.244	3.5	A	25.4	0.410	20.8	C	61.6
	R	0.030	34.6	C	1.1	0.040	45.9	D	1.5

\*1.000 due to short lane

From above it is noted that this intersection will operate within acceptable capacity limits in 2031 under Option 3. Therefore it is recommended that the intersection to be upgraded to a signalised intersection with Option 3.

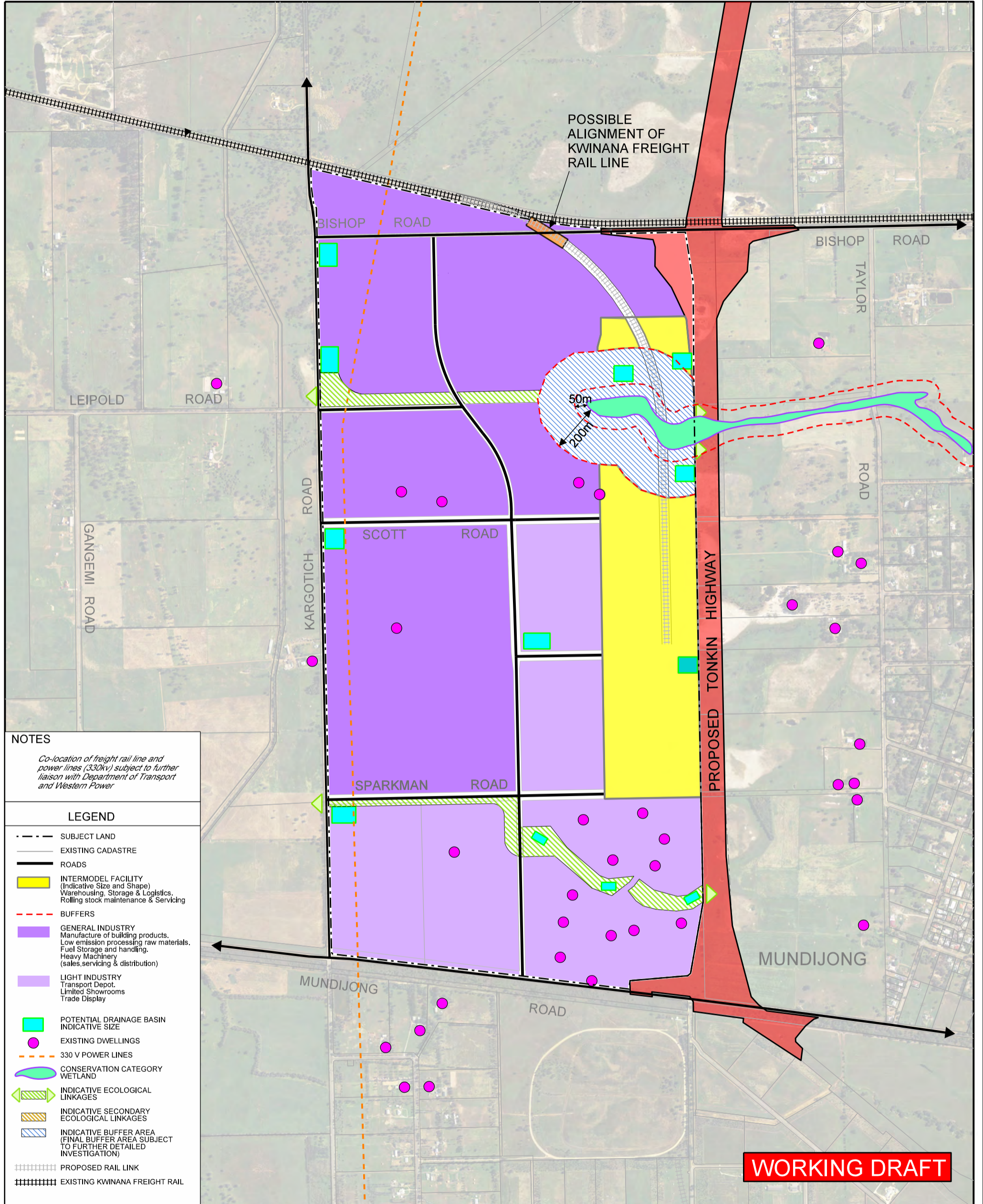
## 2.7 Geometric Design

According to the existing MRWA Restricted Access Vehicle (RAV) network, the largest vehicle that is allowed to access the West Mundijong, with the proposed Tonkin Highway extension, is likely to be a RAV4 Network vehicle. A generally equivalent vehicle is a 26m long B-Double (Class 10).

**Appendix E** provides concept design as well as the detail of the cross sections and road reserve widths of the roads at the intersections included in this assessment. These widths would likely be retained for the relevant road sections.



APPENDIX A  
PROPOSED LAYOUTS



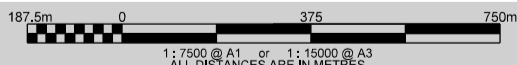
**NOTES**  
 Co-location of freight rail line and power lines (330kv) subject to further liaison with Department of Transport and Western Power

**LEGEND**

- - - - - SUBJECT LAND
- EXISTING CADASTRE
- ROADS
- INTERMODEL FACILITY (Indicative Size and Shape)  
Warehousing, Storage & Logistics.  
Rolling stock maintenance & Servicing
- - - - - BUFFERS
- GENERAL INDUSTRY  
Manufacture of building products.  
Low emission processing raw materials.  
Fuel Storage and handling.  
Heavy Machinery (sales, servicing & distribution)
- LIGHT INDUSTRY  
Transport Depot.  
Limited Showrooms  
Trade Display
- POTENTIAL DRAINAGE BASIN INDICATIVE SIZE
- EXISTING DWELLINGS
- - - - - 330 V POWER LINES
- CONSERVATION CATEGORY WETLAND
- ◀▶ INDICATIVE ECOLOGICAL LINKAGES
- ▨ INDICATIVE SECONDARY ECOLOGICAL LINKAGES
- ▨ INDICATIVE BUFFER AREA (FINAL BUFFER AREA SUBJECT TO FURTHER DETAILED INVESTIGATION)
- ===== PROPOSED RAIL LINK
- ===== EXISTING KWINANA FREIGHT RAIL

**WORKING DRAFT**

**Preliminary District Structure Plan  
 West Mundijong  
 Shire of Serpentine Jarrahdale  
 Option 1**



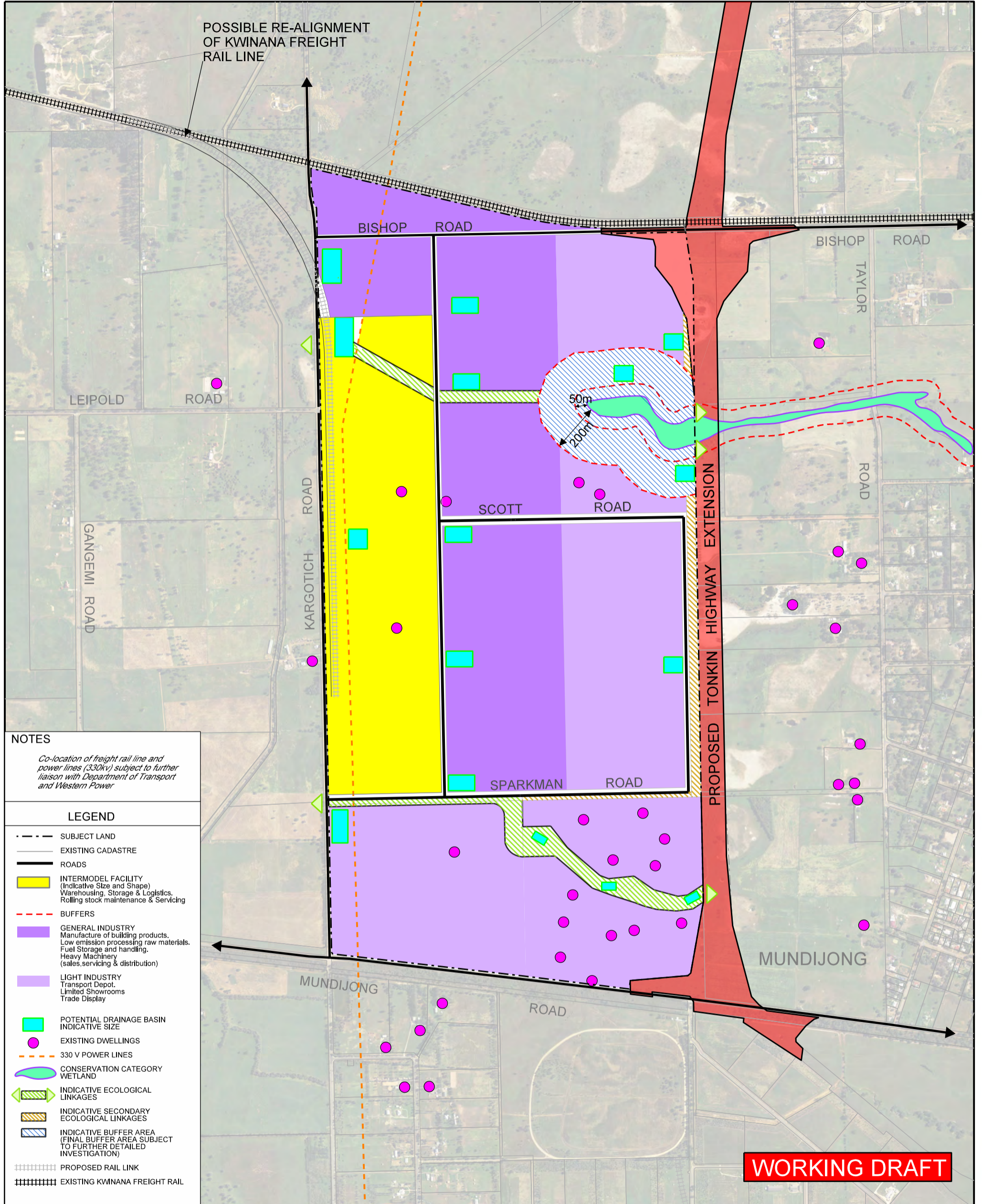
J			
I			
H			
G			
F			
E			
D			
C			
B			
A	UPDATES TO CCW AND LEGEND	JW	09082012
REVISION	DESCRIPTION	DRAFTER	DATE

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ORIGINAL PLANNER:	KK
ORIGINAL DRAFTER:	JW
CREATED DATE:	01/08/2012
AERIAL DATA:	LANDGATE ECW
CADASTRAL DATA:	LANDGATE 2012
TOPOGRAPHIC DATA:	MGA



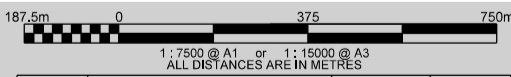
12106P-SP-01opt1A



**NOTES**  
 Co-location of freight rail line and power lines (330kv) subject to further liaison with Department of Transport and Western Power

- LEGEND**
- - - - - SUBJECT LAND
  - EXISTING CADASTRE
  - ROADS
  - INTERMODEL FACILITY (Indicative Size and Shape)  
Warehousing, Storage & Logistics, Rolling stock maintenance & Servicing
  - - - - - BUFFERS
  - GENERAL INDUSTRY  
Manufacture of building products, Low emission processing raw materials, Fuel Storage and handling, Heavy Machinery (sales, servicing & distribution)
  - LIGHT INDUSTRY  
Transport Depot, Limited Showrooms, Trade Display
  - POTENTIAL DRAINAGE BASIN INDICATIVE SIZE
  - EXISTING DWELLINGS
  - - - - - 330 V POWER LINES
  - CONSERVATION CATEGORY WETLAND
  - ↔ INDICATIVE ECOLOGICAL LINKAGES
  - ▨ INDICATIVE SECONDARY ECOLOGICAL LINKAGES
  - ▨ INDICATIVE BUFFER AREA (FINAL BUFFER AREA SUBJECT TO FURTHER DETAILED INVESTIGATION)
  - ▨▨▨▨▨▨ PROPOSED RAIL LINK
  - ▨▨▨▨▨▨ EXISTING KWINANA FREIGHT RAIL

**Preliminary District Structure Plan  
 West Mundijong  
 Shire of Serpentine Jarrahdale  
 Option 3**



REVISION	DESCRIPTION	DRAFTER	DATE
J			
I			
H			
G			
F			
E			
D			
C			
B			
A	UPDATES TO CCW	JW	09082012

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ORIGINAL PLANNER:	KK
ORIGINAL DRAFTER:	JW
CREATED DATE:	01/06/2012
AERIAL DATA:	LANDGATE ECW
CADASTRAL DATA:	LANDGATE 2012
TOPOGRAPHIC DATA:	MGA



12106P-SP-01opt3A

APPENDIX B  
TRAFFIC DATA

# Weekly Volume by Hour

OCM161.6/03/13

Traffic Flow: **Directional**  
 Site No: **5419**  
 Date Range: **11 Nov 2008 to 14 Nov 2008**

Road Name: **Mundijong Rd (1080004)**  
 Location Description: **W of Patterson Rd (SLK 0.01)**  
 Count Type: **Axle Pairs**

Average Vehicle Volume																		
Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Mon - Fri		Mon - Sun	
	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W
0000					6	0	12	1							9	1	9	1
0100					3	3	7	2							5	3	5	3
0200					3	3	4	8							4	6	4	6
0300					6	8	4	4							5	6	5	6
0400					25	10	26	13							26	12	26	12
0500					71	78	65	65							68	72	68	72
0600					125	117	118	118							122	118	122	118
0700					154	142	143	126							149	134	149	134
0800					142	131	130	128							136	130	136	130
0900					126	129	114	95							120	112	120	112
1000					113	102	97	84							105	93	105	93
1100					84	113	89	91							87	102	87	102
1200					95	98	118	59							107	79	107	79
1300					119	101	113	100							116	101	116	101
1400					120	119	100	119							110	119	110	119
1500					149	149	133	153							141	151	141	151
1600					165	200	173	170							169	185	169	185
1700					136	159	154	145							145	152	145	152
1800					100	93	79	85							90	89	90	89
1900					43	47	39	60							41	54	41	54
2000					38	33	40	25							39	29	39	29
2100					35	24	24	14							30	19	30	19
2200					16	9	17	16							17	13	17	13
2300					11	3	9	4							10	4	10	4
<b>24hr</b>					<b>1885</b>	<b>1871</b>	<b>1808</b>	<b>1685</b>							<b>1851</b>	<b>1784</b>	<b>1851</b>	<b>1784</b>

Peak Statistics																			
		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Mon - Fri		Mon - Sun	
		E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W
AM	1/4 Hour					0700	0715	0745	0845							0745	0715	0745	0715
	1/4 Hr Vol					41	48	44	38							41	41	41	41
	1/2 Hour					0645	0715	0745	0830							0730	0715	0730	0715
	1/2 Hr Vol					78	83	83	72							79	75	79	75
	1 Hour					0700	0715	0730	0800							0730	0700	0730	0700
	1 Hr Vol					154	147	159	128							156	134	156	134
	1 Hr Fact					.939	.7656	.9034	.8421							.9512	.8171	.9512	.8171
	2 Hour					0645	0715	0630	0700							0630	0700	0630	0700
2 Hr Vol					299	278	285	254							291	264	291	264	
PM	1/4 Hour					1615	1600	1615	1700							1615	1700	1615	1700
	1/4 Hr Vol					52	57	49	53							51	51	51	51
	1/2 Hour					1600	1545	1600	1645							1600	1645	1600	1645
	1/2 Hr Vol					94	103	92	96							93	99	93	99
	1 Hour					1530	1600	1615	1615							1530	1615	1530	1615
	1 Hr Vol					187	200	175	185							172	189	172	189
	1 Hr Fact					.899	.8772	.8929	.8726							.8515	.9265	.8515	.9265
	2 Hour					1515	1545	1545	1545							1515	1545	1515	1545
2 Hr Vol					323	375	328	331							322	353	322	353	
Peak	12 Hour					0615	0615	0600	0600							0615	0600	0615	0600
	12 Hr Vol					1532	1564	1482	1388							1506	1474	1506	1474

# Weekly Volume by Hour

OCM161.6/03/13

Traffic Flow: **Directional**  
 Site No: **2023**  
 Date Range: **11 Nov 2008 to 14 Nov 2008**

Road Name: **Kargotich Rd (1080009)**  
 Location Description: **N of Bishop Rd (SLK 9.67)**  
 Count Type: **Axle Pairs**

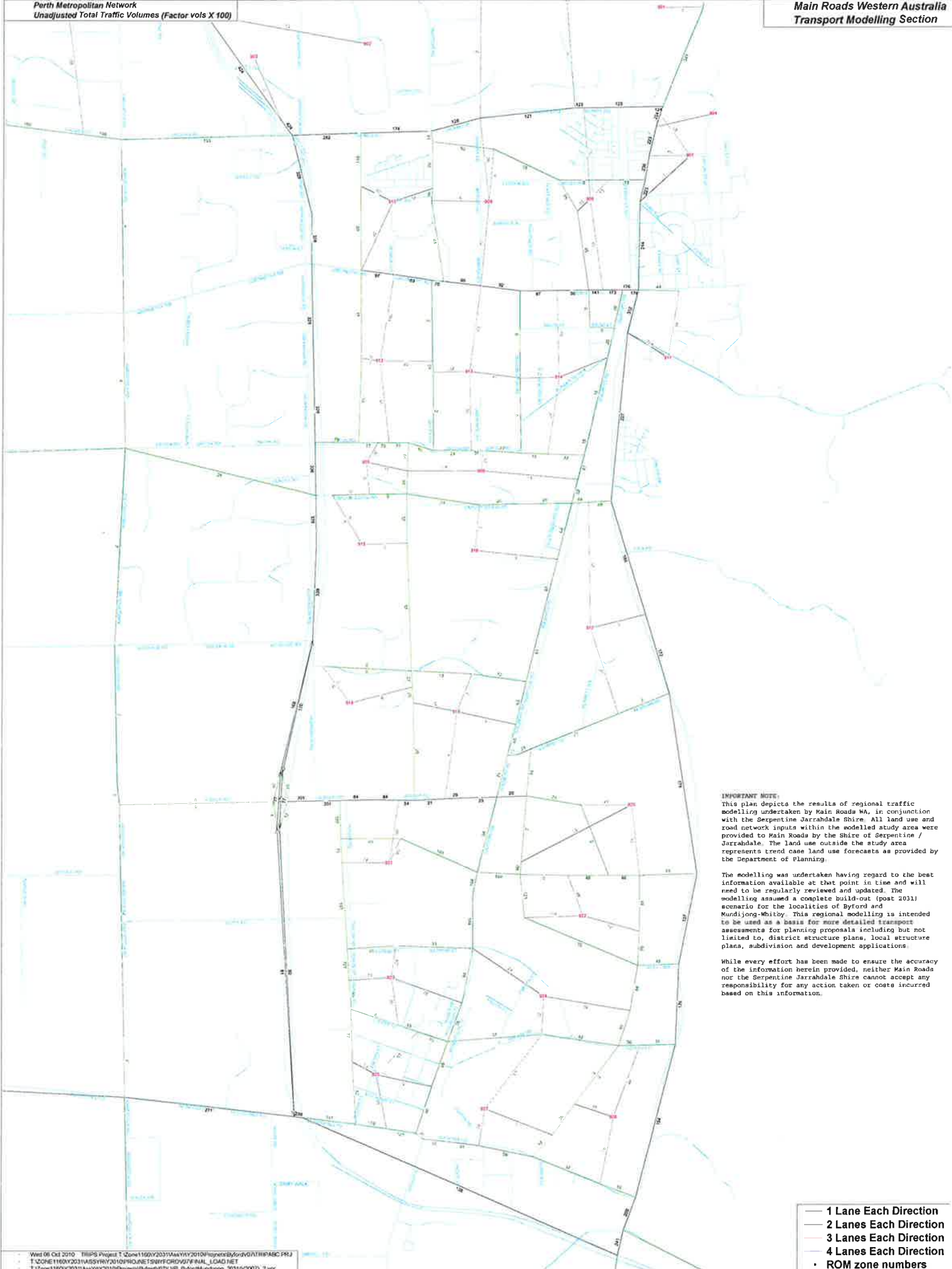
Average Vehicle Volume																		
Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Mon - Fri		Mon - Sun	
	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
0000					2	4	0	3							1	4	1	4
0100					0	4	0	5							0	5	0	5
0200					2	0	5	0							4	0	4	0
0300					0	1	2	2							1	2	1	2
0400					8	5	6	3							7	4	7	4
0500					61	24	67	22							64	23	64	23
0600					102	50	80	49							91	50	91	50
0700					80	68	100	65							90	67	90	67
0800					67	65	62	59							65	62	65	62
0900					54	48	49	43							52	46	52	46
1000					45	33	39	53							42	43	42	43
1100					45	64	39	62							42	63	42	63
1200					44	56	46	54							45	55	45	55
1300					44	55	35	57							40	56	40	56
1400					59	66	72	59							66	63	66	63
1500					60	74	61	70							61	72	61	72
1600					58	102	64	111							61	107	61	107
1700					87	117	63	142							75	130	75	130
1800					48	68	36	74							42	71	42	71
1900					20	33	36	27							28	30	28	30
2000					11	21	11	21							11	21	11	21
2100					12	13	18	17							15	15	15	15
2200					8	17	11	8							10	13	10	13
2300					4	5	5	6							5	6	5	6
<b>24hr</b>					<b>921</b>	<b>993</b>	<b>907</b>	<b>1012</b>							<b>918</b>	<b>1008</b>	<b>918</b>	<b>1008</b>

Peak Statistics																			
		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Mon - Fri		Mon - Sun	
		N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
AM	1/4 Hour					0630	0700	0700	1115							0600	0700	0600	0700
	1/4 Hr Vol					31	33	31	23							27	27	27	27
	1/2 Hour					0630	0645	0700	0700							0600	0645	0600	0645
	1/2 Hr Vol					54	47	54	40							48	43	48	43
	1 Hour					0600	0645	0700	0645							0600	0645	0600	0645
	1 Hr Vol					102	73	100	71							91	72	91	72
	1 Hr Fact					.8226	.553	.8065	.8452							.8426	.6667	.8426	.6667
	2 Hour					0600	0700	0600	0645							0600	0700	0600	0700
PM	2 Hr Vol					182	133	180	132							181	129	181	129
	1/4 Hour					1730	1730	1415	1715							1545	1715	1545	1715
	1/4 Hr Vol					28	35	27	44							23	36	23	36
	1/2 Hour					1730	1715	1415	1715							1730	1715	1730	1715
	1/2 Hr Vol					48	62	48	80							40	71	40	71
	1 Hour					1700	1700	1415	1700							1700	1700	1700	1700
	1 Hr Vol					87	117	85	142							75	130	75	130
	1 Hr Fact					.7768	.8357	.787	.8068							.8333	.9155	.8333	.9155
Peak	2 Hour					1545	1600	1400	1600							1545	1600	1545	1600
	2 Hr Vol					152	219	133	253							141	236	141	236
	12 Hour					0600	0645	0530	0645							0515	0645	0515	0645
	12 Hr Vol					745	820	722	852							729	836	729	836

Byford - Mundijong Redevelopment (V2007 Mode factors) CM161.6/03/13  
 Plot of 2031 volumes using network and land use as specified by client

Perth Metropolitan Network  
 Unadjusted Total Traffic Volumes (Factor vols X 100)

Main Roads Western Australia  
 Transport Modelling Section



**IMPORTANT NOTE:**  
 This plan depicts the results of regional traffic modelling undertaken by Main Roads WA, in conjunction with the Serpentine Jarrahdale Shire. All land use and road network inputs within the modelled study area were provided to Main Roads by the Shire of Serpentine / Jarrahdale. The land use outside the study area represents trend case land use forecasts as provided by the Department of Planning.

The modelling was undertaken having regard to the best information available at that point in time and will need to be regularly reviewed and updated. The modelling assumed a complete build-out (post 2031) scenario for the localities of Byford and Mundijong-Whitby. This regional modelling is intended to be used as a basis for more detailed transport assessments for planning proposals including but not limited to, district structure plans, local structure plans, subdivision and development applications.

While every effort has been made to ensure the accuracy of the information herein provided, neither Main Roads nor the Serpentine Jarrahdale Shire can accept any responsibility for any action taken or costs incurred based on this information.

- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- 4 Lanes Each Direction
- ROM zone numbers

Wsl 08 Oct 2010 TRIPS Project T:\zoe\1160\2031\Asa\YV\2010\Project\Byford\01\TRIPABC PRJ  
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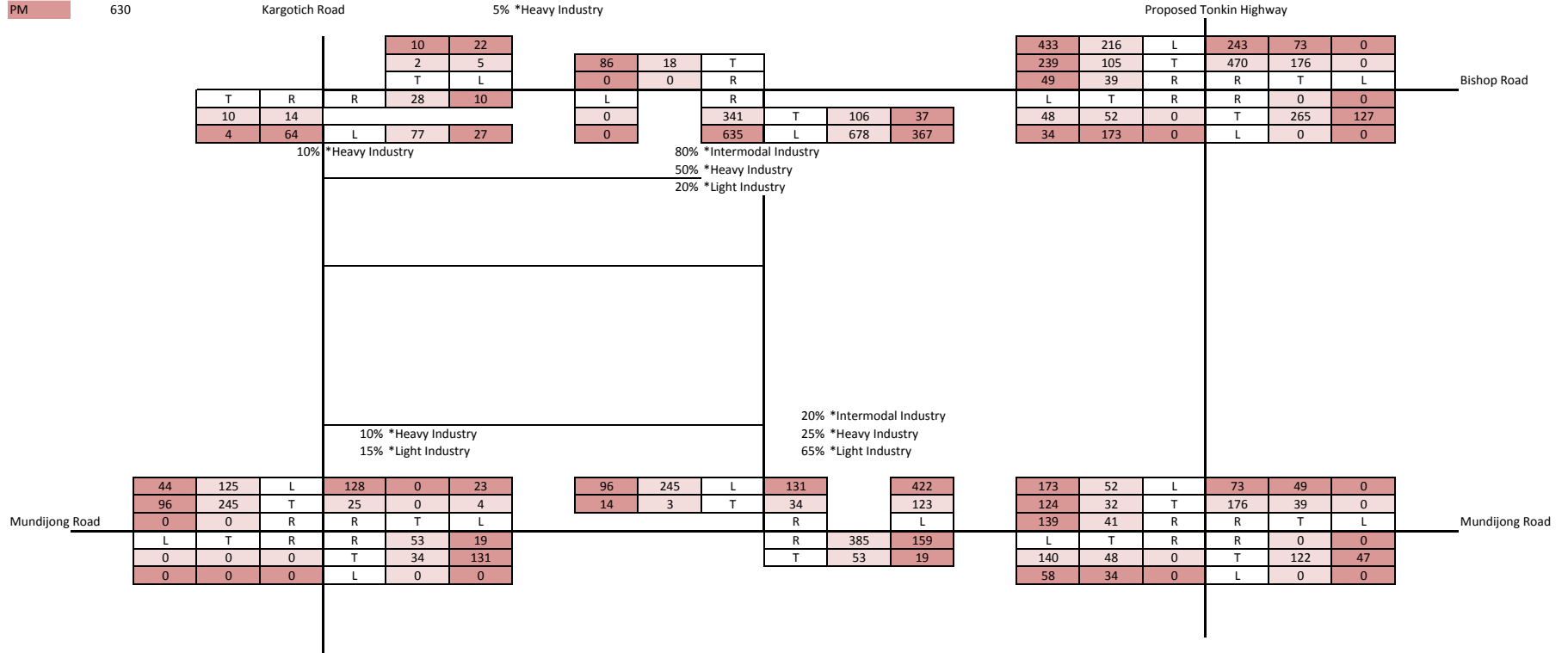
MRWA Updated Base Network - Version 2010  
 MRWA Transport Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations

**APPENDIX C**  
TRAFFIC GENERATION &  
DISTRIBUTION



CEP02161 West Mundijong Sp Traffic Advice  
 Option 1 IN+OUT Development Traffic Volumes (Include 15% HV)

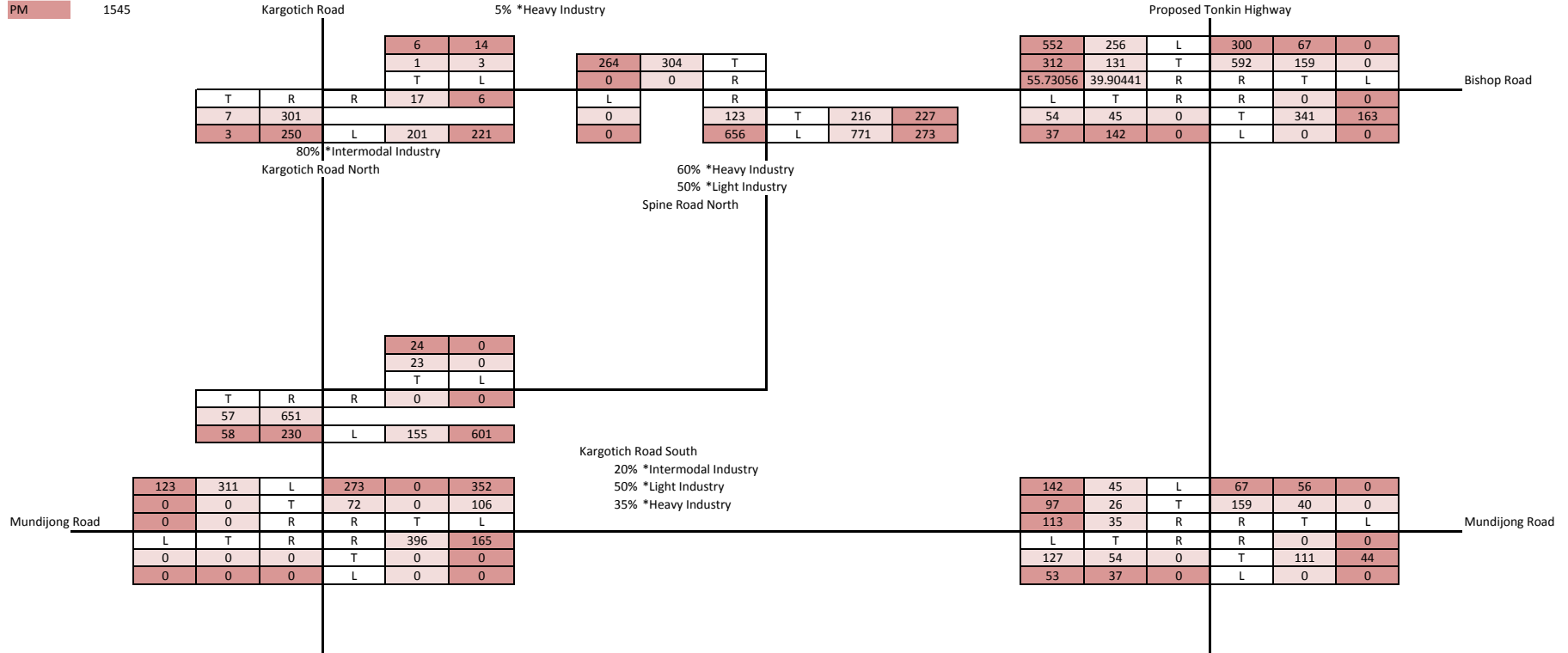
AM 1403  
 PM 630





CEP02161 West Mundijong Sp Traffic Advice  
 Option 3 IN+OUT Development Traffic Volumes (Include 15% HV)

AM 605  
 PM 1545



APPENDIX D  
SIDRA OUTPUTS



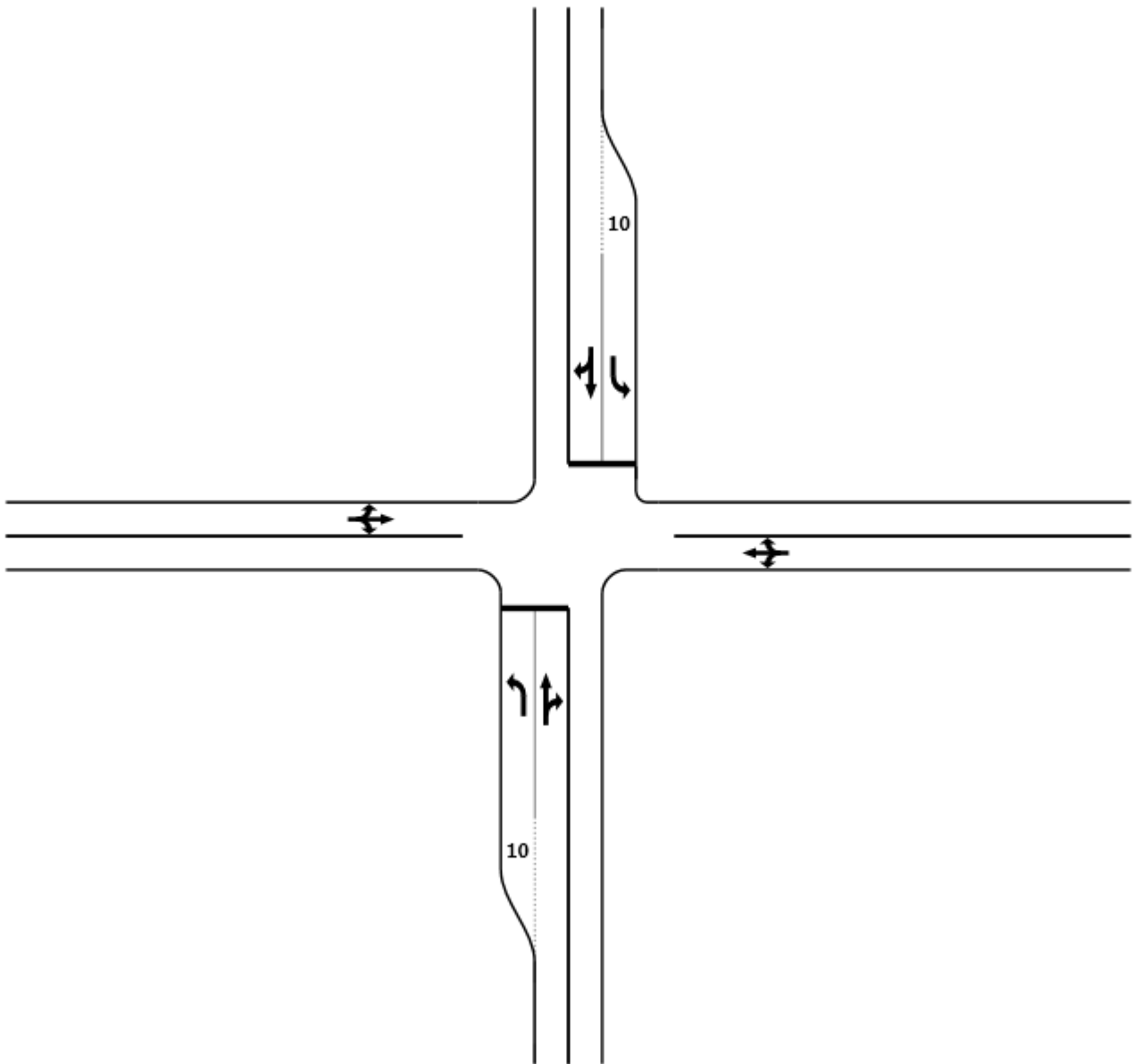
Kargotich Road



Mundijong Road

Mundijong Road

Kargotich Road



**MOVEMENT SUMMARY**

Site: 2031 AM BG+Opt 1

Mundijong Road/Kargotich Road  
 2031 AM Background + Option 1 Traffic Volumes  
 Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Kargotich Road												
1	L	1	15.0	0.007	37.3	LOS E	0.0	0.2	0.87	0.97	45.4	
2	T	8	15.0	1.950	1794.7	LOS F	77.2	609.8	1.00	2.96	1.5	
3	R	109	15.0	1.950	1794.6	LOS F	77.2	609.8	1.00	3.05	1.5	
Approach		118	15.0	1.950	1779.7	LOS F	77.2	609.8	1.00	3.02	1.6	
East: Mundijong Road												
4	L	50	15.0	2.270	2305.4	LOS F	797.2	6297.9	1.00	0.00	1.2	
5	T	931	15.0	2.270	2291.5	LOS F	797.2	6297.9	1.00	0.00	1.2	
6	R	103	15.0	2.270	2305.3	LOS F	797.2	6297.9	1.00	4.07	1.2	
Approach		1084	15.0	2.270	2293.4	NA	797.2	6297.9	1.00	0.39	1.2	
North: Kargotich Road												
7	L	24	15.0	1.000 <sup>3</sup>	279.2	LOS F	3.1	24.9	1.00	1.07	9.3	
8	T	10	15.0	1.750	1438.7	LOS F	61.8	488.3	1.00	2.71	1.9	
9	R	95	15.0	1.750	1438.7	LOS F	61.8	488.3	1.00	2.77	1.9	
Approach		129	15.0	1.750	1223.0	LOS F	61.8	488.3	1.00	2.45	2.3	
West: Mundijong Road												
10	L	202	15.0	0.814	133.4	LOS F	65.0	513.2	1.00	0.00	18.3	
11	T	1224	15.0	0.814	119.5	LOS F	65.0	513.2	1.00	0.00	18.5	
12	R	1	15.0	0.814	133.3	LOS F	65.0	513.2	1.00	1.55	18.4	
Approach		1427	15.0	0.814	121.5	NA	65.0	513.2	1.00	0.00	18.5	
All Vehicles		2758	15.0	2.270	1097.6	NA	797.2	6297.9	1.00	0.40	2.5	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

<sup>3</sup> x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

**MOVEMENT SUMMARY**

Site: 2031 PM BG+Opt 1

Mundijong Road/Kargotich Road  
2031 PM Background + Option 1 Traffic Volumes  
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Kargotich Road												
1	L	1	15.0	0.091	279.7	LOS F	0.2	1.6	0.99	1.00	9.2	
2	T	2	15.0	2.083	2026.5	LOS F	87.1	688.2	1.00	3.14	1.4	
3	R	123	15.0	2.083	2026.4	LOS F	87.1	688.2	1.00	3.22	1.4	
Approach		126	15.0	2.083	2012.6	LOS F	87.1	688.2	1.00	3.20	1.4	
East: Mundijong Road												
4	L	69	15.0	2.279	2321.6	LOS F	1134.0	8958.8	1.00	0.00	1.2	
5	T	1370	15.0	2.279	2307.7	LOS F	1134.0	8958.8	1.00	0.00	1.2	
6	R	88	15.0	2.279	2321.5	LOS F	1134.0	8958.8	1.00	3.89	1.2	
Approach		1527	15.0	2.279	2309.2	NA	1134.0	8958.8	1.00	0.22	1.2	
North: Kargotich Road												
7	L	55	15.0	1.000 <sup>3</sup>	108.8	LOS F	3.1	24.9	1.00	1.06	21.1	
8	T	16	15.0	4.267	5944.9	LOS F	253.8	2004.9	1.00	4.83	0.5	
9	R	240	15.0	4.267	5944.9	LOS F	253.8	2004.9	1.00	4.99	0.5	
Approach		311	15.0	4.267	4912.8	LOS F	253.8	2004.9	1.00	4.28	0.6	
West: Mundijong Road												
10	L	64	15.0	0.774	1043.1	LOS F	289.6	2288.2	1.00	0.00	2.6	
11	T	1199	15.0	0.774	1029.2	LOS F	289.6	2288.2	1.00	0.00	2.7	
12	R	1	15.0	0.774	1043.0	LOS F	289.6	2288.2	1.00	1.25	2.6	
Approach		1264	15.0	0.774	1029.9	NA	289.6	2288.2	1.00	0.00	2.7	
All Vehicles		3228	15.0	4.267	2047.5	NA	1134.0	8958.8	1.00	0.64	1.4	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

<sup>3</sup> x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

**MOVEMENT SUMMARY**

Site: 2031 AM BG+Opt 3

Mundijong Road/Kargotich Road  
2031 AM Background + Option 3 Traffic Volumes  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kargotich Road											
1	L	1	15.0	0.006	34.7	LOS D	0.0	0.1	0.85	0.95	47.4
2	T	8	15.0	1.950	1792.3	LOS F	77.0	608.3	1.00	2.97	1.5
3	R	109	15.0	1.950	1792.2	LOS F	77.0	608.3	1.00	3.08	1.5
Approach		118	15.0	1.950	1777.4	LOS F	77.0	608.3	1.00	3.06	1.6
East: Mundijong Road											
4	L	50	15.0	7.968	12560.6	LOS F	1571.7	12416.1	1.00	0.00	0.2
5	T	897	15.0	7.968	12546.7	LOS F	1571.7	12416.1	1.00	0.00	0.2
6	R	446	15.0	7.968	12560.5	LOS F	1571.7	12416.1	1.00	5.64	0.2
Approach		1393	15.0	7.968	12551.6	NA	1571.7	12416.1	1.00	1.81	0.2
North: Kargotich Road											
7	L	60	15.0	1.000 <sup>3</sup>	96.9	LOS F	3.1	24.9	1.00	1.04	23.2
8	T	76	15.0	3.633	4810.1	LOS F	206.5	1631.6	1.00	4.18	0.6
9	R	142	15.0	3.633	4810.1	LOS F	206.5	1631.6	1.00	4.30	0.6
Approach		278	15.0	3.633	3792.9	LOS F	206.5	1631.6	1.00	3.56	0.7
West: Mundijong Road											
10	L	388	15.0	0.787	109.4	LOS F	64.4	508.8	1.00	0.00	21.5
11	T	980	15.0	0.787	95.5	LOS F	64.4	508.8	1.00	0.00	21.6
12	R	1	15.0	0.787	109.4	LOS F	64.4	508.8	1.00	1.59	21.6
Approach		1369	15.0	0.787	99.5	NA	64.4	508.8	1.00	0.00	21.6
All Vehicles		3158	15.0	7.968	5980.0	NA	1571.7	12416.1	1.00	1.22	0.5

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

<sup>3</sup> x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

**MOVEMENT SUMMARY**

Site: 2031 PM BG+Opt 3

Mundijong Road/Kargotich Road  
 2031 PM Background + Option 3 Traffic Volumes  
 Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kargotich Road											
1	L	1	15.0	0.033	116.8	LOS F	0.1	0.6	0.97	1.00	19.9
2	T	2	15.0	2.083	2027.5	LOS F	87.2	688.7	1.00	3.13	1.4
3	R	123	15.0	2.083	2027.4	LOS F	87.2	688.7	1.00	3.21	1.4
Approach		126	15.0	2.083	2012.3	LOS F	87.2	688.7	1.00	3.19	1.4
East: Mundijong Road											
4	L	69	15.0	4.479	6279.7	LOS F	1554.7	12282.0	1.00	0.00	0.4
5	T	1239	15.0	4.479	6265.8	LOS F	1554.7	12282.0	1.00	0.00	0.5
6	R	233	15.0	4.479	6279.6	LOS F	1554.7	12282.0	1.00	5.06	0.4
Approach		1541	15.0	4.479	6268.5	NA	1554.7	12282.0	1.00	0.77	0.5
North: Kargotich Road											
7	L	60	15.0	1.000 <sup>3</sup>	96.9	LOS F	3.1	24.9	1.00	1.04	23.2
8	T	340	15.0	12.083	20011.3	LOS F	853.7	6744.2	1.00	5.79	0.1
9	R	385	15.0	12.083	20011.2	LOS F	853.7	6744.2	1.00	5.98	0.1
Approach		785	15.0	12.083	18489.1	LOS F	853.7	6744.2	1.00	5.52	0.2
West: Mundijong Road											
10	L	143	15.0	0.729	365.0	LOS F	134.0	1058.6	1.00	0.00	7.3
11	T	1103	15.0	0.729	351.1	LOS F	134.0	1058.6	1.00	0.00	7.4
12	R	1	15.0	0.729	364.9	LOS F	134.0	1058.6	1.00	1.31	7.3
Approach		1247	15.0	0.729	352.7	NA	134.0	1058.6	1.00	0.00	7.4
All Vehicles		3699	15.0	12.083	6722.7	NA	1554.7	12282.0	1.00	1.60	0.4

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

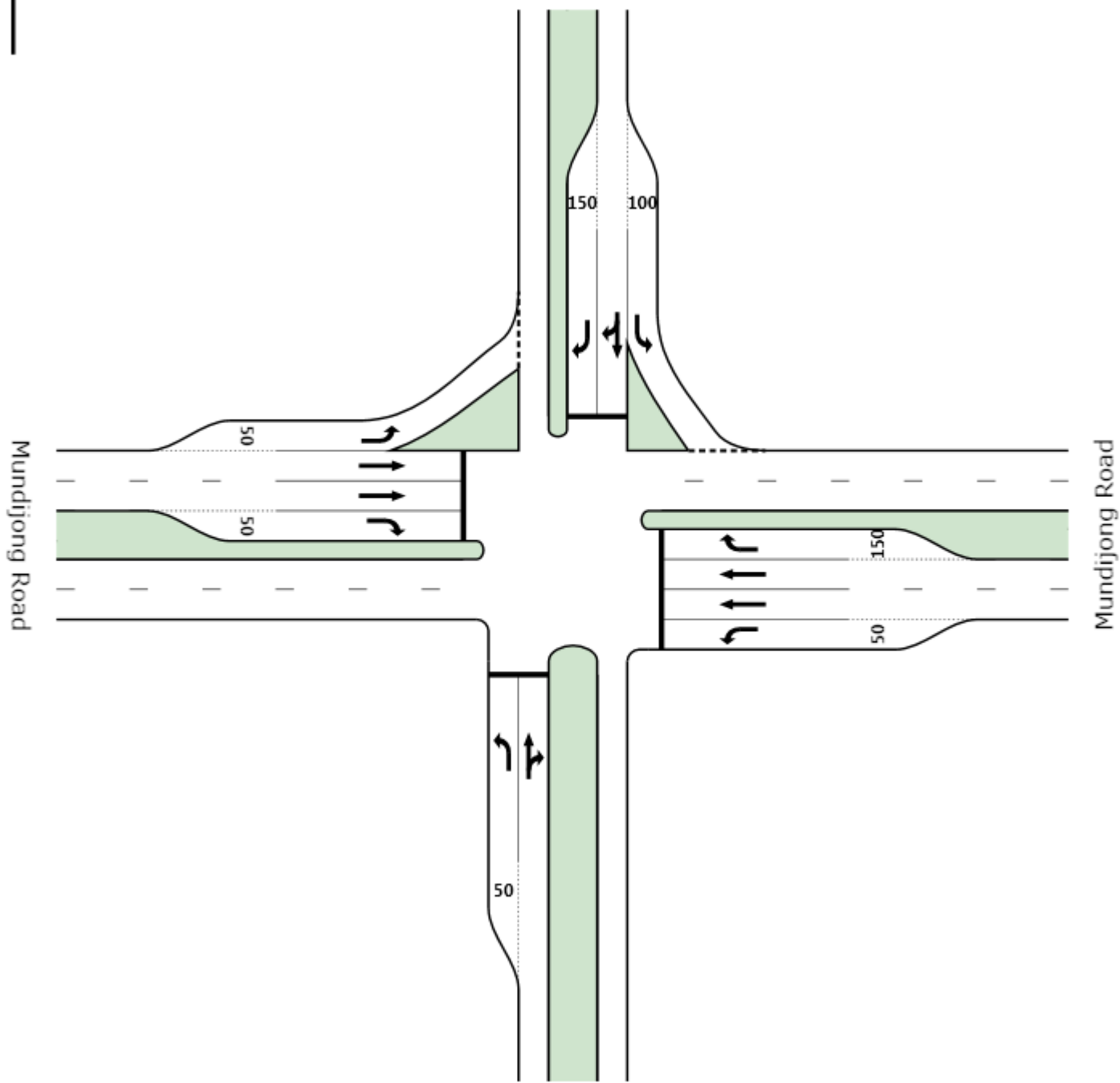
SIDRA Standard Delay Model used.

<sup>3</sup> x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.





Kargotich Road



Kargotich Road

Mundijong Road

Mundijong Road

**MOVEMENT SUMMARY**

Site: 2031 AM BG+Opt 1

Mundijong Road/Kargotich Road  
 2031 AM Background + Option 1 Traffic Volumes  
 Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
1	L	1	15.0	0.007	46.5	LOS D	0.0	0.3	0.93	0.60	38.3	
2	T	8	15.0	0.793	39.9	LOS D	4.5	35.7	1.00	0.88	35.0	
3	R	109	15.0	0.793	54.0	LOS D	4.5	35.7	1.00	0.88	34.9	
Approach		118	15.0	0.793	53.0	LOS D	4.5	35.7	1.00	0.88	35.0	
<b>East: Mundijong Road</b>												
4	L	50	15.0	0.348	49.1	LOS D	1.7	13.8	0.98	0.74	37.0	
5	T	931	15.0	0.458	9.4	LOS A	9.3	73.1	0.62	0.55	68.7	
6	R	103	15.0	0.239	36.8	LOS D	2.9	22.6	0.83	0.79	44.1	
Approach		1084	15.0	0.458	13.8	LOS B	9.3	73.1	0.66	0.58	63.0	
<b>North: Kargotich Road</b>												
7	L	24	15.0	0.031	20.8	LOS C	0.3	2.6	0.53	0.73	58.7	
8	T	10	15.0	0.354	35.2	LOS D	1.8	14.3	0.98	0.73	37.7	
9	R	95	15.0	0.354	49.3	LOS D	1.9	14.7	0.98	0.75	37.2	
Approach		129	15.0	0.354	42.9	LOS D	1.9	14.7	0.90	0.74	39.9	
<b>West: Mundijong Road</b>												
10	L	202	15.0	0.224	15.3	LOS B	1.0	8.3	0.26	0.75	66.1	
11	T	1224	15.0	0.861	29.9	LOS C	23.7	186.8	0.98	1.00	44.6	
12	R	1	15.0	0.007	46.6	LOS D	0.0	0.3	0.93	0.60	38.3	
Approach		1427	15.0	0.861	27.9	LOS C	23.7	186.8	0.88	0.96	46.7	
All Vehicles		2758	15.0	0.861	24.1	LOS C	23.7	186.8	0.80	0.80	50.8	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 2031 PM BG+Opt 1

Mundijong Road/Kargotich Road

2031 PM Background + Option 1 Traffic Volumes

Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
1	L	1	15.0	0.006	45.3	LOS D	0.0	0.2	0.92	0.60	39.0	
2	T	2	15.0	0.770	38.6	LOS D	4.8	37.6	1.00	0.88	35.5	
3	R	123	15.0	0.770	52.7	LOS D	4.8	37.6	1.00	0.88	35.3	
Approach		126	15.0	0.770	52.4	LOS D	4.8	37.6	1.00	0.87	35.4	
<b>East: Mundijong Road</b>												
4	L	69	15.0	0.480	49.7	LOS D	2.5	19.4	0.99	0.76	36.7	
5	T	1370	15.0	0.692	12.1	LOS B	17.0	134.0	0.78	0.70	63.3	
6	R	88	15.0	0.204	36.5	LOS D	2.4	19.1	0.82	0.78	44.3	
Approach		1527	15.0	0.692	15.2	LOS B	17.0	134.0	0.79	0.71	59.9	
<b>North: Kargotich Road</b>												
7	L	55	15.0	0.069	20.6	LOS C	0.8	6.0	0.53	0.75	59.0	
8	T	16	15.0	0.745	37.8	LOS D	4.8	37.6	1.00	0.86	36.1	
9	R	240	15.0	0.745	51.9	LOS D	4.8	38.2	1.00	0.86	35.9	
Approach		311	15.0	0.745	45.6	LOS D	4.8	38.2	0.92	0.84	38.6	
<b>West: Mundijong Road</b>												
10	L	64	15.0	0.068	15.1	LOS B	0.3	2.1	0.22	0.74	66.4	
11	T	1199	15.0	0.875	32.4	LOS C	24.1	190.5	0.99	1.03	42.9	
12	R	1	15.0	0.007	46.6	LOS D	0.0	0.3	0.93	0.60	38.3	
Approach		1264	15.0	0.875	31.6	LOS C	24.1	190.5	0.96	1.01	43.6	
All Vehicles		3228	15.0	0.875	26.0	LOS C	24.1	190.5	0.87	0.85	48.9	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 2031 AM BG+Opt 3

Mundijong Road/Kargotich Road  
 2031 AM Background + Option 3 Traffic Volumes  
 Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Kargotich Road												
1	L	1	15.0	0.007	46.5	LOS D	0.0	0.3	0.93	0.60	38.3	
2	T	8	15.0	0.793	40.0	LOS D	4.5	35.8	1.00	0.88	35.0	
3	R	109	15.0	0.793	54.1	LOS D	4.5	35.8	1.00	0.88	34.9	
Approach		118	15.0	0.793	53.0	LOS D	4.5	35.8	1.00	0.88	35.0	
East: Mundijong Road												
4	L	50	15.0	0.190	42.7	LOS D	1.5	12.2	0.90	0.75	40.4	
5	T	897	15.0	0.442	9.3	LOS A	8.8	69.5	0.61	0.54	69.0	
6	R	446	15.0	0.809	42.7	LOS D	16.1	126.8	0.98	0.93	40.4	
Approach		1393	15.0	0.809	21.2	LOS C	16.1	126.8	0.74	0.67	55.3	
North: Kargotich Road												
7	L	126	15.0	0.151	19.2	LOS B	1.5	12.2	0.49	0.77	60.8	
8	T	10	15.0	0.510	35.9	LOS D	2.7	21.1	1.00	0.76	37.1	
9	R	142	15.0	0.510	50.0	LOS D	2.7	21.6	1.00	0.77	36.8	
Approach		278	15.0	0.510	35.5	LOS D	2.7	21.6	0.77	0.77	44.8	
West: Mundijong Road												
10	L	388	15.0	0.702	22.2	LOS C	6.8	53.7	0.59	0.82	57.2	
11	T	980	15.0	0.839	30.7	LOS C	18.4	145.6	0.99	0.97	44.0	
12	R	1	15.0	0.007	46.6	LOS D	0.0	0.3	0.93	0.60	38.3	
Approach		1369	15.0	0.839	28.3	LOS C	18.4	145.6	0.88	0.93	47.0	
All Vehicles		3158	15.0	0.839	26.7	LOS C	18.4	145.6	0.81	0.80	49.4	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 2031 PM BG+Opt 3

Mundijong Road/Kargotich Road  
 2031 PM Background + Option 3 Traffic Volumes  
 Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

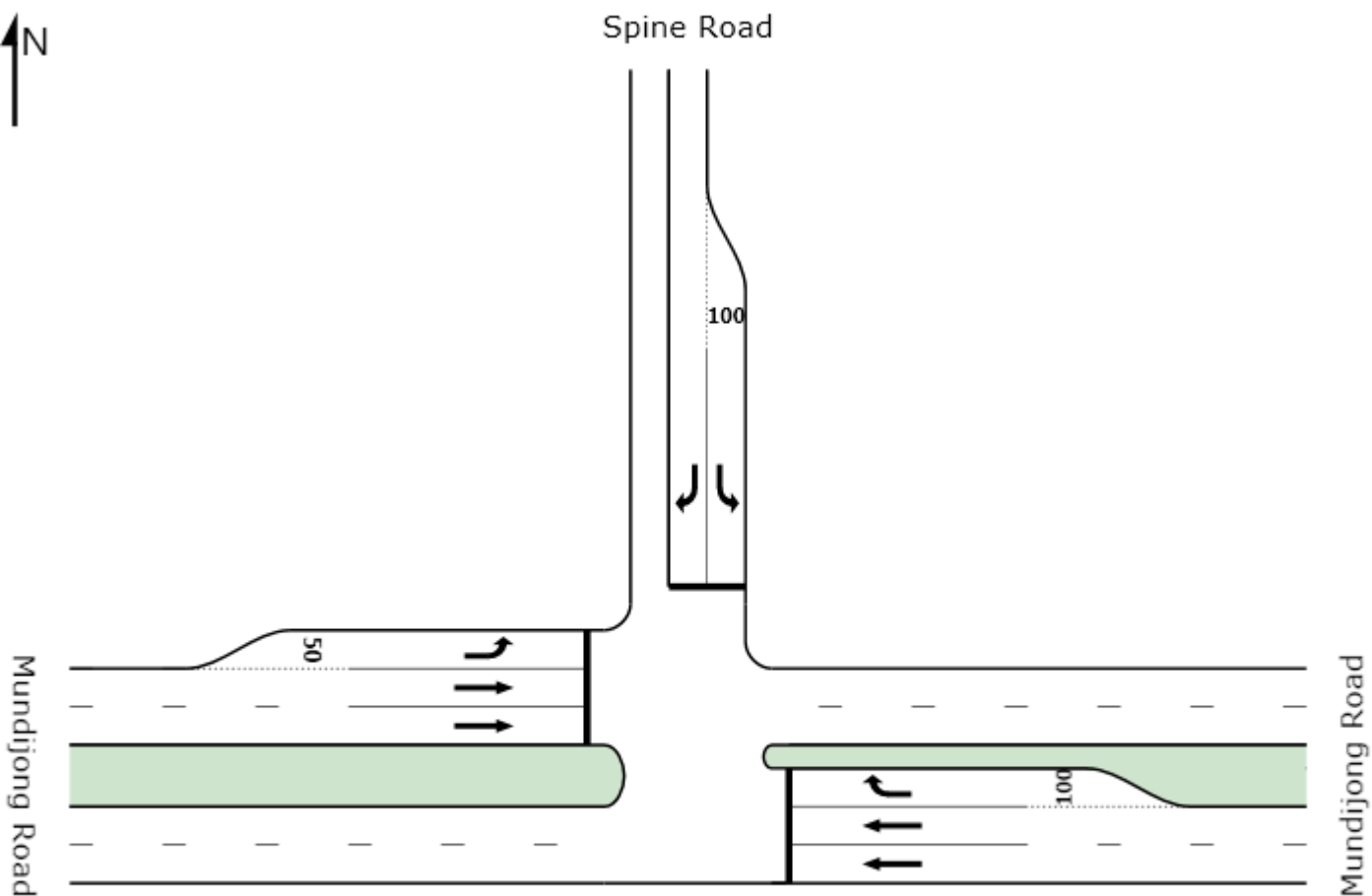
<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
1	L	1	15.0	0.004	44.1	LOS D	0.0	0.3	0.85	0.62	39.6	
2	T	2	15.0	0.534	34.9	LOS C	4.7	37.4	0.96	0.77	37.4	
3	R	123	15.0	0.534	49.0	LOS D	4.7	37.4	0.96	0.80	37.1	
Approach		126	15.0	0.534	48.8	LOS D	4.7	37.4	0.96	0.80	37.1	
<b>East: Mundijong Road</b>												
4	L	69	15.0	0.548	56.0	LOS E	2.8	22.5	1.00	0.77	34.0	
5	T	1239	15.0	0.649	14.2	LOS B	17.2	135.9	0.76	0.69	60.6	
6	R	233	15.0	0.617	45.2	LOS D	8.5	67.0	0.95	0.83	39.0	
Approach		1541	15.0	0.649	20.7	LOS C	17.2	135.9	0.80	0.71	54.3	
<b>North: Kargotich Road</b>												
7	L	384	15.0	0.529	22.3	LOS C	7.3	57.9	0.65	0.82	57.0	
8	T	16	15.0	0.816	42.0	LOS D	8.8	69.1	1.00	0.93	34.2	
9	R	385	15.0	0.816	56.1	LOS E	8.8	69.1	1.00	0.93	34.0	
Approach		785	15.0	0.816	39.3	LOS D	8.8	69.1	0.83	0.88	42.3	
<b>West: Mundijong Road</b>												
10	L	143	15.0	0.206	16.5	LOS B	1.3	9.9	0.32	0.76	64.4	
11	T	1103	15.0	0.801	27.5	LOS C	21.2	167.2	0.95	0.90	46.4	
12	R	1	15.0	0.008	52.1	LOS D	0.0	0.3	0.94	0.60	35.6	
Approach		1247	15.0	0.801	26.3	LOS C	21.2	167.2	0.88	0.88	47.9	
All Vehicles		3699	15.0	0.816	27.5	LOS C	21.2	167.2	0.84	0.81	48.5	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.



**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 1

Mundijong Road/Spine Road

2031 AM Background + Option 1 Traffic Volumes

Signals - Fixed Time Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>East: Mundijong Road</b>												
5	T	1050	15.0	0.396	3.6	LOS A	6.9	54.1	0.39	0.35	81.4	
6	R	385	15.0	0.820	47.7	LOS D	15.2	120.2	1.00	0.92	31.4	
Approach		1435	15.0	0.820	15.5	LOS B	15.2	120.2	0.55	0.50	61.1	
<b>North: Spine Road</b>												
7	L	123	15.0	0.786	49.8	LOS D	5.0	39.8	1.00	0.95	28.7	
9	R	34	15.0	0.217	44.1	LOS D	1.2	9.7	0.96	0.73	30.5	
Approach		157	15.0	0.786	48.6	LOS D	5.0	39.8	0.99	0.90	29.1	
<b>West: Mundijong Road</b>												
10	L	245	15.0	0.685	34.1	LOS C	6.9	54.7	0.76	0.84	39.6	
11	T	1111	15.0	0.809	26.8	LOS C	20.5	161.6	0.96	0.91	47.0	
Approach		1356	15.0	0.809	28.1	LOS C	20.5	161.6	0.92	0.90	45.8	
All Vehicles		2948	15.0	0.820	23.1	LOS C	20.5	161.6	0.74	0.71	50.2	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

Processed: Monday, 5 November 2012 9:07:23 AM

SIDRA INTERSECTION 5.1.12.2089

Project: T:\PROJECTS\CEP02161 West Mundijong Sp Traffic Advice\05 Technical\03 Analysis\Mundijong Rd-

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**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 1

Mundijong Road/Spine Road

2031 PM Background + Option 1 Traffic Volumes

Signals - Fixed Time Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
East: Mundijong Road												
5	T	1395	15.0	0.666	14.1	LOS B	21.7	171.5	0.73	0.66	61.0	
6	R	159	15.0	0.819	65.7	LOS E	8.2	64.4	1.00	0.90	24.7	
Approach		1554	15.0	0.819	19.4	LOS B	21.7	171.5	0.76	0.69	54.8	
North: Spine Road												
7	L	422	15.0	0.885	48.8	LOS D	20.7	163.2	1.00	0.93	29.0	
9	R	131	15.0	0.275	36.7	LOS D	4.8	37.6	0.82	0.78	33.2	
Approach		553	15.0	0.885	45.9	LOS D	20.7	163.2	0.96	0.90	29.9	
West: Mundijong Road												
10	L	96	15.0	0.310	33.0	LOS C	2.8	21.9	0.66	0.78	40.4	
11	T	1272	15.0	0.872	37.8	LOS D	32.2	254.7	0.99	0.99	39.7	
Approach		1368	15.0	0.872	37.5	LOS D	32.2	254.7	0.97	0.98	39.8	
All Vehicles		3475	15.0	0.885	30.7	LOS C	32.2	254.7	0.87	0.84	42.8	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

Processed: Monday, 5 November 2012 9:07:32 AM

SIDRA INTERSECTION 5.1.12.2089

Project: T:\PROJECTS\CEP02161 West Mundijong Sp Traffic Advice\05 Technical\03 Analysis\Mundijong Rd-

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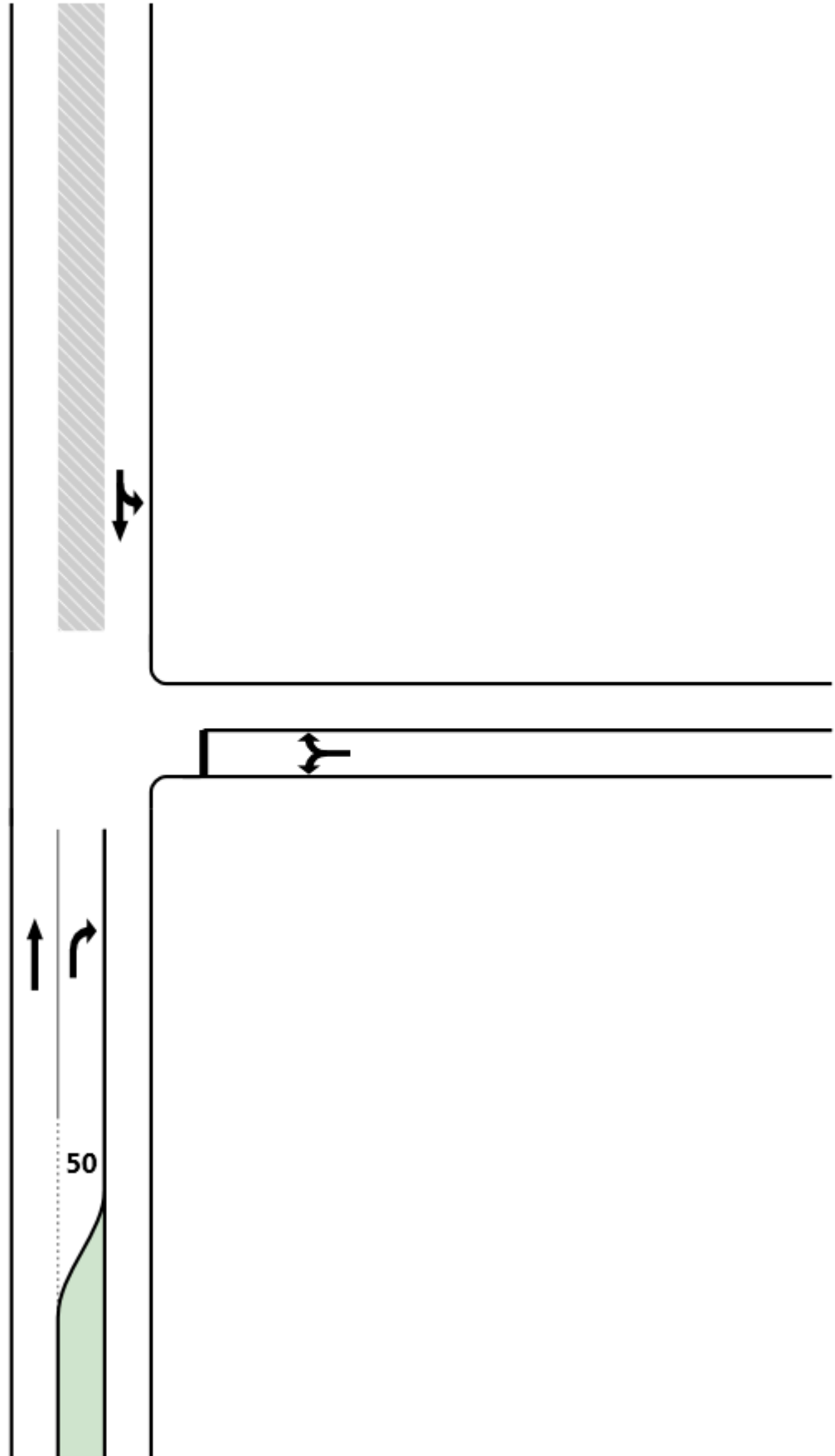
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Kargotich Road



Kargotich Road

Spine Road

**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 3

Kargotich Road/Spine Road  
2031 AM Background + Option 3 Traffic Volumes  
Stop (Two-Way)

<b>Movement Performance - Vehicles</b>											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
<b>South: Kargotich Road</b>											
2	T	192	15.0	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
3	R	651	15.0	0.627	16.8	LOS C	6.2	48.8	0.46	0.75	59.2
Approach		843	15.0	0.627	13.0	NA	6.2	48.8	0.35	0.58	67.2
<b>East: Spine Road</b>											
4	L	155	15.0	0.213	13.3	LOS B	0.8	6.6	0.32	0.87	46.6
6	R	5	15.0	0.213	12.8	LOS B	0.8	6.6	0.32	1.03	47.1
Approach		160	15.0	0.213	13.3	LOS B	0.8	6.6	0.32	0.88	46.6
<b>North: Kargotich Road</b>											
7	L	5	15.0	0.072	14.3	LOS B	0.0	0.0	0.00	1.27	63.6
8	T	123	15.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		128	15.0	0.072	0.6	NA	0.0	0.0	0.00	0.05	98.4
All Vehicles		1131	15.0	0.627	11.6	NA	6.2	48.8	0.31	0.56	65.2

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 3

Kargotich Road/Spine Road  
2031 PM Background + Option 3 Traffic Volumes  
Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
2	T	149	15.0	0.084	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
3	R	230	15.0	0.220	15.7	LOS C	1.0	7.8	0.37	0.75	61.0	
Approach		379	15.0	0.220	9.5	NA	1.0	7.8	0.23	0.46	74.9	
<b>East: Spine Road</b>												
4	L	601	15.0	0.719	17.2	LOS C	9.8	77.6	0.66	1.07	44.2	
6	R	5	15.0	0.719	16.7	LOS C	9.8	77.6	0.66	1.16	44.7	
Approach		606	15.0	0.719	17.2	LOS C	9.8	77.6	0.66	1.07	44.2	
<b>North: Kargotich Road</b>												
7	L	5	15.0	0.107	14.3	LOS B	0.0	0.0	0.00	1.27	63.6	
8	T	184	15.0	0.107	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
Approach		189	15.0	0.107	0.4	NA	0.0	0.0	0.00	0.03	98.9	
All Vehicles		1174	15.0	0.719	12.0	NA	9.8	77.6	0.41	0.71	56.2	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

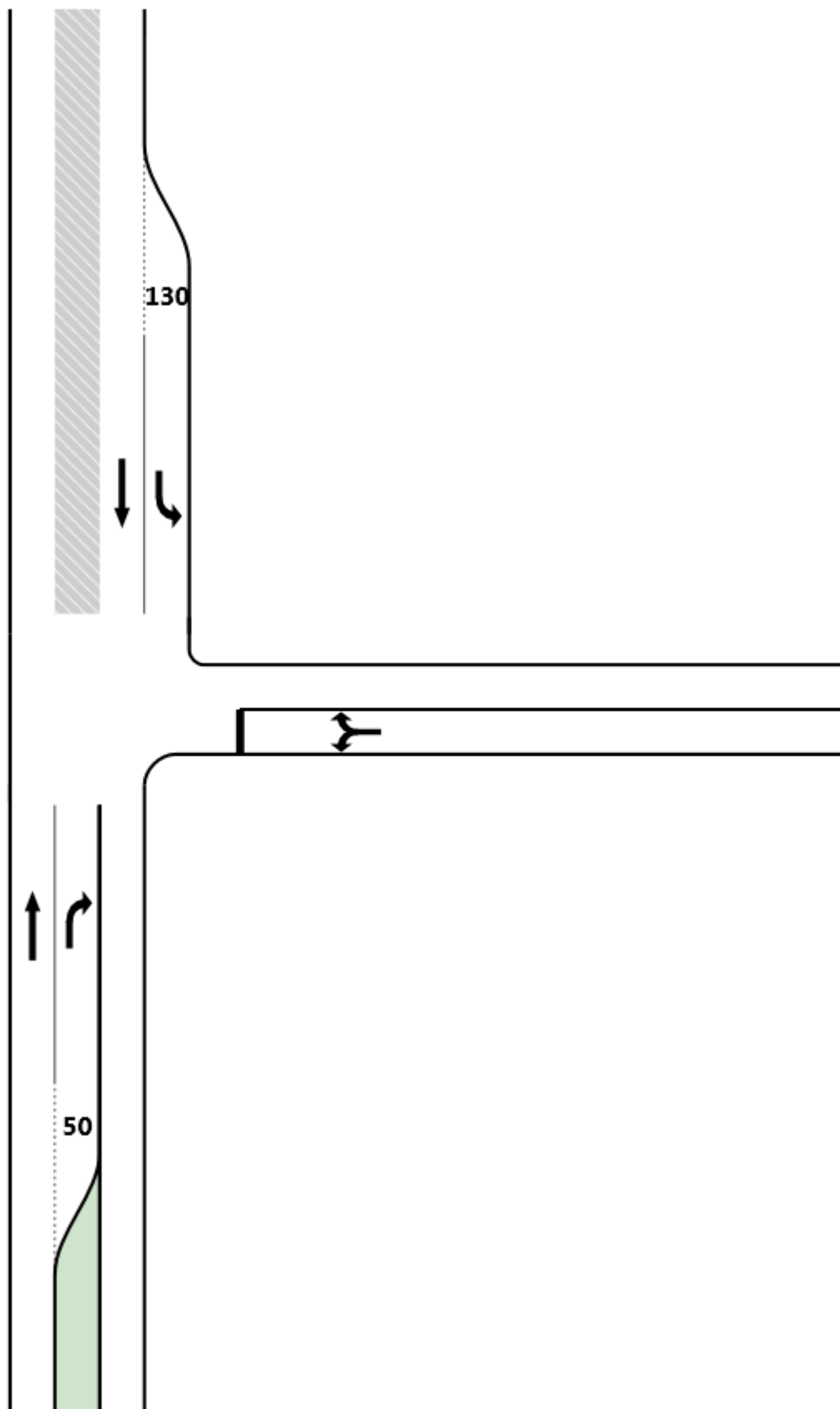
Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.



Kargotich Road



Bishop Road

Kargotich Road

**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 1

Kargotich Road/Bishop Road  
2031 AM Background + Option 1 Traffic Volumes  
Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
2	T	145	15.0	0.082	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
3	R	14	15.0	0.013	14.5	LOS B	0.0	0.3	0.05	0.76	63.2	
Approach		159	15.0	0.082	1.3	NA	0.0	0.3	0.00	0.07	96.4	
<b>East: Bishop Road</b>												
4	L	77	15.0	0.117	11.8	LOS B	0.5	3.6	0.02	0.98	47.3	
6	R	28	15.0	0.117	11.6	LOS B	0.5	3.6	0.02	1.01	47.5	
Approach		105	15.0	0.117	11.7	LOS B	0.5	3.6	0.02	0.98	47.3	
<b>North: Kargotich Road</b>												
7	L	5	15.0	0.003	14.3	LOS B	0.0	0.0	0.00	0.77	63.6	
8	T	2	15.0	0.001	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
Approach		7	15.0	0.003	10.2	NA	0.0	0.0	0.00	0.55	73.1	
All Vehicles		271	15.0	0.117	5.6	NA	0.5	3.6	0.01	0.43	68.3	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 1

Kargotich Road/Bishop Road  
 2031 AM Background + Option 1 Traffic Volumes  
 Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
2	T	95	15.0	0.053	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
3	R	64	15.0	0.061	14.6	LOS B	0.2	1.6	0.12	0.73	62.7	
Approach		159	15.0	0.061	5.9	NA	0.2	1.6	0.05	0.30	83.8	
<b>East: Bishop Road</b>												
4	L	27	15.0	0.042	11.9	LOS B	0.2	1.2	0.09	0.93	47.3	
6	R	10	15.0	0.042	11.7	LOS B	0.2	1.2	0.09	0.98	47.5	
Approach		37	15.0	0.042	11.8	LOS B	0.2	1.2	0.09	0.95	47.4	
<b>North: Kargotich Road</b>												
7	L	22	15.0	0.013	14.3	LOS B	0.0	0.0	0.00	0.77	63.6	
8	T	10	15.0	0.006	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
Approach		32	15.0	0.013	9.8	NA	0.0	0.0	0.00	0.53	74.0	
All Vehicles		228	15.0	0.061	7.4	NA	0.2	1.6	0.05	0.43	72.6	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 3

Kargotich Road/Bishop Road  
 2031 AM Background + Option 3 Traffic Volumes  
 Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Kargotich Road</b>												
2	T	142	15.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
3	R	301	15.0	0.287	14.7	LOS B	1.2	9.2	0.20	0.70	62.2	
Approach		443	15.0	0.287	10.0	NA	1.2	9.2	0.13	0.48	73.2	
<b>East: Bishop Road</b>												
4	L	201	15.0	0.237	12.1	LOS B	1.0	8.1	0.07	0.95	47.1	
6	R	17	15.0	0.237	11.9	LOS B	1.0	8.1	0.07	1.02	47.4	
Approach		218	15.0	0.237	12.1	LOS B	1.0	8.1	0.07	0.95	47.2	
<b>North: Kargotich Road</b>												
7	L	31	15.0	0.018	14.3	LOS B	0.0	0.0	0.00	0.77	63.6	
8	T	1	15.0	0.001	0.0	LOS A	0.0	0.0	0.00	0.00	100.0	
Approach		32	15.0	0.018	13.8	NA	0.0	0.0	0.00	0.74	64.6	
All Vehicles		693	15.0	0.287	10.8	NA	1.2	9.2	0.11	0.64	60.8	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 3

Kargotich Road/Bishop Road  
 2031 AM Background + Option 3 Traffic Volumes  
 Stop (Two-Way)

<b>Movement Performance - Vehicles</b>											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
<b>South: Kargotich Road</b>											
2	T	94	15.0	0.053	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
3	R	250	15.0	0.238	14.6	LOS B	0.9	7.2	0.19	0.70	62.2
Approach		344	15.0	0.238	10.6	NA	0.9	7.2	0.13	0.51	71.5
<b>East: Bishop Road</b>											
4	L	221	15.0	0.220	11.4	LOS B	1.0	7.5	0.07	0.95	47.6
6	R	6	15.0	0.220	11.2	LOS B	1.0	7.5	0.07	1.02	47.9
Approach		227	15.0	0.220	11.4	LOS B	1.0	7.5	0.07	0.95	47.7
<b>North: Kargotich Road</b>											
7	L	14	15.0	0.008	14.3	LOS B	0.0	0.0	0.00	0.77	63.6
8	T	6	15.0	0.003	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		20	15.0	0.008	10.0	NA	0.0	0.0	0.00	0.54	73.6
All Vehicles		591	15.0	0.238	10.9	NA	1.0	7.5	0.10	0.68	58.8

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

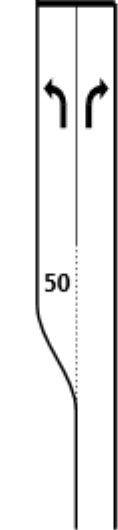




Bishop Road



50



50

Spine Road



100



Bishop Road

**MOVEMENT SUMMARY**

Bishop Road/Spine Road  
 2031 AM Background + Option 1 Traffic Volumes  
 Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Spine Road												
1	L	5	15.0	0.008	13.4	LOS B	0.0	0.2	0.49	0.86	39.1	
3	R	341	15.0	0.576	17.9	LOS C	4.1	32.2	0.69	1.19	36.2	
Approach		346	15.0	0.576	17.8	LOS C	4.1	32.2	0.69	1.19	36.3	
East: Bishop Road												
4	L	678	15.0	0.404	6.8	LOS A	0.0	0.0	0.00	0.61	43.3	
5	T	106	15.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approach		784	15.0	0.404	5.9	NA	0.0	0.0	0.00	0.53	44.1	
West: Bishop Road												
11	T	18	15.0	0.010	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
12	R	5	15.0	0.008	11.8	LOS B	0.0	0.2	0.63	0.71	39.3	
Approach		23	15.0	0.010	2.6	NA	0.0	0.2	0.14	0.16	47.2	
All Vehicles		1153	15.0	0.576	9.4	NA	4.1	32.2	0.21	0.72	41.5	

Level of Service (LOS) Method: Delay (HCM 2000).  
 Vehicle movement LOS values are based on average delay per movement  
 Minor Road Approach LOS values are based on average delay for all vehicle movements.  
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.  
 SIDRA Standard Delay Model used.



**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 1

Bishop Road/Spine Road  
2031 PM Background + Option 1 Traffic Volumes  
Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Spine Road</b>												
1	L	5	15.0	0.006	11.4	LOS B	0.0	0.2	0.34	0.84	40.3	
3	R	635	15.0	0.863	24.0	LOS C	17.0	134.0	0.89	1.66	33.0	
Approach		640	15.0	0.863	23.9	LOS C	17.0	134.0	0.88	1.65	33.0	
<b>East: Bishop Road</b>												
4	L	367	15.0	0.219	6.8	LOS A	0.0	0.0	0.00	0.61	43.3	
5	T	37	15.0	0.021	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approach		404	15.0	0.219	6.2	NA	0.0	0.0	0.00	0.56	43.8	
<b>West: Bishop Road</b>												
11	T	86	15.0	0.048	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
12	R	5	15.0	0.005	8.7	LOS A	0.0	0.2	0.47	0.60	41.6	
Approach		91	15.0	0.048	0.5	NA	0.0	0.2	0.03	0.03	49.4	
All Vehicles		1135	15.0	0.863	15.7	NA	17.0	134.0	0.50	1.13	37.3	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

Processed: Monday, 5 November 2012 8:56:37 AM

SIDRA INTERSECTION 5.1.12.2089

Project: T:\PROJECTS\CEP02161 West Mundijong Sp Traffic Advice\05 Technical\03 Analysis\Bishop Rd-Spine Rd 20121031.sip

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**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 3

Bishop Road/Spine Road  
 2031 AM Background + Option 3 Traffic Volumes  
 Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Spine Road</b>												
1	L	5	15.0	0.011	15.3	LOS C	0.0	0.3	0.58	0.89	37.8	
3	R	123	15.0	0.417	25.0	LOS D	1.8	13.9	0.82	1.09	32.4	
Approach		128	15.0	0.417	24.6	LOS C	1.8	13.9	0.81	1.09	32.5	
<b>East: Bishop Road</b>												
4	L	771	15.0	0.460	6.8	LOS A	0.0	0.0	0.00	0.61	43.3	
5	T	216	15.0	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approach		987	15.0	0.460	5.3	NA	0.0	0.0	0.00	0.48	44.6	
<b>West: Bishop Road</b>												
11	T	304	15.0	0.171	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
12	R	5	15.0	0.011	14.5	LOS B	0.0	0.3	0.73	0.80	37.3	
Approach		309	15.0	0.171	0.2	NA	0.0	0.3	0.01	0.01	49.7	
All Vehicles		1424	15.0	0.460	6.0	NA	1.8	13.9	0.08	0.43	44.1	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

Processed: Monday, 5 November 2012 8:56:48 AM

SIDRA INTERSECTION 5.1.12.2089

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**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 3

Bishop Road/Spine Road  
2031 PM Background + Option 3 Traffic Volumes  
Stop (Two-Way)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Spine Road</b>												
1	L	5	15.0	0.007	12.5	LOS B	0.0	0.2	0.45	0.84	39.6	
3	R	656	15.0	1.417	777.4	LOS F	252.2	1992.2	1.00	14.36	2.5	
Approach		661	15.0	1.417	771.6	LOS F	252.2	1992.2	1.00	14.26	2.6	
<b>East: Bishop Road</b>												
4	L	273	15.0	0.163	6.8	LOS A	0.0	0.0	0.00	0.61	43.3	
5	T	227	15.0	0.128	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approach		500	15.0	0.163	3.7	NA	0.0	0.0	0.00	0.33	46.1	
<b>West: Bishop Road</b>												
11	T	264	15.0	0.149	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
12	R	5	15.0	0.005	9.3	LOS A	0.0	0.2	0.52	0.62	41.1	
Approach		269	15.0	0.149	0.2	NA	0.0	0.2	0.01	0.01	49.8	
All Vehicles		1430	15.0	1.417	358.0	NA	252.2	1992.2	0.46	6.71	5.2	

Level of Service (LOS) Method: Delay (HCM 2000).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

Processed: Monday, 5 November 2012 8:56:58 AM

SIDRA INTERSECTION 5.1.12.2089

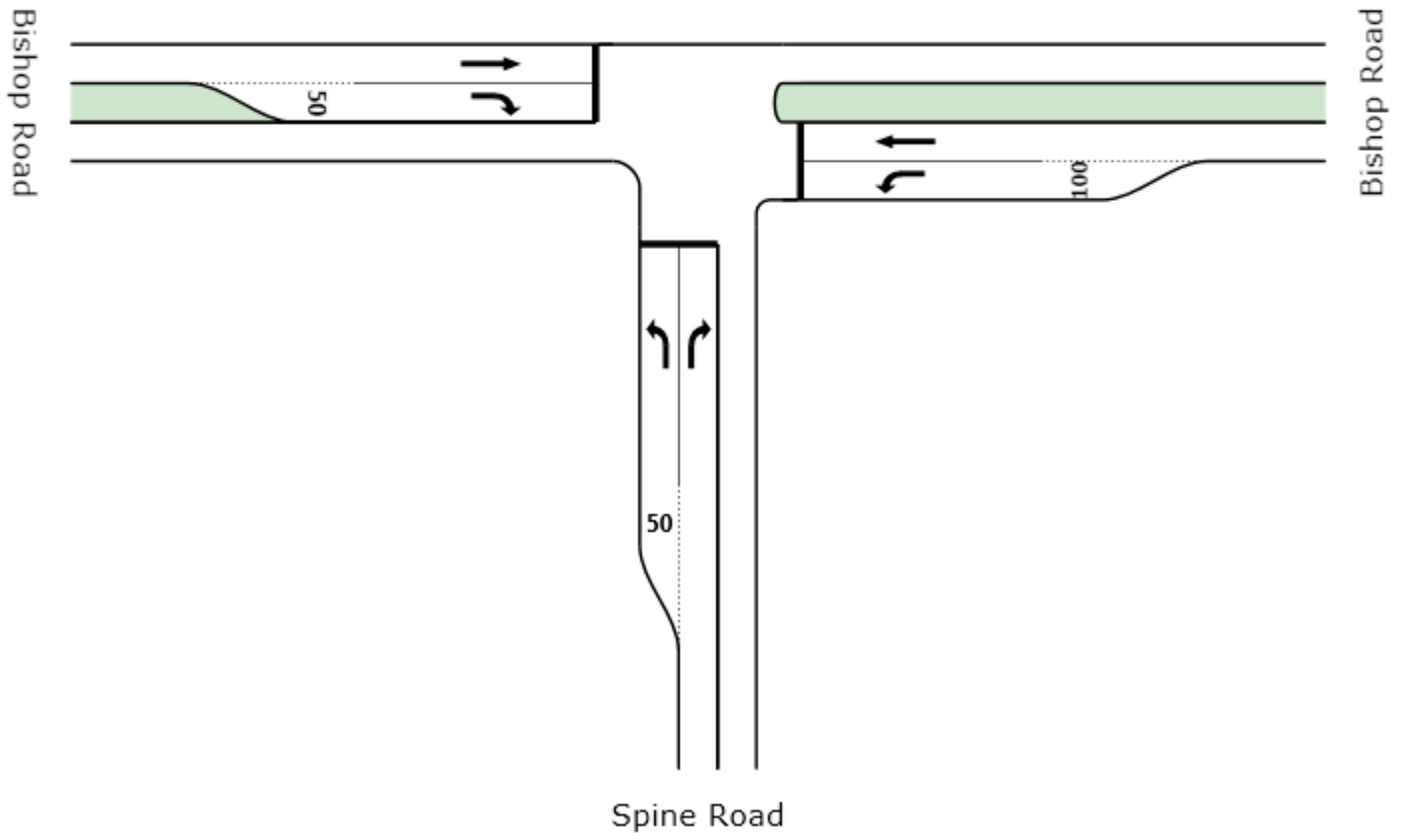
Project: T:\PROJECTS\CEP02161 West Mundijong Sp Traffic Advice\05 Technical\03 Analysis\Bishop Rd-Spine Rd 20121031.sip

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**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 1

Bishop Road/Spine Road

2031 AM Background + Option 1 Traffic Volumes

Signals - Fixed Time Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Spine Road												
1	L	5	15.0	0.015	28.6	LOS C	0.1	1.0	0.81	0.65	29.7	
3	R	341	15.0	0.944	59.0	LOS E	16.1	127.4	1.00	1.27	20.7	
Approach		346	15.0	0.944	58.6	LOS E	16.1	127.4	1.00	1.26	20.8	
East: Bishop Road												
4	L	678	15.0	0.973	27.4	LOS C	21.6	170.8	1.00	0.90	30.3	
5	T	106	15.0	0.144	12.8	LOS B	2.1	16.6	0.65	0.52	36.9	
Approach		784	15.0	0.973	25.4	LOS C	21.6	170.8	0.95	0.85	31.0	
West: Bishop Road												
11	T	18	15.0	0.017	5.6	LOS A	0.2	1.8	0.42	0.30	42.9	
12	R	5	15.0	0.032	37.4	LOS D	0.2	1.2	0.93	0.65	26.4	
Approach		23	15.0	0.032	12.5	LOS B	0.2	1.8	0.53	0.38	37.8	
All Vehicles		1153	15.0	0.973	35.1	LOS D	21.6	170.8	0.96	0.96	27.1	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

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**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 1

Bishop Road/Spine Road

2031 PM Background + Option 1 Traffic Volumes

Signals - Fixed Time Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Spine Road</b>												
1	L	5	15.0	0.014	20.7	LOS C	0.1	0.9	0.54	0.64	33.6	
3	R	635	15.0	0.799	32.6	LOS C	26.7	210.5	0.91	0.90	28.1	
Approach		640	15.0	0.799	32.5	LOS C	26.7	210.5	0.91	0.90	28.2	
<b>East: Bishop Road</b>												
4	L	367	15.0	0.799	46.3	LOS D	17.4	137.6	0.99	0.93	23.7	
5	T	37	15.0	0.076	27.5	LOS C	1.3	10.0	0.77	0.58	29.0	
Approach		404	15.0	0.799	44.6	LOS D	17.4	137.6	0.97	0.90	24.1	
<b>West: Bishop Road</b>												
11	T	86	15.0	0.121	19.2	LOS B	2.5	19.7	0.66	0.53	33.1	
12	R	5	15.0	0.047	54.4	LOS D	0.2	1.8	0.96	0.65	21.7	
Approach		91	15.0	0.121	21.1	LOS C	2.5	19.7	0.68	0.53	32.1	
All Vehicles		1135	15.0	0.799	35.9	LOS D	26.7	210.5	0.91	0.87	26.8	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

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**MOVEMENT SUMMARY**

Site: 31 AM BG+Opt 3

Bishop Road/Spine Road

2031 AM Background + Option 3 Traffic Volumes

Signals - Fixed Time Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Spine Road												
1	L	5	15.0	0.030	34.4	LOS C	0.1	1.1	0.92	0.65	27.5	
3	R	123	15.0	0.733	39.6	LOS D	4.0	31.6	1.00	0.91	25.7	
Approach		128	15.0	0.733	39.4	LOS D	4.0	31.6	1.00	0.90	25.8	
East: Bishop Road												
4	L	758	15.0	1.000 <sup>3</sup>	21.8	LOS C	20.7	163.2	0.98	0.90	33.0	
5	T	229	15.0	0.259	9.3	LOS A	3.9	30.7	0.61	0.51	39.3	
Approach		987	15.0	1.000	18.9	LOS B	20.7	163.2	0.90	0.81	34.2	
West: Bishop Road												
11	T	304	15.0	0.244	3.5	LOS A	3.2	25.4	0.39	0.33	44.9	
12	R	5	15.0	0.030	34.6	LOS C	0.1	1.1	0.92	0.65	27.4	
Approach		309	15.0	0.244	4.0	LOS A	3.2	25.4	0.39	0.34	44.5	
All Vehicles		1424	15.0	1.000	17.5	LOS B	20.7	163.2	0.80	0.71	34.9	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

<sup>3</sup> x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

**MOVEMENT SUMMARY**

Site: 31 PM BG+Opt 3

Bishop Road/Spine Road

2031 PM Background + Option 3 Traffic Volumes

Signals - Fixed Time Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

<b>Movement Performance - Vehicles</b>												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
<b>South: Spine Road</b>												
1	L	5	15.0	0.012	17.9	LOS B	0.1	0.8	0.53	0.64	35.2	
3	R	656	15.0	0.802	29.2	LOS C	23.8	188.2	0.91	0.91	29.5	
Approach		661	15.0	0.802	29.2	LOS C	23.8	188.2	0.90	0.91	29.5	
<b>East: Bishop Road</b>												
4	L	273	15.0	0.766	42.9	LOS D	11.1	87.3	1.00	0.92	24.7	
5	T	227	15.0	0.601	31.6	LOS C	8.3	65.3	0.95	0.79	27.3	
Approach		500	15.0	0.766	37.8	LOS D	11.1	87.3	0.98	0.86	25.8	
<b>West: Bishop Road</b>												
11	T	264	15.0	0.410	20.8	LOS C	7.8	61.6	0.80	0.67	32.1	
12	R	5	15.0	0.040	45.9	LOS D	0.2	1.5	0.95	0.65	23.8	
Approach		269	15.0	0.410	21.2	LOS C	7.8	61.6	0.80	0.67	31.8	
All Vehicles		1430	15.0	0.802	30.7	LOS C	23.8	188.2	0.91	0.85	28.5	

Level of Service (LOS) Method: Delay (HCM 2000).

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.

SIDRA Standard Delay Model used.

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APPENDIX E  
GEOMETRIC DESIGN

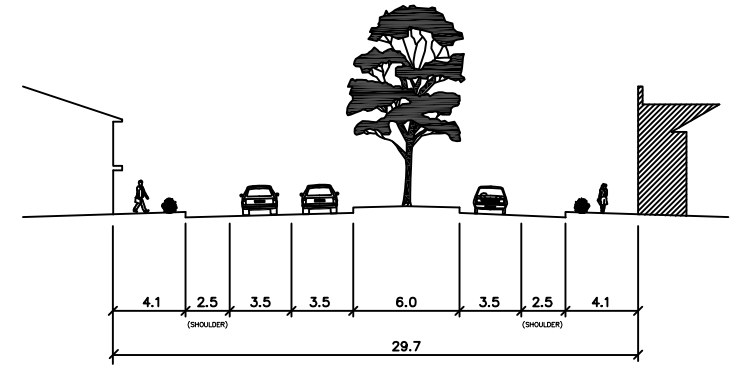
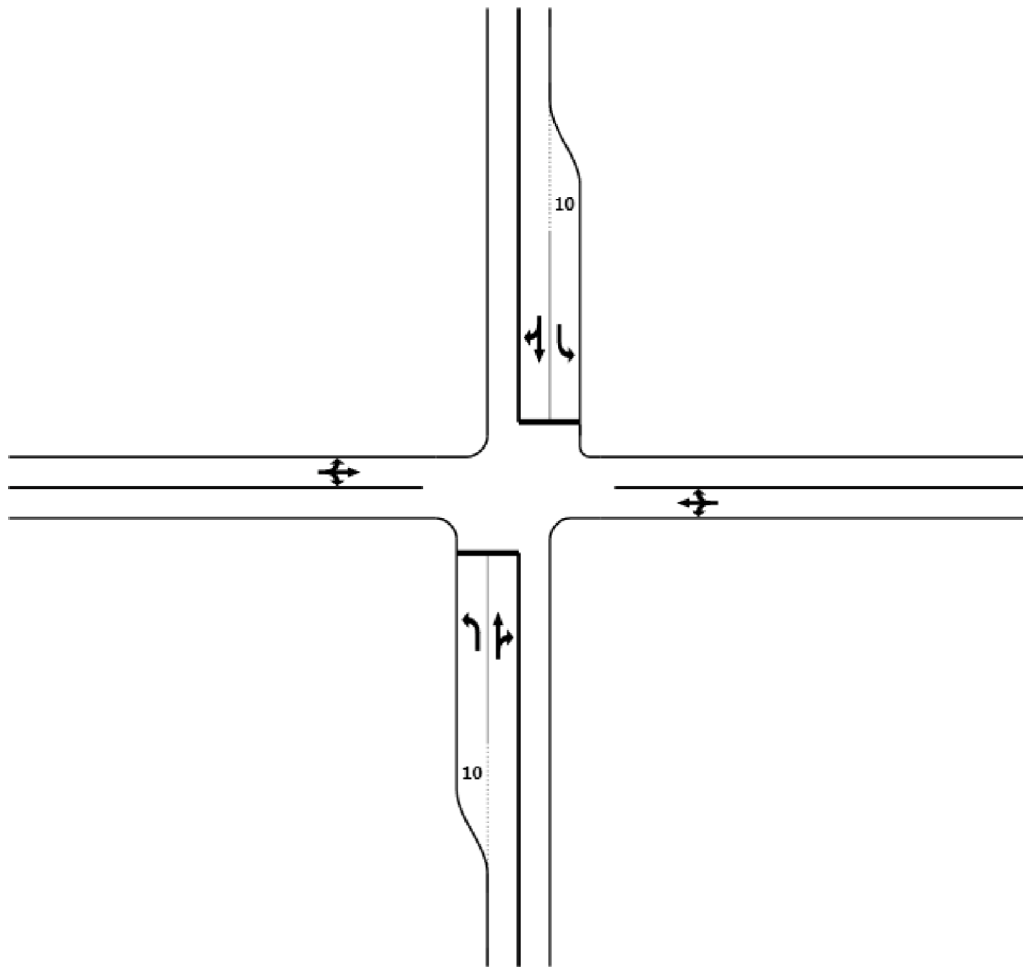


Mundijong Road

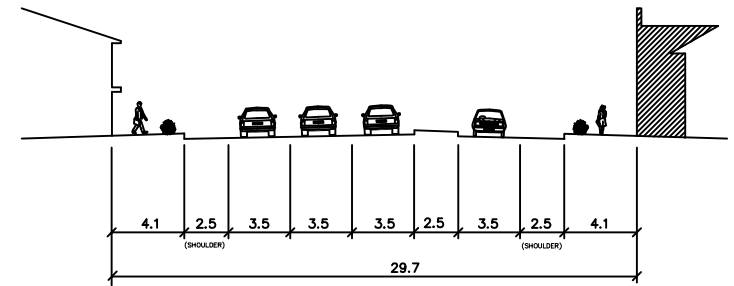
Kargotich Road

Kargotich Road

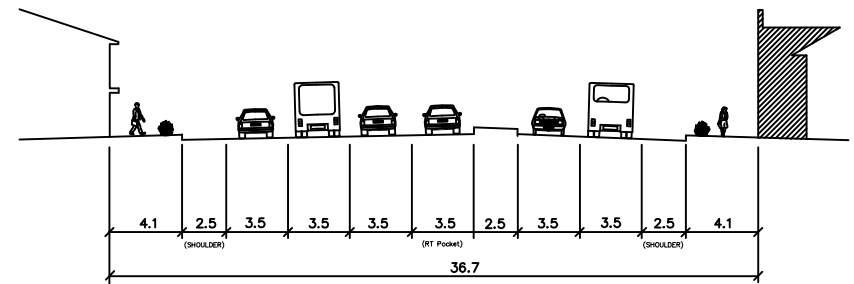
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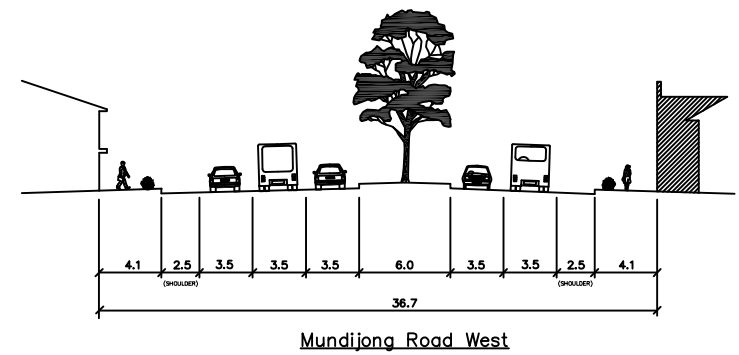
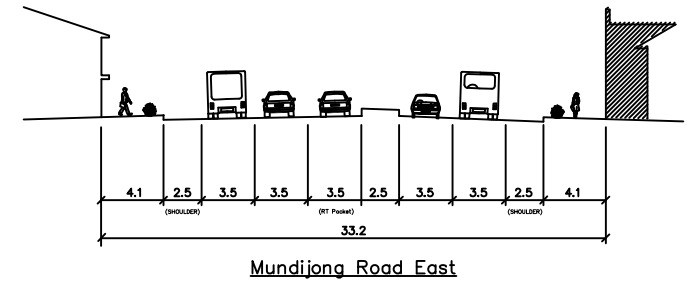
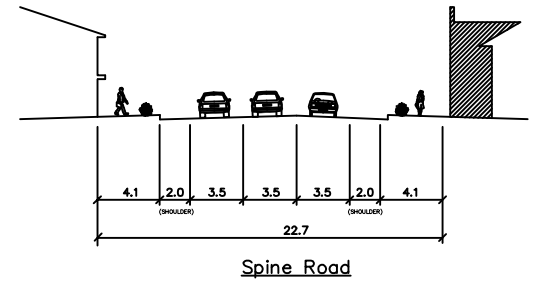
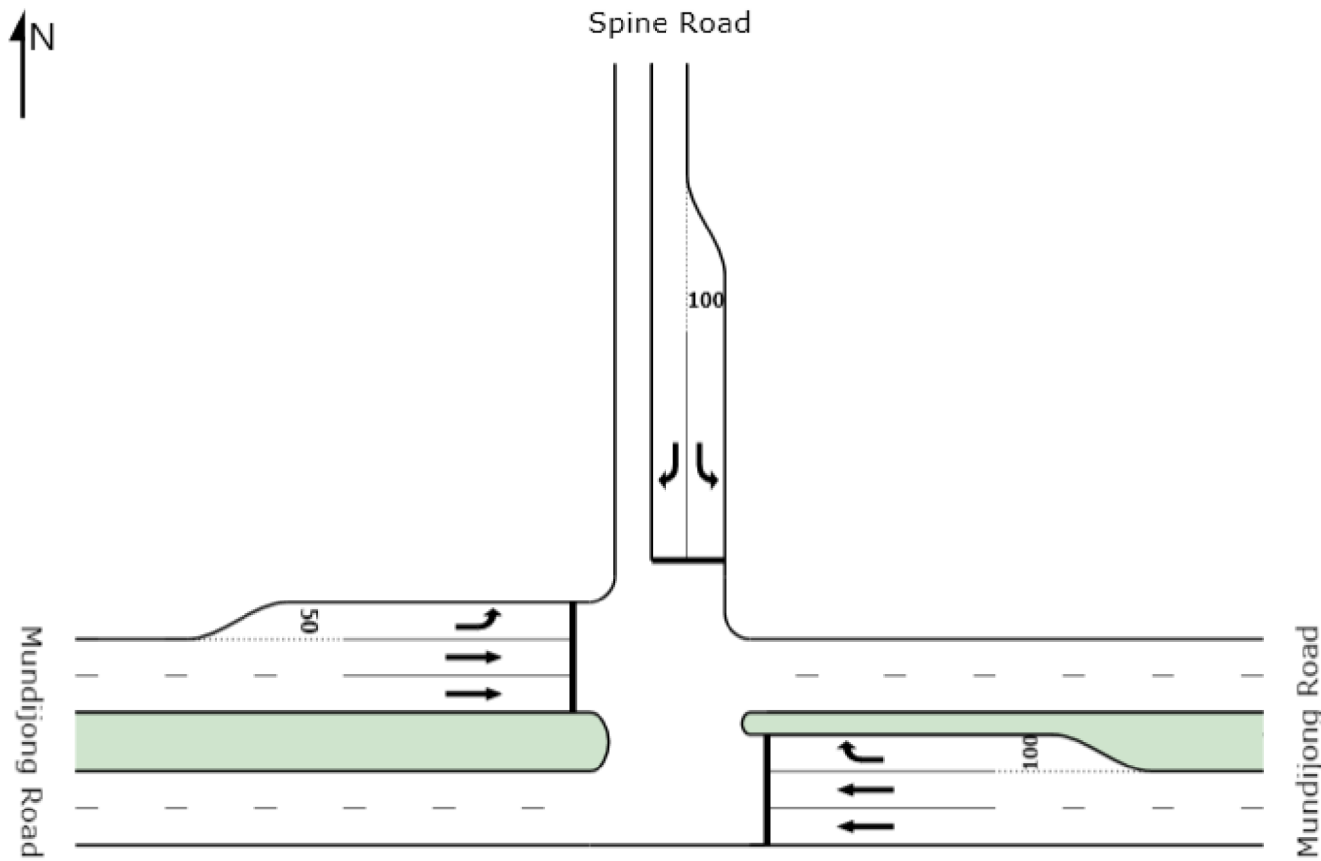
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Kargotich Road North

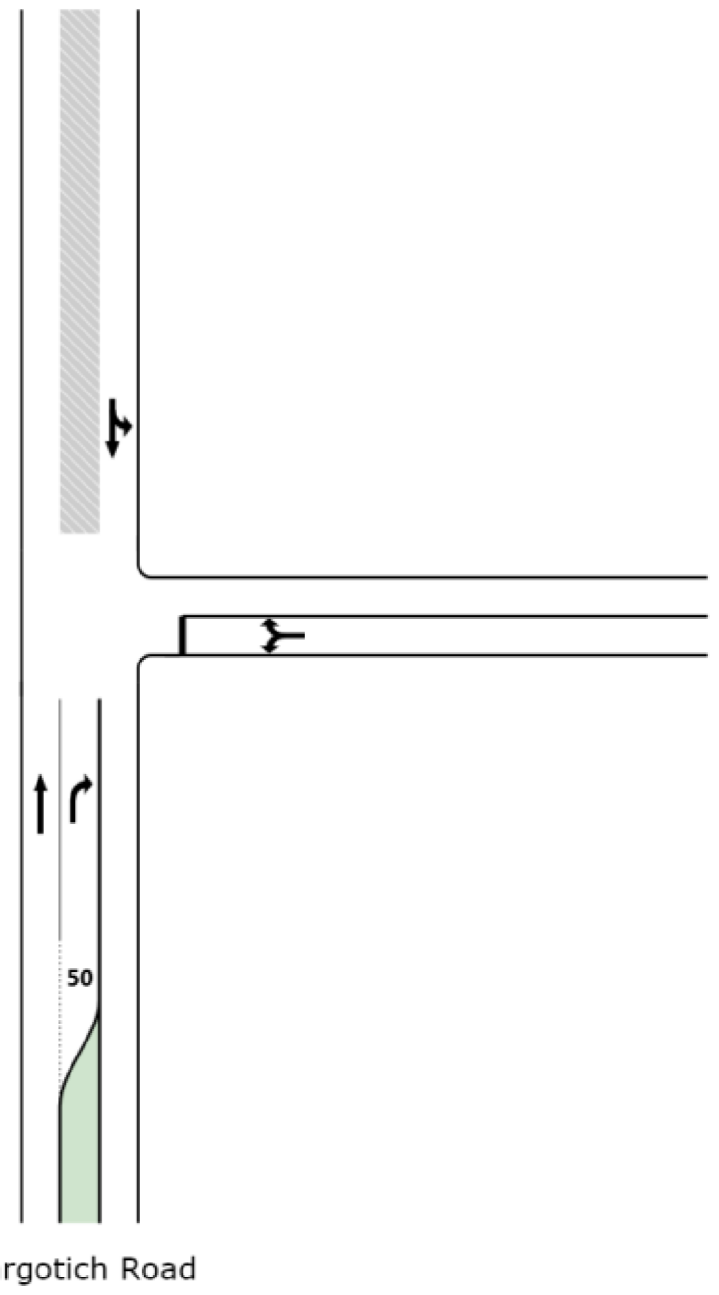


Mundijong Road



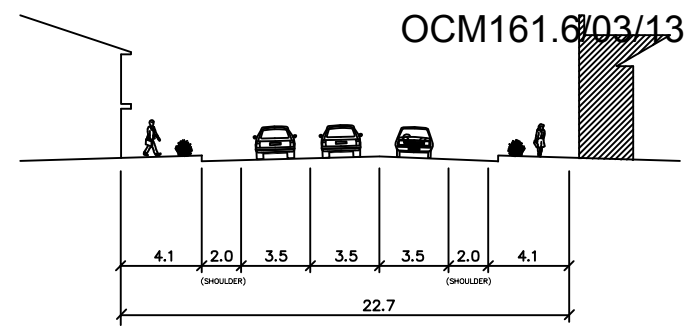


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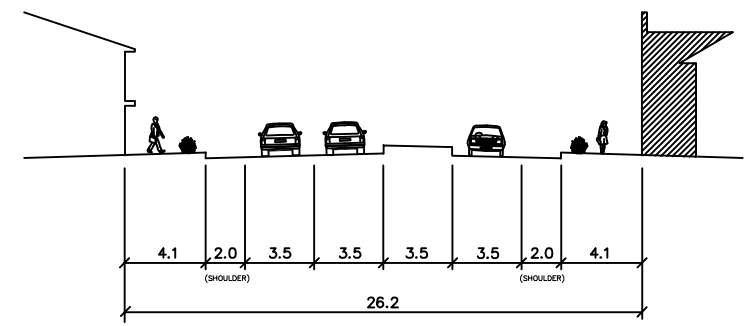


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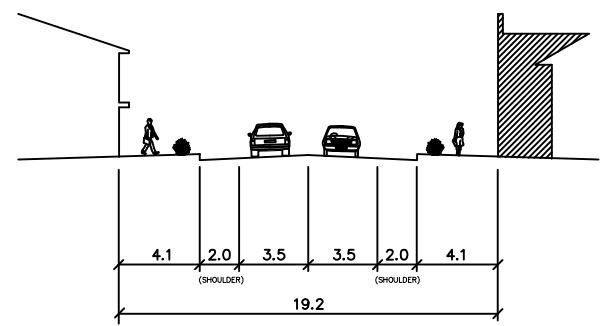
Spine Road



Kargotich Road South



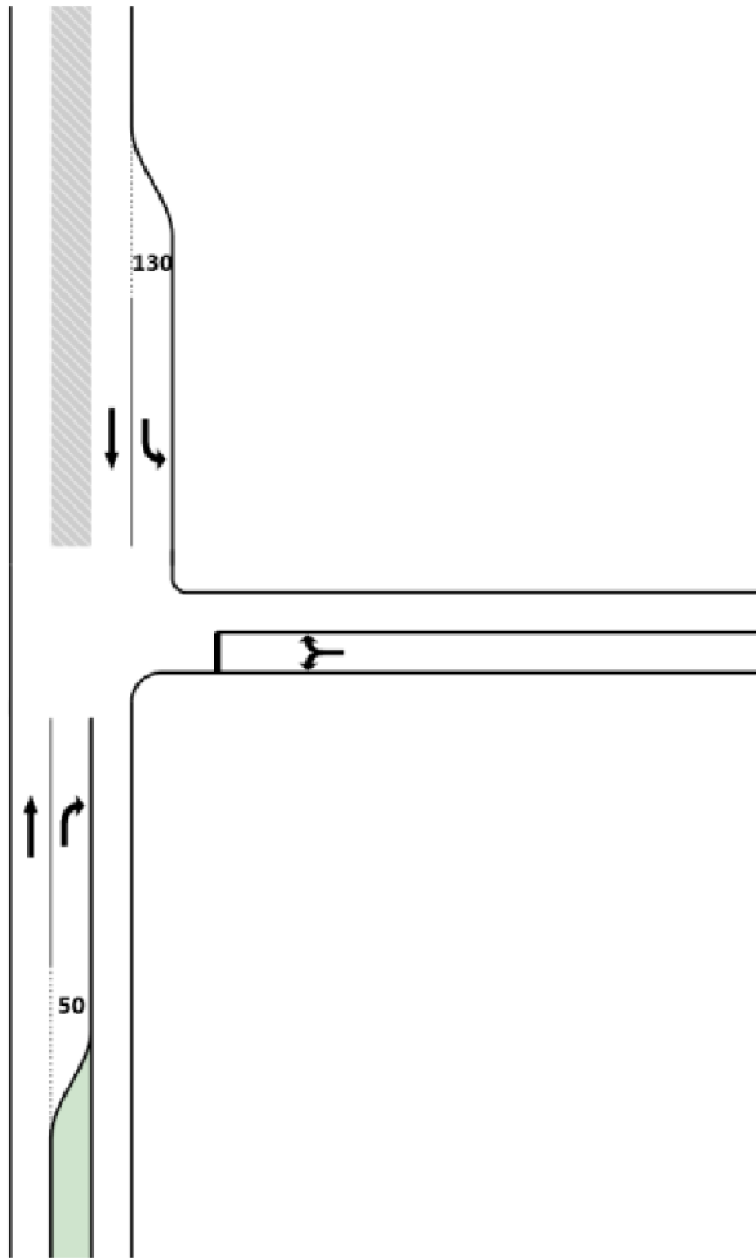
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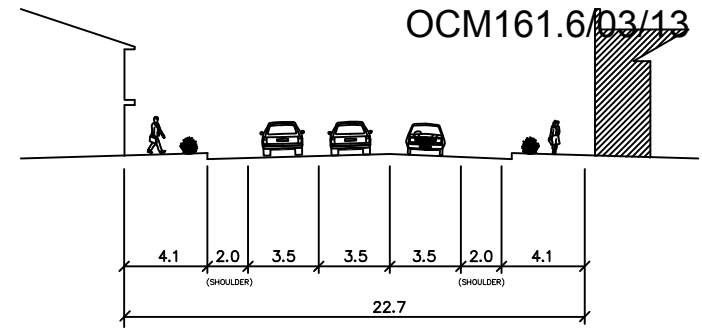
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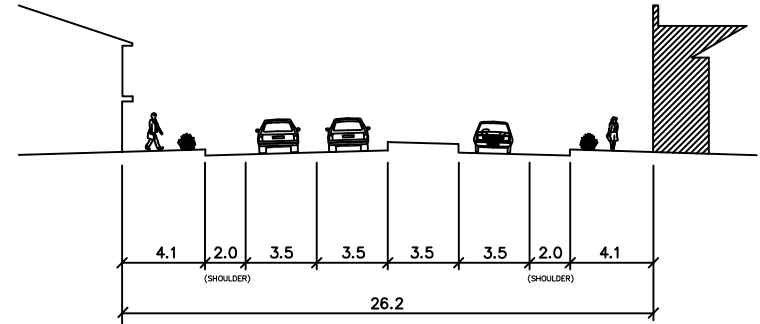
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Bishop Road

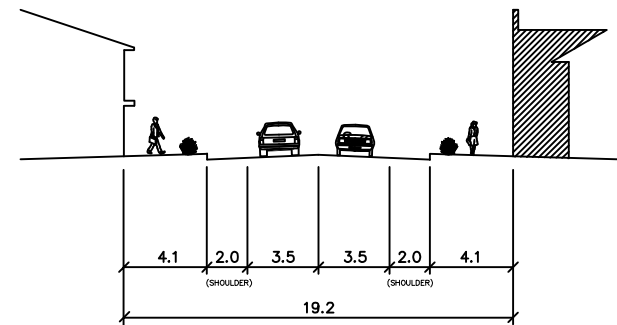
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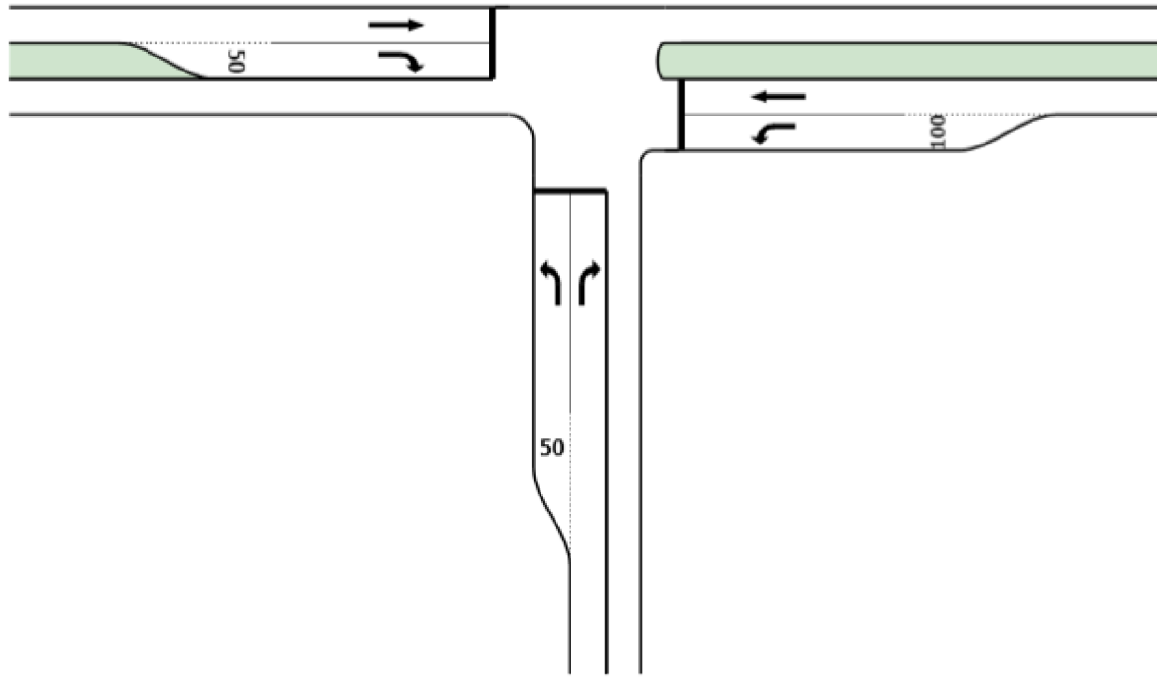
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Bishop Road

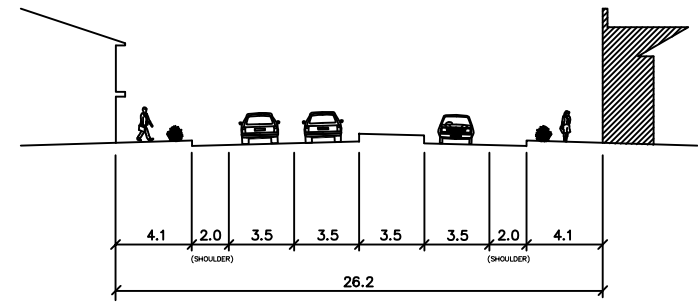


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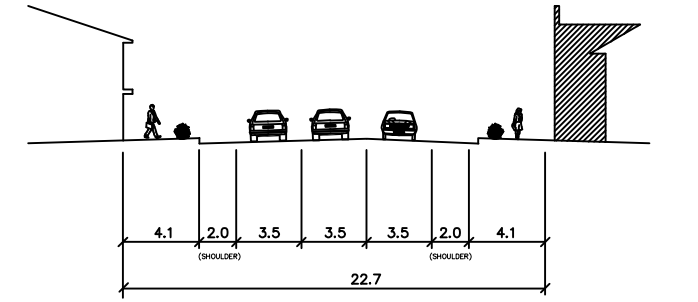


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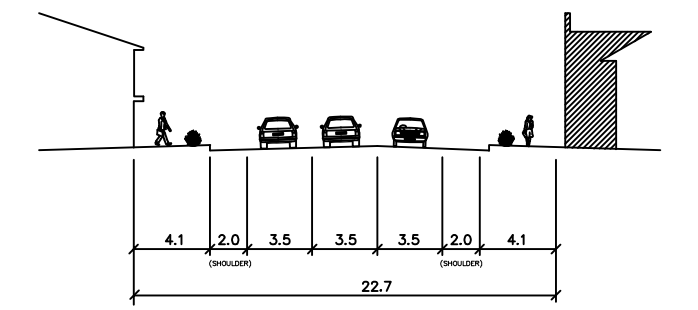
Bishop Road



Bishop Road East



Bishop Road West



Spine Road