TRAFFIC AND PARKING IMPACT ASSESSMENT
SENIORS LIVING DEVELOPMENT
120 WALKER STREET, HELENSBURGH

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Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

18633.01FA - 6th December 2018

Development Type: **Seniors Living Development**

Site Address: **120 Walker Street, Helensburgh**

Prepared for: **TCW Consulting Pty Ltd**

Document reference: **18633.01FA**

Status	Issue	Prepared By	Checked By	Date
Draft	A	CL	DF	28th November 2018
Final	A	DF	DF	6th December 2018

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1 INTRODUCTION

M^{C}Laren Traffic Engineering (MTE) was commissioned by *TCW Consulting Pty Ltd* to prepare a Traffic and Parking Impact Assessment of the proposed Seniors Living Development at 120 Walker Street, Helensburgh.

This traffic assessment will investigate future vehicular access to the site, public transport accessibility, car parking requirements and the ability of the surrounding road network to absorb future traffic flow growth associated with development on the subject site.

The site is located within the jurisdiction of Wollongong City Council and is subject to its planning controls.

1.1 Site Description

The subject site is located on the western side of Walker Street as shown in **Figures 1 & 2**. The existing site currently has a large horse ranch situated on the property with a range of stables, paddocks and three houses on the site. The site has two (2) vehicular access points with the main access being from Walker Street and a secondary access to the rear of the site from Frew Avenue.

1.2 Development Scale

The proposal provides the following scale relevant to traffic and parking impacts:

- Ten (10) two-bedroom villas for residents with dementia
- 43 two-bedroom villas for standard aged care
- 38 one-bedroom apartments for residents with dementia
- 85 one-bedroom apartments for standard aged care
- Medical Centre with two (2) rooms

1.3 State Environmental Planning Policy (Infrastructure) 2007

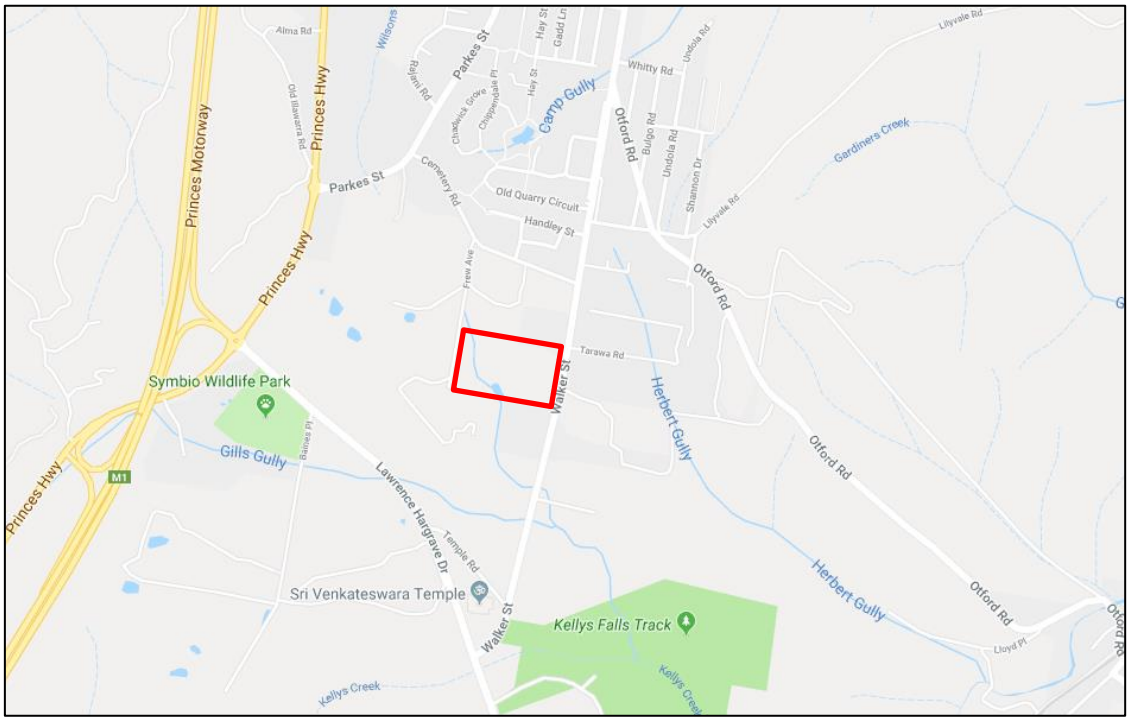
The proposed development does not qualify as a traffic generating development with relevant size and/or capacity under Clause 104 of SEPP (Infrastructure) 2007. Therefore, formal referral to the Roads & Maritime Services (RMS) is not required.

1.4 Site Context

The site location is shown on aerial imagery and a street map in **Figure 1** and **Figure 2** respectively.

Site Location

FIGURE 1: SITE CONTECT – AERIAL PHOTO



Site Location

FIGURE 2: SITE CONTECT – STREET MAP

2 EXISTING TRAFFIC AND PARKING CONDITIONS

2.1 Road Hierarchy

Walker Street has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 8m in width facilitating two traffic flow lanes (one in each direction);
- Signposted 70km/h speed limit;
- Informal shoulder parking permitted along the both sides of the road.

Temple Road has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 7m in width facilitating two traffic flow lanes (one in each direction);
- Signposted 50km/h speed limit;
- Informal shoulder parking permitted along the both sides of the road.

Cemetery Road has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 9m wide facilitating two traffic flow lanes (one in each direction) and kerbside parking along the northern side of the road;
- Signposted 50km/h speed limit.
- Unrestricted kerbside parking permitted on the northern side of the road and informal shoulder parking permitted along the southern side of the road.

2.2 Existing Traffic Management

- GIVE WAY sign controlled intersection of Cemetery Road / Walker Street;
- STOP sign controlled intersection of Walker Street / Temple Road.

2.3 Existing Traffic Environment

Traffic counts were completed at the intersections of Walker Street / Cemetery Road and Walker Street / Temple Road on Thursday 25th October between the hours of 7:00am-9:00am and 4:00pm-7:00pm, representing a typical weekday. The results of these surveys are shown in **Annexure B** for reference.

2.3.1 Intersection Performances

Existing intersection performances have been assessed using SIDRA INTERSECTION 8.0. The results of the analysis are summarised in **Table 1** below.

TABLE 1: EXISTING INTERSECTION PERFORMANCES (SIDRA INTERSECTION 8.0)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/veh)	Level of Service(3)	Control Type	Worst Movement	95th Percentile Queue
EXISTING PERFORMANCE							
Walker St / Cemetery Rd	AM	0.10	2.4 (Worst: 5.5)	**NA** (Worst: A)	Give Way	RT from Cemetery Road	0.5 veh (3.2m) Walker Street
	PM	0.09	1.9 (Worst: 5.5)	**NA** (Worst: A)		RT from Cemetery Road	0.3 veh (1.8m) Walker Street
Walker St / Temple Rd	AM	0.05	0.9 (Worst: 8.3)	**NA** (Worst: A)	Stop	LT from Temple Road	0.1 veh (0.5m) Walker Street
	PM	0.07	0.6 (Worst: 7.7)	**NA** (Worst: A)		LT from Temple Road	0.1 veh (0.5m) Walker Street

NOTES:
(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.
(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.
(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.
(4) 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.

As shown, the two relevant intersections are currently performing at a high level of efficiency, both with a level of service “A” conditions for all movements in both the AM & PM peak hours. The level of service “A” performance is characterised by low approach delays and spare capacity. Further analysis of the intersections has been undertaken in **Section 4**.

2.4 Public Transport

Bus route 15 runs along Walker Street and between Helensburgh Train Station and Stanwell Park Train Station. The nearest bus stops are located on either side of Walker Street near the northern site boundary.

The site is not located close to any railway services; however, Bus Route 15 provides a connection to Helensburgh and Stanwell Park Stations. The location of the site relative to nearby public transport infrastructure is shown in **Figure 3**.

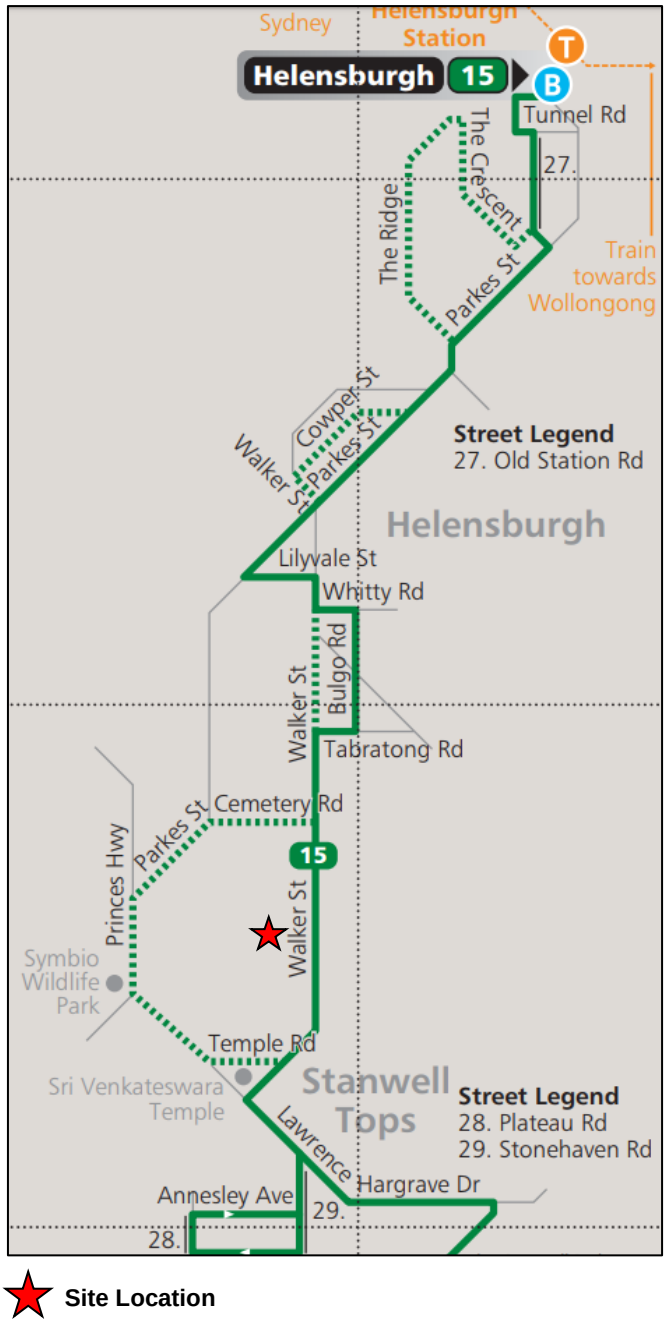


FIGURE 3: PUBLIC TRANSPORT MAP

2.4.1 Public Transport Level of Service

The Transport Research Board's *Transit Capacity and Quality of Service Manual 2003* outlines a means of determining the Level of Service of bus routes. Based on an assessment of bus frequency, hours, and coverage and indicative Level of Service can be determined.

The Level of Service is determined using the frequency and hours according to the criteria given in **Table 2** and **Table 3** respectively. Level "C" or above is considered acceptable and attractive to users.

TABLE 2: LOS CRITERIA – BUS ROUTE FREQUENCY

Level of Service (LoS)	Minutes per Service	Buses per hour	Comments
A	<10	>6	Passengers do not need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable wait time to wait if bus missed
D	21-30	2	Service unattractive to choice riders
E	31-60	1	Service available during the hour
F	>60	<1	Service unattractive to all riders

TABLE 3: LOS CRITERIA – SERVICE HOURS

Level of Service (LoS)	Hours of Service	Comments
A	19-24	Passengers do not need schedules
B	17-18	Frequent service, passengers consult schedules
C	14-16	Maximum desirable wait time to wait if bus missed
D	12-13	Service unattractive to choice riders
E	4-11	Service available during the hour
F	0-3	Service unattractive to all riders

The Level of Service (LoS) of Bus Route 15 has the following characteristics relevant to **Table 2** and **Table 3** listed below.

- Services run from 6:12am-4:23pm;
- Generally, half hourly between 6:00-7:30am;
- Generally, hourly between 9:00am-4:30pm.

The above characteristics for Bus Route 15 result in a Bus Route Frequency Level of Service of **LoS D** between 6:00-7:30am, and a **LoS E** between 9:00am-4:30pm. Additionally, the bus route operates for a total of 10 hours, which results in a Service Hours Level of Service of **LoS D**. The development will provide a private shuttle service into Helensburgh for residents, which will improve the accessibility of the site for non-private vehicles.

2.5 Future Road and Infrastructure Upgrades

According to Wollongong City Council's website, there are no future planned road works in the vicinity of the site which will impact any proposed development on the site.

Additionally, Council's DA tracker does not outline any significant developments proposed in the future within close proximity to the subject development that will have an influence on the surrounding road network or on-street parking demand.

3 PARKING ASSESSMENT

3.1 Council Parking Requirement

Wollongong City Council's *Development Control Plan 2009 – Chapter E3: Car Parking, Access, Servicing/Loading Facilities and Traffic Management* specifies rates which are *"based on the maximum rates indicated in SEPP (Housing for Seniors or People with a Disability) 2004"* for seniors living development. Therefore, the required parking provision of the proposed seniors living development shall be assessed according to the SEPP requirements.

However, the Wollongong DCP provides the following rate for medical centres:

> *the specific parking rate for Medical Centre is 4/consulting room plus 1/3 employees.*

3.2 State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 Car Parking Requirement

The NSW Government's *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* states the following parking requirements applicable to the proposed development:

> *Division 4: Self-contained dwellings*
>
> *50. Standards that cannot be used to refuse development consent for self-contained dwellings*
>
> *(h)(i) if at least 0.5 car spaces for each bedroom where the development application is made by a person other than a social housing provider*
>
> *Schedule 3: Standards concerning accessibility and useability for hostels and self-contained dwellings*
>
> *If car parking (not being car parking for employees) is provided:*
>
> *(a) car parking spaces must comply with the requirements for parking for persons with a disability set out in AS2890, and*
>
> *(b) 5% of the total number of car parking spaces (or at least one space if there are fewer than 20 spaces) must be designed to enable the width of the spaces to be increased to 3.8 metres, and*
>
> *(c) any garage must have a power-operated door, or there must be a power point and an area for motor or control rods to enable a power-operated door to be installed at a later date.*

Table 4 below summarises Council's parking requirement. It should be noted that the SEPP rates are based on number of bedrooms. The proposed villas provide two (2) bedrooms, whilst apartments provide one (1) bedroom.

TABLE 4: SEPP AND DCP PARKING REQUIREMENTS

Type	Quantity	Bedroom Scale	Rate	Spaces Required	Spaces Provided
Aged Care	43 Villas 85 Apartments	171 Bedrooms	0.5 spaces per bedroom	86	120
Dementia	10 Villas 38 Apartments	58 Bedrooms	1 per 15 beds	4	4
Medical Centre	2 rooms	N/A	4 per room + 1 per 3 employees (1)	9	9
Other					60
	Total	**-**	**-**	**99 Spaces**	**193 Spaces**

Note: (1) – The medical centre is expected to have up to 3 employees

Application of SEPP car parking rates yields a total requirement of 90 car spaces for residents. 193 spaces have been provided, including 9 medical centre spaces, 60 visitor spaces and 124 resident spaces. This results in compliant parking for medical centre, a 34-space surplus (124-90) for resident parking and an additional 60 spaces, satisfying the requirements of the SEPP and Council's DCP. It is relevant to note that 22 of the 34 surplus residential parking spaces are 10m length x 3.2m width and are of sufficient size for caravan parking. The 60 additional spaces can be used by staff which work within the development, as well as overflow parking for visitors.

3.3 Bicycle & Motorcycle Parking Requirements

Council's DCP does not require bicycle or motorcycle parking to be provided for Seniors Living developments. Therefore, no on-site bicycle or motorcycle parking has been proposed.

3.4 Servicing & Loading

Wollongong City Council's *Development Control Plan 2009 – Chapter E3: Car Parking, Access, Servicing/Loading Facilities* requires the proposed development to accommodate a large rigid vehicle on site. Regular deliveries will be made to the development by Small Rigid Vehicles (SRV) and B99 vehicles (i.e. Toyota Hiace / courier vans). Garbage collection will be undertaken on-site within the designated garbage collection area. Swept path analysis has been undertaken (with results reproduced in **Annexure C**) showing an MRV circulating the site via the garbage collection area.

3.5 Disabled Parking

Wollongong City Council's DCP states that disabled parking requirements are determined by the Building Code of Australia (BCA). The subject development is a Class 9c building according to the BCA and therefore requires one disabled car space per 100 car spaces provided. There are **193** car spaces provided, which results in the requirement of two (2) disabled car parking spaces for visitors. The proposed plans show seven (7) disabled spaces for visitors, which satisfies the DCP requirement.

The SEPP states that 5% of the residential parking must be a minimum of 3.8m in width. The proposed plans show a total of ten (10) disabled parking spaces within the 124 spaces of allocated residential parking. Ten (10) disabled spaces represents 8% of the total residential spaces ((10/124)*100%), which exceeds the 5% threshold outlined in the SEPP.

3.6 Required Changes

Any required changes for compliance are stated below:

3.6.1 Driveway Splay

The waste collection vehicle has been assumed to be an MRV. Upon exit, an MRV requires a driveway splay to provide sufficient space. The location of the driveway splay is shown in **Annexure C**.

3.7 Car Park Design & Compliance

The proposed site layout and basement plans have been assessed according to AS2890.1, AS2890.2 and AS2890.6 where applicable and found to be generally compliant with relevant clauses, subject to the recommendations and required changes outlined in **Section 3.6** and **Annexure C**. It should be noted that while we have assessed the plans to be compliant with the relevant standards, it is usual that a construction certificate is required prior to construction due to possible changes after DA approval. Swept paths of commercial vehicles and parking circulation are shown in **Annexure C** for reference. The design of the car parking areas includes the following important features:

- Minimum 2.4m X 5.4m or greater for resident parking;
- Minimum 2.6m X 5.4 or greater for visitor parking;
- Three ambulance bays sufficient for vehicles up to a 6.4m length SRV, subject to headroom considerations;
- A bus bay on the Walker Street frontage has been designed to accommodate a 12.5m length buses, which is consistent with Transport NSW requirements for standard length buses.

4 TRAFFIC ASSESSMENT

4.1 Outline

The impact of the expected traffic generation levels associated with the subject proposal is discussed in the following sub-sections.

The traffic assessment of the development options has been conducted in accordance with the RMS *Guide to Traffic Generating Developments* (October 2002) and more recent supplements. The assessment takes the view that the overall Level of Service (LoS) should be maintained whilst some increase in delay for individual movements could be tolerated, particularly for non-critical movements.

Additionally, along with the performances of the nearby critical intersections, due consideration is to be given to road safety, traffic flow efficiency for the local area.

4.2 Traffic Generation

Reference is made to the RMS *Guide to Traffic Generating Developments* (October 2002) and the RMS Technical Direction TDT 2013/04 which provide the following peak traffic generation rates for seniors living facilities.

> *Seniors Housing evening peak hour vehicle trips = 0.1 – 0.2 per dwelling*
>
> *Weekday peak hour vehicle trips = 0.4 per dwelling*
>
> *(Note that morning site peak hour does not generally coincide with the network peak hour)*

For high level care and assisted living dementia care dwellings, where residents are not expected to drive, it is more appropriate to apply the lower rate of 0.1 peak hour trips per dwelling. The more recent rate of 0.4 is more appropriate for low level care dwellings.

It is noted that recent data publicised by the RMS (RMS Technical Direction TDT 2013/04) outlines higher trips rates for “Housing for seniors”. Therefore, the rate shown below shall be used instead of the rates outlined in the RMS Guide published in 2002. Further it is assumed that the medical centre will serve residents on site, and thus is considered ancillary for traffic generation.

The following traffic split assumptions have been made:

- Residential traffic split of 20% in / 80% out during the AM and 80% in / 20% out during the PM.

The results of the future traffic generation for the yield options are summarised in **Table 5** below.

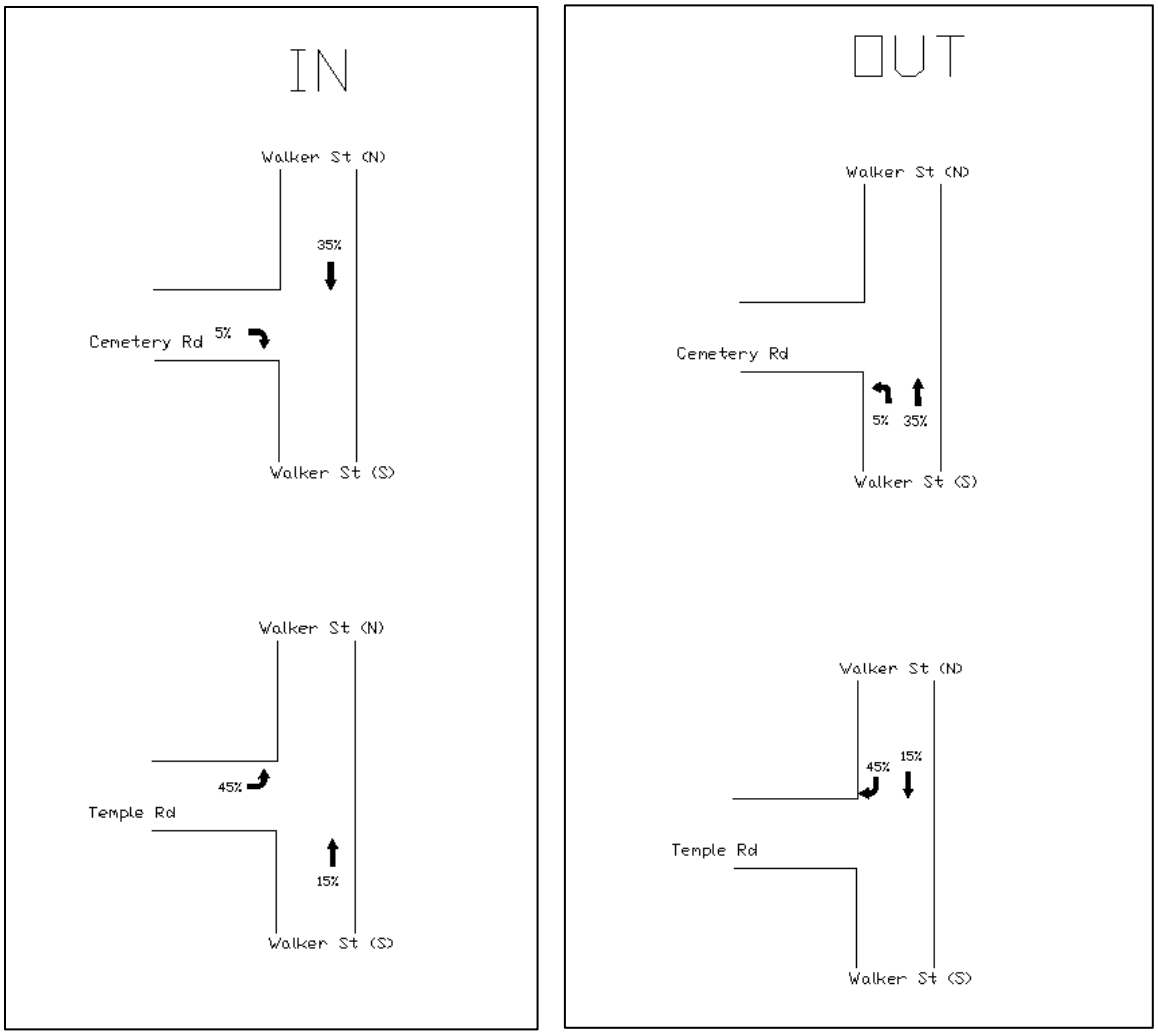
TABLE 5: PROPOSED FUTURE TRAFFIC GENERATION

Use	Type	Scale	Generation Rate	Peak Hour Traffic Generation	Traffic AM Split	Traffic PM Split
Seniors Living Facility	Low Level Care	128 dwellings	0.4 per dwelling	52	10 in; 42 out	42 in; 10 out
	High Level Care / Dementia	48 dwellings	0.1 per dwelling	5	1 in; 4 out	4 in; 1 out
	Total	**-**	**-**	**57**	**11 in; 46 out**	**46 in; 11 out**

As highlighted above, the traffic generation for the proposal will generate an estimated 57 vehicle trips during the weekday peak hour. *MTE* has assessed the site peak hour overlaps with the network peak, assuming that all 57 trips occur within the one hour. As stated in the TDT, the site peak hour generally does not coincide with the network peak hour. Further, the development proposes a shuttle service which will reduce dependency on private vehicles. Thus, the traffic generation volume is considered a conservative estimate.

4.3 Traffic Assignment

The road network and the locations of residential and commercial areas surrounding the site have been assessed and the following traffic assignment has been assumed for all traffic to and from the site, as shown in **Figures 4 & 5**.



FIGURES 4 & 5 –VEHICLE TRIP DISTRIBUTION

Arriving Trips

- 60% turn left into the site from Walker Street (south).
  - 45% from the freeway via Temple Road
  - 15% from Lawrence Hargrave Drive via Walker Street
- 40% turn right into the site from Walker Street (north).
  - 35% from Helensburgh via Walker Street
  - 5% via Cemetery Road

Departing Trips

- 60% turn right onto Walker Street (south) from the site.
  - 45% to the freeway via Temple Road
  - 15% to Lawrence Hargrave Drive via Walker Street
- 40% turn left onto Walker Street (north) from the site.
  - 35% to Helensburgh via Walker Street
  - 5% via Cemetery Road

4.4 Traffic Impact

The traffic generation and assignment outlined in **Sections 4.2 & 4.3** above have been applied to the existing traffic volumes recorded. SIDRA INTERSECTION 8.0 was used to assess the intersections performance. The purpose of this assessment is to compare the existing intersection operations to the future scenarios under the increased traffic load. The results of this assessment are shown in **Table 6**, with full detailed results showed in **Annexure D**.

TABLE 6: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 8.0)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/veh)	Level of Service(3)	Control Type	Worst Movement	95th Percentile Queue
EXISTING PERFORMANCE							
Walker St / Cemetery Rd	AM	0.10	2.4 (Worst: 5.5)	**NA** (Worst: A)	Give Way	RT from Cemetery Road	0.5 veh (3.2m) Walker Street
	PM	0.09	1.9 (Worst: 5.5)	**NA** (Worst: A)		RT from Cemetery Road	0.3 veh (1.8m) Walker Street
Walker St / Temple Rd	AM	0.05	0.9 (Worst: 8.3)	**NA** (Worst: A)	Stop	LT from Temple Road	0.1 veh (0.5m) Walker Street
	PM	0.07	0.6 (Worst: 7.7)	**NA** (Worst: A)		LT from Temple Road	0.1 veh (0.5m) Walker Street
FUTURE PERFORMANCE							
Walker St / Cemetery Rd	AM	0.10	2.3 (Worst: 5.5)	**NA** (Worst: A)	Give Way	RT from Cemetery Road	0.5 veh (3.3m) Walker Street
	PM	0.10	1.9 (Worst: 5.6)	**NA** (Worst: A)		RT from Cemetery Road	0.3 veh (1.9m) Walker Street
Walker St / Temple Rd	AM	0.06	1.5 (Worst: 8.3)	**NA** (Worst: A)	Stop	LT from Temple Road	0.2 veh (1.3m) Walker Street
	PM	0.08	1.3 (Worst: 7.8)	**NA** (Worst: A)		LT from Temple Road	0.1 veh (0.8m) Walker Street

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

(4) 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.

As shown in **Table 6**, the surrounding intersections remain unaltered under the future scenario. The existing LoS has been retained with minimal delays and additional capacity maintained.

5 ACCESS PRINCIPLES

5.1 Vehicular Access

The site will be serviced by a two-way driveway from Walker Street near the northern boundary of the site for all general traffic.

Emergency access is provided by a two-way driveway near the southern boundary of the site. This entrance is controlled by a lockable gate to deter general traffic from using this site driveway. Two (2) ambulance bays are provided within Building B, whilst one (1) ambulance bay is provided in Building A. Additionally, there is a storage area near the rear of the site which provides extra parking area for ambulances.

5.2 Pedestrian Access

The proposed site design implements shared pavement for pedestrians and vehicles as well as dedicated pedestrian pathways throughout the site. Additionally, there are separated pedestrian footpaths which provide access between the buildings and various services provided on site. It is recommended that pedestrian footpaths be provided along the internal roadways separated by a kerb. This will improve pedestrian access and increase safety within the site.

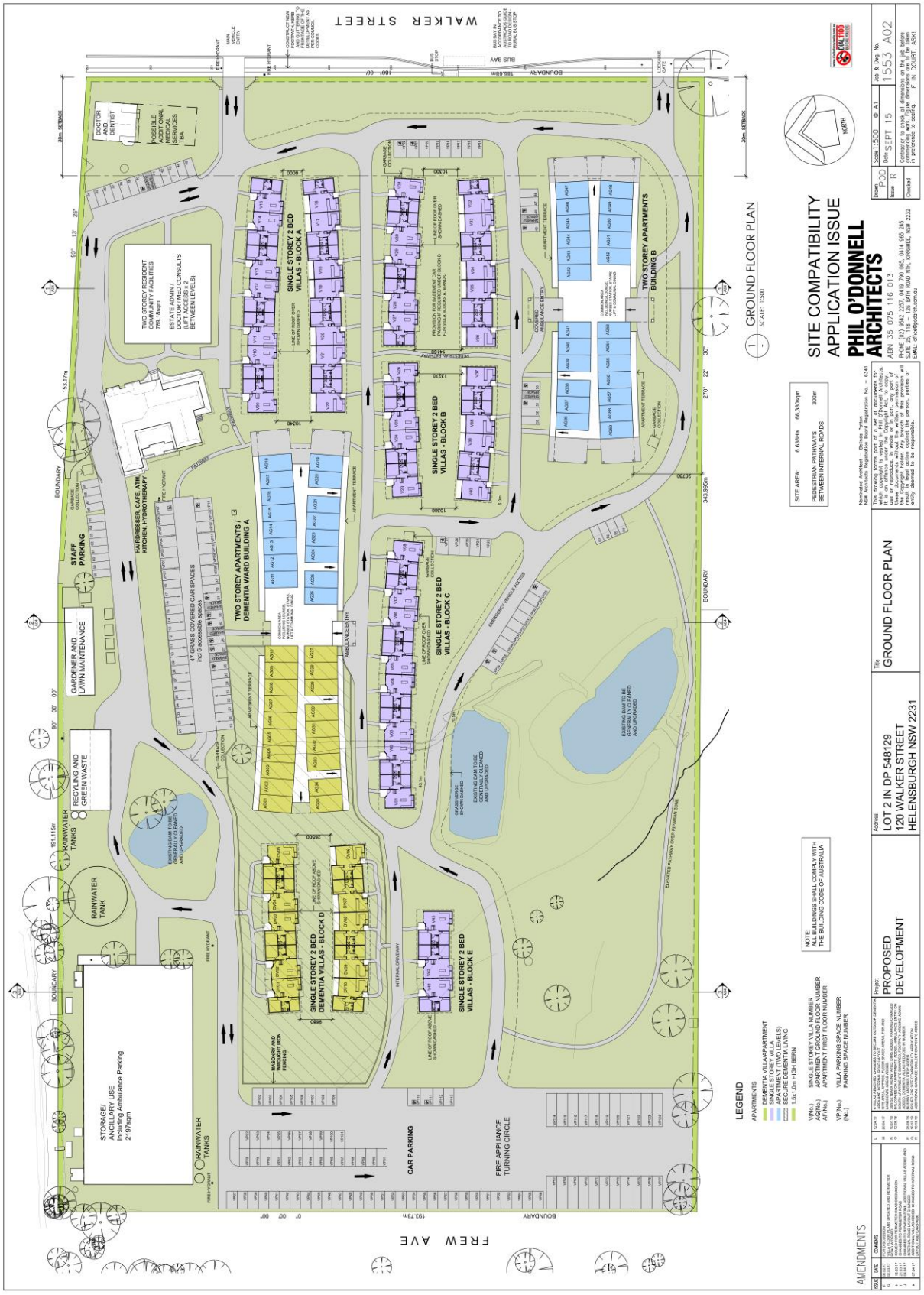
The development proposes a pedestrian footpath along the site frontage as well as an indented bay on Walker Street. The development should connect the internal footpath network with the proposed footpath along Walker Street such that convenient access is provided to the proposed bus bay.

6 CONCLUSION

In view of the foregoing, the subject proposal (as depicted in **Annexure A**) is supported on the grounds of traffic and parking. More detailed design will be required at the DA stage, though important traffic and parking features in support of the proposal include:

- The site is located on local roads, with close public transport links;
- The existing road network experiences low volumes of traffic and the surrounding intersections both perform at a high level of efficiency with Level of Service A in both AM and PM peak hours;
- The provided 193 parking spaces exceeds Council's DCP parking requirement of 90 spaces. This includes 7 disabled car parking spaces for visitors and 10 disabled spaces for residents, exceeding both the SEPP and BCA requirement;
- The site will generate an estimated 57 trips within the weekday AM and PM peak hours. This level of traffic has a negligible impact on the surrounding road network in terms of traffic flow efficiency;
- Separate site driveways are provided for general and emergency vehicle access;
- The site proposed a shuttle service which will reduce the dependency on private vehicle trips.

ANNEXURE A: SITE PLAN



ANNEXURE B: TRAFFIC SURVEYS
(SHEET 1 OF 4)

Curtis Traffic Surveys

Turning movement count

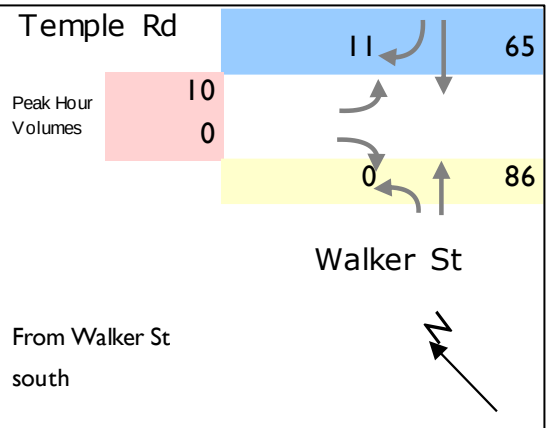
Job: 181003mcl (18_633)

Day, date 25/10/18

Location: Walker St & Temple Rd

Weather: Fine

Client: McLaren Traffic Engineering



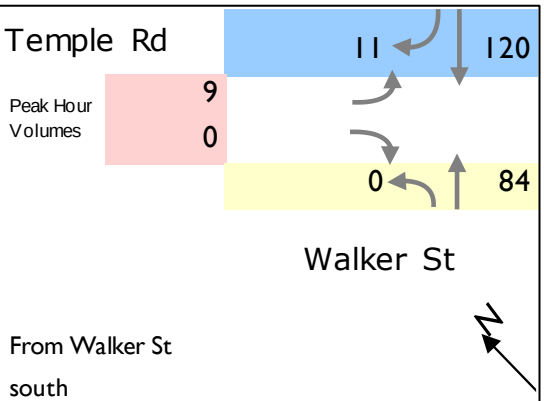
Time Period	From Walker St north through	From Walker St north right	From Temple Rd left	From Temple Rd Right (banned)	From Walker St south left	From Walker St south through	Total vehicles	Peak
07:00 to 07:15	10	1	2	0	0	20	33	
07:15 to 07:30	17	2	2	0	0	24	45	
07:30 to 07:45	8	4	2	0	1	17	32	
07:45 to 08:00	16	5	1	0	0	19	41	
08:00 to 08:15	16	3	3	0	0	12	34	
08:15 to 08:30	14	4	1	0	0	25	44	
08:30 to 08:45	18	3	3	0	0	24	48	peak
08:45 to 09:00	17	1	3	0	0	25	46	
Total	116	23	17	0	1	166		
Hourly summary								
07:00 to 08:00	51	12	7	0	1	80	151	
07:15 to 08:15	57	14	8	0	1	72	152	
07:30 to 08:30	54	16	7	0	1	73	151	
07:45 to 08:45	64	15	8	0	0	80	167	
08:00 to 09:00	65	11	10	0	0	86	172	peak hour

ANNEXURE B: TRAFFIC SURVEYS
(SHEET 2 OF 4)

Curtis Traffic Surveys

Turning movement count

Job: 181003mcl (18_633)
Day, date 25/10/18
Location: Walker St & Temple Rd
Weather: Fine
Client: McLaren Traffic Engineering



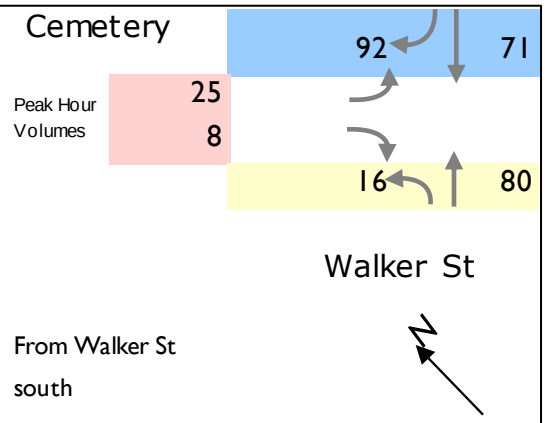
Time Period	From Walker St north through	right	From Temple Rd left	Right (banned)	From Walker St south left	through	Total vehicles	Peak
16:00 to 16:15	37	3	7	0	0	22	69	
16:15 to 16:30	32	3	5	0	0	26	66	
16:30 to 16:45	38	1	5	0	0	24	68	
16:45 to 17:00	33	2	4	0	0	17	56	
17:00 to 17:15	29	2	6	0	0	16	53	
17:15 to 17:30	43	4	5	0	0	20	72	peak
17:30 to 17:45	31	3	3	0	0	20	57	
17:45 to 18:00	28	2	4	0	1	24	59	
18:00 to 18:15	36	3	1	0	0	22	62	
18:15 to 18:30	31	2	3	0	0	19	55	
18:30 to 18:45	30	3	2	0	0	20	55	
18:45 to 19:00	23	3	3	0	0	23	52	
Total	391	31	48	0	1	253		
Hourly summary								
16:00 to 17:00	140	9	21	0	0	89	259	peak hour
16:15 to 17:15	132	8	20	0	0	83	243	
16:30 to 17:30	143	9	20	0	0	77	249	
16:45 to 17:45	136	11	18	0	0	73	238	
17:00 to 18:00	131	11	18	0	1	80	241	
17:15 to 18:15	138	12	13	0	1	86	250	
17:30 to 18:30	126	10	11	0	1	85	233	
17:45 to 18:45	125	10	10	0	1	85	231	
18:00 to 19:00	120	11	9	0	0	84	224	

ANNEXURE B: TRAFFIC SURVEYS
(SHEET 3 OF 4)

Curtis Traffic Surveys

Turning movement count

Job: 181003mcl (18_633)
Day, date 25/10/18
Location: Walker St & Cemetery Rd
Weather: Fine
Client: McLaren Traffic Engineering



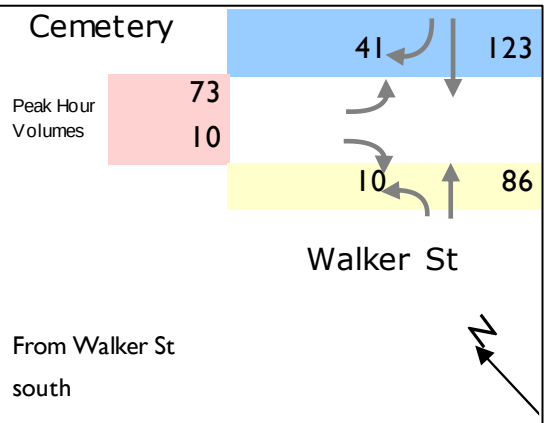
Time Period	From Walker St north through	From Walker St north right	From Cemetery Rd left	From Cemetery Rd right	From Walker St south left	From Walker St south through	Total vehicles	Peak
07:00 to 07:15	10	25	5	2	2	21	65	
07:15 to 07:30	20	34	6	1	4	23	88	peak
07:30 to 07:45	8	16	5	2	0	17	48	
07:45 to 08:00	19	26	6	1	2	19	73	
08:00 to 08:15	17	22	6	3	5	15	68	
08:15 to 08:30	15	25	5	2	6	21	74	
08:30 to 08:45	20	19	8	2	3	25	77	
08:45 to 09:00	17	20	7	3	5	14	66	
Total	126	187	48	16	27	155		
Hourly summary								
07:00 to 08:00	57	101	22	6	8	80	274	
07:15 to 08:15	64	98	23	7	11	74	277	
07:30 to 08:30	59	89	22	8	13	72	263	
07:45 to 08:45	71	92	25	8	16	80	292	peak hour
08:00 to 09:00	69	86	26	10	19	75	285	

ANNEXURE B: TRAFFIC SURVEYS
(SHEET 4 OF 4)

Curtis Traffic Surveys

Turning movement count

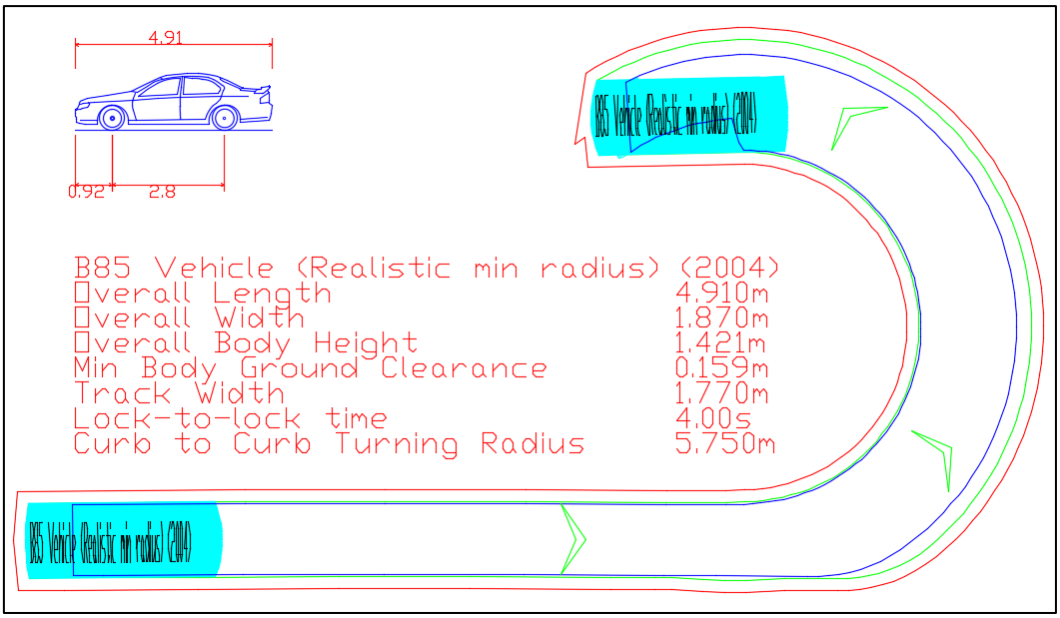
Job: 181003mcl (18_633)
Day, date 25/10/18
Location: Walker St & Cemetery Rd
Weather: Fine
Client: McLaren Traffic Engineering



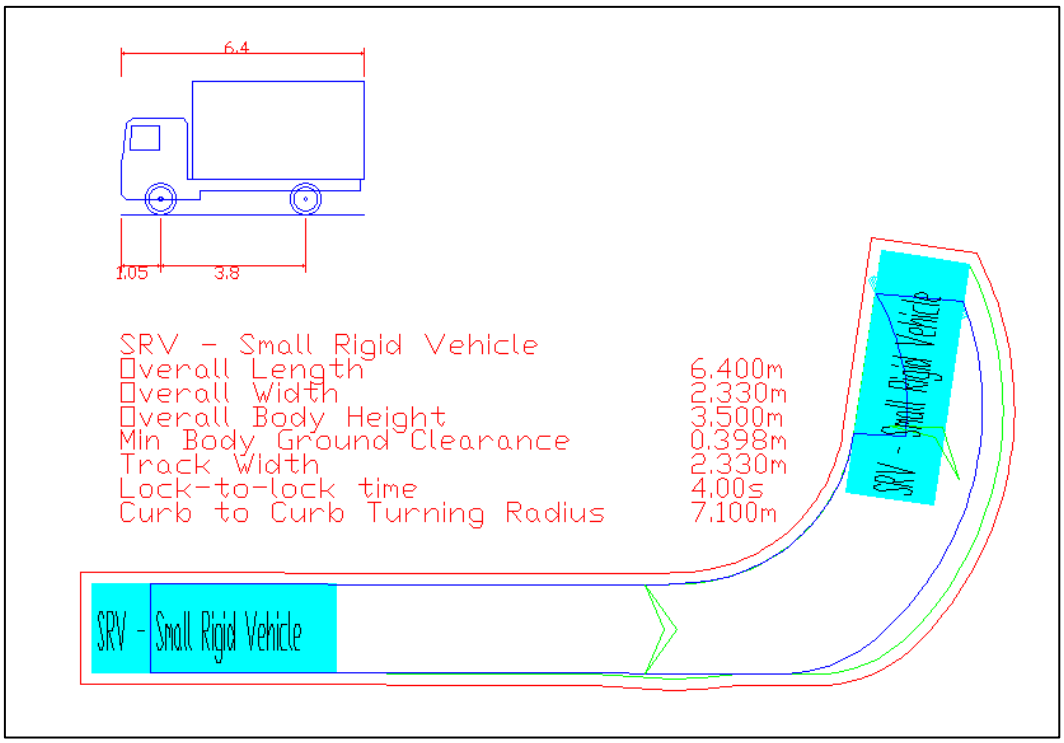
Time Period	From Walker St north through	From Walker St north right	From Cemetery Rd left	From Cemetery Rd right	From Walker St south left	From Walker St south through	Total vehicles	Peak
16:00 to 16:15	33	12	24	8	5	25	107	
16:15 to 16:30	29	9	25	7	6	26	102	
16:30 to 16:45	37	11	22	3	2	28	103	
16:45 to 17:00	31	10	25	5	3	20	94	
17:00 to 17:15	27	11	21	6	2	19	86	
17:15 to 17:30	46	12	25	4	3	27	117	peak
17:30 to 17:45	26	8	24	1	1	21	81	
17:45 to 18:00	27	10	19	3	2	26	87	
18:00 to 18:15	36	7	23	2	3	21	92	
18:15 to 18:30	33	6	15	1	3	20	78	
18:30 to 18:45	30	18	17	4	2	21	92	
18:45 to 19:00	24	10	18	3	2	24	81	
Total	379	124	258	47	34	278		
Hourly summary								
16:00 to 17:00	130	42	96	23	16	99	406	peak hour
16:15 to 17:15	124	41	93	21	13	93	385	
16:30 to 17:30	141	44	93	18	10	94	400	
16:45 to 17:45	130	41	95	16	9	87	378	
17:00 to 18:00	126	41	89	14	8	93	371	
17:15 to 18:15	135	37	91	10	9	95	377	
17:30 to 18:30	122	31	81	7	9	88	338	
17:45 to 18:45	126	41	74	10	10	88	349	
18:00 to 19:00	123	41	73	10	10	86	343	

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES

(SHEET 1 OF 6)



AUSTRALIAN STANDARD 85TH PERCENTILE SIZE VEHICLE (B85)

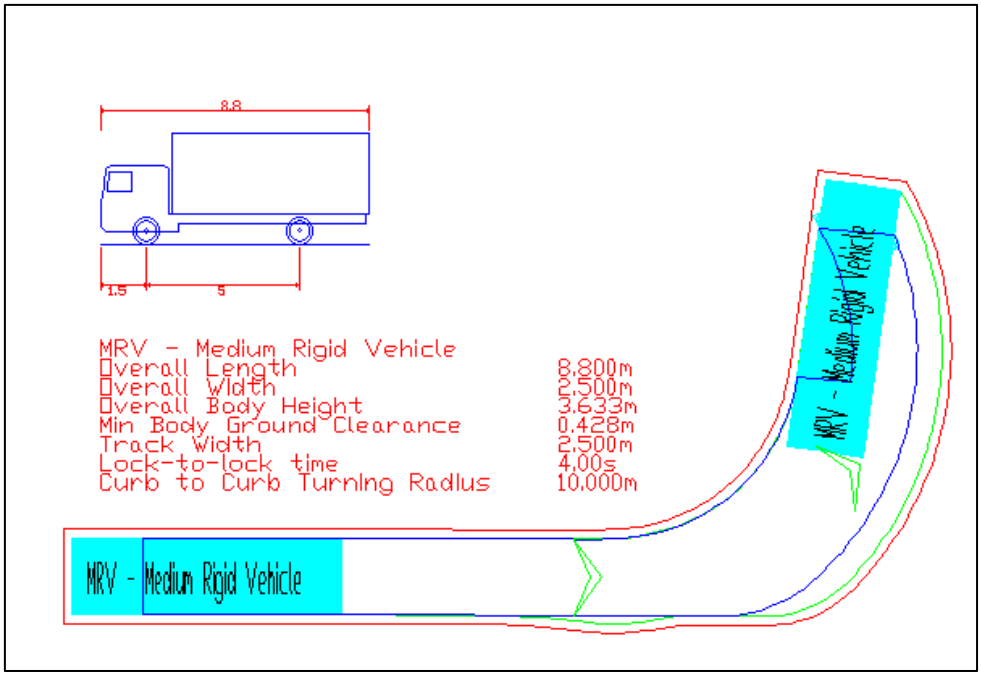


AUSTRALIAN STANDARD SMALL RIGID VEHICLE (SRV)

Blue – Tyre Path
Green – Vehicle Body
Red – 300mm Clearance (light vehicles) 500mm Clearance (heavy vehicles)

All tests performed at 5 km/h forwards and 2.5km/h reverse

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES
(SHEET 2 OF 6)

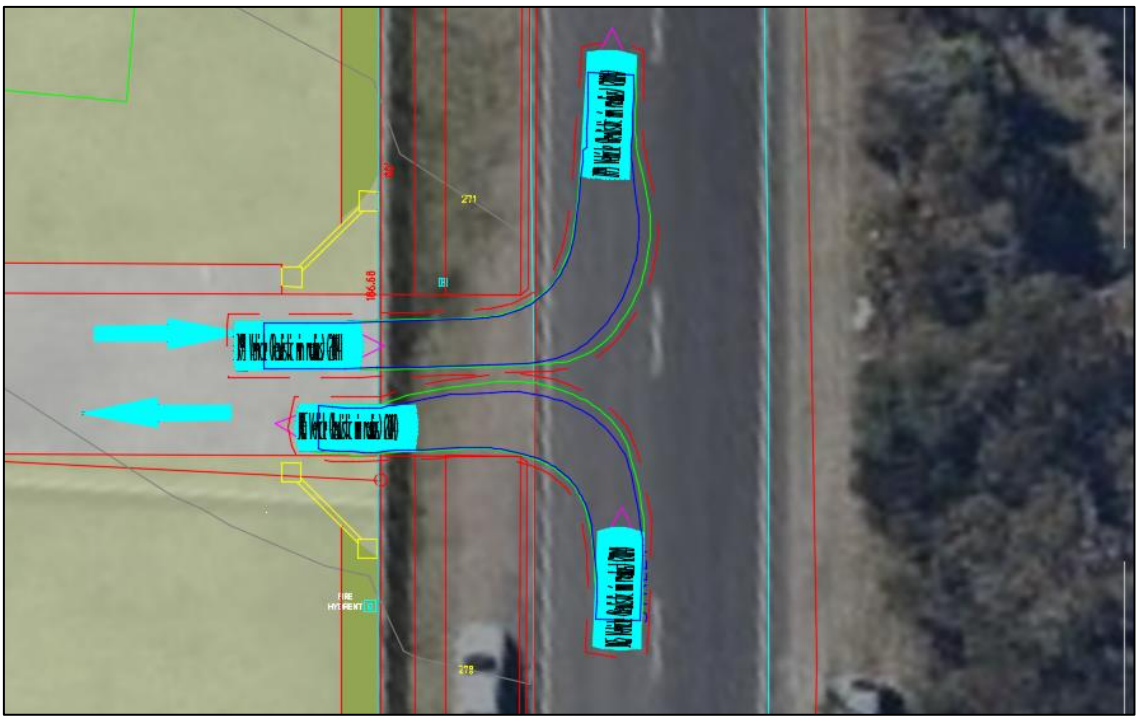


AUSTRALIAN STANDARD MEDIUM RIGID VEHICLE (MRV)

Blue – Tyre Path
Green – Vehicle Body
Red – 300mm Clearance (light vehicles) 500mm Clearance (heavy vehicles)

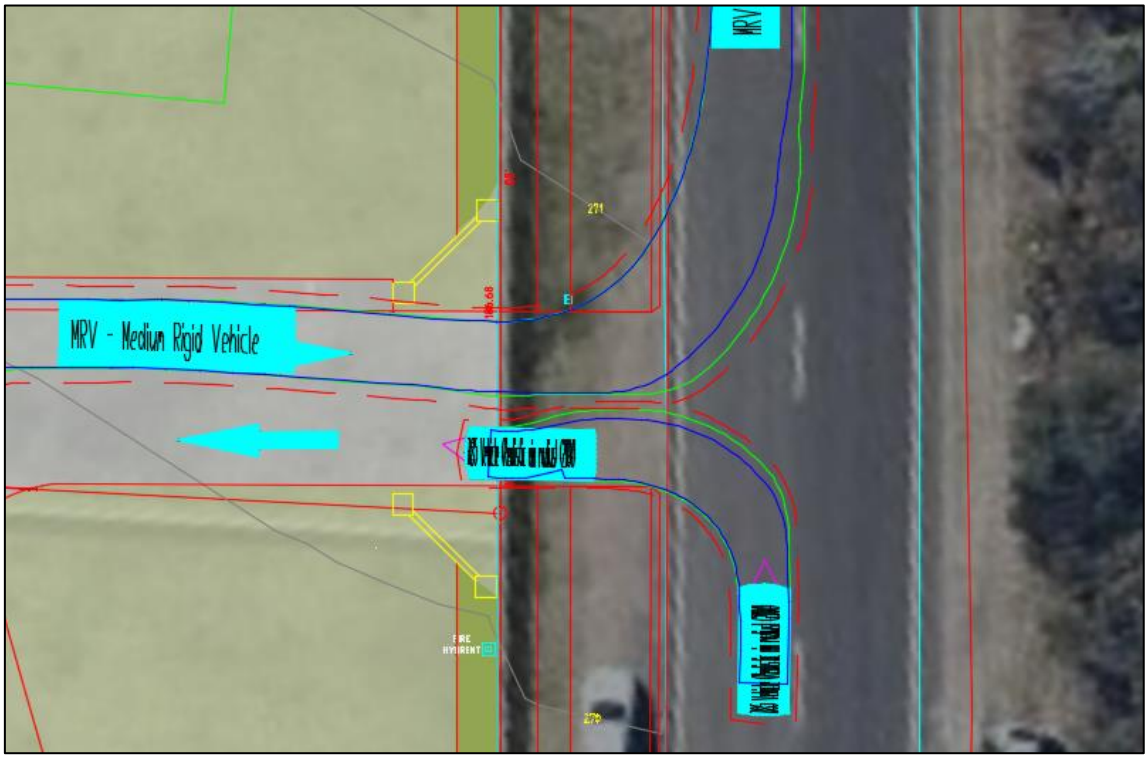
All tests performed at 5 km/h forwards and 2.5km/h reverse

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES (SHEET 3 OF 6)



B85 AN B99 PASSING AT SITE DRIVEWAY

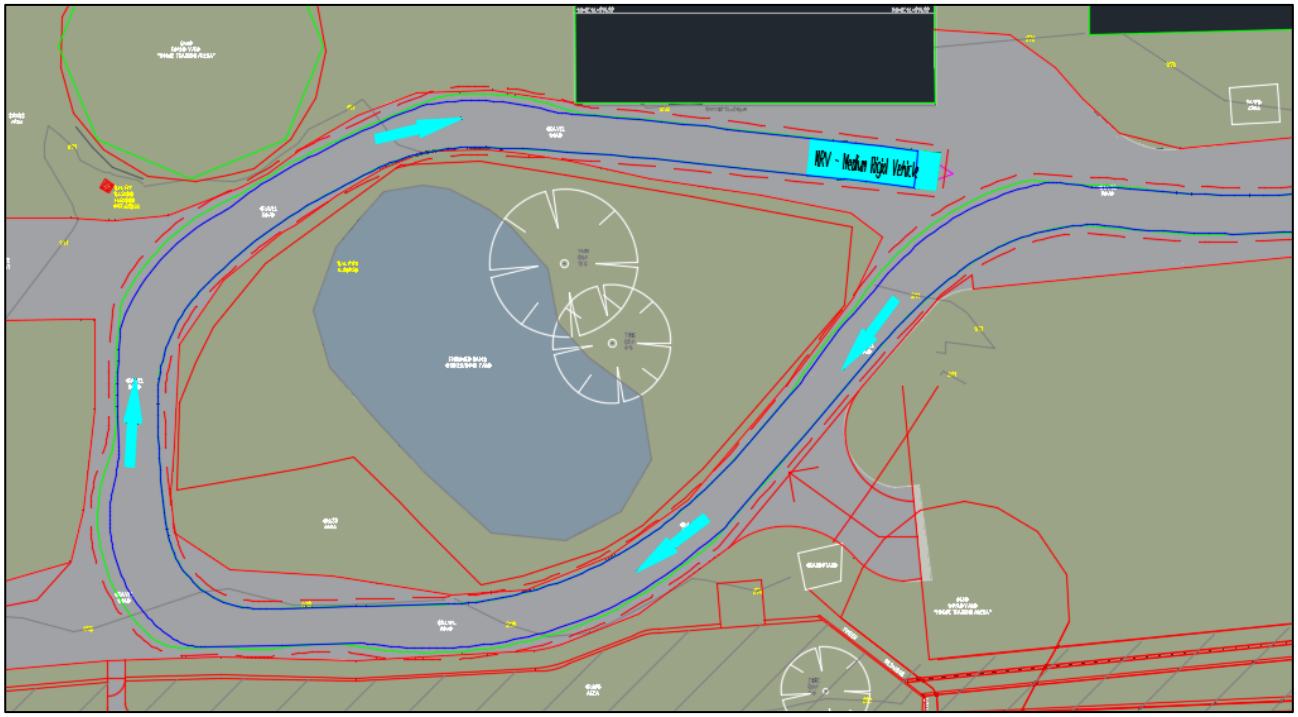
Successful



B85 AND MRV PASSING AT SITE DRIVEWAY

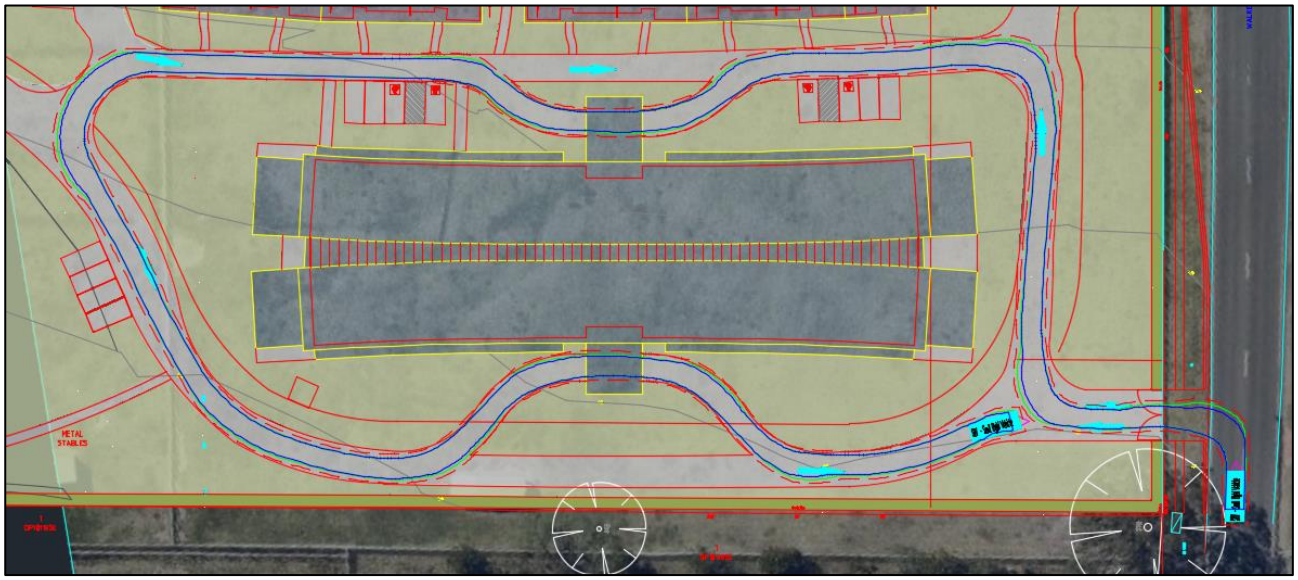
Unsuccessful – Driveway splay required depending on waste vehicle size

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES
(SHEET 4 OF 6)



MRV WASTE COLLECTION LOOP

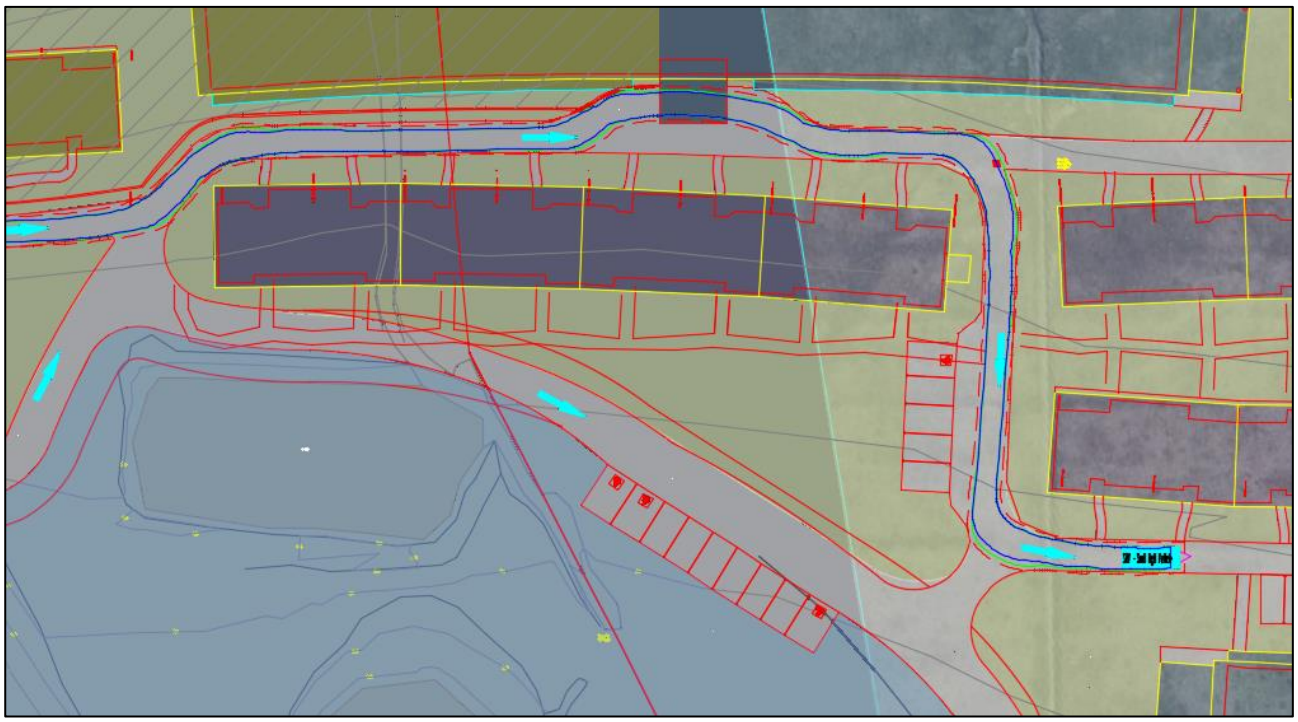
Successful



SRV CIRCULATION – EMERGENCY VEHICLES

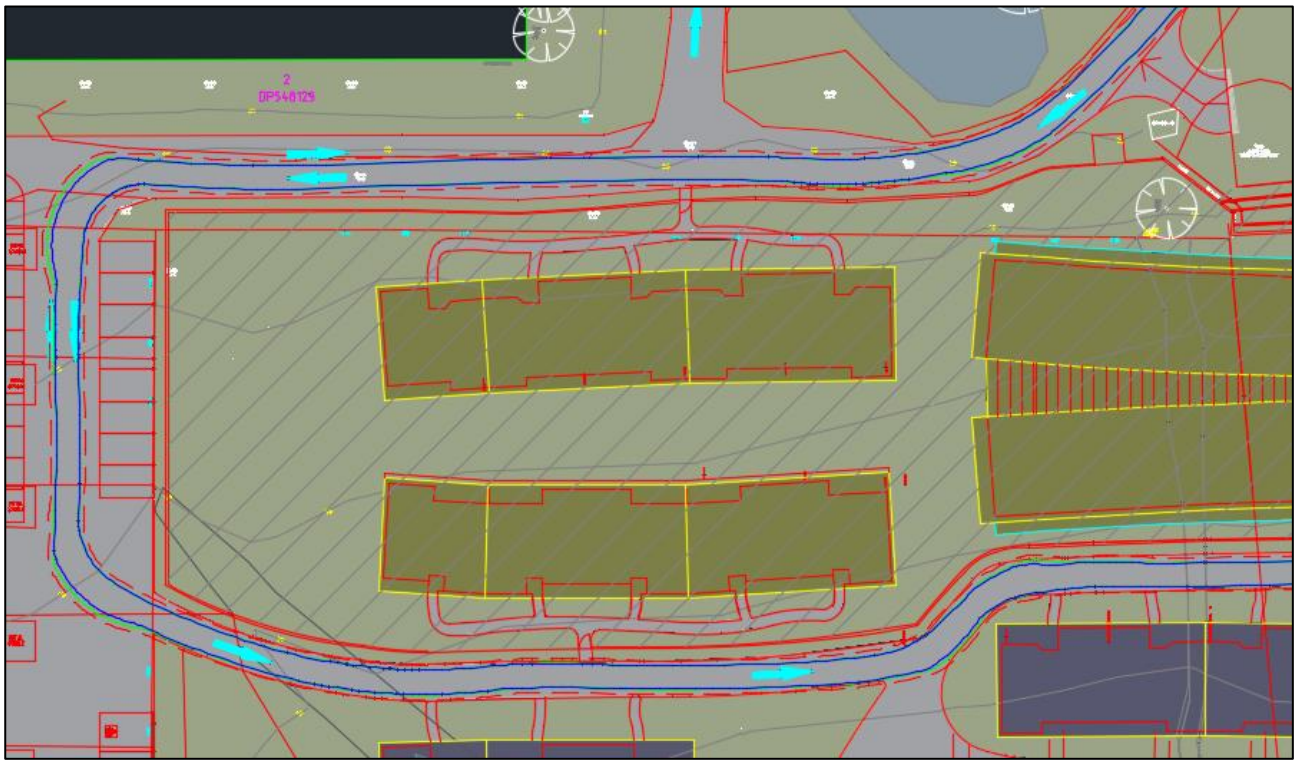
Successful – Note that the ambulance must travel opposite to the direction of flow to complete this path.

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES
(SHEET 5 OF 6)



SRV CIRCULATION – EMERGENCY VEHICLES

Successful



SRV CIRCULATION – EMERGENCY VEHICLES

Successful

ANNEXURE C: SWEPT PATH ANALYSIS AND REQUIRED CHANGES

(SHEET 6 OF 6)

STANDARD 12.5M LENGTH BUS CIRCULATION

Successful

ANNEXURE D: SIDRA INTERSECTION 8.0 RESULTS

(SHEET 1 OF 4)

MOVEMENT SUMMARY

Site: 101 [Walker/Temple - AM]

Walker/Temple
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
2	T1	91	0.0	0.046	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		91	0.0	0.046	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
North: Walker Street												
8	T1	68	0.0	0.042	0.1	LOS A	0.1	0.5	0.06	0.09	0.06	59.0
9	R2	12	0.0	0.042	5.7	LOS A	0.1	0.5	0.06	0.09	0.06	56.8
Approach		80	0.0	0.042	0.9	NA	0.1	0.5	0.06	0.09	0.06	58.6
West: Temple Road												
10	L2	11	0.0	0.008	8.3	LOS A	0.0	0.2	0.18	0.88	0.18	51.8
Approach		11	0.0	0.008	8.3	LOS A	0.0	0.2	0.18	0.88	0.18	51.8
All Vehicles		181	0.0	0.046	0.9	NA	0.1	0.5	0.04	0.09	0.04	58.8

MOVEMENT SUMMARY

Site: 101 [Walker/Temple - PM]

Walker/Temple
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
2	T1	88	0.0	0.045	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
Approach		88	0.0	0.045	0.0	NA	0.0	0.0	0.00	0.00	0.00	70.0
North: Walker Street												
8	T1	126	0.0	0.072	0.0	LOS A	0.1	0.5	0.04	0.05	0.04	69.1
9	R2	12	0.0	0.072	6.4	LOS A	0.1	0.5	0.04	0.05	0.04	56.5
Approach		138	0.0	0.072	0.6	NA	0.1	0.5	0.04	0.05	0.04	67.8
West: Temple Road												
10	L2	9	0.0	0.007	7.7	LOS A	0.0	0.2	0.18	0.88	0.18	50.2
Approach		9	0.0	0.007	7.7	LOS A	0.0	0.2	0.18	0.88	0.18	50.2
All Vehicles		236	0.0	0.072	0.6	NA	0.1	0.5	0.03	0.07	0.03	67.6

ANNEXURE D: SIDRA INTERSECTION 8.0 RESULTS

(SHEET 2 OF 4)

MOVEMENT SUMMARY

Site: 101 [Walker/Cemetery - AM]

Walker/Cemetery
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
1	L2	17	0.0	0.052	4.6	LOS A	0.0	0.0	0.00	0.09	0.00	49.0
2	T1	84	0.0	0.052	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	49.5
Approach		101	0.0	0.052	0.8	NA	0.0	0.0	0.00	0.09	0.00	49.4
North: Walker Street												
8	T1	75	0.0	0.098	0.3	LOS A	0.5	3.2	0.20	0.30	0.20	47.8
9	R2	97	0.0	0.098	4.9	LOS A	0.5	3.2	0.20	0.30	0.20	47.1
Approach		172	0.0	0.098	2.9	NA	0.5	3.2	0.20	0.30	0.20	47.4
West: Cemetery Road												
10	L2	26	0.0	0.017	4.8	LOS A	0.1	0.5	0.17	0.50	0.17	46.2
12	R2	8	0.0	0.008	5.5	LOS A	0.0	0.2	0.30	0.55	0.30	45.6
Approach		35	0.0	0.017	5.0	LOS A	0.1	0.5	0.20	0.51	0.20	46.1
All Vehicles		307	0.0	0.098	2.4	NA	0.5	3.2	0.13	0.25	0.13	47.9

MOVEMENT SUMMARY

Site: 101 [Walker/Cemetery - PM]

Walker/Cemetery
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
1	L2	11	0.0	0.052	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	49.2
2	T1	91	0.0	0.052	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	49.7
Approach		101	0.0	0.052	0.5	NA	0.0	0.0	0.00	0.06	0.00	49.6
North: Walker Street												
8	T1	129	0.0	0.093	0.1	LOS A	0.3	1.8	0.11	0.13	0.11	48.9
9	R2	43	0.0	0.093	4.9	LOS A	0.3	1.8	0.11	0.13	0.11	48.2
Approach		173	0.0	0.093	1.3	NA	0.3	1.8	0.11	0.13	0.11	48.7
West: Cemetery Road												
10	L2	77	0.0	0.051	4.8	LOS A	0.2	1.4	0.18	0.50	0.18	46.2
12	R2	11	0.0	0.010	5.5	LOS A	0.0	0.2	0.30	0.56	0.30	45.6
Approach		87	0.0	0.051	4.9	LOS A	0.2	1.4	0.19	0.51	0.19	46.1
All Vehicles		361	0.0	0.093	1.9	NA	0.3	1.8	0.10	0.20	0.10	48.3

ANNEXURE D: SIDRA INTERSECTION 8.0 RESULTS
(SHEET 3 OF 4)

MOVEMENT SUMMARY

Site: 101 [Walker/Temple - AM - Future]

Walker/Temple
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
2	T1	93	0.0	0.048	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		93	0.0	0.048	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
North: Walker Street												
8	T1	76	0.0	0.060	0.1	LOS A	0.2	1.3	0.12	0.18	0.12	57.9
9	R2	34	0.0	0.060	5.7	LOS A	0.2	1.3	0.12	0.18	0.12	55.8
Approach		109	0.0	0.060	1.8	NA	0.2	1.3	0.12	0.18	0.12	57.2
West: Temple Road												
10	L2	16	0.0	0.012	8.3	LOS A	0.0	0.3	0.19	0.88	0.19	51.8
Approach		16	0.0	0.012	8.3	LOS A	0.0	0.3	0.19	0.88	0.19	51.8
All Vehicles		218	0.0	0.060	1.5	NA	0.2	1.3	0.08	0.15	0.08	57.9

MOVEMENT SUMMARY

Site: 101 [Walker/Temple - PM - Future]

Walker/Temple
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
2	T1	96	0.0	0.049	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
Approach		96	0.0	0.049	0.0	NA	0.0	0.0	0.00	0.00	0.00	70.0
North: Walker Street												
8	T1	128	0.0	0.076	0.0	LOS A	0.1	0.8	0.05	0.07	0.05	68.7
9	R2	17	0.0	0.076	6.4	LOS A	0.1	0.8	0.05	0.07	0.05	56.3
Approach		145	0.0	0.076	0.8	NA	0.1	0.8	0.05	0.07	0.05	67.0
West: Temple Road												
10	L2	32	0.0	0.024	7.8	LOS A	0.1	0.7	0.19	0.88	0.19	50.2
Approach		32	0.0	0.024	7.8	LOS A	0.1	0.7	0.19	0.88	0.19	50.2
All Vehicles		273	0.0	0.076	1.3	NA	0.1	0.8	0.05	0.14	0.05	65.4

MOVEMENT SUMMARY

Site: 101 [Walker/Cemetery - AM - Future]

Walker/Cemetery
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
1	L2	19	0.0	0.062	4.6	LOS A	0.0	0.0	0.00	0.09	0.00	49.0
2	T1	101	0.0	0.062	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	49.5
Approach		120	0.0	0.062	0.7	NA	0.0	0.0	0.00	0.09	0.00	49.4
North: Walker Street												
8	T1	79	0.0	0.101	0.3	LOS A	0.5	3.3	0.22	0.29	0.22	47.8
9	R2	97	0.0	0.101	4.9	LOS A	0.5	3.3	0.22	0.29	0.22	47.1
Approach		176	0.0	0.101	2.9	NA	0.5	3.3	0.22	0.29	0.22	47.4
West: Cemetery Road												
10	L2	26	0.0	0.018	4.8	LOS A	0.1	0.5	0.19	0.50	0.19	46.2
12	R2	9	0.0	0.009	5.5	LOS A	0.0	0.2	0.31	0.56	0.31	45.5
Approach		36	0.0	0.018	5.0	LOS A	0.1	0.5	0.22	0.51	0.22	46.0
All Vehicles		332	0.0	0.101	2.3	NA	0.5	3.3	0.14	0.24	0.14	48.0

MOVEMENT SUMMARY

Site: 101 [Walker/Cemetery - PM - Future]

Walker/Cemetery
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Walker Street												
1	L2	12	0.0	0.055	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	49.2
2	T1	95	0.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	49.7
Approach		106	0.0	0.055	0.5	NA	0.0	0.0	0.00	0.06	0.00	49.6
North: Walker Street												
8	T1	146	0.0	0.102	0.1	LOS A	0.3	1.9	0.11	0.12	0.11	49.0
9	R2	43	0.0	0.102	4.9	LOS A	0.3	1.9	0.11	0.12	0.11	48.3
Approach		189	0.0	0.102	1.2	NA	0.3	1.9	0.11	0.12	0.11	48.8
West: Cemetery Road												
10	L2	77	0.0	0.051	4.8	LOS A	0.2	1.4	0.18	0.50	0.18	46.2
12	R2	13	0.0	0.013	5.6	LOS A	0.0	0.3	0.31	0.56	0.31	45.5
Approach		89	0.0	0.051	4.9	LOS A	0.2	1.4	0.20	0.51	0.20	46.1
All Vehicles		385	0.0	0.102	1.9	NA	0.3	1.9	0.10	0.20	0.10	48.4