



**ACT**  
Government

Transport Canberra and  
City Services

## FREEDOM OF INFORMATION COVERSHEET

The following information is provided pursuant to section 28 of the *Freedom of Information Act 2016*.

FOI reference: TCCSFOI 21-044

Information to be published	Status
1. Access application	Published
2. Decision notice and schedule	Published
3. Documents	Published
4. Additional information identified	n/a
5. Fees	n/a
6. Processing time (in working days)	18 days
7. Decision made by Ombudsman	n/a
8. Additional information identified by Ombudsman	n/a
9. Decision made by ACAT	n/a
10. Additional information identified by ACAT	n/a

**From:** [REDACTED]  
**To:** [TCCS\\_FreedomOfInformation](#)  
**Cc:** [REDACTED]  
**Subject:** FOI REQUEST - THARWA DRIVE AND LAWRENCE WACKETT TRAFFIC STUDY  
**Date:** Wednesday, 12 May 2021 4:46:16 PM  
**Attachments:** [image001.png](#)

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Good afternoon,

**RE: FOI REQUEST –THARWA DRIVE AND LAWRENCE WACKETT CRESCENT TRAFFIC STUDY**

I write to request under the *Freedom of Information Act 2016* any documentation related to the Tharwa Drive and Lawrence Wackett Crescent intersection traffic study.

I ask that my request be transferred to other entities that may hold relevant documents.

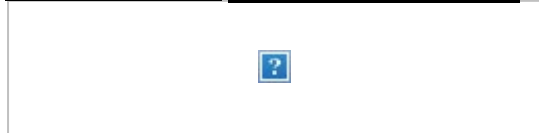
Duplicate documents may be excluded.

Should you require any further information or clarification about my request, please contact my office on [REDACTED].

Kind regards,

[REDACTED]

[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]



Ms [REDACTED]  
[REDACTED]  
[REDACTED]

Dear Ms [REDACTED]

### **Freedom of Information Request - Reference 21-044**

I refer to your application for access to government information received by Transport Canberra and City Services (TCCS) on 12 May 2021 under the *Freedom of Information Act 2016* (FOI Act) seeking the following government information:

*Any documentation related to the Tharwa Drive and Lawrence Wackett Crescent intersection traffic study*

I am an Information Officer appointed by the Director-General under section 18 of the Act to deal with access applications made under Part 5 of the FOI Act.

A decision on your application is due by 10 June 2021.

#### **Decision on access**

In accordance with the FOI Act, a search was conducted of records held by TCCS. This search identified one record as relevant to your request. In reviewing the information within this document, I have found it contrary to the public interest to disclose some information. As such, I have decided to provide you with partial access to this government information. My reasons for this decision are detailed in the statement of reasons below.

#### **Statement of Reasons**

In making my decision on disclosing government information, I must identify all relevant factors in schedule 2 of the FOI Act and determine, on balance, where the public interest lies. In reaching my access decision, I have taken the following into account:

##### ***Factors favouring disclosure in the public interest (Schedule 2, Section 2.1)***

- Section 2.1(a)(i) - promote open discussion of public affairs and enhance the government's accountability;
- Section 2.1(a)(iii) - inform the community of the government's operations, including the policies, guidelines and codes of conduct followed by the government in its dealings with members of the community;
- Section 2.1(a) (xi) - reveal environmental or health risks or measures relating to public health and safety; and
- Section 2.1(a)(viii) - reveal the reason for a government decision and any background or contextual information that informed the decision.

### **Factors favouring non-disclosure (Schedule 2, Section 2.2)**

- Section 2.2 (a)(ii) – prejudice the protection of an individual’s right to privacy or any other right under the *Human Rights Act 2004*; and
- Section 2.2 (xvi) - prejudice a deliberative process of government.

I consider that it is in the public interest to release most of this information. However, in some instances, I have found that the disclosure of some information to be contrary to the public interest.

#### Personal information and privacy

Personal information means information or an opinion whether true or not about an individual whose identity is apparent or can be ascertained from the information or opinion. The *Information Privacy Act 2014* prescribes how government collects, uses, shares, and stores this information.

I have considered the reason that TCCS has come into the possession of the personal or sensitive information together with the Territory Privacy Principles. As a general rule an agency that holds personal or sensitive information about an individual that has been collected for a particular purpose must not disclose the information to a third party without consent (*Information Privacy Act 2014* - Territory Privacy Principle 6).

I have further found that disclosing this information is likely to prejudice an individual’s right to privacy or any other right under the *Human Rights Act 2004*.

In this instance I have found that, on balance, the disclosure of the personal or sensitive information is contrary to the public interest.

#### Deliberative process of government

Some of the information within the document relates to financial considerations such as government deliberations relating to compensation claims or service procurements. I have found that the disclosure of this information is contrary to the public interest.

#### **Charges**

Pursuant to *Freedom of Information (Fees) Determination 2018* processing charges are applicable for this request because the total number of pages to release to you exceeds the charging threshold of 50 pages. However, the charges have been waived in accordance with section 107(2)(e) of the Act.

#### **Online publishing – disclosure log**

Under section 28 of the Act, TCCS maintains an online record of access applications called a disclosure log. Your original access application, my decision and documents will be published in the TCCS disclosure between 3 – 10 business days from the date of this decision.

Your personal contact details will not be published. You may view the TCCS’ disclosure log at [https://www.cityservices.act.gov.au/about-us/freedom\\_of\\_information/disclosure-log](https://www.cityservices.act.gov.au/about-us/freedom_of_information/disclosure-log) .

**Ombudsman review**

My decision on your access request is a reviewable decision as identified in Schedule 3 of the Act. You have the right to seek an Ombudsman review of this outcome under section 73 of the Act within 20 working days from the day that my decision is published in TCCS' disclosure log or a longer period allowed by the Ombudsman.

If you wish to request a review of my decision, you may write to the Ombudsman at:

The ACT Ombudsman  
GPO Box 442  
CANBERRA ACT 2601  
Via email: [actfoi@ombudsman.gov.au](mailto:actfoi@ombudsman.gov.au)

**ACT Civil and Administrative Tribunal (ACAT) review**

Under section 84 of the Act, if a decision is made under section 82 on an Ombudsman review, you may apply to the ACAT for review of the Ombudsman decision.

Further information may be obtained from ACAT at:

ACT Civil and Administrative Tribunal  
Level 4, 1 Moore Street  
GPO Box 370  
CANBERRA CITY ACT 2601  
Telephone: (02) 6207 1740  
[www.acat.act.gov.au](http://www.acat.act.gov.au)

If you have any queries concerning the directorate's processing of your request, or would like further information, please contact the TCCS FOI team on (02) 6207 2987 or email to [tccs.foi@act.gov.au](mailto:tccs.foi@act.gov.au).

Yours sincerely



Kristine Scheul  
Information Officer

8 June 2021



**ACT**  
Government

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Transport Canberra and City Services

**THARWA DRIVE/ LAWRENCE WACKETT  
CRESCENT, THEODORE**

**BLACK SPOT FEASIBILITY STUDY**

**ROADS ACT**

**FINAL**

**RG 20025-3/ 0**

**07 SEPTEMBER 2020**



**Consulting Engineers**

# THARWA DRIVE/ LAWRENCE WACKETT CRESCENT, THEODORE

## BLACK SPOT FEASIBILITY STUDY

Prepared for Roads ACT

Document Register

Revision	Date	Details	Author	Verifier	Approver
0	7/09/20	Draft report	█	█	█

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### 1.4 Locality Plan



Figure 1-1 Locality Plan

Note that ACTMAPi has been used for all aerial photography used in this report.

## 2. EXISTING SITE CONDITIONS

### 2.1 Road Hierarchy

Tharwa Drive is classified as an Arterial road linking southern Tuggeranong to the Monaro Highway. There are no property accesses on the road and parking is not permitted on this section of Tharwa Drive. The road speed is signed at 80 km/h.



Photo 2-1 Tharwa Drive (eastbound view west of the intersection with Lawrence Wackett Crescent)



Photo 2-2 Tharwa Drive (westbound view east of the intersection with Lawrence Wackett Crescent)

Lawrence Wackett Crescent is classified as a Major Collector road in the ACT road network. It provides access to Theodore via two intersections with Tharwa Drive. The eastern intersection is a 4-way signalised intersection. The report is for the western intersection. The road speed is signed at 60 km/h.



**Photo 2-3 Lawrence Wackett Crescent (southbound view north of the intersection with Tharwa Drive)**

Tharwa Drive is classified as a Main On-road Cycle route by the Active Travel Infrastructure Practitioner Tool. A Local Community Route is parallel to Tharwa Drive and crosses Lawrence Wackett Crescent to the south of the intersection with an underpass circa 50 m east from the centre of the intersection. B-double vehicles are permitted to use Tharwa Drive.

## **2.2 Geometric Layout**

### **2.2.1 Road Layout**

Tharwa Drive is an undivided two-lane two-way road on the approaches to the intersection with Lawrence Wackett Crescent (as shown in Photos 2-1 and 2-2).

Lawrence Wackett Crescent at the intersection is a divided two-lane two-way road. The median is gravel surface and circa 5 m wide (as shown in Photo 2-3).

### **2.2.2 Intersection Layout**

The intersection of Tharwa Drive with Lawrence Wackett Crescent is a priority controlled T-intersection in a seagull configuration. Below are the following properties of the intersection:

- Tharwa Drive right turn – Channelised Right turn lane (CHR) circa 150 m;
- Tharwa Drive left turn – Channelised Left turn lane (CHL) circa 105 m with a painted traffic island;
- Storage in the median for vehicles turning right from Lawrence Wackett Crescent into Tharwa Drive for circa 1 vehicle (circa 10 m at a circa 20 degree angle), and
- There are gated 'GIVE WAY' (R1-2) signs at the intersection on Lawrence Wackett Crescent.

The intersection layout is shown in Figure 2-1.



Figure 2-1 Intersection layout

### 2.3 Traffic Volumes

Traffic data was provided for the approaches to the intersection for a week starting 23 March 2020. These counts were undertaken during the first week of the COVID-19 shutdown period. Therefore, traffic volumes from the nearby signalised intersection (Tharwa Drive/ Lawrence Wackett Crescent/ Were Street) were reviewed to calibrate the provided data between the collected and historical periods. The traffic volumes on Tharwa Drive during the collected period were circa 20% less than the historical data. It is assumed this difference is also relatable to traffic volumes on Lawrence Wackett Crescent.

The provided traffic data with the volumes increased by 20% to allow for the reduced COVID-19 traffic volumes are provided in **Table 2-1**.

Table 2-1 Traffic Volumes and Speed Data

Towards	Weekday Average (vpd)	Weekday %HV	Weekday Average Speed (km/h)	Weekday 85 %ile Speed (km/h)
<b>Tharwa Drive between Fidge Street and Lawrence Wackett Crescent (West)</b>				
Fidge Street (WB)	6,067	6	75.3	84.4
Lawrence Wackett Crescent (EB)	5,864	4.4	78.6	85.6
<b>Total Volume</b>	<b>11,931</b>			
<b>Tharwa Drive between Lawrence Wackett Crescent (West) and Lawrence Wackett Crescent (East)</b>				
Lawrence Wackett Crescent (WB)	5964	4.5	77.7	84.1
Lawrence Wackett Crescent (EB)	6070	5	79.6	86.2
<b>Total Volume</b>	<b>12,034</b>			

Towards	Weekday Average (vpd)	Weekday %HV	Weekday Average Speed (km/h)	Weekday 85 %ile Speed (km/h)
<b>Lawrence Wackett Crescent between Tharwa Drive and Louis Loder Crescent</b>				
Tharwa Drive (NB)	2563	5.1	46.6	56
Louis Loder Crescent (SB)	2542	4.4	37.2	40.9
<b>Total Volume</b>	<b>5,105</b>			

The data indicates over 6,000 vehicles per day use Tharwa Drive and between 3,000 and 6,000 vehicles per day on Lawrence Wackett Crescent. These traffic volumes are typical to the assigned Arterial Road (greater than 6,000 daily vehicles) and Major Collector road classifications.

Note that intersection movement counts were not undertaken.

The following can be derived from the provided data:

- The weekday peak periods were between 8:00 am and 9:00 am during the morning and 4:00 pm and 5:00 pm during the afternoon/ evening;
- There is a circa 45% difference in the direction of traffic volumes between the peak periods, and
- The speed data indicates that the average road user complies with the speed limit through the intersection. However, the 85<sup>th</sup> percentile speed on Tharwa Drive through the intersection is over the 80 km/h speed limit by circa 5% to 7.5%.

## 2.4 Collision Statistics

A total of 20 collisions occurred in the five year period from 1 January 2014 to 31 December 2018 inclusive. These included seven injury collisions (one admitted to hospital and six received medical treatment).

An indicative guide to the performance of this intersection compared to the average for the ACT in 2017 can be obtained from the following approximate percentages for the ACT as a whole:

- approximately 10.14% of collisions occur in wet weather;
- approximately 23.51% occur in the peak hours, taken as 8.00-9.00 and 17.00-18.00.
- approximately 20.75% occur in the hours of darkness.

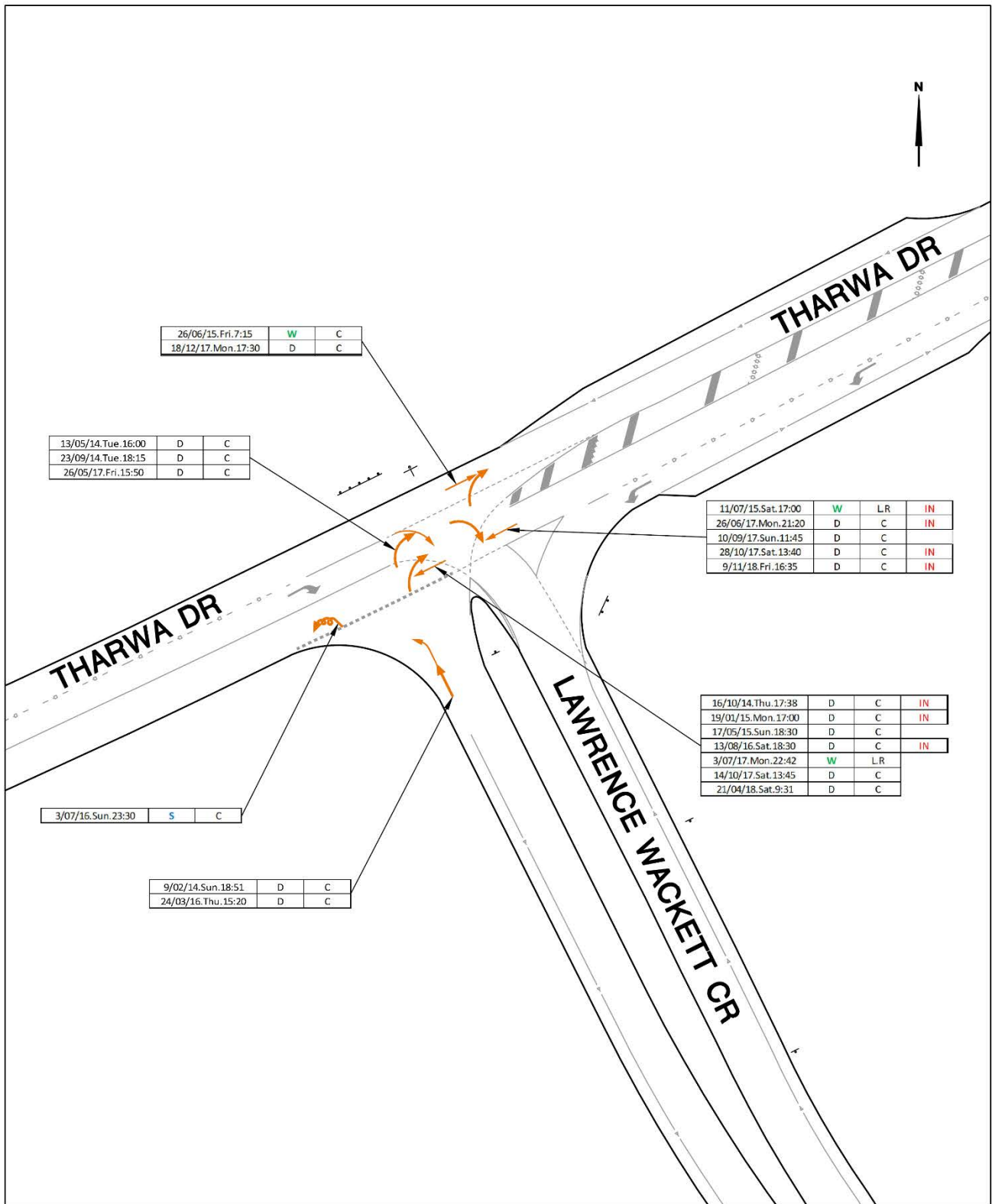
The collision history identified that:

- 2 collision (10%) occurred in wet weather, marginally below to average.
- 5 collisions (25%) occurred in the peak periods, marginally above the average, although 3 of the 7 injury collisions occurred in the evening peak.
- 5 collision (25%) occurred in hours of darkness, above the average.

Observations made during the inspection during peak periods indicate that right turning movements from Tharwa Drive experience long delays (delays observed up to 60 seconds for right turning vehicles). Several road users turned at the intersection with unacceptable gaps.

The highest collision statistic at the intersection over the five year period was 7 westbound through vehicles colliding with northbound right turning vehicles (RUM Code 104). There were 10 other collisions involving vehicles turning at the intersection (RUM Code 102, 105 and 202). The 7 injuries that occurred at the intersection occurred between a through vehicle and a turning vehicle.





ACCIDENT DATA PERIOD - 01/01/14 TO 31/12/18

ABBREVIATION AND SYMBOL SCHEDULE

DAY	ROAD SURFACE	WEATHER	SEVERITY
MO : Monday	D : Dry	C : Clear	IN : Injury
TU : Tuesday	W : Wet	O.C : Cloudy or Overcast	F : Fatal
WE : Wednesday	S : Snow or Ice	H.R : Heavy Rain	
TH : Thursday		L.R : Light Rain	
FR : Friday		FOG : FOG	
SA : Saturday			
SU : Sunday			

Figure 2-2 Collision diagram

## 2.5 Pedestrians

There is a path parallel to Tharwa drive circa 20 m south of Tharwa Drive that crosses Lawrence Wackett Crescent. The path provides a link between Calwell and Theodore.

A local community route passes under Tharwa Drive circa 50 m east of the intersection.

There is evidence of a pedestrian desire line on the eastern side of the underpass towards St. Francis of Assisi's Primary School and Calwell High School. The grade of the path on the southern side of the path and the non-directness to key attractions likely contributes to this desire line.

There were no collisions involving pedestrians.

## 2.6 Cyclists

No on-road cycle lanes are provided on Tharwa Drive in the proximity of the intersection. Note that the road width (circa 7.4 m) does not provide sufficient width for on-road cycle lanes. Additionally, based on the 80 km/h speed limit the 4 m lane width is considered inadequate for cyclists to lane share.

There are on-road cycle lanes on Lawrence Wackett Crescent.

There were no collisions involving cyclists.

## 2.7 Motorcyclists

There were no collisions involving motorcycles at this intersection.

## 2.8 Public Transport

Transport Canberra has one bus route (Route 79) that uses intersection. The bus turns right from Tharwa Drive into Lawrence Wackett Crescent and turns left from Lawrence Wackett Crescent into Tharwa Drive. This bus service has a frequency of circa 30 minutes for services travelling in both directions.

It was advised by Transport Canberra that no difficulties have been reported using the intersection.

## 2.9 Lateral Clearance Issues

The clear zone for an 80 km/h speed limit or less with traffic over 6,000 vehicles per day is 6.5 m for a flat verge and 4.5 m for a flat verge in a 60 km/h (or less) speed zone with 1,500 to 6,000 vehicle per day. There are guard rails over the pedestrian underpass east of the intersection on both sides of the road.

There are several slip-base light columns within the clear zone.

An onsite assessment of available sight distance (181 m Safe Intersection Sight Distance (SISD) for 80 km/h speed limit on Tharwa Drive) identified that the SISD is achieved in both directions. Vehicles in the Tharwa Drive left turn slip lane can block westbound vehicles.

## 2.10 Pavement

Generally, the pavement condition through the intersection in the through lanes in both directions on Tharwa Drive are an acceptable standard. The pavements in the westbound right turn lane and on Lawrence Wackett Crescent are polished, reducing the friction for stopping/ slowing vehicles.

## 2.11 Traffic Control Devices

The hold line on Lawrence Wackett Crescent and chevron markings on Tharwa Drive are worn and require maintenance.

There are no reflectors on the concrete barriers over the pedestrian underpass.

## **2.12 Future Traffic Volumes**

It is difficult to predict changes to traffic volumes on Tharwa Drive as it is an arterial road connecting southern Tuggeranong to the Monaro Highway. The surrounding area is developed with no future planned developments.

An increase of peak traffic volume at the intersection would increase the queue length and delay associated with turning movements at this intersections and possibly lead to future collisions. No known substantial increase is expected.

### 3. DISCUSSION AND POSSIBLE IMPROVEMENTS

#### 3.1 General Overview

The collisions being experienced at this location meet the criteria set by the Commonwealth Department of Infrastructure for consideration within the Black Spot Program of a minimum of three injury collisions within a 5 year period.

The collision frequency at this intersection is around 0.75 Collisions per Million Entering Vehicles (C/MEV). This rate is considered very high for a T-intersection.

#### 3.2 Predominant Conflicts and Collisions

The collision data identifies that the most common class of collision involved vehicles colliding within the intersection (RUM Codes 10 and 20) at 85% (17 of 20), with 7 through – right turning collisions (RUM code 104) between northbound and westbound vehicles.

Several issues could have contributed to a number of these cross traffic collisions. These could be as follows;

- Delays experienced by road users (including the queuing of vehicles) contributing to some road users accepting insufficient gaps in the traffic.
- Sight distance restrictions due to vehicles in the left turn lane on Tharwa Drive.
- The speed of vehicles on Tharwa Drive, with westbound road users increasing in speed after travelling through the signalised intersection to the east of the intersection and eastbound vehicles travelling down the hill.
- Right turning vehicles accepting insufficient minimum gap sight distance when turning.

It was observed during various site inspections of the intersection that some road users would turn at the intersection without hesitation relating to the traffic approaching the intersection. Some drivers observed during peak periods were also observed taking risks due to delay (whether associated with opposing traffic movements or driver hesitation) and would turn at the intersection when there was an insufficient gap in traffic, resulting in the approaching vehicles to slow. Inspections outside the peak period identified that this was more perceptible.

#### 3.3 Opportunities for Reduction of Historical Collisions

The focus of the proposed improvements are aimed at reducing the common collisions that occur at this intersection.

The five identified options that would assist in the reduction of these collisions are listed below.

**Option 1 – Signalise the intersection.** This option would reduce the majority of the collisions associated with movements through the intersection.

Signalising this intersection has the potential to increase the number of rear end collisions that occur at the intersection and could also increase the delay to road users outside of peak periods.

The provided traffic volumes for the approaches to the intersections were balanced during the peak periods to be used for a preliminary SIDRA analysis to determine whether the signal operation would be feasible. The turning volumes were balanced based on observed traffic movements at the intersection during peak periods and balancing the distribution of traffic between the approaching and departing vehicles.

Based on the preliminary analysis for the assumed turning volumes, a signalised intersection would improve the Level of Service at the intersection through reducing the delay for vehicles turning right from Lawrence Wackett Crescent.

The design of this treatment would need to account for the potential future duplication of Tharwa Drive to reduce the amount of redundant work. Intersection counts would be required to be undertaken to validate the preliminary SIDRA analysis.

**Option 2 – Extend the nose of the Lawrence Wackett Crescent median island.** This option reinforces the priority of the T-intersection. The extension of the median island will enable the “Give Way” signs to be installed closer to the hold line, encouraging vehicles to wait closer to the hold line. The option to install a traffic island on Tharwa Drive in the existing linemarked median would narrow the road and provide a visual narrowing of the road to assist with reducing the speed of through vehicles. The width of Lawrence Wackett could also be narrowed to encourage exiting vehicles to slow on the approach to the intersection.

**Option 3 – Reduce the speed to 60 km/h.** The option would assist in reducing the sight distance requirements and vehicle approach speeds. The main benefit of this option would be the reduction of the kinetic energy transferred during a collision, especially the collisions involving turning vehicles. A reduction in speed aligns with the Safe Systems Principals to reduce the exposure to impact forces associated with vulnerable users.

The roadside development along Tharwa Drive in the proximity of the intersection is set back from the road and separated by vegetation and a wide road reserve with no property accesses. The roadside environment along Tharwa Drive is considered to sparsely built-up as there is no property frontage. Based on AS 1742.4 the speed limit for this type of environment is generally 80 km/h and is appropriate on urban arterial roads. However, this standard was last updated in 2008 and does not include Safe Systems Principals. It is noted that the survivable impact speed for a side impact collision is considered to be 50 km/h.

A reduction of the speed on Tharwa Drive would need to consider whether the reduction should extend to the east to incorporate the signalised intersection of Tharwa Drive/ Lawrence Wackett Crescent/ Were Street.

**Option 4 – Convert the intersection to Left-in/ Left out.** This option would remove all collisions that resulted in injuries and reduce the majority of the other collisions at this intersection.

The removal of the right turns would require a median to be constructed to encourage road users not to turn right. However, this would result in transferring the traffic to other intersections with the potential to cause additional collisions elsewhere on the road network and impact on accessibility to Theodore. It would likely result in road users performing illegal manoeuvres (i.e. driving the wrong way on Tharwa Drive, driving over the median, etc.). Therefore this option is not considered appropriate and has not been further assessed within this report.

**Option 5 – Convert to a roundabout.** The conversion of the intersection to a roundabout was considered. However, this option is not suitable for the following reasons:

- The roundabout would need to be designed for a B-double route, increasing the footprint of the roundabout.
- There is potential that the design would impact on the pedestrian underpass.
- Highly unlikely to meet the BCR requirements.

- Impact on the future duplication of Tharwa Drive.

Therefore this option is not considered appropriate and has not been further assessed within this report.

## 4. SAFE SYSTEMS INFRASTRUCTURE ASSESSMENT OF PROPOSED OPTIONS

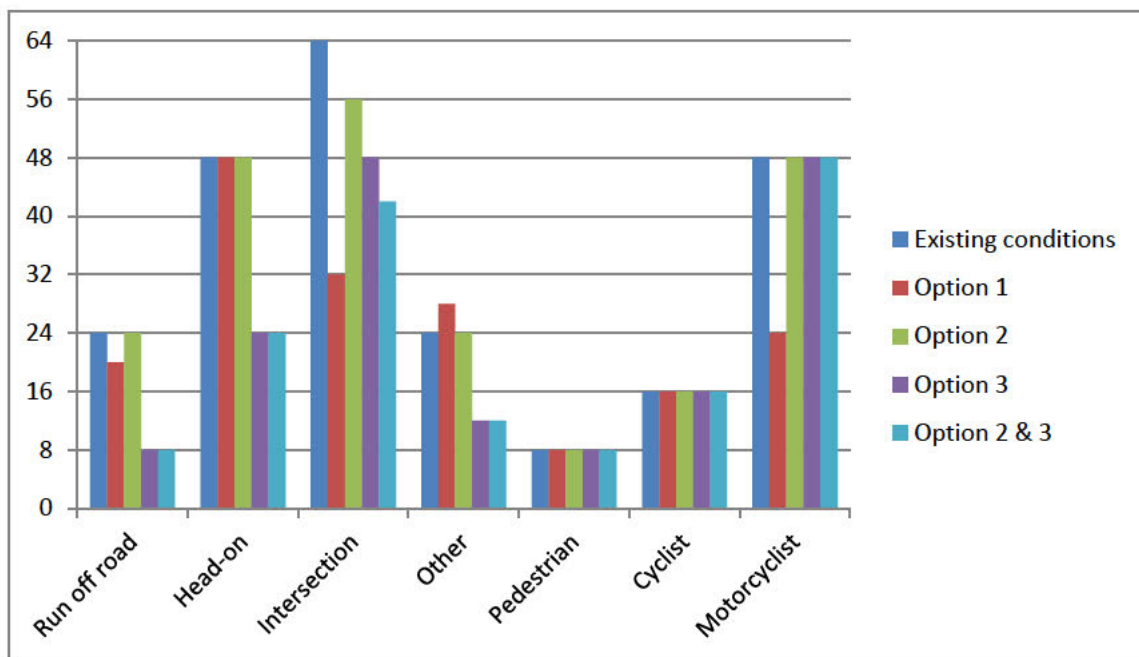
### 4.1 Assessment Summary

The Safe System Assessment (SSA) Matrix scoring was based on the Austroads Safe System Assessment Framework Table 4.4 Safe System matrix scoring system.

The Safe System Assessment Matrix scores for the existing conditions and the proposed design options are shown in **Table 4-1**. The scores for each crash type are shown in **Figure 4-1**. The detailed assessments are presented in **Section 4.2**.

**Table 4-1 SSA Matrix Scores**

Option	Score
Existing conditions	232/448
Option 1 – Signalise the intersection	176/448
Option 2 – Extend the nose of the Lawrence Wackett Crescent median island	224/448
Option 3 – Reduce the speed to 60 km/h	164/448
Option 2 and 3	158/448



**Figure 4-1 Tharwa Drive/ Lawrence Wackett Crescent SSA Scores for Crash Types**

### 4.2 Safe System Assessment Matrices

The columns of the Safe System matrix show the crash types that represent the main crash and road user types that contribute to death and serious injury.

As scores vary along routes and between intersections, an average score is taken for the project as a whole. Detailed matrix assessments were undertaken to determine the overall scores.

Reference is made to *AP-R509-16 Table 4.2* which is used to quantify the risk rating scores, with *AP-R509-16 Table 4.4* used as a scoring index.

Table 4-2 Tharwa Drive/ Lawrence Wackett Crescent Safe System Assessment Matrix – Existing Conditions

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
<b>Exposure Comments:</b>	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	Pedestrian volumes are expected to be moderate based on visual observations (10-50 units/ day).	Cyclists volumes are expected to be moderate based on visual observations (10-50 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
<b>Score:</b>	4/4	4/4	4/4	4/4	2/4	2/4	4/4
<b>Likelihood Comments:</b>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Run-off road associated with turning movements at the intersection.</li> <li>Some roadside hazards within the clear zone.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Road is undivided.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Controlled by a give way sign.</li> <li>Vehicles in left turn deceleration lane impeding sight distance for turning vehicles (dynamic visual obstruction).</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>All turn movements permitted.</li> <li>Channelised right turn and left turn lanes.</li> <li>Delineation by existing pavement markings.</li> <li>Signalised intersection to the east of the intersection creating platoons in the westbound traffic.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Queuing from intersection may result in rear end collisions in midblock.</li> <li>Vehicles tailgating.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Straight alignment on Tharwa Drive.</li> <li>Single lanes.</li> <li>Delineation by existing pavement markings.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Evidence that pedestrians are crossing the road circa 80 m east of the intersection where the road is circa 12.5 m wide.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Underpass aligning with the pedestrian route with path connections provided.</li> <li>Road side environment assists with discouraging pedestrians crossing Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>No on-road bicycle lanes, cyclists have to use vehicle lane.</li> <li>Priority controlled intersection, therefore, a vehicle is more likely to exit/enter the intersection in front of a cyclist.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Off road alternative route options.</li> <li>Underpasses provided.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Size of a motorcycle in contrast to passenger vehicles and thus more likely obscured by another vehicle.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> </ul>
<b>Score:</b>	3/4	3/4	4/4	3/4	1/4	2/4	3/4
<b>Severity Comments:</b>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>Underpass protected by a safety barrier.</li> <li>Frangible sign and slip base light poles.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Section of the road is undivided.</li> <li>B-double route</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Right angle crashes</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Score:</b>	2/4	4/4	4/4	2/4	4/4	4/4	4/4
<b>Product</b>	24/64	48/64	64/64	24/64	8/64	16/64	48/64
	<b>TOTAL</b>						<b>232/448</b>

Below is the legend for the following tables:

- Black text Common factor between this plan and the existing conditions
- ~~Strikethrough~~ Factor that is removed or significantly diminished between the existing conditions and this option
- *Blue italic text* New or significantly altered in this option compared to the existing conditions

Table 4-3 Tharwa Drive/ Lawrence Wackett Crescent Safe System Assessment Matrix – Option 1 – Signalise the intersection

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
<b>Exposure Comments:</b>	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	Pedestrian volumes are expected to be moderate based on visual observations (10-50 units/ day).	Cyclists volumes are expected to be moderate based on visual observations (10-50 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
<b>Score:</b>	4/4	4/4	4/4	4/4	2/4	2/4	4/4
<b>Likelihood Comments:</b>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Run-off road associated with turning movements at the intersection.</li> <li>Some roadside hazards within the clear zone.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> <li><i>Signalised intersection control.</i></li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Road is undivided.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li><del>Controlled by a give way sign.</del></li> <li><del>Vehicles in left turn deceleration lane impeding sight distance for turning vehicles (dynamic visual obstruction).</del></li> <li>All turn movements permitted.</li> <li><i>Likelihood of road users running the red light.</i></li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Channelised right turn and left turn lanes.</li> <li>Delineation by existing pavement markings.</li> <li>Signalised intersection to the east of the intersection creating platoons in the westbound traffic.</li> <li><i>Signalised intersection control.</i></li> <li><i>Fully controlled right turn.</i></li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Queuing from intersection may result in rear end collisions in midblock. <i>This will likely increase with traffic signals.</i></li> <li>Vehicles tailgating.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Straight alignment on Tharwa Drive.</li> <li>Single lanes.</li> <li>Delineation by existing pavement markings.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Evidence that pedestrians are crossing the road circa 80 m east of the intersection where the road is circa 12.5 m wide.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Underpass aligning with the pedestrian route with path connections provided.</li> <li>Road side environment assists with discouraging pedestrians crossing Tharwa Drive.</li> <li><i>Signalise pedestrian crossing facilities provided as part of the intersection signalisation.</i></li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>No on-road bicycle lanes, cyclists have to use vehicle lane.</li> <li><del>Priority controlled intersection, therefore, a vehicle is more likely to exit/enter the intersection in front of a cyclist.</del></li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Off road alternative route options.</li> <li>Underpasses provided.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Size of a motorcycle in contrast to passenger vehicles and thus more likely obscured by another vehicle.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li><i>Signalised intersection control.</i></li> </ul>
<b>Score:</b>	2.5/4	3/4	2/4	3.5/4	1/4	2/4	1.5/4
<b>Severity Comments:</b>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>Underpass protected by a safety barrier.</li> <li>Frangible sign and slip base light poles.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Section of the road is undivided.</li> <li>B-double route</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Right angle crashes</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Score:</b>	2/4	4/4	4/4	2/4	4/4	4/4	4/4
<b>Product</b>	20/64	48/64	32/64	28/64	8/64	16/64	24/64
	<b>TOTAL</b>						<b>176/448</b>

**Table 4-4 Tharwa Drive/ Lawrence Wackett Crescent Safe System Assessment Matrix – Option 2 – Extend the nose of the Lawrence Wackett Crescent median island**

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
<b>Exposure Comments:</b>	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	Pedestrian volumes are expected to be moderate based on visual observations (10-50 units/ day).	Cyclists volumes are expected to be moderate based on visual observations (10-50 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
<b>Score:</b>	4/4	4/4	4/4	4/4	2/4	2/4	4/4
<b>Likelihood Comments:</b>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Run-off road associated with turning movements at the intersection.</li> <li>Some roadside hazards within the clear zone.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Road is undivided.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Controlled by a give way sign.</li> <li>Vehicles in left turn deceleration lane impeding sight distance for turning vehicles (dynamic visual obstruction).</li> <li>All turn movements permitted.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Channelised right turn and left turn lanes.</li> <li>Delineation by existing pavement markings.</li> <li>Signalised intersection to the east of the intersection creating platoons in the westbound traffic.</li> <li><i>Improved delineation.</i></li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Queuing from intersection may result in rear end collisions in midblock.</li> <li>Vehicles tailgating.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Straight alignment on Tharwa Drive.</li> <li>Single lanes.</li> <li>Delineation by existing pavement markings.</li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Evidence that pedestrians are crossing the road circa 80 m east of the intersection where the road is circa 12.5 m wide.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Underpass aligning with the pedestrian route with path connections provided.</li> <li>Road side environment assists with discouraging pedestrians crossing Tharwa Drive.</li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>No on-road bicycle lanes, cyclists have to use vehicle lane.</li> <li>Priority controlled intersection, therefore, a vehicle is more likely to exit/enter the intersection in front of a cyclist.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Off road alternative route options.</li> <li>Underpasses provided.</li> </ul>	<p>Factors that <b>increase</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Size of a motorcycle in contrast to passenger vehicles and thus more likely obscured by another vehicle.</li> </ul> <p>Factors that <b>decrease</b> the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> </ul>
<b>Score:</b>	3/4	3/4	3.5/4	3/4	1/4	2/4	3/4
<b>Severity Comments:</b>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>Underpass protected by a safety barrier.</li> <li>Frangible sign and slip base light poles.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Section of the road is undivided.</li> <li>B-double route</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Right angle crashes</li> <li>B-double route.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>B-double route.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p>Factors that <b>increase</b> the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that <b>decrease</b> the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Score:</b>	2/4	4/4	4/4	2/4	4/4	4/4	4/4
<b>Product</b>	24/64	48/64	56/64	24/64	8/64	16/64	48/64
						<b>TOTAL</b>	<b>224/448</b>

Table 4-5 Tharwa Drive/ Lawrence Wackett Crescent Safe System Assessment Matrix – Option 3 – Reduce the speed to 60 km/h

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
<b>Exposure Comments:</b>	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	Pedestrian volumes are expected to be moderate based on visual observations (10-50 units/ day).	Cyclists volumes are expected to be moderate based on visual observations (10-50 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
<b>Score:</b>	4/4	4/4	4/4	4/4	2/4	2/4	4/4
<b>Likelihood Comments:</b>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Run-off road associated with turning movements at the intersection.</li> <li>Some roadside hazards within the clear zone.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> <li>60 km/h decreases distance travelled of loss of control vehicles.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Road is undivided.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> <li>Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Controlled by a give way sign.</li> <li>Vehicles in left turn deceleration lane impeding sight distance for turning vehicles (dynamic visual obstruction).</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>All turn movements permitted.</li> <li>Channelised right turn and left turn lanes.</li> <li>Delineation by existing pavement markings.</li> <li>Signalised intersection to the east of the intersection creating platoons in the westbound traffic.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Queuing from intersection may result in rear end collisions in midblock.</li> <li>Vehicles tailgating.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Straight alignment on Tharwa Drive.</li> <li>Single lanes.</li> <li>Delineation by existing pavement markings.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Evidence that pedestrians are crossing the road circa 80 m east of the intersection where the road is circa 12.5 m wide.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Underpass aligning with the pedestrian route with path connections provided.</li> <li>Road side environment assists with discouraging pedestrians crossing Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>No on-road bicycle lanes, cyclists have to use vehicle lane.</li> <li>Priority controlled intersection, therefore, a vehicle is more likely to exit/enter the intersection in front of a cyclist.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Off road alternative route options.</li> <li>Underpasses provided.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Size of a motorcycle in contrast to passenger vehicles and thus more likely obscured by another vehicle.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>Delineation by existing pavement markings.</li> </ul>
<b>Score:</b>	2/4	3/4	4/4	3/4	1/4	2/4	3/4
<b>Severity Comments:</b>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>Underpass protected by a safety barrier.</li> <li>Frangible sign and slip base light poles.</li> <li>Reduction in kinetic energy due to speed limit reduction.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Section of the road is undivided.</li> <li>B-double route</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>For head on crash types, the operating speeds (60-70 km/h) are considered to be close to tolerable levels for fatalities, however not serious injuries.</li> <li>Reduction in kinetic energy due to speed limit reduction.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>Right angle crashes</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>Reduction in kinetic energy due to speed limit reduction.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> <li>B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>Reduction in kinetic energy due to speed limit reduction.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a pedestrian.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a cyclist.</li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>80 km/h speed limit.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>None.</li> <li>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a motorcyclist.</li> </ul>
<b>Score:</b>	1/4	2/4	3/4	1/4	4/4	4/4	4/4
<b>Product</b>	8/64	24/64	48/64	12/64	8/64	16/64	48/64
						<b>TOTAL</b>	<b>164/448</b>

Table 4-6 Tharwa Drive/ Lawrence Wackett Crescent Safe System Assessment Matrix – Option 2 and 3

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
<b>Exposure Comments:</b>	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	AADT greater than 10,000 veh/day	Pedestrian volumes are expected to be moderate based on visual observations (10-50 units/ day).	Cyclists volumes are expected to be moderate based on visual observations (10-50 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
<b>Score:</b>	4/4	4/4	4/4	4/4	2/4	2/4	4/4
<b>Likelihood Comments:</b>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Run-off road associated with turning movements at the intersection.</li> <li>• Some roadside hazards within the clear zone.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Delineation by existing pavement markings.</li> <li>• Straight approaches on Tharwa Drive.</li> <li>• <i>60 km/h decreases distance travelled of loss of control vehicles.</i></li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Road is undivided.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Delineation by existing pavement markings.</li> <li>• Straight approaches on Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Controlled by a give way sign.</li> <li>• Vehicles in left turn deceleration lane impeding sight distance for turning vehicles (dynamic visual obstruction).</li> <li>• All turn movements permitted.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Channelised right turn and left turn lanes.</li> <li>• Delineation by existing pavement markings.</li> <li>• Signalised intersection to the east of the intersection creating platoons in the westbound traffic.</li> <li>• <i>Improved delineation.</i></li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Queuing from intersection may result in rear end collisions in midblock.</li> <li>• Vehicles tailgating.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Straight alignment on Tharwa Drive.</li> <li>• Single lanes.</li> <li>• Delineation by existing pavement markings.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Evidence that pedestrians are crossing the road circa 80 m east of the intersection where the road is circa 12.5 m wide.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Underpass aligning with the pedestrian route with path connections provided.</li> <li>• Road side environment assists with discouraging pedestrians crossing Tharwa Drive.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• No on-road bicycle lanes, cyclists have to use vehicle lane.</li> <li>• Priority controlled intersection, therefore, a vehicle is more likely to exit/enter the intersection in front of a cyclist.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Off road alternative route options.</li> <li>• Underpasses provided.</li> </ul>	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Size of a motorcycle in contrast to passenger vehicles and thus more likely obscured by another vehicle.</li> </ul> <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> <li>• Delineation by existing pavement markings.</li> </ul>
<b>Score:</b>	2/4	3/4	3.5/4	3/4	1/4	2/4	3/4
<b>Severity Comments:</b>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• Underpass protected by a safety barrier.</li> <li>• Frangible sign and slip base light poles.</li> <li>• <i>Reduction in kinetic energy due to speed limit reduction.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Section of the road is undivided.</li> <li>• B-double route</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>For head on crash types, the operating speeds (60-70 km/h) are considered to be close to tolerable levels for fatalities, however not serious injuries.</i></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• Right angle crashes</li> <li>• B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> <li>• B-double route.</li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a pedestrian.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a cyclist.</i></li> </ul>	<p>Factors that increase the severity include:</p> <ul style="list-style-type: none"> <li>• <del>90 km/h speed limit.</del></li> </ul> <p>Factors that decrease the severity include:</p> <ul style="list-style-type: none"> <li>• <del>None.</del></li> <li>• <i>Reduction in kinetic energy due to speed limit reduction, however, not considered significant to change the crash severity for a collision involving a motorcyclist.</i></li> </ul>
<b>Score:</b>	1/4	2/4	3/4	1/4	4/4	4/4	4/4
<b>Product</b>	8/64	24/64	42/64	12/64	8/64	16/64	48/64
						<b>TOTAL</b>	<b>158/448</b>

### 4.3 Safer Vehicles, People and Post-Crash Care

Table 4-7 provides a general high level overview of additional safe systems components associated with the assessed roads.

**Table 4-7 Additional Safe System Component**

Pillar	Prompt	Comment
Road User	Are road users likely to be alert and compliant, or are there factors that might influence this?	<ul style="list-style-type: none"> <li>The intersection is clearly signed on approach</li> <li>The straight approaches to the intersection could result in drivers exceeding the speed limit.</li> </ul>
	What are the expected compliance and enforcement levels (alcohol/drugs, speed, road rules, and driving hours) and what is the likelihood of driver fatigue? Can enforcement of these issues be conducted safely?	<ul style="list-style-type: none"> <li>There is potential for road users to use this road when travelling from an event/ club, etc. home and may be under the influence of alcohol/ drugs. However, this would occur network wide and should be addressed correspondingly.</li> <li>The straight approaches to the intersection can result in higher speeds. Suitable verge width for a mobile speed camera in proximity to the intersection on Tharwa Drive on the western side of the intersection.</li> </ul>
	Are there special road uses (e.g. entertainment precincts, elderly, children, on-road activities), distraction by environmental factors (e.g. commerce, tourism), or risk-taking behaviours?	<ul style="list-style-type: none"> <li>Road users use the intersection to enter/exit Theodore.</li> <li>Tharwa Drive is an Arterial Road.</li> <li>Turn movements are a higher level of risk due to speed.</li> </ul>
Vehicle	What level of alignment is there with the ideal of safer vehicles?	<ul style="list-style-type: none"> <li>There is nothing to indicate this project contravenes the ideals of safer vehicles.</li> </ul>
	Are there factors which might attract large numbers of unsafe vehicles? Is the percentage of heavy vehicles too high for the proposed/existing road design?	<ul style="list-style-type: none"> <li>The distribution of vehicle types will likely remain.</li> <li>Intersection used for public transport.</li> <li>Tharwa Drive is a B-double route.</li> <li>Low heavy vehicle volumes for an arterial road.</li> </ul>
	Are there enforcement resources in the area to detect non-roadworthy, overloaded or unregistered vehicles and thus remove them from the network? Can enforcement of these issues be conducted safely?	<ul style="list-style-type: none"> <li>Inspections of vehicle roadworthy are undertaken network wide. Potential to undertake additional reviews network wide at locations where compliance could be an issue.</li> <li>Nothing constrains enforcement.</li> </ul>
	Has vehicle breakdown been catered for?	<ul style="list-style-type: none"> <li>The trafficable width of Tharwa Drive would require a stopped vehicle to park on the verge.</li> <li>The trafficable width of Lawrence Wackett Crescent is sufficient for a vehicle to stop on the road and maintain two way movements.</li> </ul>
Post-crash care	Are there issues that might influence safe and efficient post-crash care in the event of a severe injury?	<ul style="list-style-type: none"> <li>No identified issues.</li> </ul>
	Do emergency and medical services operate as efficiently and rapidly as possible?	<ul style="list-style-type: none"> <li>Emergency services are nearby. It is assumed that there would be an efficient post-crash response and care.</li> </ul>
	Are other road users and emergency response teams protected during a crash event? Are drivers provided the correct information to address travelling speeds on the approach and adjacent to the incident? Is there reliable information available via radio, VMS etc.?	<ul style="list-style-type: none"> <li>Opportunity to close the road where the event occurred with minimal impact to road users.</li> <li>A detour of road users could be implemented.</li> </ul>
	Is there provision for e-safety (i.e. safety systems based on modern information and communication technologies, C-ITS)?	<ul style="list-style-type: none"> <li>Not applicable for this location due to the road side environment.</li> </ul>

## 5. PROPOSED IMPROVEMENTS

### 5.1 Option 1 – Signalise the intersection

This option has the potential to reduce the number of collisions from adjacent approaches and opposing turns that are occurring. Traffic signals can be expected to reduce adjacent approach collisions by 70% and collisions from opposing turns by 45% (based on Austroads Guide to Road Safety Part 8 Treatment of Crash Locations, Appendix F).

A preliminary assessment of the economic worth of installing traffic signals has been undertaken using assumptions detailed in the following section.

A preliminary estimate of the cost of traffic signals (including site works, ██████ consultancy fees and ██████ contingency) is ██████ excluding GST.

A sketch of the option is provided in Appendix 1 and the cost estimate is provided in Appendix 2.

### 5.2 Option 2 – Extend the nose of the Lawrence Wackett Crescent median island

This option has the potential to reduce the number of collisions from adjacent approaches from occurring. The extension of the median island and gating the “Give Way” signs would reinforce the priority of the intersection. This option can be expected to reduce adjacent approach collisions by 30% (based on Austroads Guide to Road Safety Part 8 Treatment of Crash Locations, Appendix F).

A preliminary assessment of the economic worth of extending the nose of the Lawrence Wackett Crescent median island has been undertaken using assumptions detailed in the following section.

A preliminary estimate of the cost of extending the median island and gating the “Give Way” signs (including site works, ██████ consultancy fees and ██████ contingency) is ██████ excluding GST.

A sketch of the option is provided in Appendix 1 and the cost estimate is provided in Appendix 2.

### 5.3 Option 3 – Reduce the speed to 60 km/h

This option has the potential to reduce the number of collisions from adjacent approaches and opposing turns that are occurring. It is not expected to influence rear end or loss of control collisions associated with vehicles exiting Lawrence Wackett Crescent due to the low Lawrence Wackett Crescent speed limit. A speed reduction from 80 km/h to 60 km/h is expected to reduce collisions by 20% (based on Austroads Road Safety Engineering Toolkit).

A preliminary assessment of the economic worth of this option has been undertaken using assumptions detailed in the following section.

A preliminary estimate of the cost of reducing the speed limit is ██████ excluding GST.

### 5.4 BCR Assessment

The following details the financial assessment of the costs and benefits of undertaking these modifications based on the projected extent of the reduction in accidents due to the modifications. Assumptions used in our assessments and in particular for the potential benefits for the Tharwa Drive/ Lawrence Wackett Crescent intersection are detailed below.

Roads ACT has provided the following summary data in relation to the cost of various types of collisions in the ACT.

Table 5-1 2018 Crash Cost Estimates for Different Crash Type Codes

Crash Type Code	ACT Equivalent Crash Types	Description	Costs (\$)	
			HC <sup>1</sup>	WTP <sup>2</sup>
001-009	10,16	Vehicle Hits Pedestrian	196,736	████████
101-109	2	Adjacent Approaches	33,442	████████
201	4,5	Head On	196,953	████████
202	1	Right Turn into Oncoming Vehicle	50,940	████████
203-207	9	Opposing Turns	21,510	████████
301-304	6	Rear End	13,046	████████
305-309	3,9	Lane Change/ Side Swipe	15,974	████████
401-403	9	Hit Parked / Parking Vehicle	11,734	████████
404	8	Reversing into Traffic	11,354	████████
405	12,19	Reversing into Fixed Object	10,079	████████
406-408	9	Leaving Driveway/Footway	16,950	████████
501-506	9,15,19,20,21	Overtaking	48,234	████████
601,602,604	7	Hit Parked Vehicle	13,663	████████
603	9	Collision with Broken Down Vehicle	36,750	████████
605-607	12	On Path, Hit Object	35,518	████████
609	11	Struck Animal	13,623	████████
610	15	Loads Hit Vehicle	10,658	████████
701-708	13,15,19,20,21	Loss of Control on Straight- L or R turns	56,481	████████
801-805,808	13,15,19,20,21	Loss of Control on Curve - L or R turns	69,533	████████
901	14	Fell from Moving Vehicle	1,019,477	██████████
902-907	01 to 22	Miscellaneous	58,108	████████
Other e.g. 07, 08	01 to 22	Other	34,356	████████

Table 5-2 2015 Average crash costs by crash severity

Costs by crash type	Costs (\$)	
	HC <sup>1</sup>	WTP <sup>2</sup>
Fatal crashes	2,960,016	██████████
Serious injury crashes	765,311	████████
Minor injury crashes	29,556	████████
Property Damage Only crashes	10,079	████████

Note: 1 – Human Capital (HC), 2 – Willingness-to-pay (WTP)

The above costs are calculated using accident records for the period of 2014-2018. In the calculation of BCR the Willingness-to-pay costs are used, with the Human Capital cost provided for comparison.

Assumptions of the effectiveness of countermeasures in reducing recorded accidents were taken from the Austroads publication Guide to Road Safety Part 8 Treatment of Crash Locations, Appendix F. In situations where particular circumstances are not detailed in the Austroads Guidelines, engineering judgement has been applied.

The assessment of the value of collision reductions due to improvement treatments at the intersection is summarised in the table below:

Accident Type	Number Recorded in 5 years	Annual Accident Cost		Proportion Reduction	Annual Benefit	
		HC	WTP		HC	WTP
<b>Option 1 – Signalise the intersection</b>						
102 Adjacent Approaches - Right-Thru	2	\$13,377	\$ █████	0.7	\$9,364	\$ █████
104 Adjacent Approaches - Thru-Right	6	\$40,130	\$ █████	0.7	\$28,091	\$ █████
105 Adjacent Approaches - Right-Right	3	\$20,065	\$ █████	0.7	\$14,046	\$ █████
202 Opposing Turns - thru-right	5	\$50,940	\$ █████	0.45	\$22,923	\$ █████
Injury crashes						
104 Adjacent Approaches - Thru-Right	1	\$153,062	\$ █████	0.7	\$107,144	\$ █████
<b>TOTAL</b>					<b>\$181,568</b>	<b>\$ █████</b>
<b>Option 2 – Extend the nose of the Lawrence Wackett Crescent median island</b>						
102 Adjacent Approaches - Right-Thru	2	\$13,377	\$ █████	0.3	\$4,013	\$ █████
104 Adjacent Approaches - Thru-Right	6	\$40,130	\$ █████	0.3	\$12,039	\$ █████
105 Adjacent Approaches - Right-Right	3	\$20,065	\$ █████	0.3	\$6,020	\$ █████
Injury crashes						
104 Adjacent Approaches - Thru-Right	1	\$153,062	\$ █████	0.3	\$45,919	\$ █████
<b>TOTAL</b>					<b>\$67,991</b>	<b>\$ █████</b>
<b>Option 3 – Reduce the speed to 60 km/h</b>						
102 Adjacent Approaches - Right-Thru	2	\$13,377	\$ █████	0.2	\$2,675	\$ █████
104 Adjacent Approaches - Thru-Right	6	\$40,130	\$ █████	0.2	\$8,026	\$ █████
105 Adjacent Approaches - Right-Right	3	\$20,065	\$ █████	0.2	\$4,013	\$ █████
202 Opposing Turns - thru-right	5	\$50,940	\$ █████	0.2	\$10,188	\$ █████
Injury crashes						
104 Adjacent Approaches - Thru-Right	1	\$153,062	\$ █████	0.2	\$30,612	\$ █████
<b>TOTAL</b>					<b>\$55,514</b>	<b>\$ █████</b>

Option 2 and 3						
102 Adjacent Approaches - Right-Thru	2	\$13,377	\$ [REDACTED]	0.2	\$2,675	\$ [REDACTED]
104 Adjacent Approaches - Thru-Right	6	\$40,130	\$ [REDACTED]	0.2	\$8,026	\$ [REDACTED]
105 Adjacent Approaches - Right-Right	3	\$20,065	\$ [REDACTED]	0.2	\$4,013	\$ [REDACTED]
202 Opposing Turns - thru-right	5	\$50,940	\$ [REDACTED]	0.2	\$10,188	\$ [REDACTED]
Injury crashes						
104 Adjacent Approaches - Thru-Right	1	\$153,062	\$ [REDACTED]	0.2	\$30,612	\$ [REDACTED]
<b>TOTAL</b>					<b>\$55,514</b>	<b>\$ [REDACTED]</b>

The analysis indicated the following BCR and net present value (at 7% over 10 years) for the treatments with both Human Capital costs and Willingness-to-Pay.

Treatment	Approach	Estimated Costs	NPV	NPV/Capital Cost	BCR
Option 1 – Signalise the intersection	HC	\$760,035	\$ [REDACTED]	0.74	1.79
	WTP		\$ [REDACTED]	[REDACTED]	[REDACTED]
Option 2 – Extend the nose of the Lawrence Wackett Crescent median island	HC	\$141,856	[REDACTED]	2.43	3.59
	WTP		\$ [REDACTED]	[REDACTED]	[REDACTED]
Option 3 – Reduce the speed to 60 km/h	HC	\$5,000	[REDACTED]	76.21	77.61
	WTP		\$ [REDACTED]	[REDACTED]	[REDACTED]
Option 2 & 3	HC	\$146,856	[REDACTED]	4.32	[REDACTED]
	WTP		\$ [REDACTED]	[REDACTED]	[REDACTED]

The analysis indicates that there would be benefit gained from each of the proposed options. Note that BCR values have been provided for both HC and WTP approaches for comparison. However, as the WTP approach is adopted for the Black Spot Program these values are further commented on below.

The BCR calculations are provided in Appendix 3.

### 5.5 Audit related modifications

The pavement on the Tharwa Drive westbound and Lawrence Wackett Crescent approaches and to the intersection requires to repair to improve friction for stopping/ slowing vehicles

## **6. RECOMMENDATIONS**

### **6.1 Modifications Addressing Historical collisions.**

The analysis indicates that each of the proposed options would result in adequate benefit gained, with the results indicating that reducing the speed limit to 60 km/h (Option 3) has the highest BCR. However, this treatment should only be considered as a short term treatment particularly due to the likely non-compliance to the speed limit by road users. The combination of extending the nose of Lawrence Wackett Crescent median island (Option 2) with the speed reduction would provide additional safety through reinforcing the priority of the T-intersection and providing treatments on Tharwa Drive to provide visual narrowing of the road to assist with the speed reduction.

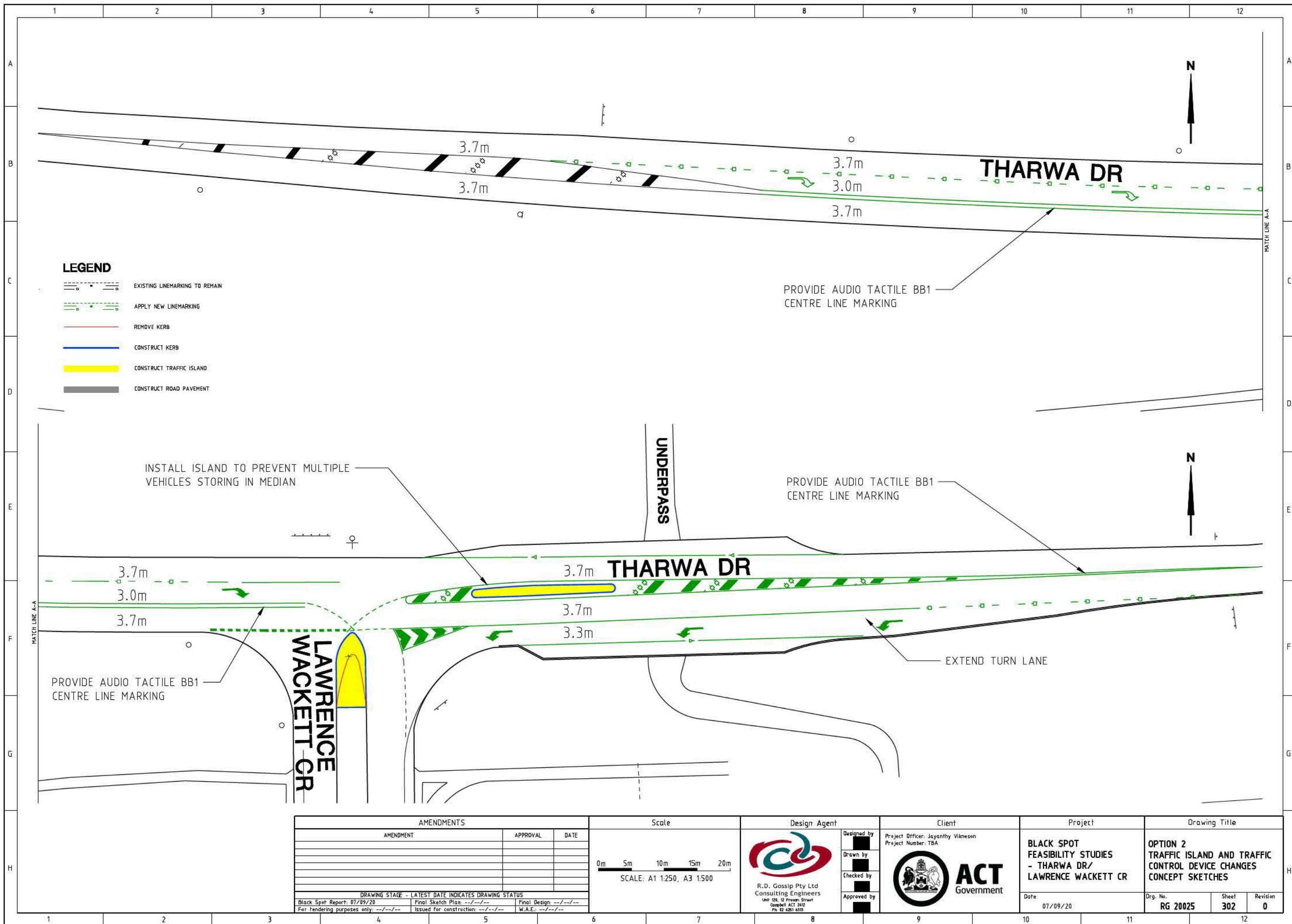
As multiple collisions involving right turning vehicles occurred at this intersection the signalisation of the intersection is considered the most suitable solution (Option 1). The SSA results validate the signalisation of the intersection with improvements in all collision types except for “other” collisions. This is due to the potential for the likelihood of rear end collisions occurring at the intersection.

### **6.2 Modifications Addressing Potential Collisions**

The options provided in this feasibility study have addressed the identified audit findings at the intersection.

## APPENDIX 1 CONCEPT SKETCHES

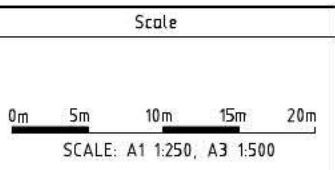




AMENDMENTS		
AMENDMENT	APPROVAL	DATE

DRAWING STAGE - LATEST DATE INDICATES DRAWING STATUS		
Black Spot Report: 07/09/20	Final Sketch Plan: --/--/--	Final Design: --/--/--
For tendering purposes only: --/--/--	Issued for construction: --/--/--	W.A.E.: --/--/--



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Drawn by  
Checked by  
Approved by

**Client**

Project Officer: Jayanthi Vikneson  
Project Number: TBA

ACT Government

**Project**

BLACK SPOT FEASIBILITY STUDIES - THARWA DR/ LAWRENCE WACKETT CR

Date: 07/09/20

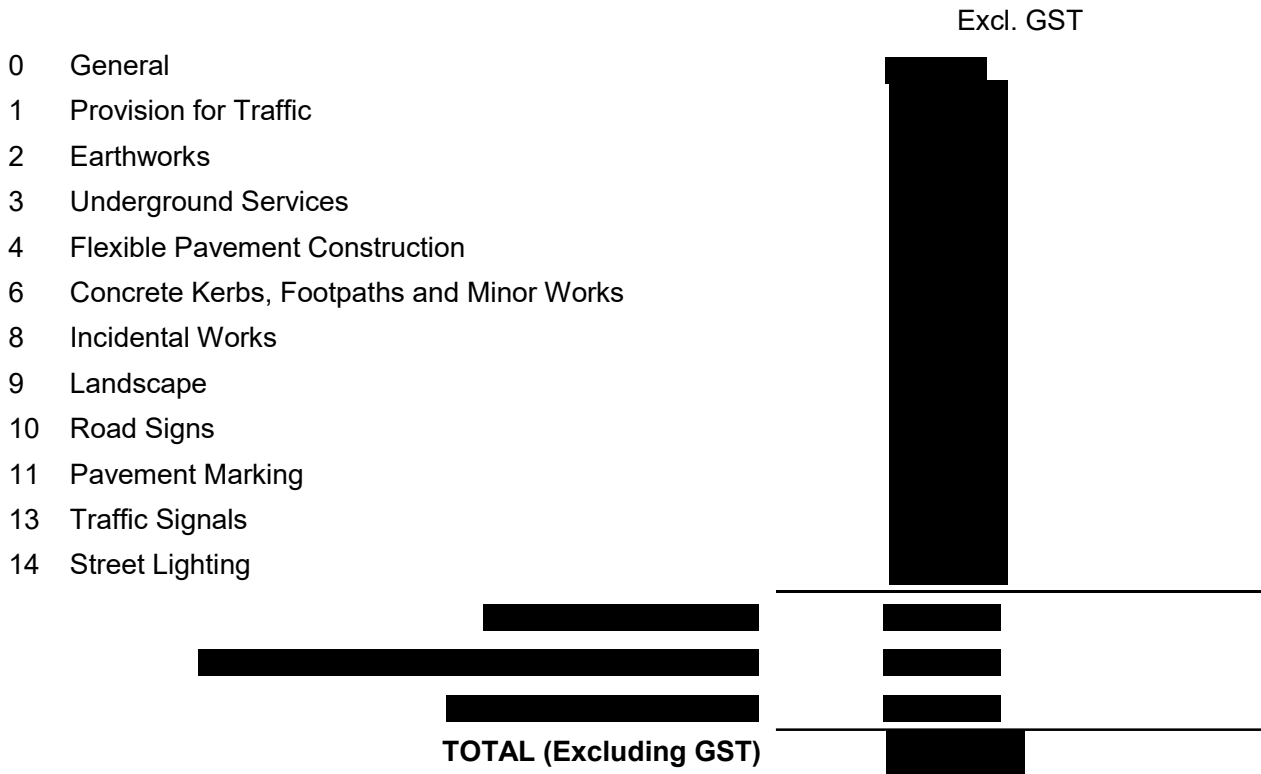
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OPTION 2 TRAFFIC ISLAND AND TRAFFIC CONTROL DEVICE CHANGES CONCEPT SKETCHES

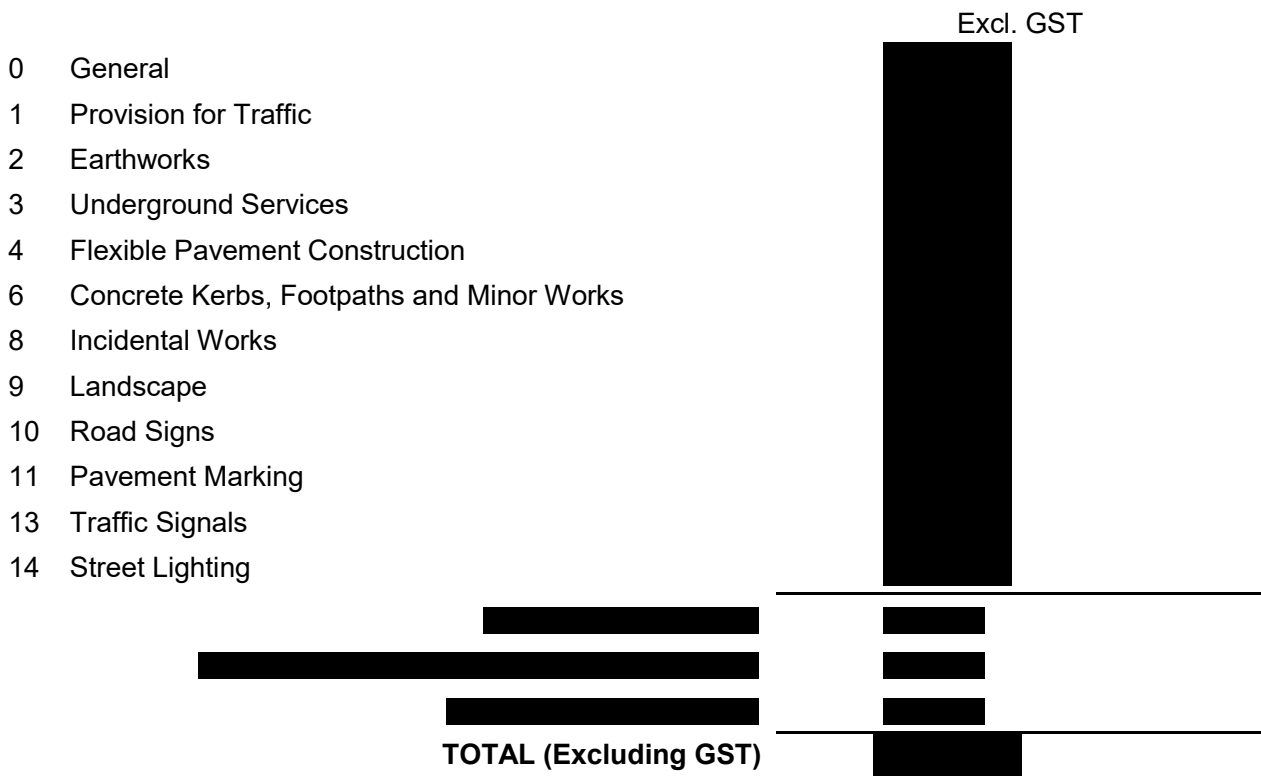
Dwg. No.	Sheet	Revision
RG 20025	302	0

**APPENDIX 2 ESTIMATED COSTS**

**Option 1 – Signalise the intersection**



**Option 2 – Extend the nose of the Lawrence Wackett Crescent median island**



Note: Costings are based on the sketch design. Service providers have not been contacted in relation to the type and location of services in the area. Potholing has not been undertaken to identify specific location and depth of services. Design and construction costs may vary depending on the Service provider requirements to relocate or protect the service where required.

## APPENDIX 3 FINANCIAL ANALYSES

Note: Benefit Cost Analysis has only been provided for the WTP approach.

