ITEM 9.5.1
APPENDIX 3

SHAWMAC

CONSULTING CIVIL & TRAFFIC ENGINEERS, RISK MANAGERS.

Project:	Transport Assessment for the Proposed Daliak Development Outline Development Plan. V4
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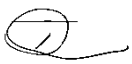
2	T Shaw	G Miles	23/01/13	Review		23/01/13
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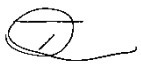
4	T Shaw	S Millen	10/07/15	Review		10/07/15

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Summary

Shawmac Pty Ltd was commissioned by York Farm Holdings to undertake an assessment of the transportation impacts associated with the preparation of an Outline Development Plan and future intended subdivision and development of an area of land in Daliak, York.

Key transport issues focus on the following:

- The capacity of the local road network to accommodate the additional traffic generated by the proposal;
- The extent to which the additional traffic generated can be safely managed on the adjacent current and future road network;
- The provision of safe access to the proposed subdivision from the adjacent road network;
- The safety and efficiency of the site's internal road network and in particular the extent that the site is able to safely and efficiently accommodate alternative and sustainable transport modes including pedestrians and cyclists.

Analysis shows that Great Southern Highway and Morris Edwards Drive are likely to be the major traffic carrying routes adjacent to the development. Trews Road will need to be treated to provide impediments to the free flow of traffic to ensure it remains consistent with its classification as an access road. With the exception of these roads and connectors within the subdivision all of the other streets are predicted to carry relatively low traffic volumes generally less than 1,000 vehicles per day.

The proposed road network is generally permeable and the design of the streets will reinforce distribution of traffic onto the higher hierarchy roads.

It is concluded that the proposed street network will provide an acceptable range of choices for travel and ensure that traffic volumes on individual streets can be kept below threshold levels to ensure the amenity of the area is preserved and safe movement options exist for pedestrians, cyclists and local traffic.

2 Introduction and Background

York Farm Holdings has prepared an Outline Development Plan (ODP) of the Morris Edward Drive and Road Residential/Commercial development, known as the Daliak subdivision which is situated on the south west boundary of the York townsite within the municipality of the Shire of York (Shire). As part of the preparation of the ODP, the planners for the project (Whelans) commissioned Shawmac to prepare a Transport Assessment for the site.

The intent of this transport assessment is to clearly demonstrate to the approving authority that the subdivision would:

- provide safe and efficient access for all modes;
- be well integrated with the surrounding land uses;
- not adversely impact on the surrounding area; and
- not adversely impact on the surrounding transport networks and the users of those networks.

This version of the Transport Assessment has been prepared following review by the Shire of York and incorporates their comments.

2.1 Proposed Outline Development Plan

The Outline Development Plan is located as shown on Figure 1.

Figure 1. Location.

The proposed outline development plan is shown on Figure 2.

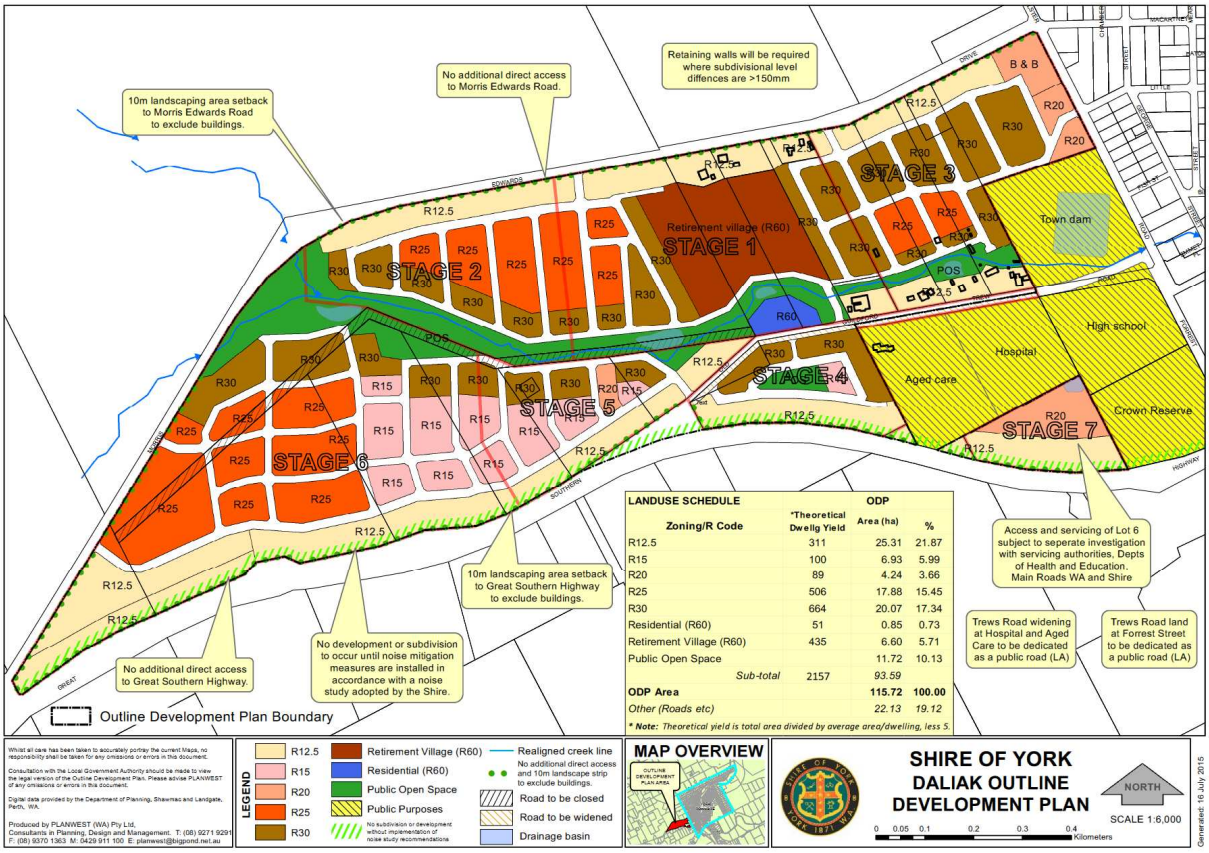


Figure 2. Proposed Outline Development Plan

Proposed land use has been estimated from the Outline Development Plan and is summarised in Table 1.

Land Use	Theoretical Lot Yield	Quantum
R12.5	311	25.31 Ha
R15	100	6.93 Ha
R20	136	4.24 Ha
R25	506	17.88 Ha
R30	664	20.07 Ha
Mixed Use R60	51	0.85 Ha
Retirement Village (R60)	435	6.60 Ha
Public Open Space		11.72 Ha
Total No of Lots	**2157**	**93.59 Ha**
Roads		22.13 Ha
ODP Area		115.72 Ha

Table 1. Proposed Land Use.

Existing uses include:

- Rural holdings;
- Scattered Residential;

- Wetland and drainage.

Changes of use includes:

- Residential lots;
- Homestead lots;
- Mixed Use lot;
- Retirement Village;
- TAFE and,
- Public Open Space.

The site comprises two sections; a small 8ha development area located to the south east of the main site (TAFE site) and the larger 111ha development area (main site) bounded by Morris Edwards Drive to the north, Great Southern Highway to the south and Ulster Road to the east. The land is principally agricultural land with a small number of properties along the southern boundary and in the centre of the northern boundary. Bed and breakfast accommodation is located in the north east corner and will remain after the redevelopment.

The TAFE site is bound by agricultural land to the north, Forrest Street to the east and Great Southern Highway to the south and west. This land is entirely agricultural land with no development.

2.2 Issues.

No Issues were identified.

2.3 Subdivision proposal

2.3.1 Regional context

The site is currently zoned "Development" and Lots 1,2,52 and 102 as “Public Purpose” under the Town Planning Scheme (TPS) No. 2 (Shire of York, 2010).

2.3.2 Proposed land uses

Land Use	R12.5	R15	R20	R25	R30	R60	RV (R60)
Area (ha)	25.31	6.93	4.24	17.88	20.07	0.85	6.60
Dwellings	311	100	136	506	664	51	435

Table 2. Proposed Land Use.

The quantum of each land use type is estimated from respective areas and is summarised on Table 2.

3 Existing situation

3.1 Land Use

Current land use of the study area is outlined in Section 2. Land use adjacent to the site is consistent with the zoning under TPS 2 part of which is shown on Figure 3.

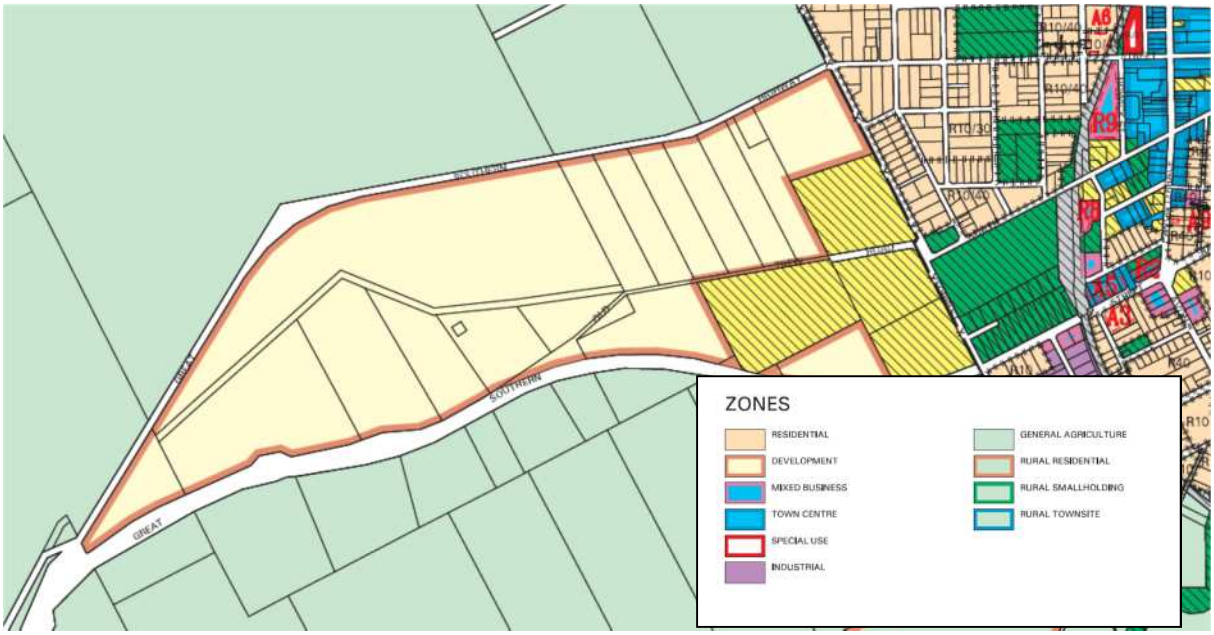


Figure 3. Site Zoning under TPS 2

3.2 Existing Road Network

Great Southern Highway (Chidlow York Road) forms the southern boundary to the site and provides the main connection between the Perth metropolitan area and the south eastern Wheatbelt (including York). It is an alternative to the Great Eastern Highway for eastbound high and wide loads and carries grain, fertiliser, general freight, commuter and tourist traffic. Great Southern Highway forms part of the MRWA RAV network being a network 4 road. This means that permit vehicles up to 27.5 metres long can use the road.

Within the study area, the Chidlow York Road provides the western access to the York town site, becoming Henrietta Street, crossing the rail line and then terminating at Avon Terrace.

Prior to 1980 the main western access from Chidlow into York was via Morris Edwards Drive, which forms the northern boundary to the site, and Macartney Street.

The eastern boundary of the site is formed by Ulster Road. Within the site Trews Road provides a connection between Ulster Road and Great Southern Highway and provides access to the York Hospital and other existing properties.

There are no bus services within walking distance of the site and cycle and pedestrian facilities are not provided.

Road infrastructure adjoining the site is shown on Table 3.

Road	Carriageways	Paths	Zoned speed limit	Intersection details
Great Southern Highway	Unkerbed single carriageway – State road – Control of Access Road 2 X 3.5 m lanes.	None	110 – 90 - 60 km/h	Unchannelised 4 way intersection at Forrest Street.
Morris Edwards Drive	Unkerbed single carriageway 1 X 6.5m carriageway	None	90 – 60 - 50 km/h	Unchannelised four way intersection at Ulster Road. Partly channelised three way intersection at Great Southern Highway.
Trews Road	Unkerbed single carriageway 1 X 7.45 m carriageway. Reducing to 1 X 6.0 m carriageway.	Partial path on south side west of Ulster Road	50 km/h	Unchannelised three way intersection at Ulster Road. Unchannelised three way intersection at Great Southern Highway.

Table 3. Existing Network.

Figure 4. Morris Edwards Drive looking towards Ulster Road

Figure 5. Morris Edwards Drive looking towards Great Southern Highway

Figure 6. Great Southern Highway looking towards Morris Edwards Drive

Figure 7. Great Southern Highway looking towards Trews Road.

Figure 8. Great Southern Highway looking towards Forrest Street.

Figure 9. Trews Road looking towards Forrest Street.

3.3 Crash History.

A review of the MRWA crash history for the 5 years ended 31 December 2014, indicates the following for intersections adjacent to and likely to be affected by the development.

Intersection of Forrest Street and Great Southern Highway: 2 right angle crashes.

Intersection of Forrest Street and Barker Street: no recorded crashes.

Intersection of Ulster Road and South Street: no recorded crashes;

Intersection of Ulster Road and Trews Road: no recorded crashes;

Intersection of Ulster Road and Morris Edward Drive: 1 right angle crash;

Intersection of Trews Court and Trews Street: no recorded crashes;

Intersection of Great Southern Highway and Trews Street: no recorded crashes;

Intersection of Great Southern Highway and Morris Edward Drive: no recorded crashes;

Morris Edward Drive: 1 crash – type hit object;

Crash patterns do not indicate any atypical trends and the additional traffic generated from the development is not considered to adversely impact on crash potential at any of the existing intersections.

4 Proposed internal transport networks

Figure 10 below indicates proposed internal transport routes and has been developed from predicted flows.

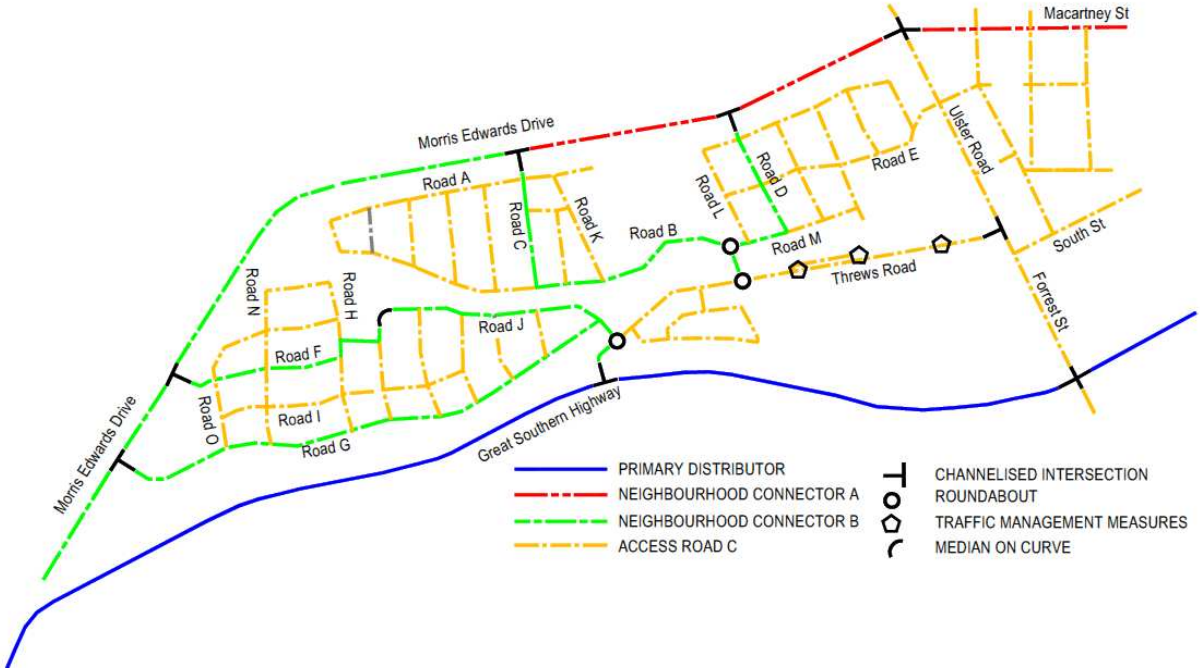


Figure 10. Proposed Infrastructure.

5 Changes to external transport networks

There are no known changes to the external road network in the immediate vicinity of the site.

Future changes within the immediate region include the construction of a heavy haulage bypass from Great Southern Highway to loop around Blandstown to the east.

6 Integration with surrounding area

6.1 Major attractors and generators

Major attractors and generators are shown on Figure 11.

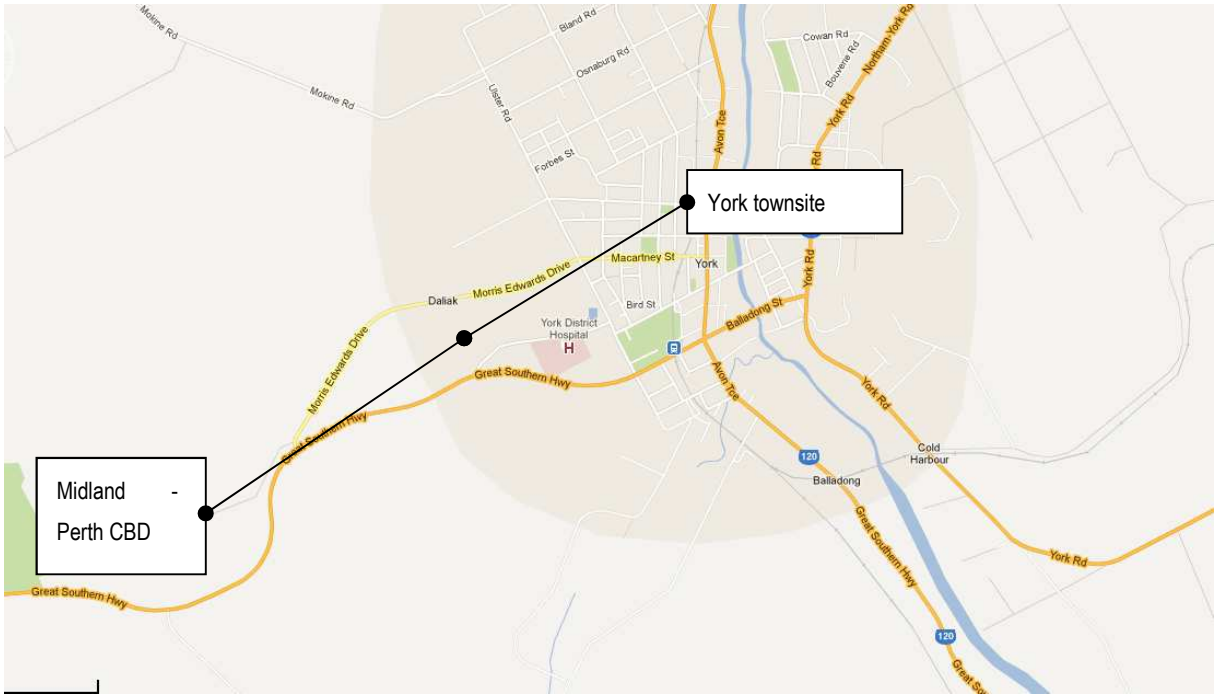


Figure 11. Attractors and Generators

Key attractors are likely to be:

- York Townsite;
- Midland;
- Perth CBD;
- Northam;
- Community and recreational facilities.

6.2 Main desire lines

Main desire lines are identified in section 6.1 with an assumed split shown on Figure 12.

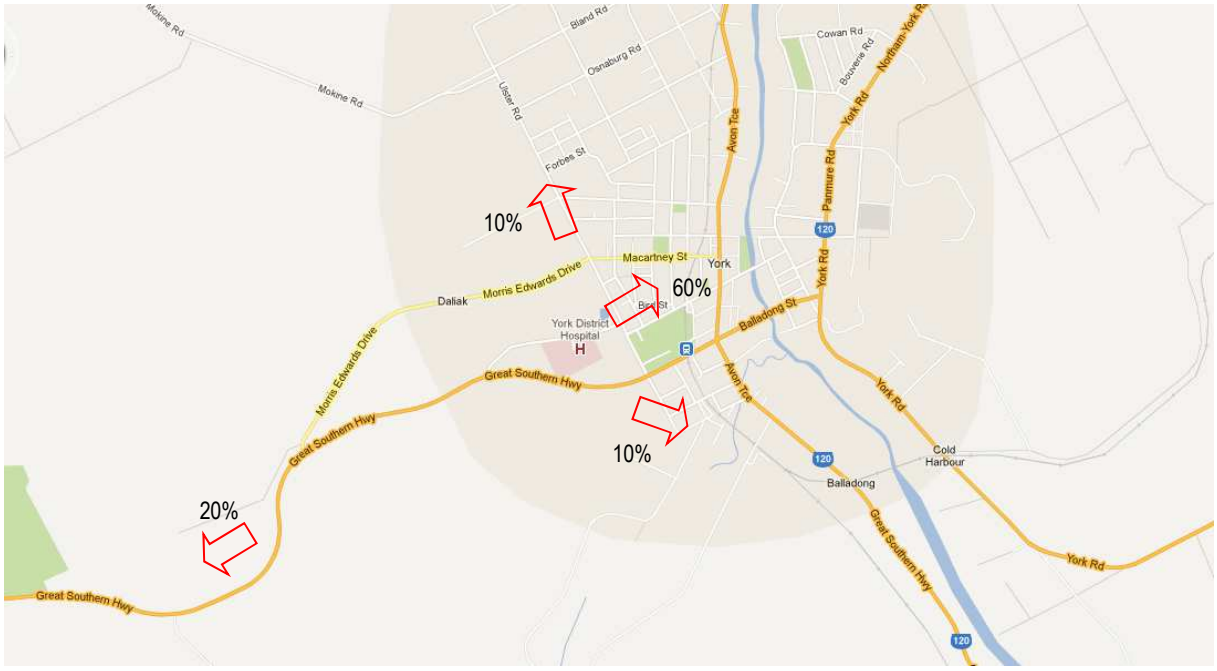


Figure 12. Assumed Traffic Split.

6.3 Gap analysis.

Assessment was carried out to determine whether or not the existing transport networks, plus any proposed changes, would adequately match predicted desire lines, particularly for pedestrians, cyclists and public transport. Identified deficiencies included lack of dedicated pedestrian facilities, lack of dedicated cyclist facilities, lack of public transport and substandard existing road widths.

7 Analysis of transport networks

7.1 Introduction

Section 2 of the assessment provides a description and an inventory of the proposal and surrounding area with respect to land uses and transport networks. The following sections provide a more detailed quantitative analysis of the proposed internal and external transport networks to demonstrate that they will provide a high level of accessibility and safety for all modes.

7.2 Assessment years

Assessment is based on the full development of the site and is taken as being 2027.

7.3 Time periods for assessment

The assessment is based on analysis of the following peaks:

PM peak period(s) on the surrounding road network;

PM peak period(s) for the site.

8 Analysis of internal transport networks

8.1 Subdivision generated traffic

Vehicle trip generation rates are based on the following recognised land use traffic generation databases:

- Land Use Traffic Generation Guidelines, March 1987 - Director General of Transport, South Australia;
- Guide to Traffic Generating Developments Version 2.2, October 2002 – Roads and Traffic Authority, New South Wales; and
- Trip Generation 7th edition, 2003 - Institute of Transportation Engineers, Washington, USA.

Assessed generation is shown on Table 4 based on Traffic Assessment Zones (TAZ's) shown on Figure 13.

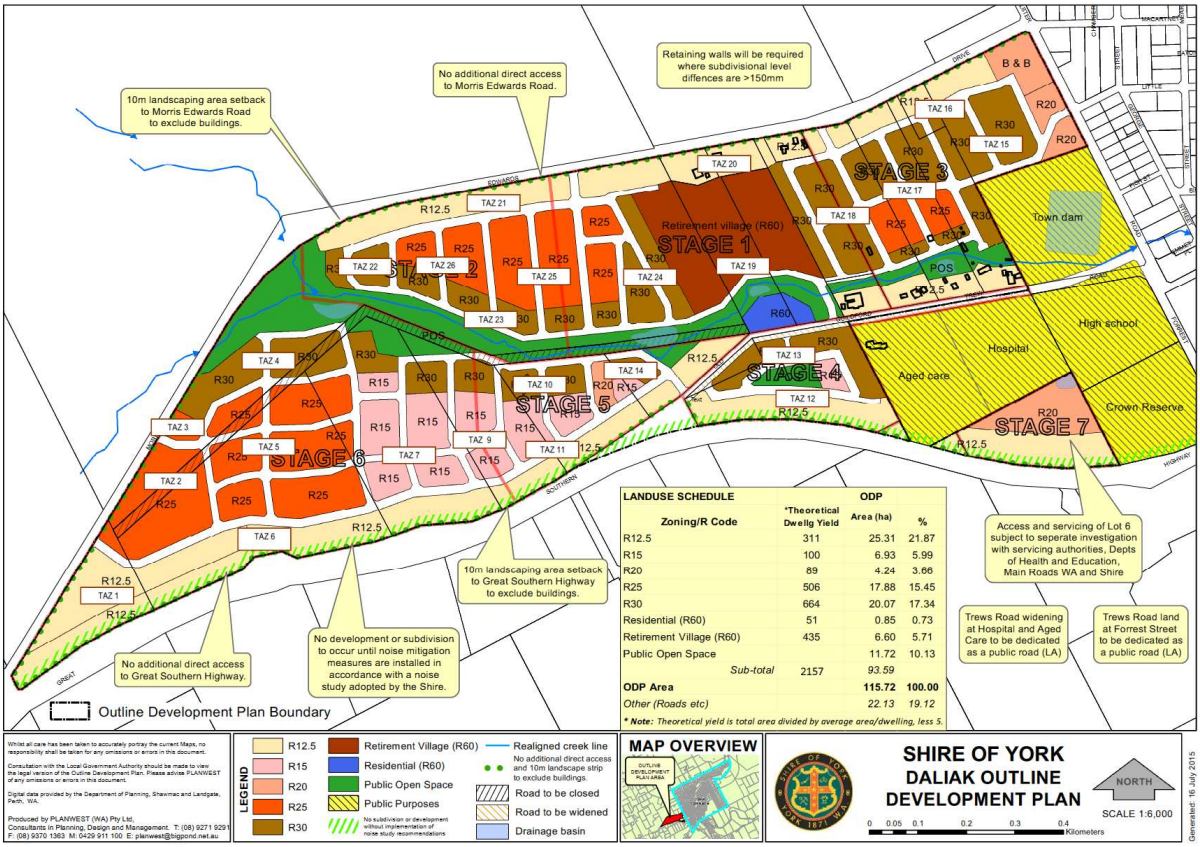


Figure 13. TAZ's

Note that the peak hour volumes for the High School will occur at different times to peaks generated by other land uses, particularly in the afternoon. However the assessment has been made on a conservative basis with afternoon peaks assumed to occur simultaneously.

Land use	Area (ha)	Dwellings	Trip rate(trips per dwelling)	Trips (vehicles per day)
R12.5	25.31 Ha	311	8	2,488
R15	6.93 Ha	100	8	800
R20	4.24 Ha	136	8	1,088
R25	17.88 Ha	506	8	4,048
R30	20.07 Ha	664	8	5,312
Mixed Use R60	0.85 Ha	51	8	408
Retirement Village (R60)	6.60 Ha			396
Hospital				500
High school				500
Total				15,540

Table 4. Estimated Daily Traffic

Using the QRS II software, flows were assigned to the network as shown on Figure 14.

Figure 14. Subdivision Generated Traffic.

8.2 Non subdivision traffic

Given the nature of the existing site and poor connectivity, non subdivision traffic is expected to be light. Great Southern Highway records daily volumes of about 1,700 vehicles per day; no traffic count information is available for Morris Edwards Drive adjacent to study site but existing traffic flows are expected to be low and in the order of 300 to 500 vpd.

Volumes on Trews Road and Ulster Road are similarly expected to be in the order of 1,200 to 1,500 vpd.

Lot 6 which is shown to the southeast of the site with frontage to Great Southern Highway does not form part of this consideration. Nonetheless should it develop as R15 lots, it is estimated that an additional 400 to 500 vehicle trips per day would be generated. These would most likely access lot 6 via a connection onto Forrest Street, potentially increasing the traffic flow on Forrest Street by up to 500 vpd, increasing the total predicted daily flow from 3,980 vpd to 4,480 vpd. This is within the capacity of the existing road and is unlikely to measurable impact on the performance of adjacent intersections which are predicted to have between 40% and 60% spare capacity.

8.3 Design traffic flows

Design traffic flows have been estimated by adding non subdivisional traffic to the subdivision generated traffic and the results are shown on Figure 15. Non subdivision traffic has been factored by an annual growth rate of 1% through to the assessment year (2020).

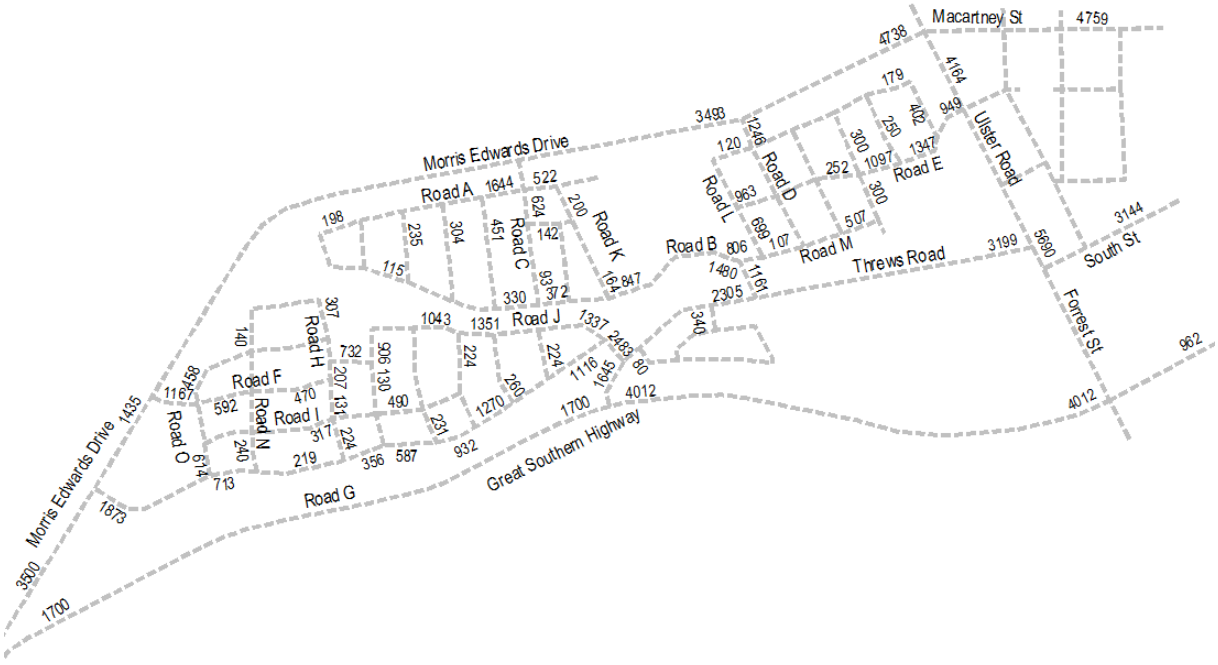


Figure 15. Design Traffic Flows

8.4 Roads and intersections

8.4.1 Mid Block Cross Sections

Where volumes are not shown on roads in Figure 15, they are predicted to be less than 1,000 vehicles per day. Requirements for road cross sections have been based on recommendations contained within Liveable Neighborhoods and the Austroads Guide to Traffic Engineering Practice which requires the following:

Indicative volume.	Route type / name.	Indicative Reserve Width.	Indicative Carriageway Width.
50,000.	Primary Distributor.		Determined by Main Roads WA
35,000.	Primary Distributor.		Determined by Main Roads WA
15,000 to 35,000.	Integrator Arterial A (District Distributor A).	50.6 – 52.6 metres.	2 X 8.2 metre carriageways including bike lane and 2 X 5.5 metre service roads containing parking.
<25,000	Integrator Arterial A (District Distributor A).	35.6 metres.	2 X 10.7 metre carriageways including combined on street parking and bike lane.
7,000 to 15,000.	Integrator Arterial B (District Distributor B).	29.2 metres.	2 X 7.5 metre carriageways with on street parking and bike lane.
15,000.	Integrator Arterial B (District Distributor B).	25.2 metres.	2 X 7.5 metre carriageways with on street parking.
7,000.	Neighborhood Connector A.	24.4 metres	2 X 7.1 metres including parking, on street bike lane, median plus shared path on one verge.
3,000.	Neighborhood Connector B.	19.4 metres	11.2 metres including parking plus shared path on one verge.
3,000.	Access Street A (Avenue).	20 - 24 metres.	2 x 3.5 metre lanes plus indented parking.

Indicative volume.	Route type / name.	Indicative Reserve Width.	Indicative Carriageway Width.
3,000.	Access Street B (Wider street).	16.5 - 18 metres.	9.7 metre lane.
3,000.	Access Street C (Yield or give way street).	15.4 - 16 metres.	7.2 (7.0 – 7.5) metre lane.
1,000.	Access Street D (Narrow yield or give way street).	14.2 metres.	5.5 – 6.0 metre lane.
150	Access Street D (Narrow yield or give way street).	14.2 metres.	3.5 metre lane plus parking indents.
3,000.	Access Street D (Wider street).	16.5 - 18 metres.	9.7 metre lane.

Table 5. Road Hierarchy Criteria.

Based on these criteria, road requirements are as shown on Table 6. Note the cross sections have been modified from the indicative widths shown on Table 5; however the capacity and provision for parking has been maintained consistent with the intent of the Liveable Neighbourhoods Criteria.

Road[1]	Predicted Volume (vpd).	Reserve Requirement.	Carriageway Requirement.
Morris Edwards Drive east of Road C	Up to 4,085	Neighborhood Connector A. 20.0m	2 X 3.5 metres plus shared path on one verge.
Morris Edwards Drive west of Road C	Up to 2,840	Neighborhood Connector B. 20.0m	2 X 3.5 metres.
Trews Road	Up to 3,200	Access Street C (Yield or give way street). 16.0m.	5.5 – 6.0 metre lane plus shared path on one verge.
Ulster Road / Forrest Street[2]	Up to 4,500	Neighborhood Connector A. 24.4 metres	2 X 7.1 metres including parking, on street bike lane, median plus shared path on one verge.
Road B east of Road C	Up to 1,700	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
Road B east of Road C	Up to 1,500	Neighborhood Connector B. 18.0m	7.4 metres including parking plus footpath on one verge.
Road C	Up to 624	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
Road D	Up to 1,246	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.

[1] Road designations as shown on figure 10.

[2] The existing reserve width in Ulster Road and Forrest Road is set at 20 metres and is considered to be satisfactory. The existing pavement width provides two through carriageways and midblock capacity is placed at 15,500 vpd. There are no warrants for embayed parking and the existing carriageway and reserve are considered to be adequate.

Road[1]	Predicted Volume (vpd).	Reserve Requirement.	Carriageway Requirement.
Road F	Up to 600	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
Road G	Up to 1,870	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
Road J north of Road G	Up to 1,350	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
Road J south of Road G	Up to 2,483	Neighborhood Connector B. 18.0m	10.0 metres including parking plus shared path on one verge.
Road M west of Road D	Up to 510	Neighborhood Connector B. 18.0m	7.4 metres including parking plus shared path on one verge.
All other roads	Varies	Access Street C (Yield or give way street). 16.0m.	5.5 – 6.0 metre lane plus footpath on one verge.

Table 6. Road Cross Sections.

Notwithstanding the above, with respect to Trews Road, there is a road reserve widening requirement which needs to be incorporated into staging considerations. Should the staging result in the lots along Trews Road being developed first, widening of the reserve and constructing Trews Road will need to occur as part of that subdivision. A review of the stage 1 to 3 development and its traffic generation potential confirms that the traffic is of a small enough magnitude so that it can be acceptably accommodated on Morris Edwards Drive. As such there is unlikely to be a need to connect stages 1 to 3 to Trews Road in the initial development stages. Notwithstanding this, if the detailed Transport Statement which is to be prepared as part of the subdivision application indicates a need, then the connection together with the widening and upgrading of Trews Road will need to occur.

Additionally, given the adjacent land use on Trews Road in the vicinity of the High School and Hospital, it is recommended that a separate parking and access study be undertaken to address site specific issues in this area. This should include consideration of all transport modes and desirably be undertaken as part of detailed considerations at the subdivision stage.

8.4.2 Intersections

Internal peak hour traffic volumes within the subdivision are generally small and as such negligible impacts are predicted. However as analysis warrants are met at a number of intersections and these were modelled using the SIDRA software. Turning movements were predicted from peak hour flows. The predictions also assume an even directional split for midblock flows.

Practical absorption capacity for the intersections were calculated from major flow and compared to predicted minor flow. Where capacity appeared to be adequate the intersections where modelled as unsignalised intersections.

Where shown on Figure 10, intersections will be designed as channelised intersections with central medians to

regulate turning movements and to provide an opportunity to double up on regulatory signage.

Warrants as shown in Table 8.1 of Austroads Guide to Engineering Practice Part 2, Roadway Capacity were applied to determine which intersections required capacity analysis. Peak hour traffic volumes were assumed to be approximately 10% of predicted daily traffic, and while peak traffic volumes are expected to exceed 10%, the peak period is expected to be longer than 1 hour in the morning and be spread over two distinct periods in the afternoon.

Intersection	Hourly volume major road	Hourly volume minor road	Comment.
Warrants as per Table 8.1 of Austroads Guide to Engineering Practice Part 2, Roadway Capacity - Two Lane Major Road Cross Road	400 vph 500 vph 650 vph	250 vph 200 vph 100 vph	Table details flows that initiate intersection analysis. As major flows increase, there is reduced capacity to accept minor flows.
Great Southern Highway – Morris Edwards Drive	299	170	3 way intersection – Analysis not required.
Road G – Morris Edwards Drive	187	112	3 way intersection – Analysis not required.
Road F – Morris Edwards Drive	117	112	3 way intersection – Analysis not required.
Road C – Morris Edwards Drive	284	62	3 way intersection – Analysis not required.
Road D – Morris Edwards Drive	284	124	3 way intersection – Analysis not required.
Ulster Road – Morris Edwards Drive	408	103	4 way intersection – Analysis required.
Ulster Road – Trews Road	400	320	3 way intersection – Analysis required.
Forrest Street – Great Southern Highway	400	143	4 way intersection – Analysis required.
Road B – Trews Road	230	116	3 way intersection – Analysis not required.
Road J – Trews Road	248	164	3 way intersection – Analysis not required.
Road J – Road G	134	112	3 way intersection – Analysis not required.
All others intersections	<100	<100	Analysis not required.

Table 7. Analysis Warrants

Initial advice from the Shire of York indicated a desire to restrict movements at the intersection of Trews Road and Great Southern Highway in order to down play the importance of Trews Road; however it may be considered desirable to maintain permeability by allowing all movements at the intersection and this should form part of detailed considerations at the subdivision stage.

8.4.3 Ulster Road – Morris Edwards Drive.

The Ulster Road – Morris Edwards Drive intersection was modelled as a four way intersection without auxiliary lanes and with Ulster Road as the priority road using the Sidra Intersection 5 software and predicted flows and gave the following results.

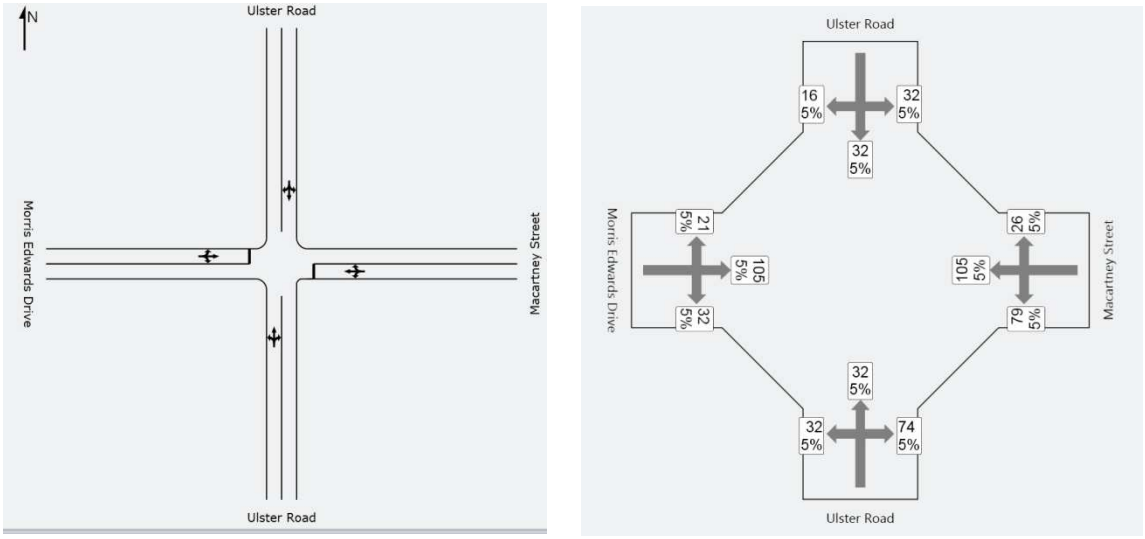


Figure 16. Modelled Geometry and Flows – Ulster Road – Morris Edwards Drive intersection.

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		Vehicles veh	Distance m		per veh	km/h
South: Morris Edwards Drive											
1	L	21	5.0	0.214	13.2	LOS B	1.0	7.0	0.33	0.79	44.8
2	T	105	5.0	0.214	12.8	LOS B	1.0	7.0	0.33	0.90	45.1
3	R	32	5.0	0.214	13.0	LOS B	1.0	7.0	0.33	1.00	45.0
Approach		158	5.0	0.214	12.9	LOS B	1.0	7.0	0.33	0.91	45.1
East: Ulster Road											
4	L	32	5.0	0.089	8.6	LOS A	0.4	3.1	0.18	0.58	48.3
5	T	32	5.0	0.089	0.2	LOS A	0.4	3.1	0.18	0.00	55.6
6	R	74	5.0	0.089	8.9	LOS A	0.4	3.1	0.18	0.71	48.1
Approach		137	5.0	0.089	6.8	NA	0.4	3.1	0.18	0.52	49.7
North: Macartney Street											
7	L	79	5.0	0.251	12.6	LOS B	1.2	8.4	0.24	0.85	45.2
8	T	105	5.0	0.251	12.2	LOS B	1.2	8.4	0.24	0.93	45.6
9	R	26	5.0	0.251	12.4	LOS B	1.2	8.4	0.24	1.00	45.4
Approach		211	5.0	0.251	12.4	LOS B	1.2	8.4	0.24	0.91	45.4
West: Ulster Road											
10	L	32	5.0	0.046	8.6	LOS A	0.2	1.7	0.20	0.62	48.4
11	T	32	5.0	0.046	0.2	LOS A	0.2	1.7	0.20	0.00	55.4
12	R	16	5.0	0.046	8.9	LOS A	0.2	1.7	0.20	0.75	48.3
Approach		79	5.0	0.046	5.3	NA	0.2	1.7	0.20	0.40	51.0
All Vehicles		584	5.0	0.251	10.3	NA	1.2	8.4	0.25	0.75	47.0

Figure 17. Modelled Performance– Ulster Road – Morris Edward Drive intersection

The intersection is predicted to perform satisfactorily as a channelised four way junction and on that basis a roundabout is not considered to be warranted. However, should the Shire of York consider it desirable to

provide a roundabout at this intersection it would operate at a similar level of service. Dependant on detailed design, this may require acquisition of some land.

8.4.4 Ulster Road – Trews Road.

The Ulster Road – Trews Road intersection was modelled as a "T" junction without auxiliary lanes to test its performance using the Sidra Intersection 5.1 software and predicted flow and gave the following results.

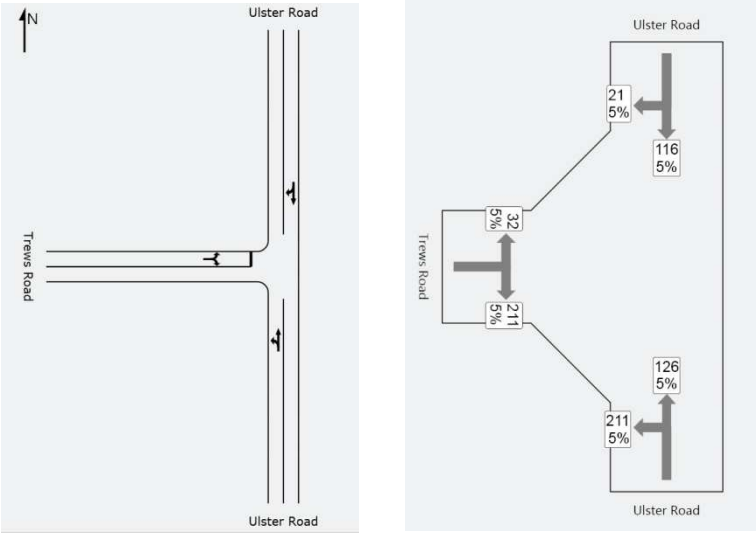


Figure 18. Modelled Geometry and Flows– Ulster Road – Trews Road intersection

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Trews Road											
1	L	32	5.0	0.451	17.8	LOS C	2.8	20.6	0.62	0.94	41.2
3	R	211	5.0	0.451	17.6	LOS C	2.8	20.6	0.62	1.09	41.4
Approach		242	5.0	0.451	17.7	LOS C	2.8	20.6	0.62	1.07	41.4
East: Ulster Road											
4	L	211	5.0	0.184	8.4	LOS A	0.0	0.0	0.00	0.78	49.0
5	T	126	5.0	0.184	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		337	5.0	0.184	5.2	NA	0.0	0.0	0.00	0.49	52.6
West: Ulster Road											
11	T	116	5.0	0.082	1.6	LOS A	0.5	3.9	0.45	0.00	51.8
12	R	21	5.0	0.082	10.3	LOS B	0.5	3.9	0.45	0.93	48.8
Approach		137	5.0	0.082	2.9	NA	0.5	3.9	0.45	0.14	51.3
All Vehicles		716	5.0	0.451	9.0	NA	2.8	20.6	0.30	0.62	48.0

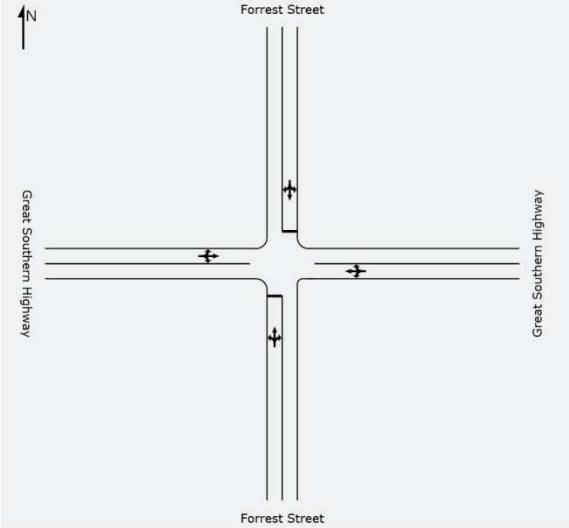
Figure 19. Modelled Performance – Ulster Road – Trews Road intersection

The intersection is predicted to perform satisfactorily.

Note that it is recommended that this intersection be channelised and the timing of the works would need to occur as and when staging affected traffic flows on Trews Road.

8.4.5 Forrest Street – Great Southern Highway.

The Forrest Street – Great Southern highway intersection was modelled as a four way intersection without auxiliary lanes and with Great Southern Highway as the priority road using the Sidra Intersection 5 software and predicted flows and gave the following results.



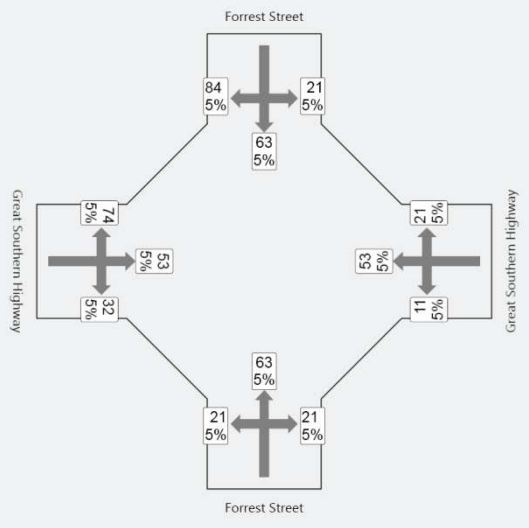


Figure 20. Modelled Geometry and Flows – Forrest Street – Great Southern Highway intersection

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Forrest Street											
4	L	21	5.0	0.089	11.8	LOS B	0.4	2.6	0.23	0.84	46.0
5	T	63	5.0	0.089	11.4	LOS B	0.4	2.6	0.23	0.91	46.4
6	R	21	5.0	0.089	11.6	LOS B	0.4	2.6	0.23	0.94	46.2
Approach		105	5.0	0.089	11.5	LOS B	0.4	2.6	0.23	0.90	46.3
East: Great Southern Highway											
7	L	11	5.0	0.062	9.7	LOS A	0.5	3.3	0.37	0.55	48.4
8	T	53	5.0	0.062	1.3	LOS A	0.5	3.3	0.37	0.00	52.5
9	R	21	5.0	0.062	10.0	LOS A	0.5	3.3	0.37	0.82	48.3
Approach		84	5.0	0.062	4.6	NA	0.5	3.3	0.37	0.27	50.9
North: Forrest Street											
10	L	21	5.0	0.141	11.8	LOS B	0.6	4.4	0.26	0.82	46.0
11	T	63	5.0	0.141	11.4	LOS B	0.6	4.4	0.26	0.87	46.4
12	R	84	5.0	0.141	11.6	LOS B	0.6	4.4	0.26	0.93	46.2
Approach		168	5.0	0.141	11.5	LOS B	0.6	4.4	0.26	0.89	46.3
West: Great Southern Highway											
1	L	74	5.0	0.108	9.1	LOS A	0.8	6.0	0.33	0.51	48.0
2	T	53	5.0	0.108	0.7	LOS A	0.8	6.0	0.33	0.00	52.7
3	R	32	5.0	0.108	9.4	LOS A	0.8	6.0	0.33	0.72	48.0
Approach		158	5.0	0.108	6.4	NA	0.8	6.0	0.33	0.38	49.5
All Vehicles		516	5.0	0.141	8.8	NA	0.8	6.0	0.29	0.64	47.9

Figure 21. Modelled Performance - Ulster Road – Great Southern Highway intersection

The intersection is predicted to perform satisfactorily.

Modelling confirms that with the development of Daliak and allowing for traffic growth, intersection modifications

are not likely to be required to accommodate flows. Notwithstanding this, channelisation of the intersection is recommended to address potential safety issues and to provide clearly defined intersection definition.

8.5 Great Southern Highway – Morris Edwards Drive.

The Morris Edwards Drive – Great Southern highway intersection was modelled as a three way intersection on its current configuration and with Great Southern Highway as the priority road using the Sidra Intersection 5 software and predicted flows and gave the following results.

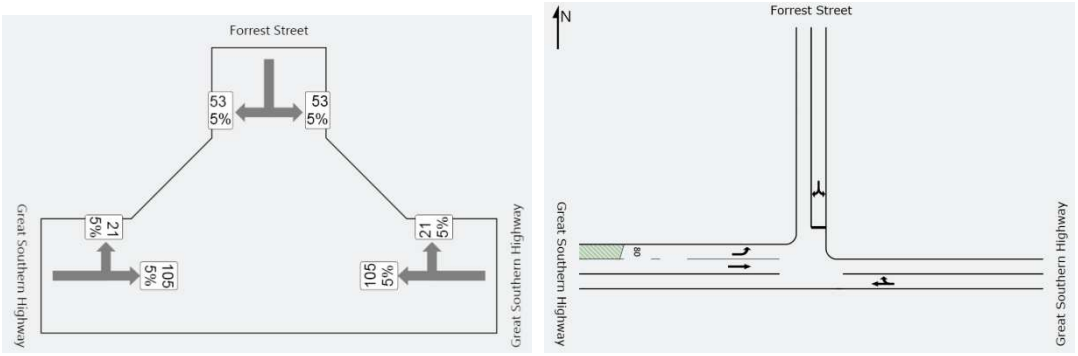


Figure 22. Modelled Geometry and Flows Morris Edwards Drive – Great Southern Highway intersection

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Great Southern Highway											
8	T	105	5.0	0.085	1.6	LOS A	0.7	5.2	0.40	0.00	52.6
9	R	21	5.0	0.085	10.2	LOS B	0.7	5.2	0.40	0.90	48.6
Approach		126	5.0	0.085	3.0	NA	0.7	5.2	0.40	0.15	51.9
North: Forrest Street											
10	L	53	5.0	0.086	11.6	LOS B	0.4	2.6	0.25	0.86	46.2
12	R	53	5.0	0.086	11.6	LOS B	0.4	2.6	0.25	0.91	46.3
Approach		105	5.0	0.086	11.6	LOS B	0.4	2.6	0.25	0.88	46.2
West: Great Southern Highway											
1	L	21	5.0	0.012	8.4	LOS A	0.0	0.0	0.00	0.67	49.0
2	T	105	5.0	0.056	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		126	5.0	0.056	1.4	NA	0.0	0.0	0.00	0.11	57.8
All Vehicles		358	5.0	0.086	5.0	NA	0.7	5.2	0.21	0.35	51.9

Figure 23. Modelled Performance – Morris Edwards Drive – Great Southern Highway intersection

The intersection is predicted to perform satisfactorily.

Modelling confirms that with the development of Daliak and allowing for traffic growth, intersection modifications are not likely to be required to accommodate flows. Notwithstanding this, modification of the intersection may be desirable to provide passing opportunities for through traffic potentially affected by traffic turning right from Great Southern Highway onto Morris Edwards Drive.

8.5.1 Staggered Intersections

Liveable Neighbourhoods recommends that staggered junctions should be spaced according to the following guidelines:

Access Roads	Left/Right stagger – 20 metre
	Right/Left stagger – 20 metres
Neighbourhood Connector	Left/Right stagger – 40 metres
	Right/Left stagger – 40 metres
Integrator B	Left/Right stagger – 60 metres
	Right/Left stagger – 40 metres

The ODP layout incorporates a number of staggered intersections on access roads which comply with the above mentioned guidelines.

8.5.2 Access to frontage properties

Liveable Neighbourhoods allows access from connector status roads and permits traffic to exit where flows are less than 5,000 vpd. As all predicted flows in the study area are less than 5,000 vpd, no control on vehicular access is required. Notwithstanding this, access is restricted from Great Southern Highway which is a designated control of access road and from Morris Edwards Drive.

8.6 Pedestrian / cycle networks

In keeping with the recommendations of Liveable Neighbourhoods it is recommended that the paths shown on Figure 22 be provided. It is also considered that path connections are necessary outside of the development area with external paths likely to be warranted as summarised below:

Ulster Road: Currently a path is provided on the eastern side between Macartney Road and Trews Road, south of Trews Road an additional path is provided on the west side to near South Street – this is likely to require upgrading and connection to the Daliak subdivision with formal crossing facilities at Macartney Street, Road E and Trews Road. A connection exists between the Ulster Road path and a path in South Street.

Forrest Street: there is no path provided in Forrest Street south of South Street and a new path is considered to be warranted.

Macartney Street: Currently pedestrians serviced by hardstand verge – formal facility considered desirable.

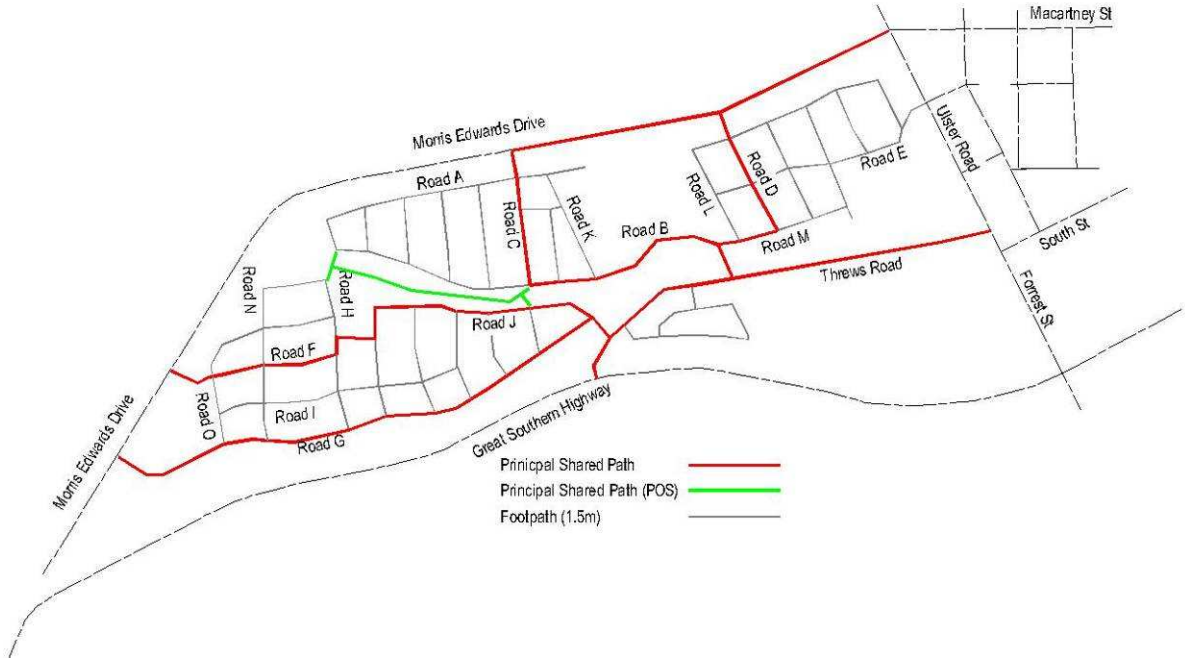


Figure 24. Proposed Path Network

8.7 Access to public transport

There is no planned access to public transport.

8.8 Speed Zoning.

Current speed zoning on adjacent roads is shown on Figure 23.

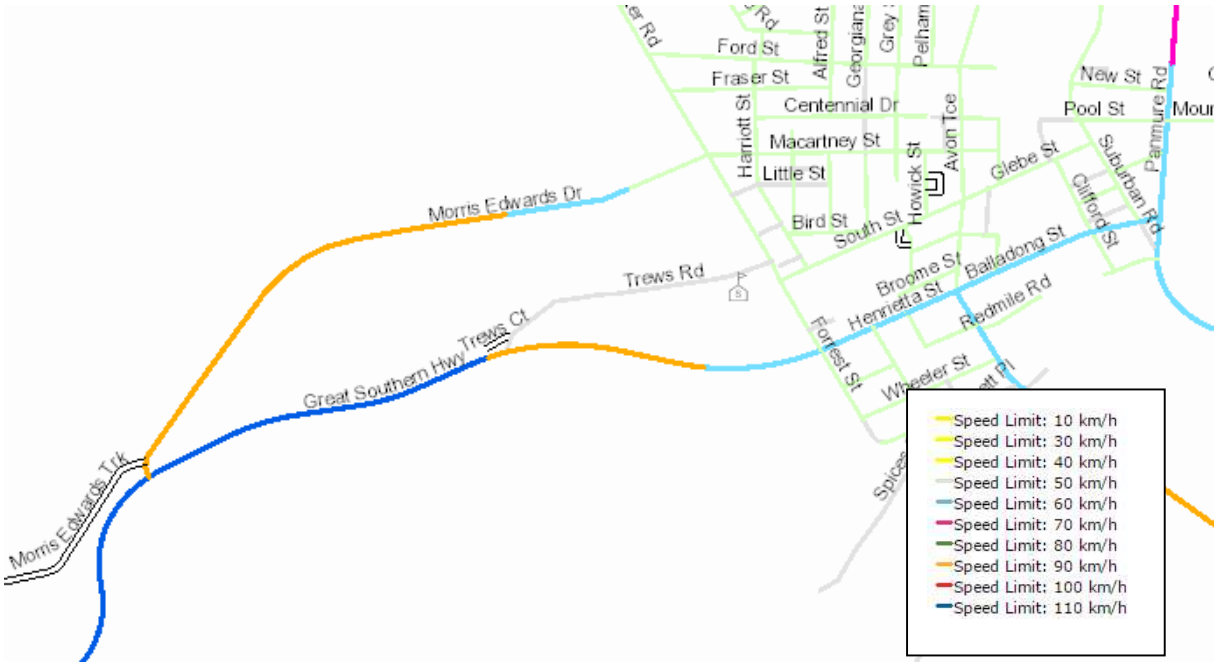


Figure 25. Current Speed Zoning

As part of the development of the site consideration should be given to the appropriate speed zonings to be applied. As a general rule it is considered that the following zonings are likely to be applicable, noting however the setting of speed zones is undertaken by MRWA.

All access roads: 50 km/h

Neighbourhood connectors: 60 km/h

With respect to Ulster Road and more importantly Morris Edwards Drive, the road environment may not be consistent with a lower speed zone and traffic management may be necessary to regulate the speed environment. This may include consideration of roundabouts at key intersections or lateral shift devices. The provision of traffic control devices should form part of detailed design considerations at the subdivision stage.

9 Analysis of external transport networks

9.1 Design traffic flows on external road network

Design traffic flows on the external network as affected by the proposal are covered in section 8.

9.2 Impact on external roads

The impacts of design traffic flows on the external network as affected by the proposal are covered in section 8.

9.3 Impact on external intersections

The impacts of design traffic flows on external intersections as affected by the proposal are covered in section 8.

9.4 Pedestrian / cycle networks

The impacts of design traffic flows on external pedestrian and cycle networks as affected by the proposal are covered in section 8.

10 Safety issues

A review of the overall transport proposals for the subdivision did not identify any specific issues that present unacceptable risks to the road user or that cannot be managed through appropriate design protocols.

Road hazards are typically present at intersections and may be manifest through inadequate sight distance, inappropriate geometry or substandard capacity that promotes undesirable and potentially hazardous movements.

For new roads, the allocation of adequate road reservation width and truncation of corners will allow sight distance requirements to be accommodated in the detailed design phase of the project. Geometric standards prescribed by Austroads and Main Roads WA guidelines will ensure that no unacceptable risk is introduced into

the road environment. Assessment of the operational performance of intersections undertaken in this study prescribes appropriate geometry and lane allocation to minimise delay and optimise performance.

Given the nature of the abutting land use on Trews Road and the desirability in ensuring that Trews Road functions as an access road with a low speed environment, it is considered desirable to install traffic management measures along Trews Road to deter traffic and to moderate speeds. Horizontal displacement devices such as Blister Islands would act as a deterrent to through traffic while enforcing restriction on the median speed along Trews Road. As there is likely to be a strong desire line along Trews Road between Ulster Road and Great Southern Highway, additional impediment to through traffic such as a "left in-left out" intersection configuration at the intersection of Trews Road and Great Southern Highway is recommended.

While treatment of the intersection of Great Southern Highway and Morris Edwards Drive is not indicated as being necessary on the basis of operational performance, the approach grade to the intersection on Morris Edwards Drive is steep and may impact adversely on the safe movement through the intersection. As such, some improvements may be warranted in terms of road user safety and as part of the Development Application process it is recommended that a formal Road Safety Audit be conducted to identify any deficiencies and recommend any desirable improvements.

Detailed design undertaken as part of the Development Application process would need to define at least the following elements:

- Road cross sections including lane widths, on-road parking requirements, on-road cycle lanes, path widths and provisions for people with disabilities;
- Intersection geometries;
- Pedestrian and cycle facilities (cross sections, crossing requirements and ramps).

11 Noise

Given the proximity of the southern side of the site to Great Southern Highway and the potential for noise impact from highway traffic, it is proposed to provide a vegetated buffer along the southern boundary to assist in reducing noise.

12 Conclusions

On the basis of the assessment undertaken, it is concluded that the proposed street network will provide an acceptable range of choices for travel and ensure that traffic volumes on individual streets can be kept below threshold levels to ensure the amenity of the area is preserved and safe movement options exist for pedestrians, cyclists and local traffic.

13 Appendix A Checklist

Item	Section	Comments/Proposals
Summary	1	
Introduction/Background	2	
name of applicant and consultant	2.1	
subdivision location and context	2.1	
brief description of subdivision	2.3	
key issues	2.2	
background information	3	
Subdivision proposal	2.3	
regional context	2.3.1	
proposed land uses	2.3.2	
table of land uses and quantities	2.3.2	
major attractors/generators	6.1	
any specific issues		
Existing situation	3	
existing land uses within structure plan	3.1	
existing land uses surrounding the subdivision	3.1	
existing road network within subdivision	3.2	
existing road network surrounding the subdivision	3.2	
traffic flows on roads within subdivision (AM and PM peak hours)	3.2	
traffic flows on roads surrounding the subdivision (AM and PM peak hours)	3.2	
existing pedestrian/cycle networks within the subdivision	3.2	
existing pedestrian/cycle networks surrounding the subdivision	3.3	
existing public transport services within the subdivision	3.3	
existing public transport services surrounding the subdivision	3.3	
Proposed internal transport networks	4	
changes/additions to existing road network	5	
road reservation widths	8.5.1	
road cross-sections & speed limits	8.5.2	
intersection controls	8.5.3 to 8.5.9	
pedestrian/cycle networks and crossing facilities	8.6	
public transport routes	8.7	
Changes to external transport networks	5	
road network	5	
intersection controls	5	
pedestrian/cycle networks and crossing facilities	5	
public transport services	5	

Item	Section	Comments/Proposals
Integration with surrounding area	6	
surrounding attractors/generators	6.1	
proposed changes to surrounding land uses	6.2	
travel desire lines from subdivision to these attractors/generators	6.3	
adequacy of existing transport networks	7	
deficiencies in existing transport networks	7	
remedial measures to address deficiencies	7	
Analysis of internal transport networks	8	
assessment years and time periods	8.1	
subdivision generated traffic	8.2	
extraneous (through) traffic	8.3	
design traffic flows	8.4	
road cross-sections	8.5	
intersection sight distances	8.5.3	
intersection operation and method of control	8.5.3	
frontage access strategy	8.5.9	
pedestrian / cycle networks	8.6	
safe walk/cycle to school		
pedestrian permeability & efficiency		
access to public transport	8.7	
Analysis of external transport networks	9	
base flows for assessment years	9	
total traffic flows	-	
road cross-sections	-	
intersection operation	-	
pedestrian/cycle networks	-	
Safety issues	-	
identify issues	-	
remedial measures	-	
Conclusions	-	

Proponent's name: York Farm Holdings Signature Date

Transport assessor's name: Tony Shaw Company: Shawmac Signature Date