COWPER STREET TRAFFIC STUDY

SAFE SYSTEMS ASSESSMENT

TRANSPORT CANBERRA AND CITY SERVICES

FINAL

RG23051-2/1

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Consulting Engineers

COWPER STREET TRAFFIC STUDY

SAFE SYSTEMS ASSESSMENT

Prepared for Transport Canberra and City Services

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1. SUMMARY

Project Name:	Cowper Street Traffic Study
Assessment for:	Transport Canberra and City Services
Project Officer	Jayanthy Vikneson
Telephone:	(02) 6205 3208
Assessors:	Sch 2.2(a)(ii) Senior Traffic Engineer, Lead Level 3 Road Safety Auditor Senior Designer, Level 2 Road Safety Auditor
Meetings:	A start-up meeting was held with Roads ACT on 14 August 2023. The different elements and background information for Cowper Street were discussed
Site Inspections:	Tuesday 5 September 2023 and Wednesday 6 September 2023 between: • 8:00 am – 9:15 am • 2:30 pm – 3:30 pm (school afternoon) • 4:30 pm – 5:30 pm • 8:30 pm – 9:30 pm
Site Description	Cowper Street is a 2 lane 2 way Major Collector Road. Existing 60 km/h speed limit with 40 km/h school zone. Ainslie (Limestone Avenue – Majura Avenue) – Urban Road with access to single and multi-unit dwelling residences. Dickson (Majura Avenue – Antill Street) – Urban Road with access to single and multi-unit dwelling residences, a school (Yr 7-12), swimming pool and Dickson Group Centre.
Assessment Options	The assessment was undertaken on the following sections of Cowper Street: • Limestone Avenue – Majura Avenue. • Cowper Street/ Majura Avenue intersection. • Majura Avenue – Davenport Street. • Davenport Street – Antill Street.
Design Options:	The assessment was undertaken for the following design options: • Traffic lane width reduction. • Speed reduction to 50 km/h between Limestone Avenue and Davenport Street. • Speed reduction to 40 km/h between Davenport Street and Antill Street. • Vertical deflection devices. • Intersection improvements.

The Safe System Matrix scores for the existing conditions and the score that would be achieved if the identified design options were to be incorporated are provided in **Table 1-1**.

Table 1-1 Safe System Matrix scores

Road Section	Score out of 448	
	Existing	Proposed
Cowper Street – Limestone Avenue to Majura Avenue	176	99.5
Cowper Street/ Majura Avenue intersection	224	133
Cowper Street – Majura Avenue to Davenport Street	232	129
Cowper Street – Davenport Street to Antill Street	232	66

1.1 Conclusion

The installation of the treatments associated with the proposed design options would provide benefit to the safety of the assessed road. It is recommended that the following be undertaken:

- Cowper Street – Limestone Avenue to Majura Avenue
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h.
  - Vertical deflection devices.
- Cowper Street/ Majura Avenue intersection
  - Speed reduction to 50 km/h on Cowper Street.
  - Provide a dedicated right-turn lane on Cowper Street in both directions.
- Cowper Street – Majura Avenue to Davenport Street
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h (retain the 40 km/h school zone).
  - Vertical deflection devices.
- Cowper Street – Davenport Street to Antill Street
  - Traffic lane width reduction.
  - Speed reduction to 40 km/h (expand the 40 km/h High Pedestrian Area).
  - Extend the right turn deceleration lane to Dickson Place.
  - Reduction of Cowper Street to one lane in each direction at the Dickson Shop Access road intersection.

2. ASSESSMENT DETAILS

2.1 Introduction

Transport Canberra and City Service (TCCS) has received a number of enquiries regarding speeding and road safety on Cowper Street.

This study was initiated following a recent Ministerial response committed to undertake a traffic investigation on this street.

RD Gossip were engaged to undertake a traffic investigation on Cowper Street and provide recommendations to mitigate traffic concerns raised for this road and identified during the study.

2.2 Assessment Scope

The purpose of this project is to undertake a traffic investigation on Cowper Street, including a Safe Systems Assessment, to assess existing conditions against the proposed infrastructure so it aligns with the Safe Systems principles and the objectives to eliminate collisions that result in fatal and serious injuries.

2.3 Assessment Team

The following team members are involved with this project:

- Sch 2.2(a)(ii) R D Gossip Pty Ltd Senior Traffic Engineer, Lead Level 3 Road Safety Auditor
- R D Gossip Pty Ltd Senior Designer, Level 2 Road Safety Auditor

2.4 Meeting and Site Inspections

2.4.1 Meetings

A start-up meeting was held with Roads ACT on 14 August 2023. The different elements and background information for Cowper Street were discussed.

3. SITE INSPECTIONS

Site inspections were undertaken on Tuesday 5 September 2023 and Wednesday 6 September 2023 between:

- 8:00 am – 9:15 am
- 2:30 pm – 3:30 pm (school afternoon)
- 4:30 pm – 5:30 pm
- 8:30 pm – 9:30 pm

A summary of the key observations are listed below for the respective periods:

3.1 General Comments

- The function of Cowper Street differs along the route based on the roadside environment. Majura Avenue splits the operation of Cowper Street between Ainslie and Dickson, with further separation of the Dickson component associated with activities at the Dickson Group Centre and Daramalan College.
- Several vehicles were parked on the verge along various sections of the road. On-street parking is permitted along some sections.
- The congestion of traffic during the peak periods assisted with encouraging road users to drive slower. However, as the traffic cleared several road users appeared to travel above the posted speed limit.
- Buses stopped at the Dickson Group Centre impede the visibility of path users crossing the road at the wombat crossing.
- The Dickson Aquatic Centre is currently closed, scheduled to be reopened in late October. It is expected that active travel activities will increase in the proximity of the centre when it reopens.

3.1.1 AM Inspection (8:30 am – 9:30 am)

3.1.1.1 Limestone Avenue – Majura Avenue

- There is a high number of southbound vehicles using Cowper Street as a rat run rather than staying on Majura Avenue/ Limestone Avenue.
- Several vehicles were observed using Bonney Street rather than Cowper Street, with some diverting to Paterson Street (via Foveaux Street) to avoid congestion on Limestone Avenue.
- There were several instances where vehicles that appeared to be travelling at the speed limit were tailgated.
- The northbound traffic volume was low to moderate.
- Several cyclists were observed using Sherbrooke Street, with some continuing to cycle on Cowper Street (on the road and the path), some crossing towards Angas Street and some using Bonney Street.
- The roundabout with Wakefield Street assisted with slowing through traffic, particularly with the traffic generated during the morning period.
- The observed delay at the priority controlled intersections was minimal (less than 20 seconds).

3.1.1.2 Cowper Street/ Majura Avenue Intersection

- The majority of the traffic at the intersection was associated with Majura Avenue and the north side of Cowper Street.
- The majority of the traffic in the southbound right lane on Cowper Street at the signals turned right.
- The observed traffic movements appeared very orderly. Several vehicles did proceed through the traffic signals during the initial inter-green period (yellow light only) when travelling on Cowper Street and Majura Avenue.
- Although the "Form One Lane" sections are short on Cowper Street, due to the right turning movements in the southbound direction and the low volumes in the northbound direction they appeared to operate satisfactorily.

3.1.1.3 Majura Avenue – Antill Street

- Traffic movements between Morphett Street and Antill Street were slowed by traffic volumes and roadside interactions (pedestrian crossings/ traffic signals/ children's crossings).
- Southbound road users are likely diverting to Cowper Street at the intersection with Antill Street to avoid congestion at the Northbourne Avenue intersections.
- There were moderate delays at the priority controlled intersections at Morphett Street, Davenport Street and Dickson Place.
- A vehicle was observed not stopping at the children's crossing while a pedestrian was about to cross the road.
- Pedestrian movements between the Dickson Group Centre and Daramalan College were high.
- The pedestrian and cyclist crossing volumes associated with the Dickson to ANU community path were high. During some periods there was high congestion by path users at the crossing.
- The wombat crossing adjacent to Dickson Pool was moderately used. A cyclist was observed using the wombat crossing to cross the road at high speed and nearly collided with a pedestrian on the west side of the road.

3.1.2 PM School Inspection (2:30 pm – 3:30 pm)

3.1.2.1 Limestone Avenue – Majura Avenue

- Traffic volumes appeared lower with fewer rat running activities than in the AM period.
- There was moderate pedestrian and cyclist roadside activity associated with school-aged children.

3.1.2.2 Cowper Street/ Majura Avenue Intersection

- Traffic volumes through the intersection appeared lower than in the AM period.

3.1.2.3 Majura Avenue – Antill Street

- There were high pedestrian movements associated with end of school activities from Daramalan College and nearby schools (including parents/ carers arriving at the centre after collecting children).
- Queuing on Davenport Street was similar to the AM period, however, the other intersections, including Morphett Street appeared to operate satisfactorily.

3.1.3 PM Inspection (4:30 pm – 5:30 pm)

3.1.3.1 Limestone Avenue – Majura Avenue

- Traffic volumes appeared lower with fewer rat running activities than in the AM period.
- There were fewer pedestrian and cyclist roadside activities than in the other periods.

3.1.3.2 Cowper Street/ Majura Avenue Intersection

- Traffic volumes through the intersection appeared to be similar to the AM period.

3.1.3.3 Majura Avenue – Antill Street

- Similar conditions to the AM inspection.
- The crossing volume associated with the Dickson to ANU community path appeared to have higher cyclist numbers in comparison with the AM inspection. There was less congestion at the crossing due to lower pedestrian volumes/fewer school related movements.
- The wombat crossing was moderately used.

4. PROJECT CONTEXT AND DESCRIPTION

4.1 Existing Conditions

4.1.1 Road Description

Cowper Street has the following characteristics:

- Major Collector Road in the ACT road hierarchy.
- The majority is a two-lane two-way undivided road except for approaches to the Majura Avenue and Antill Street signalised intersections.
- Provides a connection between Limestone Avenue and Antill Street.
- Passes through Ainslie between Limestone Avenue and Majura Avenue (circa 1.2 km).
- Passes through Dickson between Majura Avenue and Antill Street (circa 1 km).
- It has a speed limit of 60 km/h with a 40 km/h school zone between Hope Street and Davenport Street.
- Between Limestone Avenue and Dickson Place, it is circa 9.2 m wide with localised widening at the signalised intersections at Limestone Avenue and Majura Avenue.
- Between Dickson Place and Antil Street, it is circa 12 m wide with localised widening at the signalised intersection at Antill Street.
- Paths are provided on both sides of the road for the entire length.
- On road cycle lanes are provided between Morphett Street and Dooring Street. These cycle lanes were introduced as part of a road reseal program due to the short section and not continuing in other sections.
- The road has the following traffic calming measures:

  - A roundabout with Wakefield Avenue.

- A refuge island between Suttor Street and Bonney Street.

- A children's crossing between Morphett Street and Davenport Street.

- A wombat crossing between Dickson Place (south) and (north) opposite the Dickson Aquatic Centre.

4.1.2 Traffic Volume and Speed Data

Traffic volume and speed data were measured by TCCS at five locations on Cowper Street in 2019.

The results are provided in **Table 4-1**.

Table 4-1 Traffic Volumes and Speed Data

Towards	Survey Start Date	Weekday Average (vpd)	Weekday Average Speed (km/h)	Weekday 85 %ile Speed (km/h)
Between Toms Crescent and Foveaux Street				
Foveaux Street (EB)	11/08/2019	1,443	46.4	55.1
Toms Crescent (WB)		3,083	47.1	55.4
Total Volume		**4,526**		
Between Cox Street and Wakefield Avenue				
Wakefield Avenue (NB)	5/09/2019	956	48.8	56.1
Cox Street (SB)		2,192	50.2	56.4
Total Volume		**3,148**		
Between Wakefield Avenue and Suttor Street				
Suttor Street (NB)	10/08/2019	873	46.7	52.9
Wakefield Avenue (SB)		2,273	47.7	54.4
Total Volume		**3,146**		

Towards	Survey Start Date	Weekday Average (vpd)	Weekday Average Speed (km/h)	Weekday 85 %ile Speed (km/h)
Between Dooring Street and Hope Street				
Hope Street (NB)	10/08/2019	5,857	48.4	54.0
Dooring Street (SB)		4,855	48.8	55.8
Total Volume		**10,712**		
Between Hope Street and Morphett Street				
During School Hours				
Morphett Street (NB)	10/08/2019	2,846	40.0	48.9
Hope Street (SB)		2,719	41.8	47.2
Outside School Hours				
Morphett Street (NB)	10/08/2019	3,037	48.4	56.9
Hope Street (SB)		1,464	51.5	59.8
Total Volume		**10,066**		

The traffic volumes on Cowper Street between Limestone Avenue and Majura Avenue are between 3,001 to 6,000 vehicles per day, which are typical volumes for a major collector road classification. There is a distinctive difference between the northbound/eastbound and southbound/westbound traffic volumes between Limestone Avenue and Majura Avenue, with the northbound/eastbound traffic volumes circa half the southbound/westbound traffic volumes. This exemplifies the “rat-running movement between Majura Avenue and Limestone Avenue that was observed over the various inspections.

The traffic volumes on Cowper Street between Majura Avenue and Antill Street are over 6,000 vehicles per day, falling within the range of an arterial road (greater than 6,000 vehicles per day). This would be attributed to traffic generated by the Dickson Group Centre and Daramalan College. Roads to group centres typically have traffic volumes above their road classification allocation. Traffic volumes are split relatively evenly between directions over a daily period, however, indicated a high southbound movement in the AM peak period and northbound in the PM peak period.

Roads where traffic volumes are higher than their classification can result in the following safety implications:

- Intersections could experience long delays on the non priority leg of the intersection, resulting in road users accepting insufficient gaps in the traffic.
- Property accesses are impacted, particularly where vehicles reverse onto the road.
- Pedestrian and cyclist movements are impacted by the increase in vehicle movements.

Although traffic volumes associated with the Dickson Group Centre and Daramalan College will remain regardless of the treatment, there should be consideration to discourage “rat running” movements between Antill Street and Majura Avenue.

The review of speed data is based on the 85th percentile speed. The 85th percentile speed is the speed at which 85% of the surveyed road users travelled at or below. The 85th percentile speed is often referred to as the operating speed for a road and represents the travel speed adopted for the road conditions and environment. In instances where the 85th percentile speed is 10% over the posted speed limit, treatments (e.g. engineered treatments, enforcement) should be considered to address road users exceeding the posted speed limit, with consideration for treatments in school zones where the 85%

percentile speed is greater than 5% due to the higher activity generated by the school and younger pedestrian activities.

Speed data indicates that the majority of road users comply with the 40 km/h school zone speed limit and the 60 km/h speed limit, except for a marginal increase in the southbound direction (vehicles leaving the school zone). The 85th percentile motorists are travelling below the 60 km/h speed limit, however, are travelling circa 20% above the 40 km/h school zone speed limit.

4.1.3 Collision History

Collision data was provided for the seven year period from 1 January 2015 to 31 December 2021 for Cowper Street.

A total of 190 collisions occurred on Cowper Street, excluding collisions at the intersections with Limestone Avenue and Antill Street. There were no collisions which resulted in a fatality. 17 collisions resulted in injuries. 2 pedestrians, 18 cyclists and 2 motorcyclists were involved in collisions.

Comparisons of the collision characteristics for Cowper Street with the ACT average are provided below:

Collision characteristic	Cowper Street	ACT Average (2020 ACT Crash Report)
Collisions resulting in injuries	8.9%	9.3%
Collisions occurring on a weekday	78.9%	80.3%
Collisions occurring during wet weather	11.1%	11.9%
Collisions occurring during reduced lighting conditions (dusk to dawn)	24.2%	19.9%

4.1.3.1 Cowper Street – Limestone Avenue to Majura Avenue (50 Collisions)

From the 50 collisions that occurred on Cowper Street between Limestone Avenue and Majura Avenue, 5 collisions resulted in injuries. 1 pedestrian, 4 cyclists and 1 motorcyclist were involved in collisions.

Collision characteristic	Cowper Street (Limestone Avenue to Majura Avenue)	ACT Average (2020 ACT Crash Report)
Collisions resulting in injuries	10.0%	9.3%
Collisions occurring on a weekday	80.0%	80.3%
Collisions occurring during wet weather	16.0%	11.9%
Collisions occurring during reduced lighting conditions (dusk to dawn)	26.0%	19.9%

- The collision involving a pedestrian, 2 collisions involving cyclists, and 2 collisions at intersections between two vehicles, resulted in injuries (total 5 collisions).
- 80% of the collisions occurred at intersections, with collisions from adjacent approaches/ opposing directions (RUM Code 10 and 20 series) comprising 52% of all these collisions.
- 12 of the 40 collisions at intersections occurred at the Cowper Street/ Foveaux Street/ Bonney Street intersection.

4.1.3.2 Cowper Street/ Majura Avenue intersection (52 Collisions)

From the 52 collisions that occurred at the Cowper Street/ Majura Avenue intersection, 4 collisions resulted in injuries. 1 cyclist and 1 motorcyclist were involved in collisions.

Collision characteristic	Cowper Street/ Majura Avenue Intersection	ACT Average (2020 ACT Crash Report)
Collisions resulting in injuries	7.7%	9.3%
Collisions occurring on a weekday	76.9%	80.3%
Collisions occurring during wet weather	7.7%	11.9%
Collisions occurring during reduced lighting conditions (dusk to dawn)	26.9%	19.9%

- 4 collisions resulted in injuries. All injury collisions involved vehicles only.
- 17 of the 52 collisions involved vehicles on Cowper Street. The collisions were circa even between directions (northbound/ southbound) and collisions from adjacent approaches/ opposing directions (RUM Code 10 and 20 series)/ collisions from the same direction (RUM Code 30 series).
- One collision that could be associated with the intersection merge arrangement was a southbound overtaking collision where the vehicle lost control (RUM Code 502).

4.1.3.3 Cowper Street – Majura Avenue to Antill Street (88 Collisions)

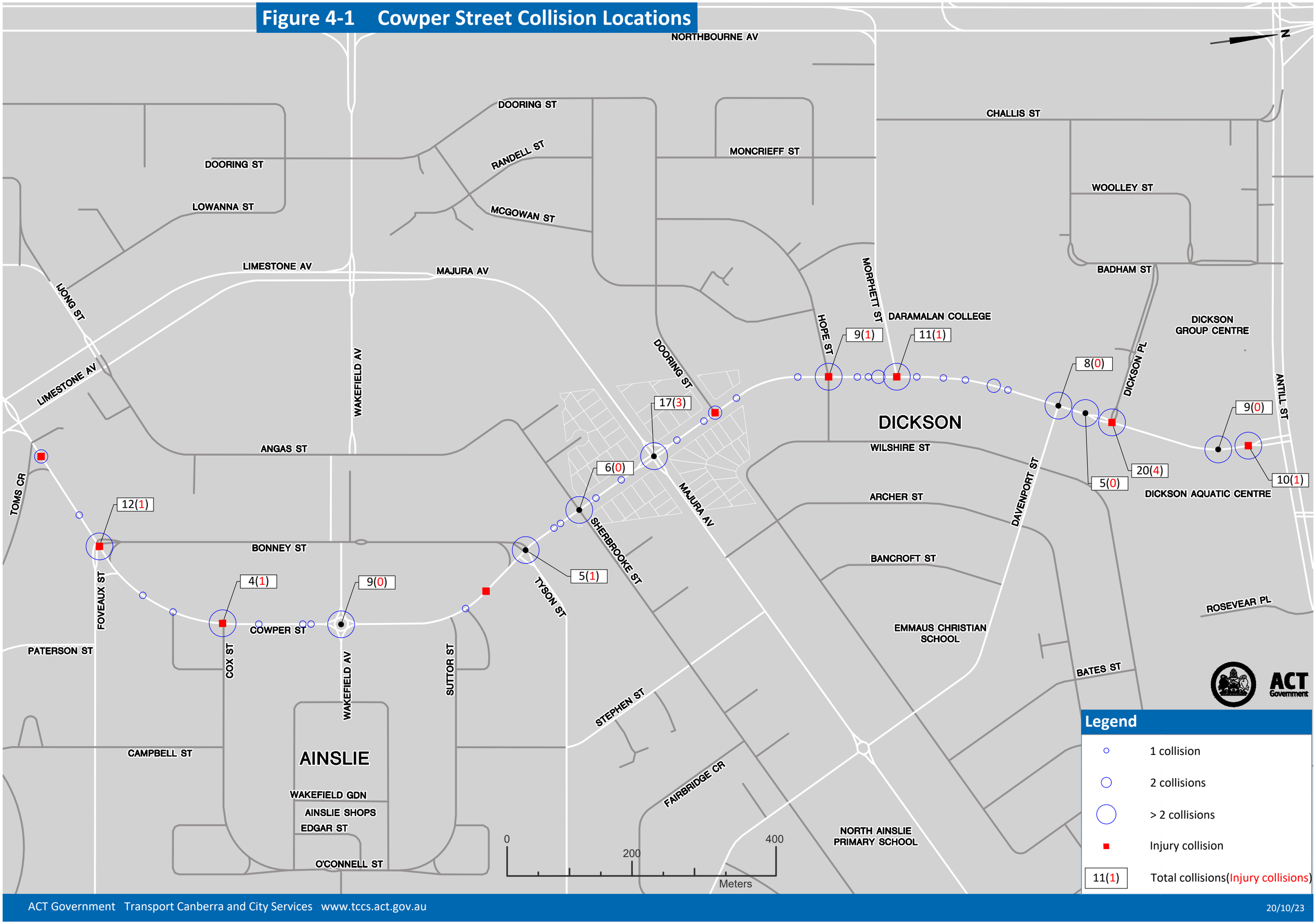
From the 88 collisions that occurred on Cowper Street between Majura Avenue and Antill Street, 8 collisions resulted in injuries. 1 pedestrian and 13 cyclists were involved in collisions.

Collision characteristic	Cowper Street (Majura Avenue to Antill Street)	ACT Average (2020 ACT Crash Report)
Collisions resulting in injuries	9.1%	9.3%
Collisions occurring on a weekday	79.5%	80.3%
Collisions occurring during wet weather	10.2%	11.9%
Collisions occurring during reduced lighting conditions (dusk to dawn)	21.6%	19.9%

- 8 collisions resulted in injuries. Injuries occurred with collisions that involved a pedestrian collision, 4 collisions involved cyclists and 3 collisions occurred at intersections between vehicles.
- 67% of the collisions occurred at intersections, with collisions from adjacent approaches/ opposing directions (RUM Code 10 and 20 series) comprising 40% of all collisions.
- 50% of all collisions occurred between Davenport Street and Antill Street.

The location of the collisions are provided in Figure 4-1.

Figure 4-1 Cowper Street Collision Locations



Legend

- 1 collision
- 2 collisions
- > 2 collisions
- Injury collision
- 11(1) Total collisions(Injury collisions)

4.2 Lighting lux levels

- The majority of street lights on Cowper Street are mounted to power poles or pole top mounted lights offset from the road. Some sections of Cowper Street have street lights columns installed.
- The sections of Cowper Street where street lights are mounted to power poles or pole mounted lights generally do not achieve the minimum 3.5 Lux lighting required for Major Collector Roads (V5 Category). This included the roundabout with Wakefield Avenue.
- Circa 20 Lux was recorded under the light columns and circa 1 Lux between light columns where street light columns are installed. The existing refuge island between Suttor Street and Bonney Street complies with the 3.5 Lux requirements.
- The horizontal lighting requirement of 32 Lux was not achieved at some of the measured points at the wombat crossing.
- At the time of the inspection, all the street lights were operating.

5. CONTEXT OF ASSESSMENT

Table 5-1 Project Context

Austroads AP-R509-16 Prompts	Comments
What is the reason for the project? Is there specific crash type risk? Is it addressing specific issues such as poor speed limit compliance, road access, congestion, future traffic growth, freight movement, amenity concerns from the community, maintenance/asset renewal, etc.	• The project aims to improve safety for all users on Cowper Street. • The road is in a residential area with direct access. • There is a school on Cowper Street between Morphett Street and Davenport Street. • The Dickson Group Centre is located between Davenport Street and Antill Street. • There are several locations where there is pedestrian interaction with the roads, including several bus stops. • The section between Limestone Avenue and Majura Avenue is subject to “rat-running” activities.
What is the function of the road? Consider location, roadside land use, area type, speed limit, intersection type, presence of parking, public transport services and vehicle flows. What traffic features exist nearby (e.g. upstream and downstream)? What alternative routes exist?	• The road is a major collector road that provides a connection to Limestone Avenue, Majura Avenue and Antill Street • The street is a mix of residential, educational and retail use. • The speed limit is 60 km/h with a 40 km/h school zone between Morphett Street and Davenport Street. • There is a combination of signalised intersections, roundabouts and priority controlled intersections (Give Way). • The Dickson to ANU (C6) shared path crosses Cowper Street between Davenport Street and Dickson Place) • There is a bus service that travels in both directions on Cowper Street (Route 31). The Dickson Shops bus stop (between Dickson Place and Antill Street provides interchange services for several services.
What is the speed environment? What is the current speed limit? Has it changed recently? Is it similar to other roads of this type? How does it compare to Safe System speeds? What is the acceptability of lowering the speed limit at this location?	• The road has a 60 km/h speed limit with a 40 km/h school zone. • Potential consideration to reduce the speed limit to 50 km/h to align with the residential nature of the road, with the extension of the Dickson Group Centre 40 km/h high pedestrian area between Davenport Street and Antill Street.
What road users are present? Consider the presence of elderly pedestrians, school children and cyclists. Also note what facilities are available to vulnerable road users (e.g. signalised crossings, bicycle lanes, school speed limits, etc.)	• The majority of road users are expected to be passenger vehicles. • Pedestrian activity is school children, local recreational activities and movements connected to the bus stops. • There is a major path crossing point associated with the Dickson to ANU (C6) shared path that crosses Cowper Street between Davenport Street and Dickson Place). • Sherbrooke Street is proposed to be an “Active Travel Street”. • Cowper Street is not classified as an on-road cycle route.
What is the vehicle composition? Consider the presence of heavy vehicles (and what type), motorcyclists and other vehicles using the roadway.	• It is expected that at least 94% of vehicles would be passenger sized vehicles (including utes). • Circa 5% are heavy vehicles including buses. • Circa 1% would be motorcycles.

6. IMPROVEMENT TREATMENTS

6.1 Design Considerations

Design treatments within Cowper Street will need to consider the following:

- Heritage considerations between, and including, Bonney Street/ Foveaux Street and Bonney Street/ Tyson Street (Wakefield Gardens Housing Precinct) and between Limestone Avenue and the midpoint between Tom Crescent and Bonney Street/ Foveaux Street (Corroboree Park Housing Precinct).

  "1.1b Roads should retain their current alignments and widths and should remain bitumen or asphalt sealed. Kerbs should remain of 'upright' design. Kerbs and gutters should retain their current alignments and should be concrete.

  1.1c New traffic calming and other road and traffic control devices should be designed to minimise disruption to the original street pattern, and the installation of raised humps or islands should be avoided.

  1.1d Original footpath alignments and widths should be retained. Surfacing treatments should be consistent throughout the precinct.

  1.1e Original traffic islands should be retained and maintained in their current locations. Preferred surface treatments are gravel, pebble or grass and the practice of planting low shrubs and flowering plants in traffic islands should be continued."

- Cowper Street borders the City Renewal Authority precinct of Dickson. The Dickson Master Plan indicates that landscaping is proposed at the entry to the precinct on Cowper Street, however, limited detail is available. A tender recently closed for the Dickson Shops and Streetscapes Design project, however, it is unknown whether this would include Cowper Street.
- Traffic calming devices should be visible for approaching road users from 73 m at 60 km/h and 55 m at 50 km/h (not accounting for corrections due to grade).
- Lighting – 3.5 Lux is required within 3 m of the device as per Australian Standard AS/NZS 1158.1.1:2005 Lighting for roads and public spaces Part 1.1: Vehicular traffic (Category V) lighting—Performance and design requirements.
- Sherbrooke Street – An active travel street is proposed for Sherbrooke Street. Although the design has not been finalised, there is potential that the priority at the intersection with Cowper Street could change to provide priority to Sherbrooke Street. This could also include traffic calming devices on Cowper Street to improve the safety of cyclists crossing at the intersection. Changing the priority could result in delay at the intersection and discourage 'rat-running' on Cowper Street between Limestone Avenue and Majura Avenue. Changes to the intersection as part of the development of the active travel street would need to assess the impact on the intersection and the surrounding roads.

Based on the site inspections, road geometry and observations and the review of the traffic volume, speed and collision data, the following options could be considered to enhance safety for all road users and align with Safe System principles.

6.1.1 Speed reduction to 40 km/h

Based on the environment of the area and roadside activity, a speed reduction to 40 km/h is considered appropriate for Cowper Street between Davenport Street and Antill Street. This can be undertaken with the extension of the existing 40 km/h High Pedestrian Area in Dickson Place. The speed reduction will align with the group centre nature of the street.

The existing wombat crossing and traffic signals would assist with encouraging road users to comply with the 40 km/h speed limit in this area. However, police or speed camera van presence would be required to support the reduction in the posted speed to 40 km/h.

6.1.2 Speed reduction to 50 km/h

Based on the volume of traffic, road geometry and the number of property accesses, a speed reduction to 50 km/h is considered appropriate for Cowper Street between Limestone Avenue and Davenport Street and aligns with the default speed limit for urban areas. The speed reduction will align with the residential nature of the street. It would also reduce the sight distance requirements at intersections and driveways, particularly located on the inside of curves where vegetation impedes on sight distance.

There is potential that a speed reduction on Cowper Street between Limestone Avenue and Majura Avenue could assist with discouraging road users from “rat-running” through Ainslie. Additional speed limit signs should be installed on Bonney Street to assist with conformance.

The reduction of the speed would reduce the kinetic energy transferred in a collision. Through reducing the speed limit, and with the assistance of other measures and enforcement, there is potential that it could increase the number of road users travelling at a lower speed, reducing the 85th percentile speed. Scientists at the University of Adelaide estimate that the risk of a serious collision circa doubles for every 5 km/h above 60 km/h, with the serious collision risk reducing correspondingly for speeds below 60 km/h. Therefore it may be expected that the risk of a serious collision would be reduced fourfold by encouraging motorised vehicles to travel at 50 km/h rather than 60 km/h. This aligns with the Safe Systems Principals to reduce the exposure to impact forces associated with vulnerable users.

Traffic calming measures and police or speed camera van presence would be required to support the reduction in the posted speed to 50 km/h.

6.1.3 Traffic lane width reduction

Sections of Cowper Street between Dooring Street and Morphett Street have on-road cycle lanes. There is an opportunity to continue the on-road cycle lanes or provide a marked shoulder.

The narrowing of the traffic lanes with the provision of marked shoulders would assist with encouraging road users to conform to the speed limit through constraining lane widths. The following lane configurations could be considered:

- 3.1 m traffic lanes with circa 1.5 m marked shoulders/ cycle lanes on both sides of the road (desirable on road cycle lane width).
- 3.4 m traffic lanes with circa 1.2 m marked shoulders/ cycle lanes on both sides of the road (minimal on road cycle lane width).

The above options would need to be discussed with key stakeholders (residents, Transport Canberra) to decide on the preferred treatment. Although it appears that on street parking is being removed, there were no vehicles observed parking on-street, with residents parking on the verge.

Both options would also assist with encouraging the 85th percentile road users to conform to a 50 km/h speed limit.

The section of Cowper Street between Dickson Place and the Dickson Shop Access Road could be reduced to one lane in each direction. This could include the provision of on street parking (incorporating the existing bus stops and reducing the crossing distance at the wombat crossing. Kerb blister/ extensions could be used at the wombat crossing to provide physical narrowing and improve the visibility of path users crossing the road.

The use of pavement markings in the heritage area is considered to be exempt from the heritage conditions as the road pattern/ alignment does not change.

6.1.4 Intersection Improvements

A large proportion of collisions occur at intersections. The reduction in the speed limit and narrowing of traffic lanes would assist with the safety at intersections by reducing collision severity and reducing the crossing distance and gap acceptance, however, further treatments could be considered.

Intersection	Improvement options
Cowper Street/ Bonney Street, Foveaux Street (12 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. There could be a consideration to adjust the layout of the intersection with the use of pavement markings to change the approaches to minimise the impact of the existing kerb profiles. Such treatments could consider creating short one-way approaches. However, without adjusting the kerb profiles this approach could create confusion for road users. Lane narrowing (reducing crossing distance) and speed reduction would assist. Narrowing lanes should be considered on all approaches to the intersection.
Cowper Street/ Wakefield Avenue (9 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. Lane narrowing (reducing crossing distance) and speed reduction would assist. Narrowing lanes should be considered on all approaches to the roundabout.
Cowper Street/ Sherbrooke Street (6 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. Lane narrowing (reducing crossing distance) and speed reduction would assist. Narrowing lanes should be considered on all approaches to the intersection, including providing painted traffic islands on Sherbrooke Street to reinforce the existing stop priority.
Cowper Street/ Majura Avenue (17 collisions)	The conspicuity of the traffic signal lanterns appears adequate, however, there are collisions where it appears that vehicles are proceeding through red phases. Speed reduction would assist the reaction time on the approach to the traffic signals. The provision of a dedicated right turn at the intersection and the removal of the Form One Lane will assist with removing side swipe collisions at the intersection.

Intersection	Improvement options
Cowper Street/ Hope Street (9 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. Lane narrowing (reducing crossing distance) and speed reduction would assist. Narrowing lanes should be considered on all approaches to the intersection, including providing painted traffic islands on Hope Street to reinforce the existing stop priority.
Cowper Street/ Morphett Street (11 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. Lane narrowing (reducing crossing distance) and speed reduction would assist. Channelisation (turn lanes) was considered, however, the adjacent driveways and the use of turning vehicles to slow traffic are considered more appropriate. A roundabout was considered to assist with delays on Morphett Street and reduce speeds, however, impacts pedestrian accessibility and would require construction into the verge to provide a compliant roundabout.
Cowper Street/ Davenport Street (9 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions. Lane narrowing (reducing crossing distance) and speed reduction would assist.
Cowper Street/ Dickson Place (20 collisions)	The majority of vehicle collisions involved vehicles from one direction. Lane narrowing (reducing crossing distance) and speed reduction would assist. The southbound right turn lane can be extended as part of the lane narrowing.
Cowper Street/ Dickson Shops Access (9 collisions)	The majority of vehicle collisions involved vehicles from adjacent directions, with the majority involving right turning vehicles exiting the Dickson Shops Access Road. This is likely contributed to sight distance. Banning the right turn was considered, however, the detour would be significant and is not recommended. Narrowing the traffic lanes to one lane in each direction would reduce the crossing distance and gap acceptance at this intersection.

6.1.5 Traffic Calming – Deflection Devices

With a reduction in the posted speed limit, there would be a requirement to reinforce the speed reduction with the installation of traffic calming measures to reduce travel speed.

Horizontal deflection devices could be considered to assist with reinforcing reduced speed limits. However, as Cowper Street is a Major Collector Road the design of these devices would need to consider the movement of buses and service vehicles (i.e. garbage vehicles). The width of the remaining traffic lane road would also need to consider the provisions for on-road cyclists. Therefore, they are less effective for passenger vehicles.

Vertical deflection devices can be designed to accommodate all types of vehicles, with the option to install either rubber, concrete or asphalt cushions or asphalt humps. Asphalt humps are considered a more appropriate solution due to the forecasted lifecycle and installation cost. They are also easier

traversed meaning that road users abiding by the speed limit do not have to significantly decrease speed to the same extent as at a rubber cushion. However, asphalt humps should not be installed in proximity to pedestrian crossing locations due to potential confusion that the device is a raised pedestrian crossing.

TCCS are currently trialling concrete cushions and asphalt cushions that have a similar profile to rubber cushions. At the time of writing the report, the trial was not complete, however, depending on the trial outcome these devices provide another vertical deflection device option.

Locations where vertical deflection devices (asphalt humps or rubber speed cushions) are considered appropriate are:

- Between Toms Crescent and Bonney Street.
  - Discourages rat-running, including rat-running on Bonney Street.
  - Desirable due to the number of collisions at the Bonney Street/ Foveaux Street intersection.
  - Outside the Heritage constrained Wakefield Gardens Housing and Corroboree Park Housing Precincts.
- Between Sherbrooke Street and Bonney Street.
  - Discourages rat-running, including rat-running on Bonney Street.
  - Assists with the Sherbrooke Street active travel streets project.
  - Outside the Heritage constrained Wakefield Gardens Housing Precinct.
- Between Hope Street and Morphett Street.
  - Speed data indicates speeding during the operation of the school zone.
  - Number of collisions at both intersections.

The devices would also assist with the speed limit reduction to 50 km/h.

6.2 Assessment Options

An assessment based on the worst-case scenario for the road section was undertaken for the various sections of Cowper Street with the following design options:

- Cowper Street – Limestone Avenue to Majura Avenue
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h.
  - Vertical deflection devices.
- Cowper Street/ Majura Avenue intersection
  - Speed reduction to 50 km/h on Cowper Street.
  - Provide a dedicated right-turn lane on Cowper Street.
- Cowper Street – Majura Avenue to Davenport Street
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h.
  - Vertical deflection devices.
- Cowper Street – Davenport Street to Antill Street
  - Traffic lane width reduction.

- Speed reduction to 40 km/h (expand the 40 km/h High Pedestrian Area).
- Extend the right turn deceleration lane to Dickson Place.
- Reduction of Cowper Street to one lane in each direction at the Dickson Shop Access road intersection.

It is proposed to include the above options within the school zone with the continuation of the speed reduction to 50 km/h to align with the section outside the school zone.

7. ASSESSMENT OF DESIGN OPTIONS

7.1 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 (refer to Appendix 1).

The Safe System Assessment Matrix scores for the existing conditions and the proposed design options are shown in **Table 7-1**. The scores for each crash type are shown in **Figure 7-1**,

Figure 7-2, **Figure 7-3** and **Figure 7-4**. The detailed assessments are presented in **Section 7.2**.

Table 7-1 SSA Matrix Scores for the Project

Road Section	Score out of 448	
	Existing	Proposed
Cowper Street – Limestone Avenue to Majura Avenue	176	99.5
Cowper Street/ Majura Avenue intersection	224	133
Cowper Street – Majura Avenue to Davenport Street	232	129
Cowper Street – Davenport Street to Antill Street	232	66

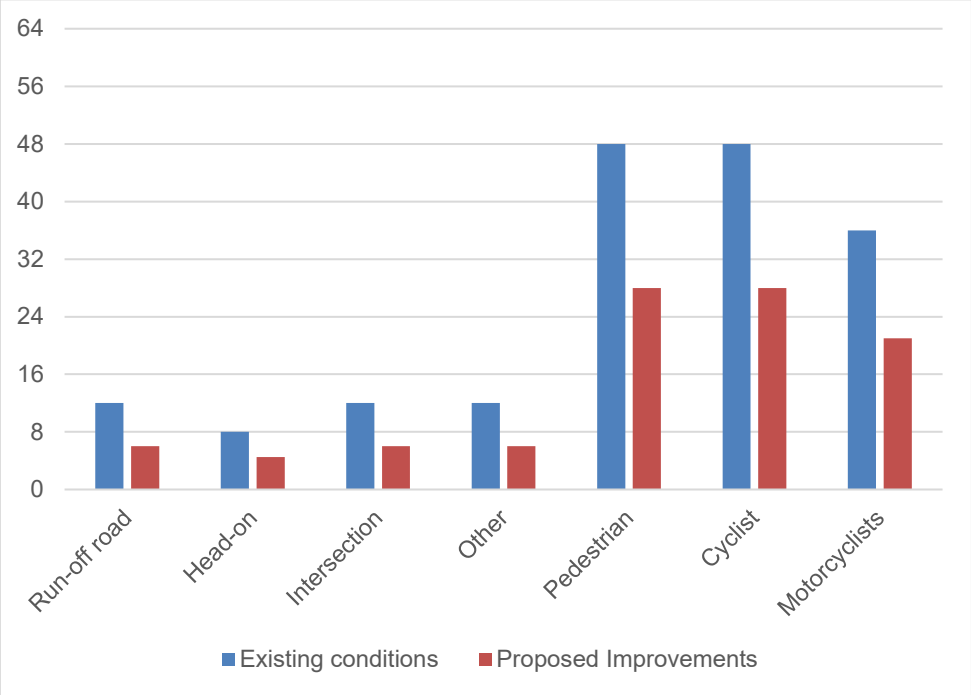


Figure 7-1 Cowper Street – Limestone Avenue to Majura Avenue SSA Scores for Crash Types

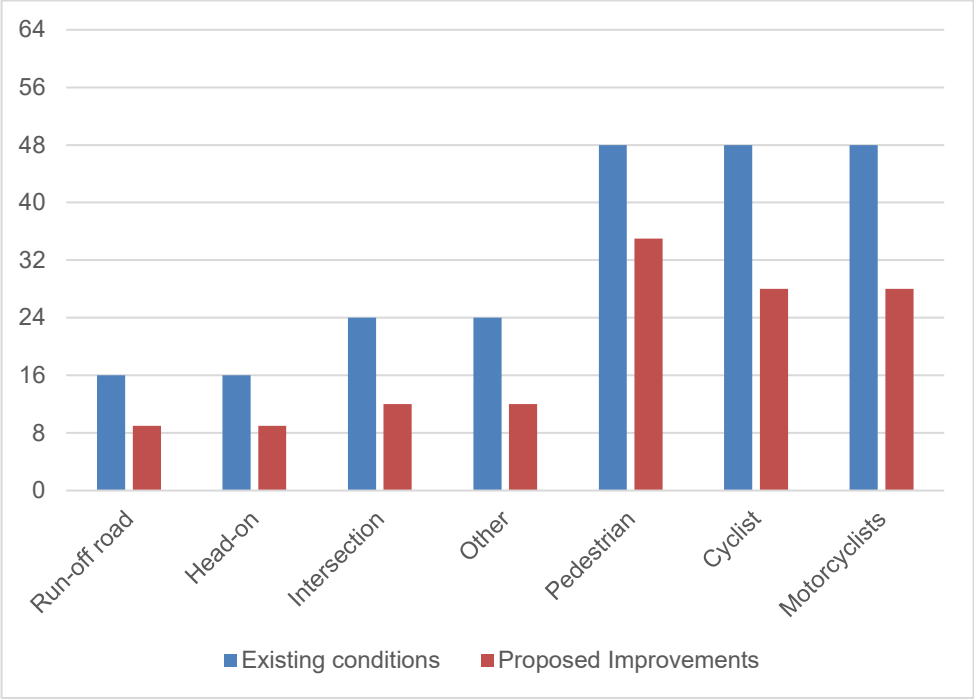


Figure 7-2 Cowper Street/ Majura Avenue intersection SSA Scores for Crash Types

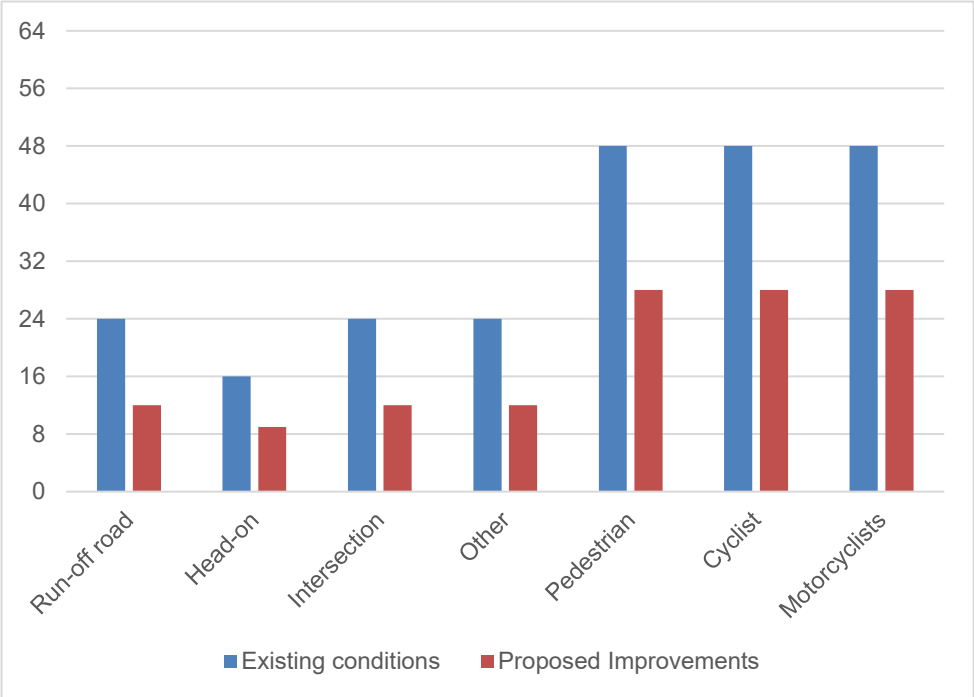


Figure 7-3 Cowper Street – Majura Avenue to Davenport Street SSA Scores for Crash Types

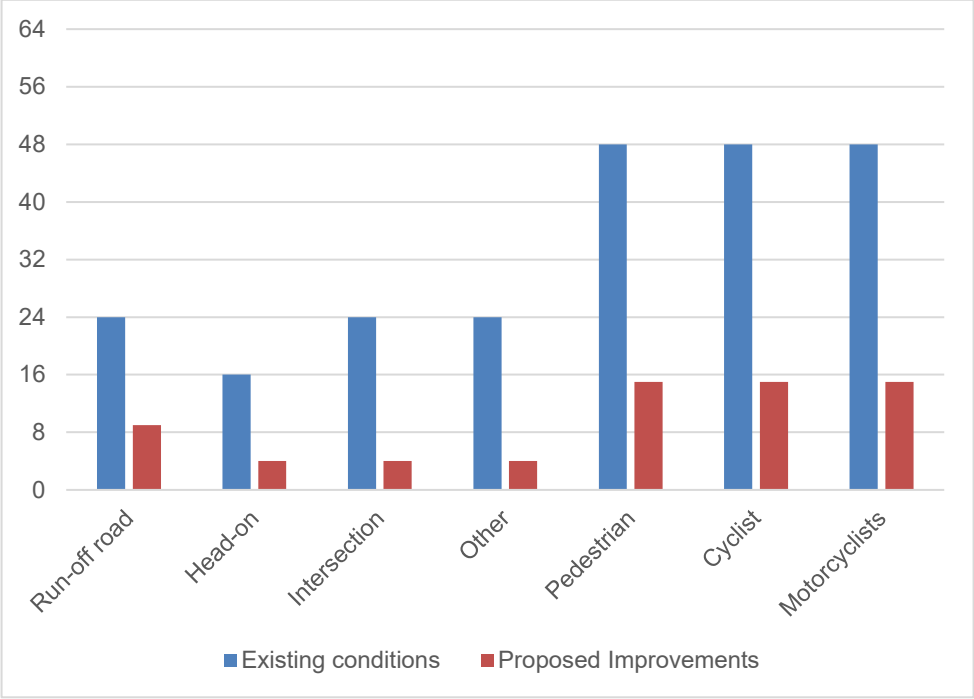


Figure 7-4 Cowper Street – Davenport Street to Antill Street SSA Scores for Crash Types

7.2 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.

Below is the legend for the following tables:

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

Table 7-2 Safe System Assessment Matrix – Cowper Street – Limestone Avenue to Majura Avenue

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	AADT is between 1,000 and 5,000 veh/day	AADT is between 1,000 and 5,000 veh/day	AADT is between 1,000 and 5,000 veh/day	AADT is between 1,000 and 5,000 veh/day Crash types: Rear end, manoeuvring	Pedestrian volumes are expected to be very high based on visual observations (>100 units/ day).	Cyclist volumes are expected to be very high based on visual observations (>100 units/ day).	For motorcyclist crash types, AADT is estimated between 50-100 vehicles per day
Score:	2/4	2/4	2/4	2/4	4/4	4/4	3/4
Likelihood Comments:	Factors that **increase** the likelihood include: • Road used as a rat run. • Uncontrolled intersections and roundabouts meaning that vehicles are likely to run off the road avoiding a vehicle entering or exiting the side road. • Some roadside hazards close to the lane. • The curvature of the road. • Poor lighting. Factors that **decrease** the likelihood include: • Delineation by kerb alignment (existing pavement markings require reapplication). • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Lane width reduction shifts the travel lane further from roadside hazards and reduces crossing distance for turning traffic**. • **Improved delineation**.	Factors that **increase** the likelihood include: • Road used as a rat run. • The road is undivided. • Curvature of the road. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Remark centre linemarking including RRPMs**.	Factors that **increase** the likelihood include: • Road used as a rat run. • Controlled by roundabouts and give way signs. Factors that **decrease** the likelihood include: • Deflection on approach to the roundabout. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Reduces crossing distance for turning traffic**.	Factors that **increase** the likelihood include: • Road used as a rat run. • Vehicles tailgating. • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • Road used as a rat run. • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Decreases pedestrian crossing sight distance**. • **Reduced lane width reduces the traffic lane so pedestrians have less exposure to traffic**.	Factors that **increase** the likelihood include: • Road used as a rat run. • Driveways with a high number of reversing movements. • ~~No on-road cycle lane~~. • On street parking is permitted. Factors that **decrease** the likelihood include: • Off-road alternative route options. • **Vertical deflection devices discourage some rat-running activities**. • **Provision of marked shoulder**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • Road used as a rat run. • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.
Score:	~~3/4~~ 2/4	~~2/4~~ 1.5/4	~~3/4~~ 2/4	~~3/4~~ 2/4	~~3/4~~ 2/4	~~3/4~~ 2/4	~~3/4~~ 2/4
Severity Comments:	Factors that **increase** the severity include: • Trees and non-frangible, structures are located in the clear zone. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • 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. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • Right angle collisions. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction. Note the survivable threshold for side impact collision is 50 km/h**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a pedestrian (survivable threshold for a collision between a vehicle and a pedestrian is 30 km/h)**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a cyclist (survivable threshold for a collision between a vehicle and a cyclist is 30 km/h)**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a motorcyclist**.
Score:	~~2/4~~ 1.5/4	~~2/4~~ 1.5/4	~~2/4~~ 1.5/4	~~2/4~~ 1.5/4	~~4/4~~ 3.5/4	~~4/4~~ 3.5/4	~~4/4~~ 3.5/4
Product	~~12/64~~ 6/64	~~8/64~~ 4.5/64	~~12/64~~ 6/64	~~12/64~~ 6/64	~~48/64~~ 28/64	~~48/64~~ 28/64	~~36/64~~ 21/64
						TOTAL	~~176/448~~ 99.5/448

Table 7-3 Safe System Assessment Matrix – Cowper Street/ Majura Avenue Intersection

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day Crash types: Rear end, manoeuvring	Pedestrian volumes are expected to be very high based on visual observations (>100 units/ day).	Cyclist volumes are expected to be very high based on visual observations (>100 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	Factors that **increase** the likelihood include: • Run-off road associated with turning movements at the intersection. • The auxiliary lane does not limit speed for exiting vehicles. Factors that **decrease** the likelihood include: • Delineation by kerb alignment (existing pavement markings require reapplication). • Straight approaches. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**. • **Removal of Form One Lane reducing run-off road collisions**.	Factors that **increase** the likelihood include: • Opportunity for a road user to turn into opposing traffic due to dual lanes in each direction. Factors that **decrease** the likelihood include: • Straight approaches. • Split phasing of traffic signals separates the direction of vehicles travelling through the intersection. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**.	Factors that **increase** the likelihood include: • ~~*Short Form One Lane on departure*~~. Factors that **decrease** the likelihood include: • Intersection signalised. • Split phasing of traffic signals separates the direction of vehicles travelling through the intersection. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**. • **Removal of form one lane through providing dedicated right turn lanes and improving delineation**.	Factors that **increase** the likelihood include: • Queuing from the intersection may result in rear end collisions in midblock. • Vehicles tailgating. Factors that **decrease** the likelihood include: • Straight approaches. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**. • **Removal of Form One Lane reducing side swipe/ rear end collisions**.	Factors that **increase** the likelihood include: • Width of road. Factors that **decrease** the likelihood include: • Pedestrian crossing phasing is provided on all approaches. • Straight approaches. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**.	Factors that **increase** the likelihood include: • No on-road cycle lane. Factors that **decrease** the likelihood include: • Off-road alternative route options. • Pedestrian crossing phasing is provided on all approaches. • Straight approaches. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**.	Factors that **increase** the likelihood include: • Short Form One Lane on departure. Factors that **decrease** the likelihood include: • Straight approaches. • **Lower speed limit, reducing the sight distance requirements and distance of travel after response to hazard**. • **Removal of form one lane through providing dedicated right turn lanes and improving delineation**.
Score:	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**	~~3/4~~ **2.5/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**
Severity Comments:	Factors that **increase** the severity include: • Trees and non-frangible, structures are located in the clear zone. Factors that **decrease** the severity include: • None. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • 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. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • Right angle collisions. Factors that **decrease** the severity include: • ~~*None*~~. • **Reduction in kinetic energy due to speed limit reduction. Note the survivable threshold for side impact collision is 50 km/h**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~*None*~~. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~*None*~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a pedestrian (survivable threshold for a collision between a vehicle and a pedestrian is 30 km/h)**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~*None*~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a cyclist (survivable threshold for a collision between a vehicle and a cyclist is 30 km/h)**.	Factors that **increase** the severity include: • None. Factors that **decrease** the severity include: • ~~*None*~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a motorcyclist**.
Score:	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~4/4~~ **3.5/4**	~~4/4~~ **3.5/4**	~~4/4~~ **3.5/4**
Product	~~16/64~~ **9/64**	~~16/64~~ **9/64**	~~24/64~~ **12/64**	~~24/64~~ **12/64**	~~48/64~~ **35/64**	~~48/64~~ **28/64**	~~48/64~~ **28/64**
						TOTAL	~~224/448~~ **133/448**

Table 7-4 Safe System Assessment Matrix – Cowper Street – Majura Avenue to Davenport Street

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day Crash types: Rear end, manoeuvring	Pedestrian volumes are expected to be very high based on visual observations (>100 units/ day).	Cyclist volumes are expected to be very high based on visual observations (>100 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	Factors that **increase** the likelihood include: • Uncontrolled intersections meaning that vehicles are likely to run off the road avoiding a vehicle entering or exiting the side road. • Some roadside hazards close to the lane. • The curvature of the road. • Poor lighting. Factors that **decrease** the likelihood include: • Delineation by kerb alignment (existing pavement markings require reapplication). • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Lane width reduction shifts the travel lane further from roadside hazards**. • **Improved delineation**.	Factors that **increase** the likelihood include: • The road is undivided. • Curvature of the road. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Remark centre linemarking including RRPMs**.	Factors that **increase** the likelihood include: • Controlled by give way and stop signs. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Reduces crossing distance for turning traffic**.	Factors that **increase** the likelihood include: • Vehicles tailgating. • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • Children's crossing at Daramalan College. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Decreases pedestrian crossing sight distance**. • **Reduced lane width reduces the traffic lane so pedestrians have less exposure to traffic**.	Factors that **increase** the likelihood include: • Driveways with a high number of reversing movements. • ~~No on-road cycle lane~~. Factors that **decrease** the likelihood include: • Off-road alternative route options. • **Vertical deflection devices discourage some rat-running activities**. • **Provision of marked shoulder**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • Driveways with a high number of reversing movements. Factors that **decrease** the likelihood include: • ~~None~~. • **Vertical deflection devices discourage some rat-running activities**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.
Score:	~~3/4~~ **2/4**	~~2/4~~ **1.5/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**	~~3/4~~ **2/4**
Severity Comments:	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. • Trees and non-frangible, structures are located in the clear zone. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. Factors that **decrease** the severity include: • 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. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. • Right angle collisions. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction. Note the survivable threshold for side impact collision is 50 km/h**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**. • **Additional reduction in kinetic energy at hump location**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a pedestrian (survivable threshold for a collision between a vehicle and a pedestrian is 30 km/h)**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a cyclist (survivable threshold for a collision between a vehicle and a cyclist is 30 km/h)**.	Factors that **increase** the severity include: • 85th percentile exceeding the 40 km/h school zone speed limit. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a motorcyclist**.
Score:	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~2/4~~ **1.5/4**	~~4/4~~ **3.5/4**	~~4/4~~ **3.5/4**	~~4/4~~ **3.5/4**
Product	~~24/64~~ **12/64**	~~16/64~~ **9/64**	~~24/64~~ **12/64**	~~24/64~~ **12/64**	~~48/64~~ **28/64**	~~48/64~~ **28/64**	~~48/64~~ **28/64**
						TOTAL	~~232/448~~ **129/448**

Table 7-5 Safe System Assessment Matrix – Cowper Street – Davenport Street to Antill Street

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day	AADT is >10,000 veh/day Crash types: Rear end, manoeuvring	Pedestrian volumes are expected to be very high based on visual observations (>100 units/ day).	Cyclist volumes are expected to be very high based on visual observations (>100 units/ day).	For motorcyclist crash types, AADT is estimated to be greater than 100 vehicles per day
Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	Factors that **increase** the likelihood include: • Uncontrolled intersections meaning that vehicles are likely to run off the road avoiding a vehicle entering or exiting the side road. • Some roadside hazards close to the lane. Factors that **decrease** the likelihood include: • Delineation by kerb alignment (existing pavement markings require reapplication). • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Lane width reduction shifts the travel lane further from roadside hazards**. • **Improved delineation**.	Factors that **increase** the likelihood include: • The road is undivided. • Curvature of the road. Factors that **decrease** the likelihood include: • ~~None~~. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Remark centre linemarking including RRPMs**.	Factors that **increase** the likelihood include: • Controlled by give way signs. Factors that **decrease** the likelihood include: • ~~None~~. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Adjustment to intersections**.	Factors that **increase** the likelihood include: • Vehicles tailgating. • A driveway with vehicle movements on the verge. Factors that **decrease** the likelihood include: • ~~None~~. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • A driveway with vehicle movements on the verge. Factors that **decrease** the likelihood include: • Pedestrian crossing facilities at traffic signals and a wombat crossing. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**. • **Decreases pedestrian crossing sight distance**. • **Reduced lane width reduces the traffic lane so pedestrians have less exposure to traffic**.	Factors that **increase** the likelihood include: • A driveway with vehicle movements on the verge. • ~~No on-road cycle lane~~. Factors that **decrease** the likelihood include: • Off-road alternative route options. • **Provision of marked shoulder**. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.	Factors that **increase** the likelihood include: • A driveway with vehicle movements on the verge. Factors that **decrease** the likelihood include: • ~~None~~. • **Lower speed limit reduces the sight distance requirements and distance of travel after response to the hazard**.
Score:	~~3/4~~ **1.5/4**	~~2/4~~ **1/4**	~~3/4~~ **1/4**	~~3/4~~ **1/4**	~~3/4~~ **1.5/4**	~~3/4~~ **1.5/4**	~~3/4~~ **1.5/4**
Severity Comments:	Factors that **increase** the severity include: • Trees and non-frangible, structures are located in the clear zone. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. Factors that **decrease** the severity include: • 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. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. • Right angle collisions. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction. Note the survivable threshold for side impact collision is 50 km/h**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a pedestrian (survivable threshold for a collision between a vehicle and a pedestrian is 30 km/h)**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a cyclist (survivable threshold for a collision between a vehicle and a cyclist is 30 km/h)**.	Factors that **increase** the severity include: • Speed limit not appropriate for roadside environment. Factors that **decrease** the severity include: • ~~None~~. • **Reduction in kinetic energy due to speed limit reduction, however, it is not considered a significant reduction to change the crash severity for a collision involving a motorcyclist**.
Score:	~~2/4~~ **1.5/4**	~~2/4~~ **1/4**	~~2/4~~ **1/4**	~~2/4~~ **1/4**	~~4/4~~ **2.5/4**	~~4/4~~ **2.5/4**	~~4/4~~ **2.5/4**
Product	~~24/64~~ **9/64**	~~16/64~~ **4/64**	~~24/64~~ **4/64**	~~24/64~~ **4/64**	~~48/64~~ **15/64**	~~48/64~~ **15/64**	~~48/64~~ **15/64**
						TOTAL	~~232/448~~ **66/448**

7.3 Safer Vehicles, People and Post-Crash Care

Table 7-6 provides a general high level overview of additional safe systems components associated with the assessed road.

Table 7-6 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?	• Cowper Street is used by local, inter-district and interstate drivers. Treatments associated with the design options would assist with providing guidance to road users and support compliance. • There could be objections from older drivers and Transport Canberra regarding vehicle deflection devices due to driver discomfort. However, there are multiple locations where devices are installed, and when travelling over the device at a low speed there is minimal discomfort.
	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 safety?	• There is potential for road users under the influence of alcohol/ drugs to use this road when travelling from an event/ club, etc. to home. This would occur network wide and should be addressed correspondingly.
	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?	• A school has a frontage to Cowper Street. • Aged care/ assisted living complexes are provided in Ainslie. • The road travels through the Dickson Group Centre.
Vehicle	What level of alignment is there with the ideal of safer vehicles?	• There is nothing to indicate this project contravenes the ideals of safer vehicles.
	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?	• The distribution of vehicle types will likely remain. • No factors are considered to affect unsafe vehicles.
	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 safety?	• Inspections of vehicle roadworthy are undertaken network wide. Potential to undertake additional reviews network wide at locations where compliance could be an issue (i.e. schools). • Nothing constrains enforcement.
	Has vehicle breakdown been catered for?	• The road width is generally sufficient for a vehicle to pass a broken down vehicle.
Post-crash care	Are there issues that might influence safe and efficient post-crash care in the event of a severe injury?	• No identified issues.
	Do emergency and medical services operate as efficiently and rapidly as possible?	• Emergency services are in close proximity. It is assumed that there would be an efficient post-crash response and care.
	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.?	• There is opportunity to close the road when a crash event has occurred with minimal impact to road users. • A detour of road users could be implemented depending on the location of the crash event.
	Is there provision for e-safety (i.e. safety systems based on modern information and communication technologies, C-ITS)?	• Not applicable for this location due to the road side environment

8. CONCLUSION

The design of the proposed options can be undertaken to align with Safe System principles.

The installation of the treatments associated with the proposed design options would provide benefit to the safety of the assessed road. It is recommended that the following be undertaken:

- Cowper Street – Limestone Avenue to Majura Avenue
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h.
  - Vertical deflection devices.
- Cowper Street/ Majura Avenue intersection
  - Speed reduction to 50 km/h on Cowper Street.
  - Provide a dedicated right-turn lane on Cowper Street.
- Cowper Street – Majura Avenue to Davenport Street
  - Traffic lane width reduction.
  - Speed reduction to 50 km/h.
  - Vertical deflection devices.
- Cowper Street – Davenport Street to Antill Street
  - Traffic lane width reduction.
  - Speed reduction to 40 km/h (expand the 40 km/h High Pedestrian Area).
  - Extend the right turn deceleration lane to Dickson Place.
  - Reduction of Cowper Street to one lane in each direction at the Dickson Shop Access road intersection.

The 40 km/h speed limit is considered appropriate for Cowper Street between Davenport Street and Antill Street based on the environment of the area and roadside activity and aligns with the group centre nature of the street.

A 50 km/h speed limit aligns with the default speed limit for urban areas applicable for Cowper Street, improving the safety at intersections and driveways, particularly located on the inside of curves where vegetation impedes sight distance. There is potential that a speed reduction could assist in discouraging “rat-running” on Cowper Street.

The narrowing of the traffic lanes are proposed to encourage conformance to the reduced speed limit and improve intersection safety. Narrowing Cowper Street through the Dickson Group Centre would also assist in the operation of the intersection with the Dickson Shop Access Road.

Vertical deflection devices are proposed to discourage rat-running through Ainslie and encourage conformance to the reduced speed limit (including the 40 km/h school zone).

Additional improvements to intersections are proposed to improve safety by reducing conflict points and reiterating priority.

APPENDIX 1 SAFE SYSTEM MATRIX SCORING SYSTEM

Table A-1 Safe System Matrix Scoring System

Road user exposure	Crash likelihood	Crash severity
0 = there is no exposure to a certain crash type. This might mean there is no side flow or intersecting roads, no cyclists, no pedestrians, or motorcyclists).	0 = there is only minimal chance that a given crash type can occur for an individual road user given the infrastructure in place. Only extreme behaviour or substantial vehicle failure could lead to a crash. This may mean, for example, that two traffic streams do not cross at grade, or that pedestrians do not cross the road.	0 = should a crash occur, there is only minimal chance that it will result in a fatality or serious injury to the relevant road user involved. This might mean that kinetic energies transferred during the crash are low enough not to cause a fatal or serious injury (FSI), or that excessive kinetic energies are effectively redirected/dissipated before being transferred to the road user. Users may refer to Safe System-critical impact speeds for different crash types, while considering impact angles, and types of roadside hazards/barriers present.
1 = volumes of vehicles that may be involved in a particular crash type are particularly low, and therefore exposure is low. For run-of-road, head-on, intersection and 'other' crash types, AADT is < 1 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are < 10 units per day.	1 = it is highly unlikely that a given crash type will occur.	1 = should a crash occur, it is highly unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies must be fairly low during a crash, or the majority is effectively dissipated before reaching the road user.
2 = volumes of vehicles that may be involved in a particular crash type are moderate, and therefore exposure is moderate. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 1 000 and 5 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 10–50 units per day.	2 = it is unlikely that a given crash type will occur.	2 = should a crash occur, it is unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, and the majority of the time they are effectively dissipated before reaching the road user.
3 = volumes of vehicles that may be involved in a particular crash type are high, and therefore exposure is high. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 5 000 and 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 50–100 units per day.	3 = it is likely that a given crash type will occur.	3 = should a crash occur, it is likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, but are not effectively dissipated and therefore may or may not result in an FSI.

Road user exposure	Crash likelihood	Crash severity
4 = volumes of vehicles that may be involved in a particular crash type are very high, or the road is very long, and therefore exposure is very high. For run-of-road, head-on, intersection and 'other' crash types, AADT is > 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are > 100 units per day.	4 = the likelihood of individual road user errors leading to a crash is high given the infrastructure in place (e.g. high approach speed to a sharp curve, priority movement control, filtering right turn across several opposing lanes, high speed).	4 = should a crash occur, it is highly likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are high enough to cause an FSI crash, and it is unlikely that the forces will be dissipated before reaching the road user.

APPENDIX 2 INDICATIVE PRELIMINARY COSTING

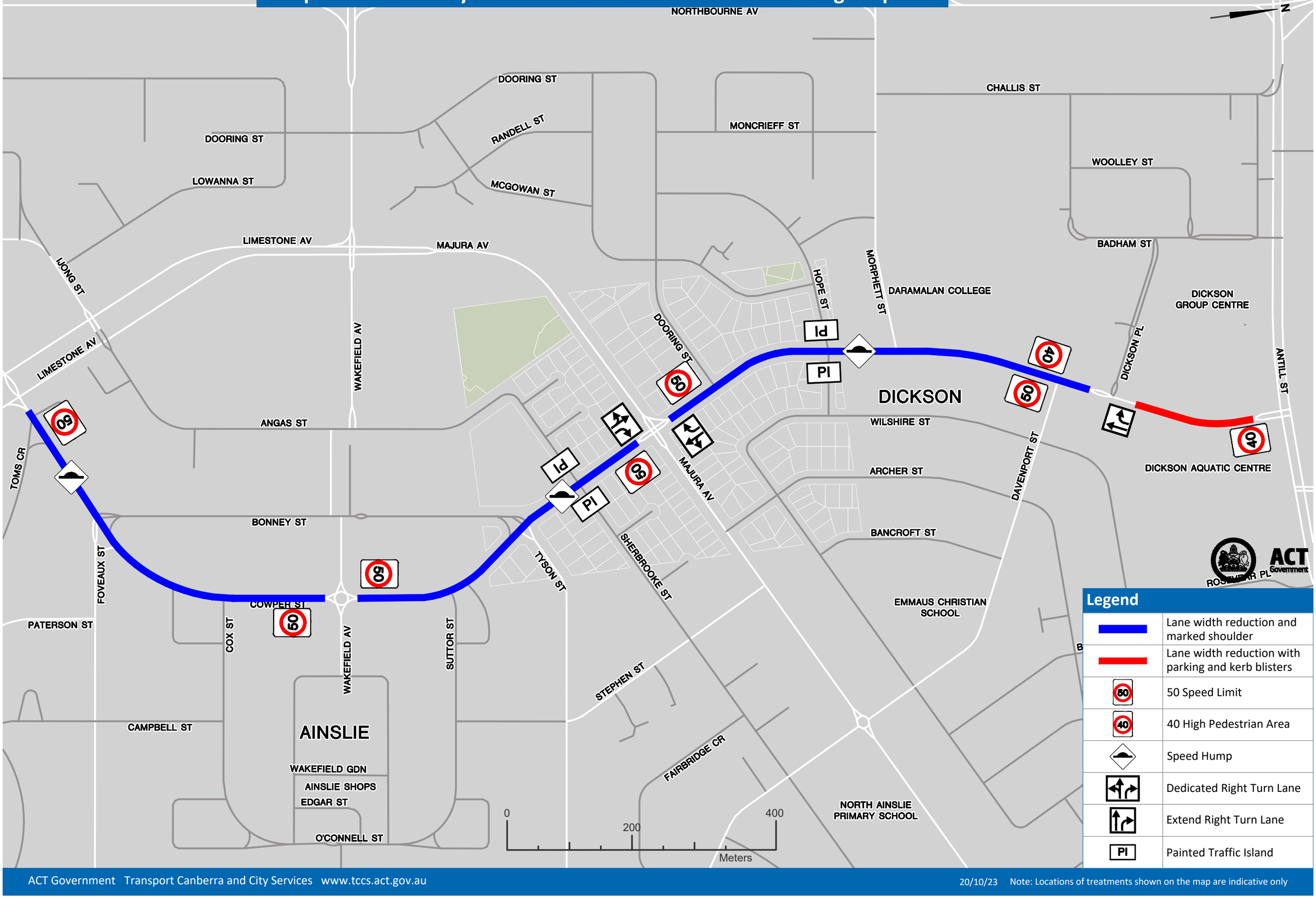
	Description	Estimated Costs (Excl. GST)
Cowper Street – Limestone Avenue to Majura Avenue		
Traffic lane width reduction	Provision of marked shoulder	$12,000
Vertical Deflection Devices	2 Asphalt humps (new streetlight required at one location)	$75,000 ($30,000 per hump) ($15,000 streetlight)
50 km/h sign speed reduction	4 x 50 km/h signs	$2,000
	Sub-total	***$89,000* (excl. GST)***
Cowper Street/ Majura Avenue intersection		
50 km/h sign speed reduction	Included in other sections	-
Dedicated right turn lane on Cowper Street	Pavement arrows, removal of Form One Lane	$8,000 (requires linemarking eradication)
	Sub-total	***$8,000 (excl. GST)***
Cowper Street – Majura Avenue to Davenport Street		
Traffic lane width reduction	Provision of marked shoulder	$6,500
Vertical Deflection Devices	1 Asphalt hump (new streetlight required)	$45,000 ($30,000 per hump) ($15,000 streetlight)
50 km/h sign speed reduction	4 x 50 km/h signs	$2,000
	Sub-total	***$53,500* (excl. GST)***
Cowper Street – Davenport Street to Antill Street		
Traffic lane width reduction	Provision of marked shoulder	$3,500
Intersection Improvements	Extend the right turn deceleration lane to Dickson Place. Reduction of Cowper Street to one lane in each direction at the Dickson Shop Access road intersection.	$6,000
40 km/h sign speed reduction	2 x 40 km/h High Pedestrian signs Adjustment to existing 40 km/h High Pedestrian signs	$2,000
	Sub-total	***$11,500* (excl. GST)***
	Total	**$162,000.00* (excl. GST)**

Note:

* A review of services has not been undertaken and the impact of work on existing services is unknown. Estimated costs are indicative only and exclude relocation of services.

APPENDIX 3 CONCEPT SKETCH OF OPTIONS

Cowper Street Safe Systems Infrastructure Assessment - Design Options



Legend

	Lane width reduction and marked shoulder
	Lane width reduction with parking and kerb blisters
50	50 Speed Limit
40	40 High Pedestrian Area
	Speed Hump
	Dedicated Right Turn Lane
	Extend Right Turn Lane
PI	Painted Traffic Island