



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 2018-046

Information to be published	Status
1. Access application	Published
2. Decision notice and schedule	Published
3. Documents	Published
4. Additional information identified	No
5. Fees	n/a
6. Processing time (in working days)	21 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]
Sent: Wednesday, 13 June 2018 1:15 PM
To: TCCS_FreedomOfInformation
Subject: FOI Request

Freedom of Information Requests
Transport Canberra and City Services
GPO Box 158
Canberra City, ACT 2601

Dear Madam or Sir:

I write to request under the *Freedom of Information Act 2016* (FOI Act) documents generated or received by the ACT Government in relation to the proposal to install traffic lights and other safety improvements at the intersection of Kuringa Drive and Owen Dixon Drive, including all traffic management or other studies that have informed this decision and final (or interim) design plans for the installation of traffic lights, including any related changes to either Kuringa Drive or Owen Dixon Drive involved with this installation.

I make this request pursuant to section 30 of the FOI Act.

As a member of the ACT Legislative Assembly, I note that any fees and charges associated with this request will be waived pursuant to section 107 (e) of the Act.

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

[REDACTED]

ACT Legislative Assembly

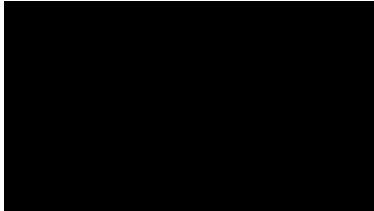
[REDACTED]





ACT
Government

Transport Canberra and
City Services



Dear Ms [REDACTED]

Freedom of Information request: Reference - 18-046

I refer to your application under section 30 of the Freedom of Information Act 2016 (the Act), received on 13 June 2018 in which you sought access to:

- documents generated or received by the ACT Government in relation to the proposal to install traffic lights and other safety improvements at the intersection of Kuringa Drive and Owen Dixon Drive, including all traffic management or other studies that have informed this decision and final (or interim) design plans for the installation of traffic lights, including any related changes to either Kuringa Drive or Owen Dixon Drive involved with this installation.

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 Act. A decision on your access application was due by 11 July 2018. [REDACTED] from your office has agreed to an extension of 16 July 2018.

Decision on access

Searches were completed for relevant documents and a feasibility study has been identified that falls within the scope of your request. I have provided a summary of the report and its attachments in the schedule at [Attachment A](#). This provides a description of each document that falls within the scope of your request and the access decision for each of those documents.

I have applied the public interest test under section 17 of the Act and I have determined that disclosure of the information captured is not contrary to public interest. I have therefore decided to provide you with full access to the information with a copy of the documents at [Attachment B](#).

Charges

No fee is payable as the number of pages being released is within the fee-free threshold.

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 released to you in response to your access application will be published in TCCS' from 3 days after the date of this decision. Your personal contact details will not be published.

You may view the TCCS' disclosure log at <http://www.tccs.act.gov.au/about-us/freedom-of-information>.

Ombudsman review

My decision on your access request is a reviewable decision 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: Via email at: 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(1) on an Ombudsman review, you may apply to the ACAT for review of the Ombudsman decision.

Further information may be obtained from the ACAT at:

ACT Civil and Administrative Tribunal
Level 4, 1 Moore Street
GPO Box 370
CANBERRA CITY ACT 2601

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 directorate's FOI Coordinator on telephone 6205 5408 or email tccs.foi@act.gov.au.

Yours sincerely



Ben McHugh
Information Officer
13 July 2018

KURINGA DRIVE AND OWEN DIXON DRIVE INTERSECTION AUGMENTATION AND SHARED PATH CONNECTION TO THE BARTON HIGHWAY FOR FEASIBILITY STUDY

OCTOBER 2016



CANBERRA

O: Level 1, Equinox 4
70 Kent Street
Deakin ACT 2600
M: PO Box 148
Deakin West ACT 2600
Phone: (02) 6285 1022
Fax: (02) 6285 2618

SYDNEY

O: Level 7, 80 George Street
Parramatta NSW 2150
M: PO Box W67
Parramatta Westfield NSW 2150
Phone: (02) 9633 2273

ABN: 37 008 581 066
ACN: 008 581 066
Web: www.indesco.com.au
Email: indesco@indesco.com.au

PROJECT TITLE: KURINGA DRIVE & OWEN DIXON DRIVE INTERSECTION AUGUMENTATION & SHARED PATH CONNECTION TO BARTON HIGHWAY

PROJECT NUMBER: 5966

Prepared by:	██████████	3/12/2015	
Reviewed by:	██████████	3/12/2015	
Approved by:			

REVISION CONTROL

Document	Issue Date	Recipient	Details
<i>Draft Feasibility Study</i>	10/12/2015	TCCS	John Hillman
<i>Feasibility Study</i>	17/3/2016	TCCS	John Hillman
<i>Final Feasibility Study</i>	10/4/2016	TCCS	John Hillman
<i>Feasibility Updated</i>	4/10/2016	TCCS	Neil Pincome

Base Template:	Version: A May 2013
-----------------------	---------------------

TABLE OF CONTENTS

1.	INTRODUCTION.....	5
1.1	OBJECTIVE	5
1.2	SCOPE OF WORKS	5
1.3	PREVIOUS STUDIES	5
2.	TRAFFIC CHARACTERISTICS	5
2.1	KURINGA DRIVE.....	5
2.2	OWEN DIXON DRIVE.....	6
2.3	BICENTENNIAL trail	6
2.4	SHARED PATH NETWORK	7
3.	CRASH ANALYSIS	8
3.1	CRASH DATA ANALYSIS	8
3.2	CRASH DIAGRAM	9
4.	SITE INSPECTION	9
4.1	OBSERVATIONS.....	9
5.	SITE RISK ANALYSIS	14
5.1	CRASH ANALYSIS	14
5.2	SIDRA ANALYSIS USING 2015 TRAFFIC VOLUMES	14
5.3	SIDRA ANALYSIS USING 2021 and 2031 TRAFFIC VOLUMES	14
5.4	CONSTRAINTS	14
6.	DEVELOPMENT OF OPTIONS	15
6.1	KURINGA and OWEN DIXON DRIVE INTERSECTION DESIGN OPTIONS FOR 2021 DESIGN TRAFFIC.....	16
6.2	KURINGA and OWEN DIXON DRIVE INTERSECTION FOR 2031 DESIGN TRAFFIC	18
6.3	SHARED PATH FROM OWEN DIXON DRIVE TO BARTON HIGHWAY.....	18
7.	TRAFFIC ANALYSIS.....	19
7.1	SIDRA ANALYSIS.....	19
7.2	SIDRA ANALYSIS USING 2015 TRAFFIC VOLUMES	20
7.3	SIDRA ANALYSIS USING 2021 TRAFFIC VOLUMES	20
7.4	SIDRA ANALYSIS USING 2031 TRAFFIC VOLUMES	20
8.	ANALYSIS AND RECOMMENDATIONS	21
8.1	BACKGROUND	21
8.2	OPTIONS COMPARISON	22
8.3	RECOMMENDATION	22

ATTACHMENTS

Attachment A	<i>SIDRA ANALYSIS</i>
Attachment B	<i>DRAWINGS</i>
Attachment C	<i>COST BENEFIT ANALYSIS</i>
Attachment D	<i>INTERSECTION OPTIONS FOR 2031 DESIGN TRAFFIC</i>

EXECUTIVE SUMMARY

Indesco Pty Limited was engaged by Transport Canberra and City Services (TCCS) in August 2015 to prepare a Feasibility Study for augmentation of Kuringa Drive and Owen Dixon Drive intersection and the development of a Shared Path connection between this intersection and the Barton Highway.

Kuringa Drive is a two lane arterial road connecting the suburbs of Fraser and Spence to the Barton Highway. Owen Dixon Drive is a minor collector road connecting William Slim Drive to Kuringa Drive. Kuringa Drive and Owen Dixon Drive, currently form a unsignalised T intersection that has a noted crash history. As part of this report, we looked at a range of viable options to upgrade the intersection to achieve an acceptable Level Of Service (LOS) for 2021 design traffic, reduce the common types of crashes, minimise impact on existing infrastructure and make provision for the future duplication of Kuringa Drive.

Kuringa Drive does not have a shared path between Owen Dixon Drive and Barton Highway. Currently there is a concrete path that varies from one to two metres wide on the western side of Owen Dixon Drive to Boote Street. Barton Highway has an existing 2.5m wide shared path that has an Asphaltic concrete wearing surface. As part of this commission, we looked at different options for the alignment of the 2.5m wide shared path to provide connectivity from Owen Dixon Drive to Barton Highway, existing constraints and to ensure provision for future duplication of Kuringa Drive.

Below is a summary of what has been found as part of the Feasibility Study:

- Previous studies have been completed looking at low cost solutions to reduce crash history along Kuringa Drive and Final Sketch Plans (FSP).
- Crash data was obtained for a five year period. The crash data has been analysed to determine common types of crashes.
- Site has been visited and constraints have been determined to minimise the amount of modification required to existing infrastructure.
- Options have been developed for Kuringa Drive and Owen Dixon Drive Intersection to provide an acceptable LOS, reduce cause of common crashes and provide value for money.
- Traffic modelling has been completed in SIDRA based on the options considered to ensure an acceptable LOS is achieved and to determine queue lengths to ensure these don't impact on surrounding intersections.
- The various Intersection options and shared path have been compared through a Cost Benefit Analysis to determine which option provides the best value for money.

1. INTRODUCTION

1.1 OBJECTIVE

The objective of the feasibility study is to deliver the following:

- Assess options to improve safe travel through the Kuringa Drive and Owen Dixon Drive T-intersection for all users of the intersection including pedestrians.
- Determine the alignment of a shared path between the existing path network, leading to the Kuringa Drive and Owen Dixon Drive intersection and the Barton Highway signalised intersection.
- Improve the level of service at the intersection, to an appropriate level as defined in the Roads ACT Strategic Asset Management Plan.
- Adopt Smart Traffic Management Systems, where appropriate.
- Assess the relative cost of the viable input options through a cost/benefit analysis of the options considered and provide a recommended solution to improve safe travel through intersection.
- Provide and assess options towards a value for money solution.

1.2 SCOPE OF WORKS

The scope of works is summarised below:

- Undertake site survey of the limit of works.
- Review traffic accidents and access common mode of accident at the site.
- Review existing site constraints.
- Complete a traffic analysis and provide recommendations to improve level of service at the intersection.
- Determine alignment of shared path from existing shared paths on Owen Dixon Drive to the Barton Highway.
- Provide options to allow an appropriate level of service, reduce mode of accidents for all road users at Kuringa Drive and Owen Dixon Drive intersection and to minimise impact on existing services from the change in intersection layout. The options are to provide for future duplication of Kuringa Drive.
- Recommend landscaping improvements and removal of trees where required.
- Safety In Design Report
- Liaise with relevant stakeholders
- Prepare a Feasibility Study addressing the above items and all site issues.

1.3 PREVIOUS STUDIES

In 2012 AECOM completed a report for Roads ACT titled '*Low Cost Safety Improvements*' which provided a background on some of the safety improvements that had been installed on Kuringa Drive and Owen Dixon Drive intersection in previous years to improve safety.

In 2014 SMEC undertook a community path feasibility study which included a concept for Sketch Plans for the proposed shared path alignment from Kuringa Drive and Owen Dixon Drive to Barton Highway.

2. TRAFFIC CHARACTERISTICS

Below is a summary of the existing traffic characteristics at the intersection of Owen Dixon Drive and Kuringa Drive and the existing shared paths accessing the area.

2.1 KURINGA DRIVE

Kuringa Drive is a two lane arterial road connecting Fraser and Spence to the Barton Highway. The pavement width varies from 7.5m to 8m and has a posted speed sign of 70km/h at Owen Dixon Drive intersection which changes to 80km/h north of Owen Dixon Drive towards Barton Highway.

2.2 OWEN DIXON DRIVE

Owen Dixon Drive is a two lane minor collector road connecting William Slim Drive to Kuringa Drive. The pavement width lanes between 8m to 10m and has a posted speed of 60km/h.

2.3 BICENTENNIAL TRAIL

The Bicentennial Trail runs adjacent to Kuringa Drive on the south/east side on a varying alignment. Below is an aerial view of Kuringa Drive and Owen Dixon Drive intersection.



Diagram 2.1: Nearmap Image of Kuringa and Owen Dixon Drive intersection.

2.4 SHARED PATH NETWORK

Diagram 2.2 below, details the existing off road shared path on the west side of Owen Dixon Drive which ceases at Boote Street. This Tertiary Network path varies in width from 1m to 2m and is constructed of concrete. On the west side of Barton Highway is an existing onroad Primary Network that is approximately 2.5m wide that has an Asphaltic concrete wearing surface. These paths are shown below in part of "Option 4 - Complete Strategic Cycle Network" which is obtained from www.transport.act.gov.au. The community has been consulted on this proposal path network.

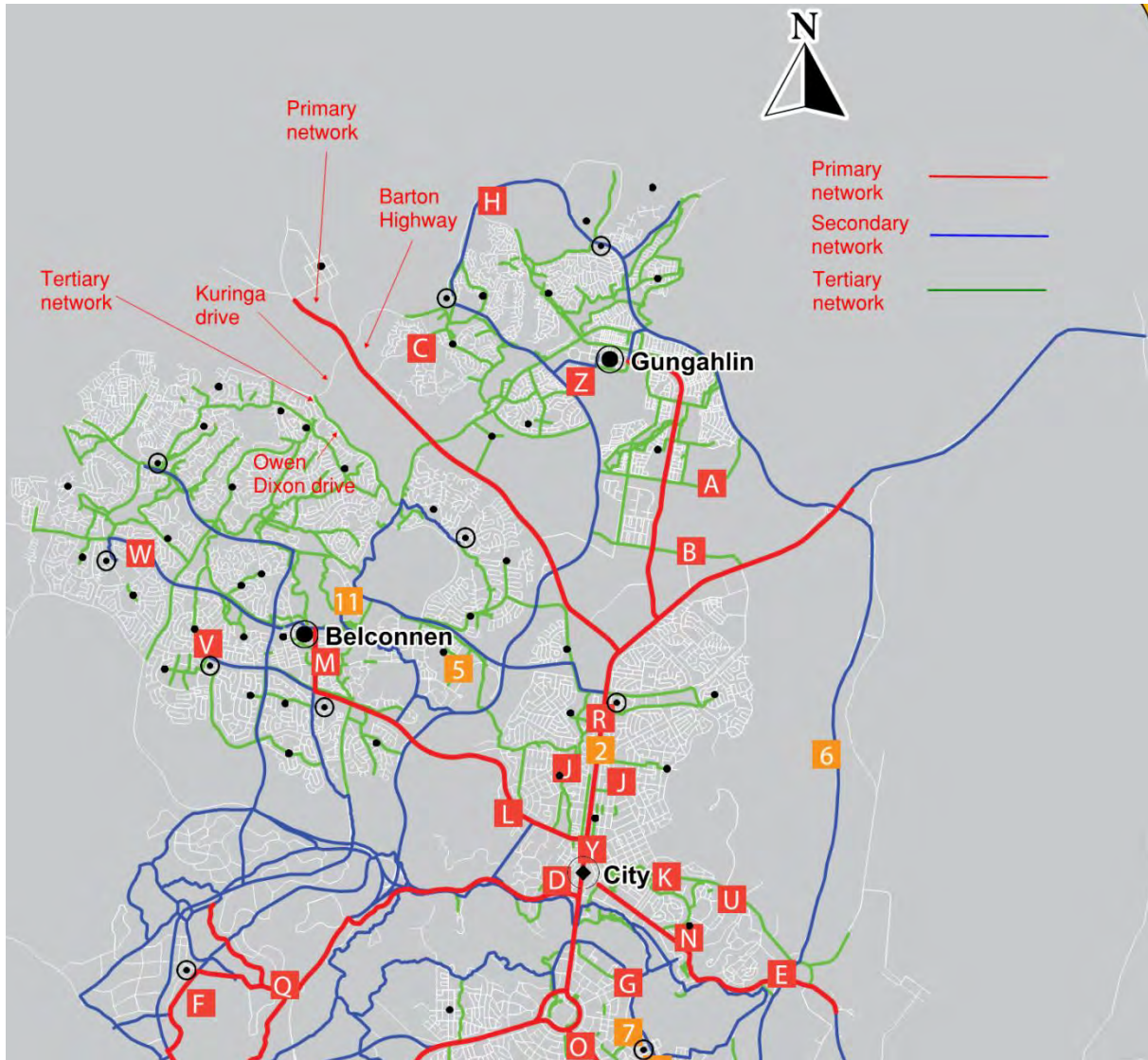


Diagram 2.2: "Option 4 - Complete Strategic Cycle Network" which is obtained from www.transport.act.gov.au.

3. CRASH ANALYSIS

3.1 CRASH DATA ANALYSIS

Crash history reports were obtained from Roads ACT for the five year period from 1st January 2010 to 31st December 2014 for the Kuringa Drive/Owen Dixon Drive intersection. An analysis of the crash data was undertaken to determine any crash patterns at the intersection and to develop an approach for any intersection modifications that will/may minimise the chance of crashes occurring. A total of 24 crashes were recorded at this intersection over the five year period with the most crashes in 2012 and the least in 2013. The tables below show a summary of crashes.

Severity	2010	2011	2012	2013	2014
Property Damage Only	3	3	6	1	7
Received Medical Treatment			2	1	
Admitted to Hospital	1				
Fatality					
TOTAL	4	3	8	2	7

Table 3.1: Crashes by severity and year

An analysis of the Road User Movement (RUM) code accidents follows:

Road Users Movement (RUM) code	Vehicle 1 direction	Vehicle 2 direction				Crashes per year					Day of the Week	
		Northbound	Eastbound	Westbound	Southbound	2010	2011	2012	2013	2014	Weekday	Weekend
102	Eastbound Westbound	1								1	1	
104	Eastbound Westbound	6						3		3	5	1
201	Westbound Eastbound		1			1					1	
202	Westbound Eastbound		1	5		1	1	1	1	1	4	1
301	Westbound Eastbound		1				1				1	
303	Westbound Eastbound		8	1		1	1	4	1	1	5	3

Table 3.1.1: Crash factor matrix

An analysis of the crash matrix is provided below:

- A total of 24 crashes were recorded at the intersection of Kuringa Drive and Owen Dixon Drive.
- The most common crash category was for vehicles travelling in the same direction. These totalled 10 crashes constituting 41.6% of all crashes.
- Three crashes resulted in injuries requiring medical treatment with one crash victim admitted to hospital. There were no fatalities in this five year period.
- 87% of the crashes occurred during dry road conditions with 83% fine weather conditions.
- 83% of the crashes occurred on weekdays.
- 92% of the crashes occurred during the day.

3.2 CRASH DIAGRAM

Diagram 3.2 below shows a summary of the crash data, that occurred for the five year period from 1st January 2010 to 31st December 2014.

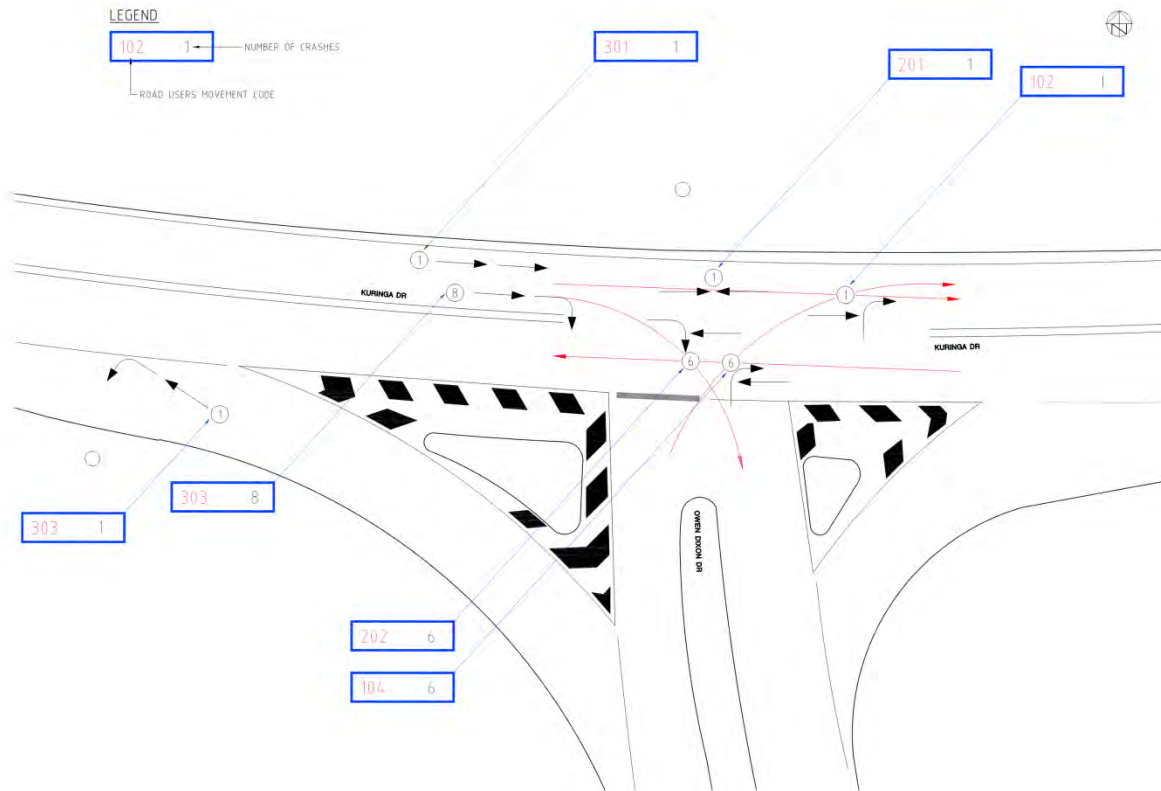


Diagram 3.2: Summary of crash data

- Eight crashes involved vehicles being rear ended while turning right from Kuringa Drive to Owen Dixon Drive.
- Five of six crashes involved vehicles turning right from Kuringa Drive to Owen Dixon Drive colliding with Westbound through traffic on Kuringa Drive.
- Six crashes involved vehicles turning right from Owen Dixon Drive to Kuringa Drive colliding with Westbound through traffic on Kuringa Drive
- One crash involved vehicles turning right from Owen Dixon Drive to Kuringa Drive colliding with Eastbound through traffic on Kuringa Drive.
- One crash involved vehicles being rear ended while travelling Eastbound on Kuringa Drive.
- One crash involved a head on within the Kuringa Drive intersection.

4. SITE INSPECTION

4.1 OBSERVATIONS

Site inspections were conducted on Friday 21st, Monday 24th of August and Thursday 10th of September. During this time the following observations were noted:

- There are existing street lights approximately 1.6m off the face of kerb along Kuringa Drive and Owen Dixon Drive
- There is an existing high pressure gas main marker on the northern side of Kuringa Drive.
- There is an existing stormwater open drain on the northern side of Kuringa Drive.
- There is a strip of cleared land that has earthworks formed for the future duplication of Kuringa Drive which is offset on the South/Eastern side of the current alignment, carried out by NCA. This is completed between Barton Highway and Owen Dixon Drive.

- The intersection of Kuringa Drive and Owen Dixon Drive was observed at 3:30pm on Thursday September 2015 and it was noted that cars were heading along Kuringa Drive in an eastbound direction while cars were attempting to turn right onto Owen Dixon Drive. Some cars were passing to the left hand side heading east on a gravel shoulder that has numerous potholes (refer Photo 4.1). There was a near miss between two cars partly due to dust and car merging from gravel shoulder to the carriageway. If contact had occurred would have been a RUM code 303 crash.

Some site photos are shown below which provide an indication of the alignment of the future shared path in red dashed line and the existing Kuringa Drive/Owen Dixon Drive Intersection:



Photo 4.1: Kuringa Drive at the T-intersection with Owen Dixon Drive, looking East. Ruts, pot holes and wheel tracks can be seen on the left hand shoulder where cars have been travelling to overtake vehicles turning right into Owen Dixon Drive.



Photo 4.2: Kuringa Drive looking North/East, showing the open concrete drain on the left. The future alignment of the shared path shown in red dashed line.



Photo 4.3: Kuringa Drive looking North with the future alignment of the shared path shown in red dashed line.



Photo 4.4: Kuringa Drive looking North/East with the future alignment of the shared path shown in red dashed line.



Photo 4.5: Kuringa Drive looking South/West. The earthworks formation is shown on the left to allow future duplication of Kuringa Drive on left hand side and future shared path alignment is shown by red dashed line.



Photo 4.6: Kuringa Drive looking North/East. The future duplication of Kuringa Drive is visible as the unmade rural road formation, east of the current two-way road.



Photo 4.7: Owen Dixon Drive at T-Intersection with Kuringa Drive, looking North, with proposed shared path construction shown in red.



Photo 4.8: Kuringa Drive looking East to T Intersection with Owen Dixon Drive intersection on right hand side, proposed shared path detailed in red.



Photo 4.9: Kuringa Drive and Owen Dixon Drive T- Intersection, looking South. The existing street lights and concrete medians/refuge islands are shown on the intersection.

5. SITE RISK ANALYSIS

5.1 CRASH ANALYSIS

Over the past five years, the intersection of Kuringa Drive and Owen Dixon Drive there has been an increasing number of crashes at the site. The most common causes of accidents at the site has been:

- Rear ending (RUM code 303)
- Through traffic on Kuringa Drive colliding with traffic from or heading into Owen Dixon Drive (RUM code 104 and 202).
- RUM code 104, 202 and 303 have accounted for 87% of all the accidents at the site.

5.2 SIDRA ANALYSIS USING 2015 TRAFFIC VOLUMES

The existing intersection layout was analysed using 2015 traffic volumes derived from the CSIRO Ginninderra Territory Plan Variation for AM and PM using SIDRA. This analysis showed that the current intersection is performing at a Level Of Service (LOS) B in the AM peak and at LOS D in the PM peak. The worst performing movement was for Owen Dixon Drive with vehicles/traffic attempting to turn right to enter Kuringa Drive. The results from the SIDRA analysis are shown in Attachment A. Please note that LOS D indicates the intersection is near capacity and an accident study is required as per Table 7.1.

5.3 SIDRA ANALYSIS USING 2021 AND 2031 TRAFFIC VOLUMES

The intersection improvement Options 1 to 5, Option A and Option B has been analysed using applicable design year (2021 or 2031) traffic volumes derived from the Canberra Strategic Model EMME results provided by the Environment and Planning Directorate (EPD).

5.4 CONSTRAINTS

Physical constraints to the modification of Kuringa Drive and Owen Dixon Drive intersection and the construction of the proposed shared path are detailed below.

- Existing 50mm High Pressure (210Kpa) gas main on the northern side of Kuringa Drive that is on a varying alignment (gas marker shown up to 18m) away from the edge of seal. Consultation with Jim Dawson of Jemena indicates that any proposed road works need to be a minimum of 0.5m clear of the roadworks. It is acceptable to build shared path over the gas main.

- Existing open drain on north/west side of Kuringa Drive is on a varying alignment between 32m to 8m from the edge of seal. The proposed intersection improvement options are not anticipated to impact this asset, however the shared path will be in close proximity in places and provision for batters and retaining walls with handrails will be made where required.
- Existing street lights are located approximately 1.6m from the face of kerb along Kuringa Drive and Owen Dixon Drive and associated underground cables. Dependent upon the improvement option selection, these street lights will be relocated to ensure the appropriate offset is maintained.
- The existing 600mm diameter bulk supply water main on the south/eastern side of Kuringa Drive is not expected to be impacted by the proposed works.
- Existing sewer main on the West side of Owen Dixon Drive near the intersection of Boote Street. The shared path will be built over this as required.
- Existing underground stormwater at Kuringa Drive and Owen Dixon Drive varies in diameter from 375mm to 750mm. Proposed intersection works will require a range of modifications to existing pit lids and the installation of new pits to suit the geometry of intersection and extension of stormwater as required.
- Existing boundary on the northeast side of Owen Dixon Drive will be a constraint on the geometry for any intersection works because of its close proximity to the edge of the proposed Intersection.
- To allow for an Intersection improvement Option that makes provision for future duplication of Kuringa Drive.
- Existing trees adjacent to Owen Dixon Drive and Kuringa Drive. The shared path will impact the existing trees in the road reserve. Consultation will occur with the Tree Protection Unit being on unleased land upon adoption of the proposed works option/concept.
- Existing overpass on Kuringa Drive will be a constraint on the proposed alignment of the shared path as there is a limited width behind the abutment and the edge of the carriageway. There is sufficient vertical room to facilitate the path at this location.
- Existing Bicentennial Trail runs adjacent Kuringa Drive on the southeast side on a varying alignment. TCCS requires at least 10m offset is maintained between the shared path and the Trail. This requirement and the future duplication of Kuringa Drive dictated that the shared path be located on the north/west side of Kuringa Drive carriageway.
- Several large scale existing directional signs are in place, adjacent to Kuringa Drive on the approach to the Barton Highway Intersection. These signs will impact on the alignment of the shared path and a retaining wall may be required on the downstream side of the path in places to alleviate safety concerns
- Existing posted speed of 70km/h through Kuringa Drive and Owen Dixon Drive intersection.
- The existing intersection is relatively flat (up to 2% longitudinal fall) which will facilitate safe sight and stopping distance on all appropriate to the intersection.

6. DEVELOPMENT OF OPTIONS

A range of options were considered for the intersection upgrade of Kuringa and Owen Dixon Drive. A number of low cost options were considered based on the required 2021 design traffic year to provide an acceptable Level Of Service (LOS), reduce the common types of crashes, minimise the impact on existing infrastructure, provide provision for future duplication of Kuringa Drive that provides value for money.

We have also looked at a number of different alignments to provide a shared path offset from the existing concrete path on Owen Dixon Drive to an existing 2.5m wide asphalt concrete path on the Barton Highway

The options are listed in the headings below:

6.1 KURINGA AND OWEN DIXON DRIVE INTERSECTION DESIGN OPTIONS FOR 2021 DESIGN TRAFFIC

The following options were considered:

6.1.1 Base Case

The existing intersection layout was analysed. It was found that this would not reduce the common cause of crashes and would provide a LOS F, when modelled in SIDRA; which is unacceptable.

6.1.2 Option 1 - Unsignalised T Intersection with right turn lane from Kuringa Drive to Owen Dixon Drive.

An unsignalised T intersection with a right turn lane from Kuringa Drive to Owen Dixon Drive was analysed. It was found this would reduce the common cause of crashes in Section 3. When it was modelled in SIDRA it would provide a LOS F which would usually discount the option. However in this case TCCS have requested the option be cost estimated as it may be considered as a short term option to reduce common cause of accidents.

The estimated cost of Option 1 which is shown below is based on a preliminary layout and does not include any design or approval fees.

Item	unit	Quantity	Rate	Price excluding GST
Site establishment (7% of construction)		1		\$28,608
400mm thick DGB20	sqm	1415	\$52	\$74,193
40mm thick AC	Tonne	130	\$280	\$36,450
Supply and spray primer (3mm thick)	litres	4245	\$5	\$21,225
Concrete Median	sqm	1346	\$70	\$94,220
Kerb	m	964	\$40	\$38,560
Stormwater	item	2	\$4,000	\$8,000
Remove existing kerbs and median	item	1	\$5,000	\$5,000
Relocation of existing street lights	No	1	\$2,000	\$2,000
Remove trees	No	19	\$1,000	\$19,000
Earthworks and remove material from site	m3	1104	\$35	\$38,654
Clearing and grubbing	sqm	2761	\$1	\$1,381
Traffic management	item	1	\$50,000	\$50,000
Survey	item	1	\$20,000	\$20,000
Contingency (30%)				\$131,187
Total				\$568,478

Table 6.1: Estimated cost of intersection upgrade Option 1.

6.1.3 Option 2 - Roundabout

Installation of a roundabout was considered which would reduce the common cause of crashes in Section 3. However it would require an extensive modification to the existing pavement, streetlights, stormwater modification and relocation of part of a 600 diameter water main depending on its exact location onsite. Based on the large upfront capital cost this option was discounted.

6.1.4 Option 3 - Signalised intersection with single lane in each direction on Kuringa Drive, right turn lane from Kuringa to Owen Dixon Drive and pedestrian crossing.

A signalised intersection was considered with a single through lanes in each direction on Kuringa Drive and an additional right turn lane from Kuringa to Owen Dixon Drive. It was found that this would reduce the common cause of crashes. When this option was analysed in SIDRA it would provide a LOS D. However, the queue length on eastern Kuringa Drive approach of 563m which is excessive and this option was discounted on this basis.

6.1.5 Option 4 - Signalised intersection with two lanes in east approach to Kuringa Drive and pedestrian crossing.

A signalised intersection was considered that has two through lanes on Kuringa Drive for the east approach to the intersection. This intersection layout would minimise the chance of the RUM code 102, 104 and 202 occurring by providing signalisation of the intersection legs which represents 54% of crash data in Section 3 and when the intersection was analysed in SIDRA it would provide a LOS C which is acceptable. A layout of the proposed intersection is shown in Attachment A.

6.1.6 Option 5 - Signalised intersection with two lanes in east approach to Kuringa Drive, right turn lane from Kuringa Drive to Owen Dixon Drive and pedestrian crossing

A signalised intersection was considered that has two through lanes on Kuringa Drive for the east approach to the intersection and a right turn lane from Kuringa Drive to Owen Dixon Drive which was a request from TCCS Traffic Signals section. The intersection layout would minimise the chance of the RUM code 104, 202 and 303 occurring by providing signalisation and also a dedicated right turn lane. These crashes represent 87% of crash data. The intersection was analysed in SIDRA and would provided a LOS C which is acceptable. A layout of the proposed intersection is shown in Attachment A and B (drawing F05).

Provision has been made for future on road cycling as part of the Kuringa Drive and Owen Dixon Drive intersection layout by providing a wider central median strip and also making allowance for the future duplication of Kuringa Drive. The intersection would also incorporate pedestrian movements into the phasing to improve safety when using the shared path.

The turn lanes lengths based on minimum queue length from the SIDRA analysis or design vehicle plus deceleration length for applicable design speed (which is posted speed plus 10km/h) have been applied.

The alignment of the proposed intersection modifications have been sited, where possible, to minimise earthworks and disruption to the existing road pavement construction. It is anticipated that the existing pavement can be recycled. No geotech and pavement analysis has been undertaken at this time

As part of signalisation for the intersection Smart Traffic Management System (STMS) will be implemented to ensure the intersection operates in a co-ordinated, safer and smarter manner. The implementation would involve loop detectors on all lanes approaching the intersection, connectivity to a central SCATS system and use of dynamic traffic signal configurations. A further STMS that could be implemented is Closed Circuit Television (CCTV) to provide video surveillance of the intersection during operation dependant upon funding allocation.

The estimated cost of Option 5 which is shown below is based on a preliminary layout and does not include any design or approval fees.

Item	unit	Quantity	Rate	Price excluding GST
Site establishment (7% of construction)		1		\$95,203
400mm thick DGB20	sqm	6284	\$52	\$329,491
Supply and spray primer (3mm thick)	litres	18852	\$5	\$94,260
40mm thick AC	Tonne	528	\$280	\$147,800
Concrete Median	sqm	3470	\$70	\$242,900
Kerb	m	1879	\$40	\$75,160
Stormwater	item	1	\$50,000	\$50,000
Remove existing kerbs and median	item	1	\$20,000	\$20,000
Relocation of existing street lights	No	9	\$2,000	\$18,000
Remove trees	No	1	\$1,000	\$1,000
Earthworks and remove material from site	m3	3902	\$35	\$136,556
Clearing and grubbing	sqm	9754	\$1	\$4,877
Traffic lights	item	1	\$170,000	\$170,000
Traffic management	item	1	\$50,000	\$50,000
Survey	item	1	\$20,000	\$20,000
Contingency (30%)				\$436,574
Total				\$1,891,821

Table 6.2: Estimated cost of intersection upgrade Option 5.

6.2 KURINGA AND OWEN DIXON DRIVE INTERSECTION FOR 2031 DESIGN TRAFFIC

TCCS requested that a focus of the report be re adjusted to provide "a low cost 2021" solution for the intersection options. The Intersection options for 2031 have been included in Attachment D for reference.

6.3 SHARED PATH FROM OWEN DIXON DRIVE TO BARTON HIGHWAY

Currently there is a existing concrete path of a varying width (1m to 2m) on the western side of Owen Dixon Drive to the intersection of Boote Street. There is also a 2.5m wide asphalt path adjacent to Barton Highway to the intersection of Kuringa Drive. The existing paths and the extension from Boote Street to Kuringa Drive are shown in "Option 4 - Complete Strategic cycle network' (see Diagram 2.2). It is proposed to build a 2.5m wide shared path to provide connectivity between the existing two paths. The site was walked, Dial Before You Dig (DBYD) and survey obtained to determine the best alignment. When considering the alignment it was noted that:

1. The Bicentennial Trail runs adjacent Kuringa Drive on the South eastern side on a varying alignment and the shared path should be at least 10m away from the trail.
2. The future duplication of Kuringa Drive would be in the formed earthworks formation on the southeast side of the existing Kuringa Drive carriageway.

It was determined on consideration of those two constraints, to closely examine the alignment on the northwest side of Kuringa Drive as this would allow for future flexibility for duplication of Kuringa Drive, ensure path is at least 10m away from Bicentennial Trail and ensure that the path is not in the middle of the two roads when duplication does occur. Attachment B (Drawings F10 to F20) show proposed alignment and typical cross section of the shared path. The estimated cost of the shared path is shown below, based on a preliminary design information and does not include any design fees or approval fees.

Item	unit	Quantity	Rate	Price excluding GST
Site establishment (7% of construction)	item	1		\$31,473
gravel pavement (150mm gravel)	sqm	3606	\$19	\$68,514
Supply and spray primer (3mm thick)	litres	10818	\$5	\$54,090
25mm Asphalt	tonne	189	\$280	\$53,008
Retaining walls (up to 1m high)	sqm	435	\$300	\$130,500
Handrails	m	290	\$100	\$29,000
Modify stormwater pits	item	1	\$2,500	\$2,500
Earthworks	No	1	\$40,000	\$40,000
Remove trees	No	50	\$750	\$37,500
Clearing and grubbing	sqm	4508	\$1	\$4,508
Traffic management	item	1	\$20,000	\$20,000
Survey	item	1	\$10,000	\$10,000
Contingency (30%)				\$143,192
Total				\$625,421

Table 6.3: Estimated cost of Shared Path

7. TRAFFIC ANALYSIS

As part of this investigation, traffic modelling was completed at Kuringa Drive and Owen Dixon Drive intersection using traffic volumes derived from the 2015, 2021 and 2031 Canberra Strategic Model EMME results. From this traffic modelling the existing intersection layout and the Options considered in Section 6 were analysed to provide an acceptable level of service and determine the potential queues based on 2015, 2021 and 2031.

7.1 SIDRA ANALYSIS

The traffic volumes have been modelled using SIDRA traffic modelling software. Table 7.1 below which is extracted from 'RTA Guide to Traffic Generation Developments' shows the operation level for various Levels Of Service (LOS) for the intersection based on SIDRA design criteria.

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode

Table 7.1: LOS Criteria

7.2 SIDRA ANALYSIS USING 2015 TRAFFIC VOLUMES

The existing Giveaway T-intersection was analysed in SIDRA using 2015 design traffic. It was found to provide a LOS D in PM peak, had a average delay of 26 seconds on the worst leg (Owen Dixon Drive) in PM peak and had a queue length of 67m.

7.3 SIDRA ANALYSIS USING 2021 TRAFFIC VOLUMES

The viable Options listed in Section 6.1 have been analysed using 2021 design traffic. The following table details the resulting LOS, average delay and queue length:

Option	Level Of Service (LOS)	Average Delay (s)	Back of Queue (m)
Base	F (AM)	31 (AM)	197 (AM)
1	F (PM)	142.4 (PM)	665.2 (PM)
3	D (AM)	44 (AM)	563 (AM)
4	C (PM)	29 (PM)	140 (PM)
5	C (PM)	23 (PM)	136 (PM)

Table 7.3: SIDRA 2021 Summary Results

Please note that the above SIDRA LOS is based on the worst case from AM and PM.

7.4 SIDRA ANALYSIS USING 2031 TRAFFIC VOLUMES

The Options listed in Section 6.1 have been analysed using 2031 design traffic. Below is a table that shows LOS, Average delay and Back of queue length:

Option	Level Of Service	Average Delay (s)	Back of Queue (m)
A	A (PM&PM)	7 (PM)	21 (AM)
B	C (PM)	25 (PM)	72 (PM)

Table 7.3: SIDRA 2013 Summary Results

Please note that the above SIDRA LOS is based on the worst case from AM and PM.

8. ANALYSIS AND RECOMMENDATIONS

8.1 BACKGROUND

Roads ACT crash cost estimates for 2014 have been used to develop an economic cost benefit analysis for the proposed intersection upgrades. Crash costs by crash type have been used for costing future crashes which are summaries in Table 8.1 below.

2014 CRASH COST ESTIMATES FOR DIFFERENT RUM CODES

RUM CODE	ACT EQUIVALENT CRASH TYPES	DESCRIPTION	AVERAGE COST
101 – 109	02	Adjacent Approaches	\$35,830
201	04,05	Head On	\$121,318
202 – 206	01, 09	Opposing Turns	\$47, 771
301 – 304	06	Rear End	\$20,418
305 – 309	03,09	Lane Change	\$22,674
001 – 008	10,16	Vehicle Hits Pedestrian	\$165,719
706 – 707	13,15,19,20,21	Loss of Control-L or R turns	\$43,904
401 – 403	09	Hit Parked/Parking Vehicle	\$18,572
601 - 604	07	Collision with Parked Vehicle	\$23,467
501 – 506	09,15,19,21,22	Overtaking	\$36,313
901	14	Fell From Moving Vehicle	\$140,048
609	11	Struck Animal	\$21,508
801-805	13,15,19,21	Loss of Control L or R Turns	\$68,038

Table 8.1: Crash cost estimate

The above costs are calculated using accident records for the period of 2011-2014.

The base accident costs used by the ACT for the different severity categories are as follows:

Fatal	\$2,580,672.00
Serious injury	\$424,924.00
Minor Injury	\$67,093.00
Property Damage Only	\$18,407.00

These costs are based on the information contained in the Bureau of Transport and Communications Economics Report '*Procedure for block report identification treatment and evaluation*'.

8.2 OPTIONS COMPARISON

A cost benefit analysis was undertaken for the intersection of Kuringa Drive and Owen Dixon Drive to determine which options will provide the greater benefit based on the cost of completing intersection works compared to the assumed reduction in crashes. Options 2 and 3 have not been analysed in cost benefit analysis as these have been discounted for reasons detailed in Section 6.

The following assumptions were made:

- Crash costs were based in accordance with Section 8.1.
- When determining benefit from intersection modification, a percentage of reduction has been applied for each crash type based on engineering judgement for the intersection modification.
- A periodic maintenance cost of \$1,000 per year has been applied to all intersection options.
- A discount rate of 7% has been applied across all options.
- The options have listed in Table 8.2 below, have had a benefit cost ratio calculated based on the period of crash data available. Please note that as options A&B have been designed to 2031 design traffic the period of benefit will be longer than has been calculated which underestimates the true.
- The Shared Path from Owen Dixon Drive along Kuringa Drive to Barton Highway has also been included and it has been assumed that the construction of the shared path will result in one less Minor Injury to a cyclist each year as no crash data is available.

	Base Case	Option 1 Priority controlled Intersection	Option 4 Signalised Intersection	Option 5 Signalised Intersection	Option A Roundabout	Option B Signalised Intersection	Shared Path
Appraisal period (years)	6	6	6	6	16	16	20
Capital Costs	\$0	\$568,478	\$1,700,000	\$1,891,821	\$1,759,189	\$2,132,119	\$625,421
Whole of Life Costs	\$5,000	\$573,478	\$1,705,000	\$1,896,821	\$1,764,189	\$2,137,119	\$646,421
Cost-benefit analysis of monetary costs and benefits at the Public Sector Discount Rate							
Present Value of Benefits	-\$728,095	-\$491,007	\$260,984	\$498,073	\$260,984	\$260,984	\$752,002
Present Value of Costs	\$4,241	\$572,719	\$1,704,241	\$1,896,062	\$1,763,430	\$1,763,430	\$636,629
Benefit Cost Ratio	-171.67	-0.86	0.15	0.26	0.15	0.15	1.18
Net Present Value	-\$732,337	-\$1,063,726	-\$1,443,257	-\$1,397,990	-\$1,502,446	-\$1,502,446	\$115,373

Table 8.2: Summary of options assessed for Cost Benefit Analysis

The Benefit Cost Ratio Analysis may show that option 5 provides the greatest benefit for the Intersection from capital expenditure. However this does not take into account the longer design life and hence benefits of reduction in crashes from options A and B due to the limited crash data. Options 4 to B all provide an acceptable LOS (See section 7.3 and 7.4).

8.3 RECOMMENDATION

Based on TCCS request to change focus to "low cost 2021" solution its recommended that option 4 be adopted, as this provides the greatest benefit from capital expenditure and will reduce the incidence of the common causes, crash data identified through the crash analysis. The intersection will also make provision for pedestrians to cross the intersection when using the proposed shared path, allows for future duplication of Kuringa Drive and wider median will also allow for on road cycle lanes if required. If it is determined that the on road cycle lanes are not warranted then the geometry could be adjusted to reduce the upfront capital cost.

ATTACHMENT A - SIDRA RESULTS

ATTACHMENT B - DRAWINGS

ATTACHMENT C - COST BENEFIT ANALYSIS

ATTACHMENT D - INTERSECTION OPTIONS FOR 2031 DESIGN TRAFFIC

MOVEMENT SUMMARY

▽ Site: Kuringa Drive/ Owen Dixon Drive - AM Peak

2015

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	6	5.0	0.623	14.6	LOS B	3.7	27.2	0.75	1.08	47.8
3	R2	343	5.0	0.623	14.4	LOS B	3.7	27.2	0.75	1.08	46.8
Approach		349	5.0	0.623	14.4	LOS B	3.7	27.2	0.75	1.08	46.9
East: Kuringa Dr											
4	L2	435	5.0	0.482	8.4	LOS A	4.4	31.9	0.59	0.54	53.3
5	T1	199	5.0	0.482	2.7	LOS A	4.4	31.9	0.59	0.54	54.2
Approach		634	5.0	0.482	6.6	NA	4.4	31.9	0.59	0.54	53.6
West: Kuringa Dr											
11	T1	21	5.0	0.235	0.8	LOS A	1.2	9.0	0.36	0.57	54.2
12	R2	325	5.0	0.235	6.3	LOS A	1.2	9.0	0.36	0.57	52.2
Approach		346	5.0	0.235	6.0	NA	1.2	9.0	0.36	0.57	52.3
All Vehicles		1329	5.0	0.623	8.5	NA	4.4	31.9	0.58	0.69	51.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: Kuringa Drive / Owen Dixon Drive PM Peak

2015

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	16	5.0	0.880	26.1	LOS D	9.1	66.6	0.91	1.58	41.5
3	R2	420	5.0	0.880	25.9	LOS D	9.1	66.6	0.91	1.58	40.8
Approach		436	5.0	0.880	25.9	LOS D	9.1	66.6	0.91	1.58	40.8
East: Kuringa Dr											
4	L2	396	5.0	0.510	8.5	LOS A	5.4	39.8	0.62	0.44	53.8
5	T1	326	5.0	0.510	2.8	LOS A	5.4	39.8	0.62	0.44	54.7
Approach		722	5.0	0.510	5.9	NA	5.4	39.8	0.62	0.44	54.2
West: Kuringa Dr											
11	T1	18	5.0	0.251	1.5	LOS A	1.3	9.3	0.47	0.64	53.9
12	R2	306	5.0	0.251	7.0	LOS A	1.3	9.3	0.47	0.64	51.8
Approach		324	5.0	0.251	6.7	NA	1.3	9.3	0.47	0.64	52.0
All Vehicles		1482	5.0	0.880	12.0	NA	9.1	66.6	0.68	0.82	49.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Priority Control 2021 - Option 1

MOVEMENT SUMMARY

▽ Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak - priority control

Priority control - 2021 traffic volumes
 Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	11	5.0	1.248	299.2	LOS F	27.0	197.1	1.00	2.73	10.1
3	R2	157	5.0	1.248	299.0	LOS F	27.0	197.1	1.00	2.73	10.0
Approach		167	5.0	1.248	299.0	LOS F	27.0	197.1	1.00	2.73	10.0
East: Kuringa Dr											
4	L2	477	5.0	0.677	5.8	LOS A	8.1	59.1	0.15	0.21	56.3
5	T1	694	5.0	0.677	0.1	LOS A	8.1	59.1	0.15	0.21	57.2
Approach		1171	5.0	0.677	2.4	NA	8.1	59.1	0.15	0.21	56.8
West: Kuringa Dr											
11	T1	352	5.0	0.186	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	14	5.0	0.018	9.0	LOS A	0.1	0.5	0.59	0.72	50.4
Approach		365	5.0	0.186	0.4	NA	0.1	0.5	0.02	0.03	59.5
All Vehicles		1703	5.0	1.248	31.1	NA	27.0	197.1	0.21	0.42	39.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

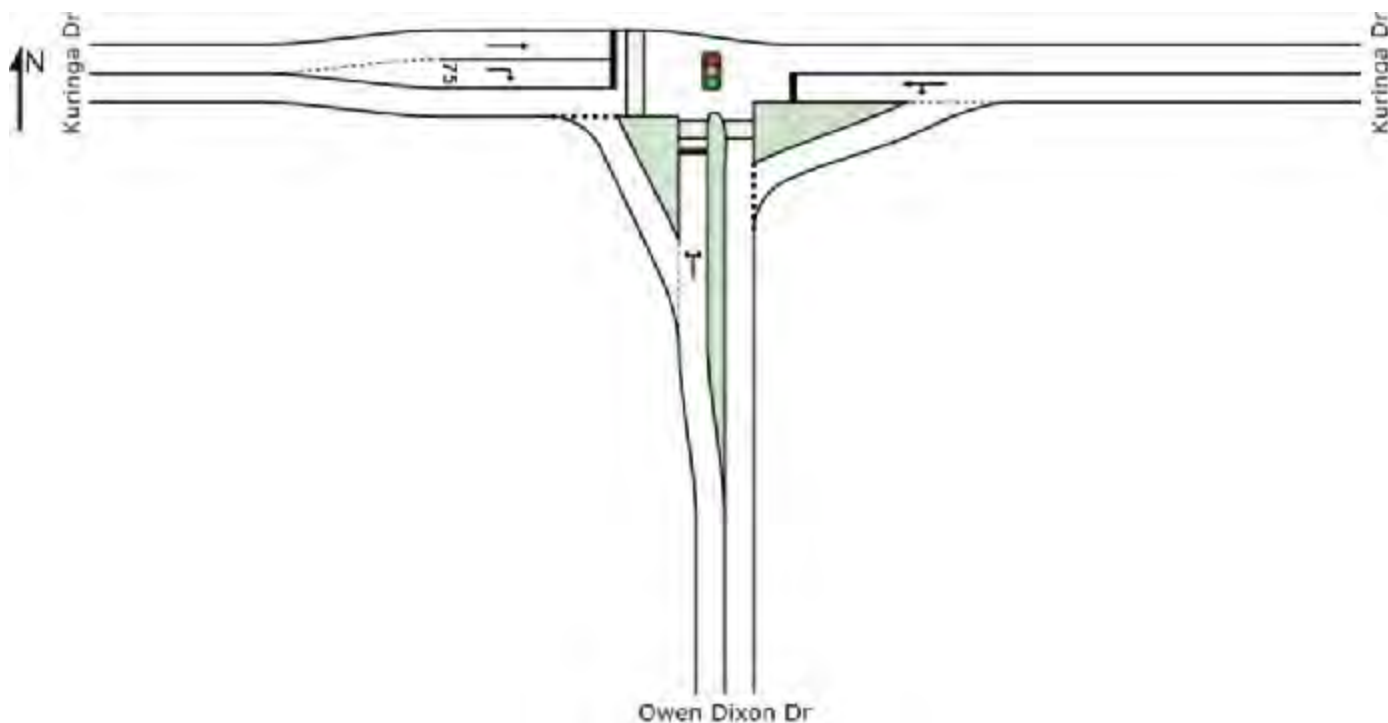
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

 **Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak-signalised**

signalised layout
Signals - Fixed Time



Created: Wednesday, 21 October 2015 3:51:33 PM
SIDRA INTERSECTION 6.0.24.4877

Copyright © 2000-2014 Akcelik and Associates Pty Ltd
www.sidrasolutions.com

Project: H:\5966 Kuringa Drive Intersection\Design Admin_DA\Reports\Traffic\SIDRA\2021 final - signalised.sip6
8000134, 6017787, INDESCO, PLUS / 1PC

**SIDRA
INTERSECTION 6**

MOVEMENT SUMMARY**Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak-signalised**

signalised layout

Signals - Fixed Time Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	m		per veh	km/h
South: Owen Dixon Dr											
1	L2	11	5.0	0.703	62.5	LOS E	8.2	60.0	1.00	0.88	29.3
3	R2	157	5.0	0.703	62.4	LOS E	8.2	60.0	1.00	0.88	29.0
Approach		167	5.0	0.703	62.4	LOS E	8.2	60.0	1.00	0.88	29.0
East: Kuringa Dr											
4	L2	477	5.0	0.966	56.4	LOS E	77.2	563.5	1.00	1.19	31.8
5	T1	694	5.0	0.966	50.8	LOS D	77.2	563.5	1.00	1.19	32.1
Approach		1171	5.0	0.966	53.1	LOS D	77.2	563.5	1.00	1.19	31.9
West: Kuringa Dr											
11	T1	352	5.0	0.248	4.0	LOS A	5.2	37.7	0.33	0.29	56.2
12	R2	14	5.0	0.127	56.4	LOS E	0.7	4.9	0.98	0.68	30.4
Approach		365	5.0	0.248	6.0	LOS A	5.2	37.7	0.35	0.30	54.5
All Vehicles		1703	5.0	0.966	43.9	LOS D	77.2	563.5	0.86	0.97	34.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	53	9.3	LOS A	0.1	0.1	0.43	0.43	
P4	West Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
All Pedestrians		105	26.8	LOS C			0.69	0.69	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

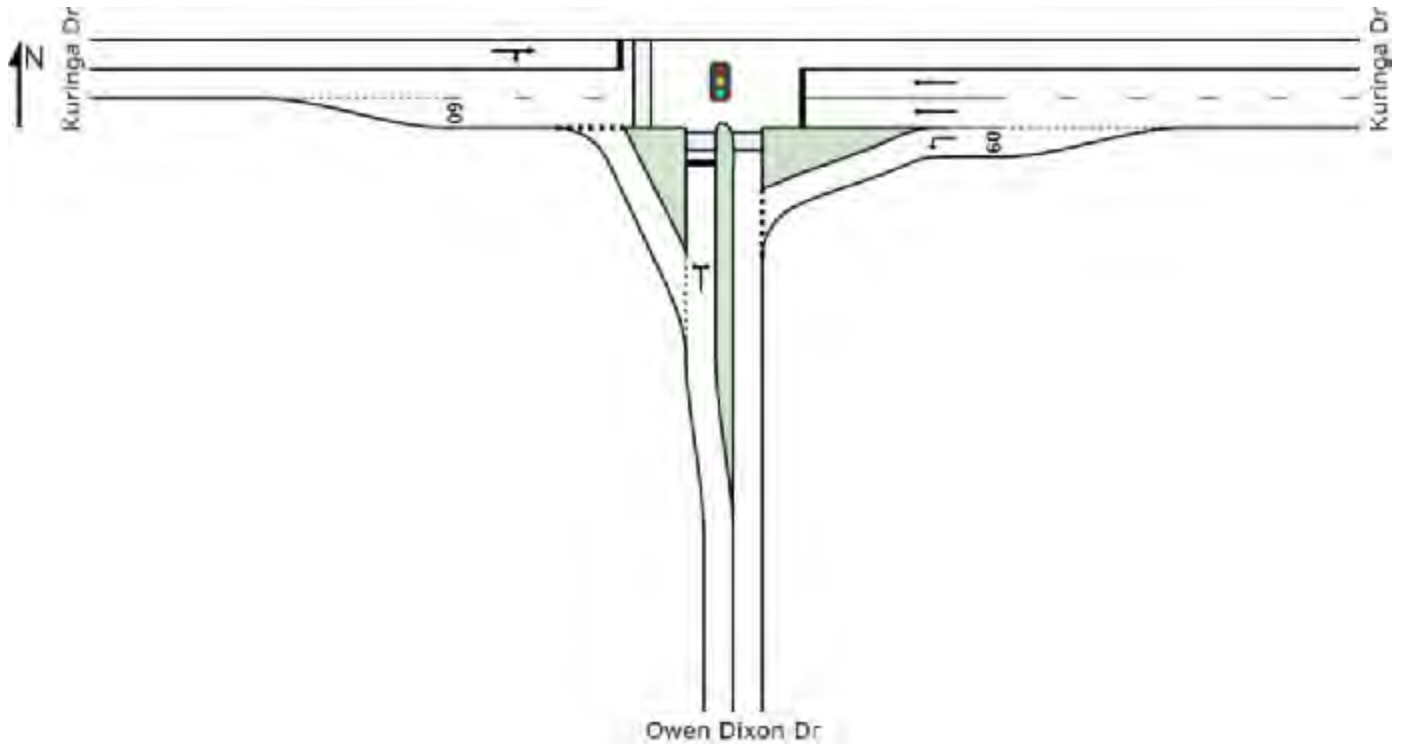
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

 **Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak-signalised**

signalised layout
Signals - Fixed Time



Created: Tuesday, 10 November 2015 12:03:42 PM
SIDRA INTERSECTION 6.0.24.4877

Copyright © 2000-2014 Akcelik and Associates Pty Ltd
www.sidrasolutions.com

Project: H:\5966 Kuringa Drive Intersection\Design Admin_DA\Reports\Traffic\SIDRA\2021 final - 2 and 1 - one lane westbound.sip6
8000134, 6017787, INDESCO, PLUS / 1PC

**SIDRA
INTERSECTION 6**

MOVEMENT SUMMARY**Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak-signalised**

signalised layout

Signals - Fixed Time Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed	
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m	per veh	km/h	
South: Owen Dixon Dr											
1	L2	11	5.0	0.511	49.9	LOS D	7.4	54.0	0.95	0.83	32.7
3	R2	157	5.0	0.511	49.8	LOS D	7.4	54.0	0.95	0.83	32.5
Approach		167	5.0	0.511	49.8	LOS D	7.4	54.0	0.95	0.83	32.5
East: Kuringa Dr											
4	L2	477	5.0	0.300	6.2	LOS A	2.0	14.7	0.17	0.60	53.5
5	T1	694	5.0	0.489	13.5	LOS B	15.1	110.5	0.62	0.54	49.1
Approach		1171	5.0	0.489	10.5	LOS B	15.1	110.5	0.44	0.57	50.8
West: Kuringa Dr											
11	T1	352	5.0	0.452	21.6	LOS C	12.6	91.6	0.76	0.66	44.1
12	R2	14	5.0	0.452	27.2	LOS C	12.6	91.6	0.76	0.66	42.9
Approach		365	5.0	0.452	21.8	LOS C	12.6	91.6	0.76	0.66	44.1
All Vehicles		1703	5.0	0.511	16.8	LOS B	15.1	110.5	0.55	0.61	46.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian	Distance	per ped		
					ped	m			
P1	South Full Crossing	53	12.5	LOS B	0.1	0.1	0.50		
P4	West Full Crossing	53	39.7	LOS D	0.1	0.1	0.89		
All Pedestrians		105	26.1	LOS C			0.70		

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY**Site: 2021 - Kuringa Drive/ Owen Dixon Drive - PM Peak-signalised**

signalised layout

Signals - Fixed Time Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed	
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m	per veh	km/h	
South: Owen Dixon Dr											
1	L2	11	5.0	0.622	44.3	LOS D	16.8	122.6	0.88	0.86	34.4
3	R2	381	5.0	0.622	44.2	LOS D	16.8	122.6	0.88	0.86	34.2
Approach		392	5.0	0.622	44.2	LOS D	16.8	122.6	0.88	0.86	34.2
East: Kuringa Dr											
4	L2	125	5.0	0.082	6.1	LOS A	0.4	2.9	0.14	0.58	53.6
5	T1	281	5.0	0.584	39.8	LOS D	9.5	69.6	0.94	0.77	36.2
Approach		406	5.0	0.584	29.4	LOS C	9.5	69.6	0.69	0.71	40.3
West: Kuringa Dr											
11	T1	555	5.0	0.591	18.4	LOS B	19.1	139.7	0.75	0.68	46.0
12	R2	8	5.0	0.591	23.9	LOS C	19.1	139.7	0.75	0.68	44.7
Approach		563	5.0	0.591	18.4	LOS B	19.1	139.7	0.75	0.68	46.0
All Vehicles		1361	5.0	0.622	29.1	LOS C	19.1	139.7	0.77	0.74	40.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian	Distance	per ped		
					ped	m			
P1	South Full Crossing	53	37.9	LOS D	0.1	0.1	0.87		
P4	West Full Crossing	53	26.0	LOS C	0.1	0.1	0.72		
All Pedestrians		105	32.0	LOS D			0.80		

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

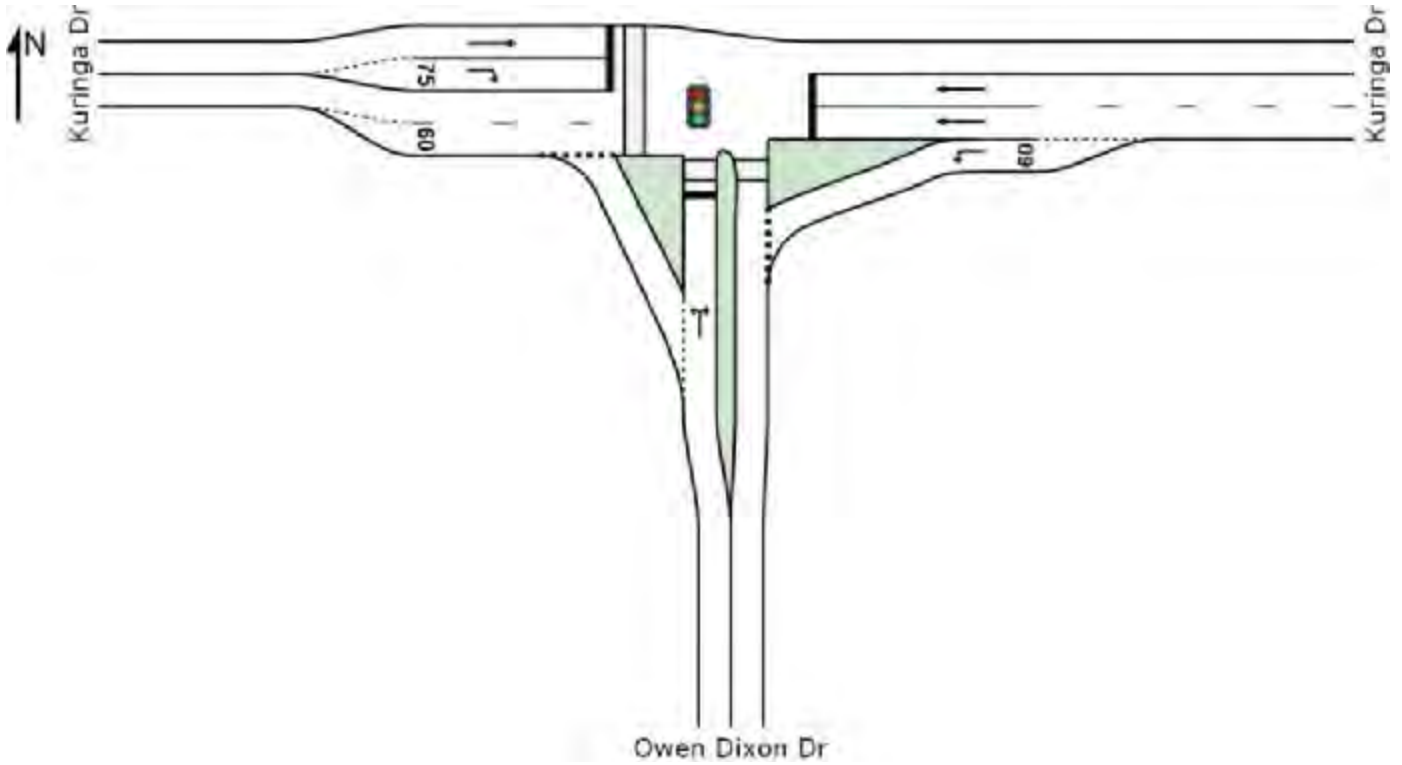
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

 **Site: 2021 - Kuringa Drive/ Owen Dixon Drive - PM Peak-signalised**

signalised layout
Signals - Fixed Time Isolated



MOVEMENT SUMMARY**Site: 2021 - Kuringa Drive/ Owen Dixon Drive - AM Peak-signalised**

signalised layout

Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	m		per veh	km/h
South: Owen Dixon Dr											
1	L2	11	5.0	0.484	48.3	LOS D	7.3	53.2	0.93	0.82	33.2
3	R2	157	5.0	0.484	48.2	LOS D	7.3	53.2	0.93	0.82	33.0
Approach		167	5.0	0.484	48.2	LOS D	7.3	53.2	0.93	0.82	33.0
East: Kuringa Dr											
4	L2	477	5.0	0.300	6.2	LOS A	2.0	14.7	0.17	0.60	53.5
5	T1	694	5.0	0.481	12.8	LOS B	14.8	107.9	0.60	0.53	49.5
Approach		1171	5.0	0.481	10.1	LOS B	14.8	107.9	0.43	0.56	51.1
West: Kuringa Dr											
11	T1	352	5.0	0.270	6.2	LOS A	6.4	46.8	0.41	0.36	54.4
12	R2	14	5.0	0.127	56.4	LOS E	0.7	4.9	0.98	0.68	30.5
Approach		365	5.0	0.270	8.1	LOS A	6.4	46.8	0.43	0.37	52.9
All Vehicles		1703	5.0	0.484	13.4	LOS B	14.8	107.9	0.48	0.54	48.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	53	12.0	LOS B	0.1	0.1	0.49	0.49	
P4	West Full Crossing	53	41.5	LOS E	0.1	0.1	0.91	0.91	
All Pedestrians		105	26.8	LOS C			0.70	0.70	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY
 **Site: 2021 - Kuringa Drive/ Owen Dixon Drive - PM Peak-signalised**

signalised layout

Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Average Speed	
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m	per veh	km/h	
South: Owen Dixon Dr											
1	L2	11	5.0	0.588	35.0	LOS D	15.3	111.4	0.85	0.84	37.7
3	R2	381	5.0	0.588	35.0	LOS C	15.3	111.4	0.85	0.84	37.4
Approach		392	5.0	0.588	35.0	LOS C	15.3	111.4	0.85	0.84	37.4
East: Kuringa Dr											
4	L2	125	5.0	0.079	6.1	LOS A	0.4	3.1	0.14	0.58	53.6
5	T1	281	5.0	0.292	22.7	LOS C	7.1	51.8	0.72	0.60	43.7
Approach		406	5.0	0.292	17.6	LOS B	7.1	51.8	0.54	0.59	46.3
West: Kuringa Dr											
11	T1	555	5.0	0.582	18.2	LOS B	18.6	136.1	0.75	0.67	46.2
12	R2	8	5.0	0.067	54.5	LOS D	0.4	2.9	0.96	0.67	31.0
Approach		563	5.0	0.582	18.7	LOS B	18.6	136.1	0.75	0.67	45.8
All Vehicles		1361	5.0	0.588	23.0	LOS C	18.6	136.1	0.72	0.69	43.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

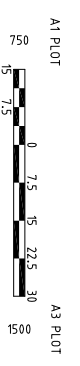
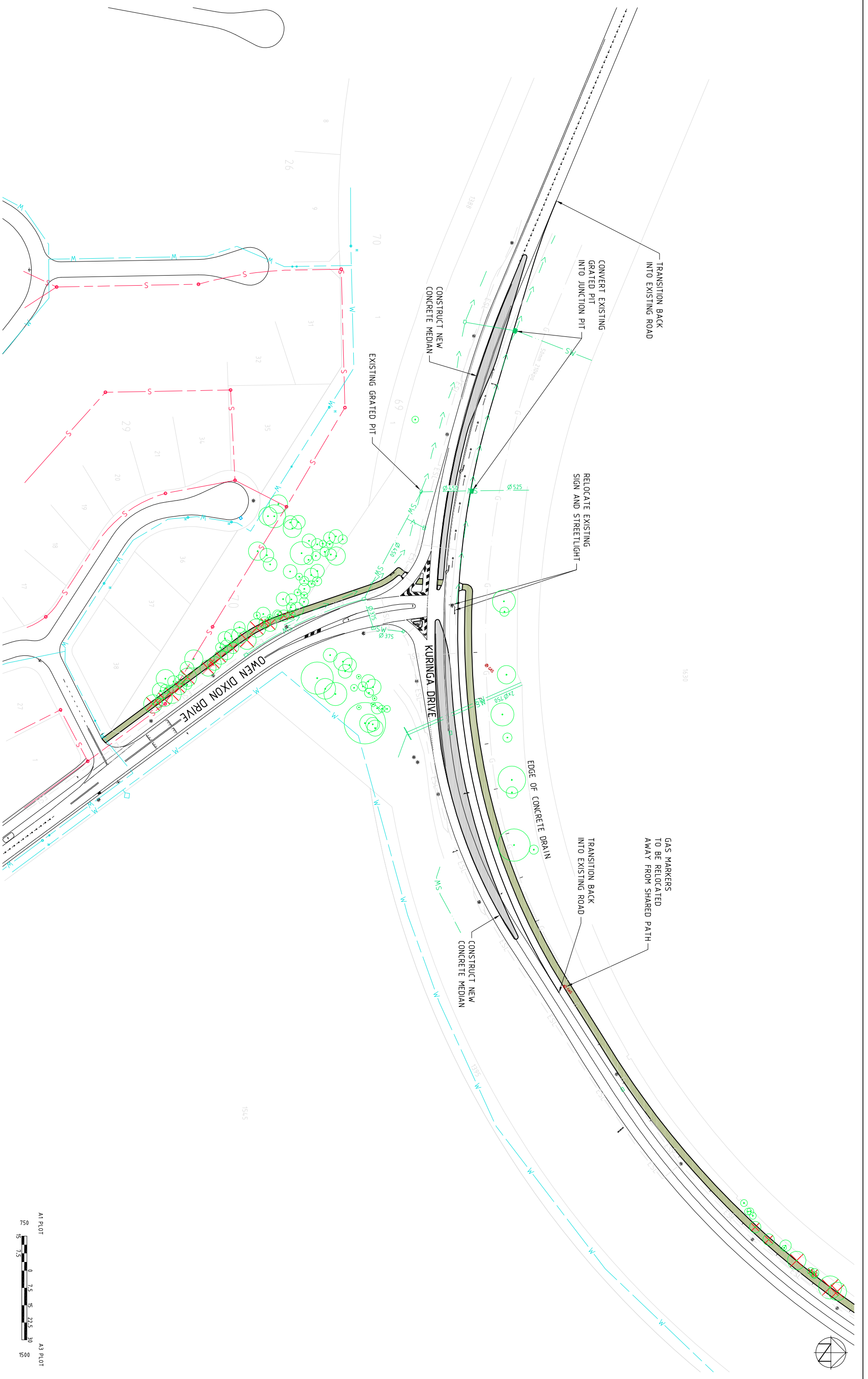
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian ped	Distance m	per ped		
P1	South Full Crossing	53	23.2	LOS C	0.1	0.1	0.68		
P4	West Full Crossing	53	26.7	LOS C	0.1	0.1	0.73		
All Pedestrians		105	24.9	LOS C			0.71		

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.



NO.	REVISION	DATE	ISSUED BY	DEVELOPMENT TEAM
1	FOR INFORMATION	11.10.2016	HS	

NO.	REVISION	DATE	ISSUED BY	DEVELOPMENT TEAM



INDESCO
 CONSULT AUSTRALIA
 Level 7, 20 George St Parramatta NSW 2150
 Phone: (02) 9633 3273 Fax: (02) 9633 2618

APPROVED	RS	DATE	22.08.2016
CHECKED BY	RS	DATE	22.08.2016
DRAWN BY	MJ		

PROJECT
KURUNGA DRIVE / OWEN DIXON INTERSECTION AND SHARED PATH FEASIBILITY STUDY

DRAWING TITLE	OPTION 1
PROJECT NO.	59666
DRAWING NO.	F06
SHEET NO.	A

Economic Analysis Of Kuringa Drive Intersection

Summary Table

Thursday, 21 April 2016

	Base Case	Option 4 Singalised Intersection	Option 5 Singalised Intersection	Option A Roundabout	Option B Singalised Intersection	Shared Path
Appraisal period (years)	6	6	6	16	16	20
Capital Costs	\$0	\$1,700,000	\$1,891,821	\$1,759,189	\$2,132,119	\$625,421
Whole of Life Costs	\$5,000	\$1,705,000	\$1,896,821	\$1,764,189	\$2,137,119	\$646,421
Cost-benefit analysis of monetary costs and benefits at the Public Sector Discount Rate						
Present Value of Benefits	-\$728,095	\$260,984	\$498,073	\$260,984	\$260,984	\$752,002
Present Value of Costs	\$4,241	\$1,704,241	\$1,896,062	\$1,763,430	\$1,763,430	\$636,629
Benefit Cost Ratio	-171.67	0.15	0.26	0.15	0.15	1.18
Net Present Value	-\$732,337	-\$1,443,257	-\$1,397,990	-\$1,502,446	-\$1,502,446	\$115,373

Cost Benefit Analysis
Option Base Case: Existing Layout
 Thursday, 21 April 2016

<title of the investment proposal>
 <description of the option>

Key Assumptions:

Public Sector Discount Rate 2011	7.00%
Appraisal period (years)	6 years

Summary of the Results of the Analysis:

Capital Costs	\$0
Whole of Life Costs	\$5,000
Present Value of Benefits	-\$728,095
Present Value of Costs	\$4,241
Benefit Cost Ratio	-171.67
Net Present Value	<u><u>-\$732,337</u></u>

Year	0 2010	1 2011	2 2012	3 2013	4 2014
Discount factor (mid-year)	0.96674	0.90349	0.84439	0.78914	0.73752
Discount factor (start of year)	1.00000	0.93458	0.87344	0.81630	0.76290

Benefit (RUM code 102) with 0% Assumed Reduction from intersection upgrade

-\$35,830

Benefit (RUM code 104) with 0% Assumed Reduction from intersection upgrade

-\$107,490

-\$107,490

Benefit (RUM code 201) with 0% Assumed Reduction from intersection upgrade

-\$121,318

Benefit (RUM code 202) with 0% Assumed Reduction from intersection upgrade	-\$47,771	-\$47,771	-\$47,771	-\$47,771	-\$95,542
Benefit (RUM code 301) with 0% Assumed Reduction from intersection upgrade		-\$20,418			
Benefit (RUM code 303) with 0% Assumed Reduction from intersection upgrade	-\$40,836	-\$20,418	-\$81,672	-\$20,418	-\$20,418
Total Benefits (mid-year)	-\$209,925	-\$88,607	-\$236,933	-\$68,189	-\$259,280
Present Value of Benefits (mid-yr)	-\$202,942	-\$80,056	-\$200,063	-\$53,811	-\$191,224
Present Value of Benefits	-\$728,095				
Cost 1 Periodic maintenance	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Cost 2 <description>					
Cost 3 <description>					
Cost 4 <description>					
Cost 5 <description>					
Total Costs (mid-year)	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Capital Costs (at start of year)	\$0	\$0	\$0	\$0	\$0
Total Costs	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Total Capital Costs	\$0				
Total Whole of Life Costs	-\$5,000				
Present Value of Costs (mid-year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs (start year)	\$0	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs	-\$4,241				
Net Cash Flows	-\$210,925	-\$89,607	-\$237,933	-\$69,189	-\$260,280
Net Present Value (by year)	-\$203,909	-\$80,959	-\$200,907	-\$54,600	-\$191,961

Cumulative NPV						
		-\$203,909	-\$284,868	-\$485,775	-\$540,375	-\$732,337

Chart data only:

Year		0		1		2		3		4
Present Value of Benefits (\$million)	-\$	0.203	-\$	0.080	-\$	0.200	-\$	0.054	-\$	0.191
Present Value of Costs (\$million)	-\$	0.001	-\$	0.001	-\$	0.001	-\$	0.001	-\$	0.001
Cumulative Net Present Value (\$million)	-\$	0.204	-\$	0.285	-\$	0.486	-\$	0.540	-\$	0.732

Cost Benefit Analysis

Option A: Roundabout

Thursday, 21 April 2016

<title of the investment proposal>

<description of the option>

Key Assumptions:

Public Sector Discount Rate 2011	7.00%
Appraisal period (years)	16 years

Summary of the Results of the Analysis:

Capital Costs	\$1,759,189
Whole of Life Costs	\$1,764,189
Present Value of Benefits	\$260,984
Present Value of Costs	\$1,763,430
Benefit Cost Ratio	0.15
Net Present Value	<u><u>-\$1,502,446</u></u>

Year	0 2010	1 2011	2 2012	3 2013	4 2014
Discount factor (mid-year)	0.96674	0.90349	0.84439	0.78914	0.73752
Discount factor (start of year)	1.00000	0.93458	0.87344	0.81630	0.76290

Benefit (RUM code 102) with 60% Assumed Reduction from intersection upgrade

\$21,498

Benefit (RUM code 104) with 60% Assumed Reduction from intersection upgrade

\$64,494

\$64,494

Benefit (RUM code 201) with 90% Assumed Reduction from intersection upgrade

\$109,186

Benefit (RUM code 202) with 90% Assumed Reduction from intersection upgrade	\$42,994	\$42,994	\$42,994	\$42,994	\$85,988
Benefit (RUM code 301) with 00% Assumed Reduction from intersection upgrade		-\$20,418			
Benefit (RUM code 303) with 0% Assumed Reduction from intersection upgrade	-\$40,836	-\$20,418	-\$81,672	-\$20,418	-\$20,418
Total Benefits (mid-year)	\$111,344	\$2,158	\$25,816	\$22,576	\$151,562
Present Value of Benefits (mid-yr)	\$107,640	\$1,950	\$21,799	\$17,816	\$111,780
Present Value of Benefits	\$260,984				
Cost 1 Periodic maintenance	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Cost 2 <description>					
Cost 3 <description>					
Cost 4 <description>					
Cost 5 <description>					
Total Costs (mid-year)	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Capital Costs (at start of year)	-\$1,759,189	\$0	\$0	\$0	\$0
Total Costs	-\$1,760,189	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Total Capital Costs	-\$1,759,189				
Total Whole of Life Costs	-\$1,764,189				
Present Value of Costs (mid-year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs (start year)	-\$1,759,189	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-\$1,760,156	-\$903	-\$844	-\$789	-\$738
Present Value of Costs	-\$1,763,430				
Net Cash Flows	-\$1,648,845	\$1,158	\$24,816	\$21,576	\$150,562
Net Present Value (by year)	-\$1,652,515	\$1,046	\$20,954	\$17,027	\$111,042

Cumulative NPV						
		-\$1,652,515	-\$1,651,469	-\$1,630,515	-\$1,613,488	-\$1,502,446

Chart data only:

Year		0		1		2		3		4
Present Value of Benefits (\$million)	\$	0.108	\$	0.002	\$	0.022	\$	0.018	\$	0.112
Present Value of Costs (\$million)	-\$	1.760	-\$	0.001	-\$	0.001	-\$	0.001	-\$	0.001
Cumulative Net Present Value (\$million)	-\$	1.653	-\$	1.651	-\$	1.631	-\$	1.613	-\$	1.502

Cost Benefit Analysis
Option B: Signalised Intersection
 Thursday, 21 April 2016

<title of the investment proposal>
 <description of the option>

Key Assumptions:

Public Sector Discount Rate 2011	7.00%
Appraisal period (years)	16 years

Summary of the Results of the Analysis:

Capital Costs	\$2,132,119
Whole of Life Costs	\$2,137,119
Present Value of Benefits	\$260,984
Present Value of Costs	\$2,136,360
Benefit Cost Ratio	0.12
Net Present Value	-\$1,875,376

Year	0 2010	1 2011	2 2012	3 2013	4 2014
Discount factor (mid-year)	0.96674	0.90349	0.84439	0.78914	0.73752
Discount factor (start of year)	1.00000	0.93458	0.87344	0.81630	0.76290

Benefit (RUM code 102) with 60% Assumed Reduction from intersection upgrade					\$21,498
Benefit (RUM code 104) with 60% Assumed Reduction from intersection upgrade			\$64,494		\$64,494
Benefit (RUM code 201) with 90% Assumed Reduction from intersection upgrade	\$109,186				
Benefit (RUM code 202) with 90% Assumed Reduction from intersection upgrade	\$42,994	\$42,994	\$42,994	\$42,994	\$85,988
Benefit (RUM code 301) with 0% Assumed Reduction from intersection upgrade		-\$20,418			
Benefit (RUM code 303) with 0% Assumed Reduction from intersection upgrade	-\$40,836	-\$20,418	-\$81,672	-\$20,418	-\$20,418
Total Benefits (mid-year)	\$111,344	\$2,158	\$25,816	\$22,576	\$151,562

Present Value of Benefits (mid-yr)	\$107,640	\$1,950	\$21,799	\$17,816	\$111,780
Present Value of Benefits	\$260,984				
Cost 1 Periodic maintenance	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Cost 2 <description>					
Cost 3 <description>					
Cost 4 <description>					
Cost 5 <description>					
Total Costs (mid-year)	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Capital Costs (at start of year)	-\$2,132,119	\$0	\$0	\$0	\$0
Total Costs	-\$2,133,119	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Total Capital Costs	-\$2,132,119				
Total Whole of Life Costs	-\$2,137,119				
Present Value of Costs (mid-year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs (start year)	-\$2,132,119	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-\$2,133,086	-\$903	-\$844	-\$789	-\$738
Present Value of Costs	-\$2,136,360				
Net Cash Flows	-\$2,021,775	\$1,158	\$24,816	\$21,576	\$150,562
Net Present Value (by year)	-\$2,025,445	\$1,046	\$20,954	\$17,027	\$111,042
Cumulative NPV	-\$2,025,445	-\$2,024,399	-\$2,003,445	-\$1,986,418	-\$1,875,376

Chart data only:

Year	0	1	2	3	4
Present Value of Benefits (\$million)	\$ 0.108	\$ 0.002	\$ 0.022	\$ 0.018	\$ 0.112
Present Value of Costs (\$million)	-\$ 2.133	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001
Cumulative Net Present Value (\$million)	-\$ 2.025	-\$ 2.024	-\$ 2.003	-\$ 1.986	-\$ 1.875

Cost Benefit Analysis
Option 4: Signalised Intersection

Thursday, 21 April 2016

<title of the investment proposal>

<description of the option>

Key Assumptions:

Public Sector Discount Rate 2011	7.00%
Appraisal period (years)	6 years

Summary of the Results of the Analysis:

Capital Costs	\$1,700,000
Whole of Life Costs	\$1,705,000
Present Value of Benefits	\$260,984
Present Value of Costs	\$1,704,241
Benefit Cost Ratio	0.15
Net Present Value	<u><u>-\$1,443,257</u></u>

Year	0 2010	1 2011	2 2012	3 2013	4 2014
Discount factor (mid-year)	0.96674	0.90349	0.84439	0.78914	0.73752
Discount factor (start of year)	1.00000	0.93458	0.87344	0.81630	0.76290

Benefit (RUM code 102) with 60% Assumed Reduction from intersection upgrade

\$21,498

Benefit (RUM code 104) with 60% Assumed Reduction from intersection upgrade

\$64,494

\$64,494

Benefit (RUM code 201) with 90% Assumed Reduction from intersection upgrade

\$109,186

Benefit (RUM code 202) with 90% Assumed Reduction from intersection upgrade	\$42,994	\$42,994	\$42,994	\$42,994	\$85,988
Benefit (RUM code 301) with 0% Assumed Reduction from intersection upgrade		-\$20,418			
Benefit (RUM code 303) with 0% Assumed Reduction from intersection upgrade	-\$40,836	-\$20,418	-\$81,672	-\$20,418	-\$20,418
Total Benefits (mid-year)	\$111,344	\$2,158	\$25,816	\$22,576	\$151,562
Present Value of Benefits (mid-yr)	\$107,640	\$1,950	\$21,799	\$17,816	\$111,780
Present Value of Benefits	\$260,984				
Cost 1 Periodic maintenance	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Cost 2 <description>					
Cost 3 <description>					
Cost 4 <description>					
Cost 5 <description>					
Total Costs (mid-year)	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Capital Costs (at start of year)	-\$1,700,000		\$0	\$0	\$0
Total Costs	-\$1,701,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Total Capital Costs	-\$1,700,000				
Total Whole of Life Costs	-\$1,705,000				
Present Value of Costs (mid-year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs (start year)	-\$1,700,000	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-\$1,700,967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs	-\$1,704,241				
Net Cash Flows	-\$1,589,656	\$1,158	\$24,816	\$21,576	\$150,562
Net Present Value (by year)	-\$1,593,326	\$1,046	\$20,954	\$17,027	\$111,042

Cumulative NPV						
		-\$1,593,326	-\$1,592,280	-\$1,571,326	-\$1,554,299	-\$1,443,257

Chart data only:

Year		0		1		2		3		4
Present Value of Benefits (\$million)	\$	0.108	\$	0.002	\$	0.022	\$	0.018	\$	0.112
Present Value of Costs (\$million)	-\$	1.701	-\$	0.001	-\$	0.001	-\$	0.001	-\$	0.001
Cumulative Net Present Value (\$million)	-\$	1.593	-\$	1.592	-\$	1.571	-\$	1.554	-\$	1.443

Cost Benefit Analysis

Option 5: Signalised Intersection

Thursday, 21 April 2016

<title of the investment proposal>

<description of the option>

Key Assumptions:

Public Sector Discount Rate 2011

7.00%

Appraisal period (years)

6 years

Summary of the Results of the Analysis:

Capital Costs	\$1,891,821
Whole of Life Costs	\$1,896,821
Present Value of Benefits	\$498,073
Present Value of Costs	\$1,896,062
Benefit Cost Ratio	0.26
Net Present Value	<u><u>-\$1,397,990</u></u>

Year	0 2010	1 2011	2 2012	3 2013	4 2014
Discount factor (mid-year)	0.96674	0.90349	0.84439	0.78914	0.73752
Discount factor (start of year)	1.00000	0.93458	0.87344	0.81630	0.76290

Benefit (RUM code 102) with 60% Assumed Reduction from intersection upgrade

\$21,498

Benefit (RUM code 104) with 60% Assumed Reduction from intersection upgrade

\$64,494

\$64,494

Benefit (RUM code 201) with 90% Assumed Reduction from intersection upgrade

\$109,186

Benefit (RUM code 202) with 90% Assumed Reduction from intersection upgrade	\$42,994	\$42,994	\$42,994	\$42,994	\$85,988
Benefit (RUM code 301) with 0% Assumed Reduction from intersection upgrade		-\$20,418			
Benefit (RUM code 303) with 50% Assumed Reduction from intersection upgrade	\$20,418	\$10,209	\$40,836	\$10,209	\$10,209
Total Benefits (mid-year)	\$172,598	\$32,785	\$148,324	\$53,203	\$182,189
Present Value of Benefits (mid-yr)	\$166,857	\$29,621	\$125,242	\$41,985	\$134,368
Present Value of Benefits	\$498,073				
Cost 1 Periodic maintenance	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Cost 2 <description>					
Cost 3 <description>					
Cost 4 <description>					
Cost 5 <description>					
Total Costs (mid-year)	-\$1,000	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Capital Costs (at start of year)	-\$1,891,821		\$0	\$0	\$0
Total Costs	-\$1,892,821	-\$1,000	-\$1,000	-\$1,000	-\$1,000
Total Capital Costs	-\$1,891,821				
Total Whole of Life Costs	-\$1,896,821				
Present Value of Costs (mid-year)	-\$967	-\$903	-\$844	-\$789	-\$738
Present Value of Costs (start year)	-\$1,891,821	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-\$1,892,788	-\$903	-\$844	-\$789	-\$738
Present Value of Costs	-\$1,896,062				
Net Cash Flows	-\$1,720,223	\$31,785	\$147,324	\$52,203	\$181,189
Net Present Value (by year)	-\$1,725,931	\$28,717	\$124,398	\$41,196	\$133,630

Cumulative NPV						
		-\$1,725,931	-\$1,697,213	-\$1,572,815	-\$1,531,620	-\$1,397,990

Chart data only:

Year		0		1		2		3		4
Present Value of Benefits (\$million)	\$	0.167	\$	0.030	\$	0.125	\$	0.042	\$	0.134
Present Value of Costs (\$million)	-\$	1.893	-\$	0.001	-\$	0.001	-\$	0.001	-\$	0.001
Cumulative Net Present Value (\$million)	-\$	1.726	-\$	1.697	-\$	1.573	-\$	1.532	-\$	1.398

10 2020	11 2021	12 2022	13 2023	14 2024	15 2025	16 2026	17 2027	18 2028	19 2029	20 2030
0.49144	0.45929	0.42924	0.40116	0.37492	0.35039	0.32747	0.30604	0.28602	0.26731	0.24982
0.50835	0.47509	0.44401	0.41496	0.38782	0.36245	0.33873	0.31657	0.29586	0.27651	0.25842
\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093
\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093	\$67,093
\$32,972	\$30,815	\$28,799	\$26,915	\$25,154	\$23,509	\$21,971	\$20,533	\$19,190	\$17,935	\$16,761

Cost 1 Periodic maintenance	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Cost 2 <description>											
Cost 3 <description>											
Cost 4 <description>											
Cost 5 <description>											
Total Costs (mid-year)	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Capital Costs (at start of year)	-625,421	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Costs	-626,421	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Total Capital Costs	-625,421										
Total Whole of Life Costs	-646,421										
Present Value of Costs (mid-year)	-967	-903	-844	-789	-738	-689	-644	-602	-563	-526	
Present Value of Costs (start year)	-625,421	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Present Value of Costs (by year)	-626,388	-903	-844	-789	-738	-689	-644	-602	-563	-526	
Present Value of Costs	-636,629										
Net Cash Flows	-559,328	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093
Net Present Value (by year)	-561,526	\$59,714	\$55,808	\$52,157	\$48,745	\$45,556	\$42,576	\$39,790	\$37,187	\$34,754	
Cumulative NPV	-561,526	-\$501,812	-\$446,004	-\$393,847	-\$345,102	-\$299,546	-\$256,971	-\$217,180	-\$179,993	-\$145,239	

Chart data only:

Year	0	1	2	3	4	5	6	7	8	9
Present Value of Benefits (\$million)	\$ 0.065	\$ 0.061	\$ 0.057	\$ 0.053	\$ 0.049	\$ 0.046	\$ 0.043	\$ 0.040	\$ 0.038	\$ 0.035
Present Value of Costs (\$million)	-\$ 0.626	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001	-\$ 0.001
Cumulative Net Present Value (\$million)	-\$ 0.562	-\$ 0.502	-\$ 0.446	-\$ 0.394	-\$ 0.345	-\$ 0.300	-\$ 0.257	-\$ 0.217	-\$ 0.180	-\$ 0.145

-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000

-491	-459	-429	-401	-375	-350	-327	-306	-286	-267	-250
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
-491	-459	-429	-401	-375	-350	-327	-306	-286	-267	-250

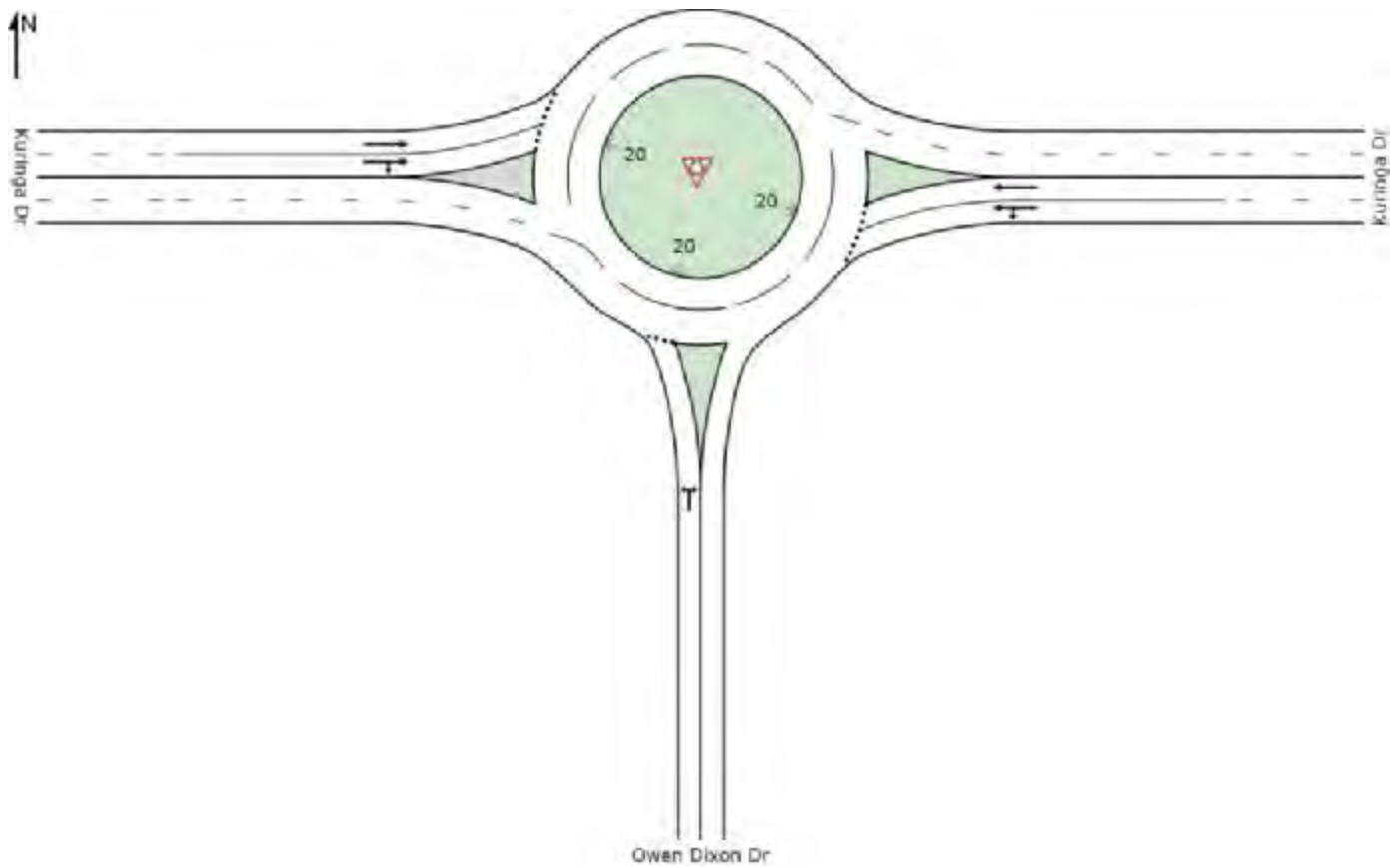
\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093	\$66,093
\$32,481	\$30,356	\$28,370	\$26,514	\$24,779	\$23,158	\$21,643	\$20,227	\$18,904	\$17,667	\$16,512	
-112,758	-82,402	-54,032	-27,518	-2,739	20,419	42,063	62,290	81,194	98,861	115,373	

	10		11		12		13		14		15		16		17		18		19		20
\$	0.033	\$	0.031	\$	0.029	\$	0.027	\$	0.025	\$	0.024	\$	0.022	\$	0.021	\$	0.019	\$	0.018	\$	0.017
-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000	-\$	0.000
-\$	0.113	-\$	0.082	-\$	0.054	-\$	0.028	-\$	0.003	\$	0.020	\$	0.042	\$	0.062	\$	0.081	\$	0.099	\$	0.115

SITE LAYOUT

 Site: 2031 - Kuringa Drive/ Owen Dixon Drive - PM Peak - roundabout

2015
Roundabout



MOVEMENT SUMMARY

 **Site: 2031 - Kuringa Drive/ Owen Dixon Drive - AM Peak - roundabout**

2015
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	9	5.0	0.270	7.9	LOS A	1.3	9.6	0.65	0.85	49.4
3	R2	186	5.0	0.270	12.9	LOS B	1.3	9.6	0.65	0.85	50.5
Approach		196	5.0	0.270	12.7	LOS B	1.3	9.6	0.65	0.85	50.4
East: Kuringa Dr											
4	L2	480	5.0	0.377	4.2	LOS A	2.8	20.3	0.10	0.44	55.0
5	T1	687	5.0	0.377	4.3	LOS A	2.8	20.3	0.11	0.40	56.4
Approach		1167	5.0	0.377	4.2	LOS A	2.8	20.3	0.11	0.42	55.8
West: Kuringa Dr											
11	T1	304	5.0	0.139	5.1	LOS A	0.8	5.8	0.40	0.49	54.9
12	R2	13	5.0	0.139	9.8	LOS A	0.8	5.7	0.40	0.50	54.6
Approach		317	5.0	0.139	5.3	LOS A	0.8	5.8	0.40	0.49	54.9
All Vehicles		1680	5.0	0.377	5.4	LOS A	2.8	20.3	0.22	0.48	55.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 2031 - Kuringa Drive/ Owen Dixon Drive - PM Peak - roundabout**

2015
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	11	5.0	0.393	5.7	LOS A	2.3	16.6	0.50	0.70	50.6
3	R2	384	5.0	0.393	10.6	LOS B	2.3	16.6	0.50	0.70	51.7
Approach		395	5.0	0.393	10.5	LOS B	2.3	16.6	0.50	0.70	51.7
East: Kuringa Dr											
4	L2	149	5.0	0.128	4.1	LOS A	0.8	5.6	0.06	0.44	55.1
5	T1	243	5.0	0.128	4.2	LOS A	0.8	5.6	0.06	0.40	56.7
Approach		393	5.0	0.128	4.2	LOS A	0.8	5.6	0.06	0.42	56.1
West: Kuringa Dr											
11	T1	549	5.0	0.289	6.5	LOS A	1.8	13.2	0.60	0.63	54.0
12	R2	7	5.0	0.289	11.3	LOS B	1.8	12.9	0.61	0.65	53.8
Approach		557	5.0	0.289	6.6	LOS A	1.8	13.2	0.60	0.64	54.0
All Vehicles		1344	5.0	0.393	7.0	LOS A	2.3	16.6	0.41	0.59	53.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

 **Site: 2031 - Kuringa Drive/ Owen Dixon Drive - AM Peak - Owen Dixon Drive single lane**

2015

Signals - Fixed Time



Created: Friday, 4 September 2015 2:31:06 PM
SIDRA INTERSECTION 6.0.24.4877

Project: H:\5966 Kuringa Drive Intersection\Design Admin_DAI\Reports\Traffic\SIDRA\2031 final - signalised.sip6
8000134, 6017787, INDESCO, PLUS / 1PC

Copyright © 2000-2014 Akcelik and Associates Pty Ltd
www.sidrasolutions.com

**SIDRA
INTERSECTION 6**

MOVEMENT SUMMARY

 **Site: 2031 - Kuringa Drive/ Owen Dixon Drive - AM Peak - Owen Dixon Drive single lane**

2015

Signals - Fixed Time Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Owen Dixon Dr											
1	L2	9	5.0	0.539	41.7	LOS D	6.9	50.6	0.94	0.83	35.3
3	R2	186	5.0	0.539	41.6	LOS D	6.9	50.6	0.94	0.83	34.9
Approach		196	5.0	0.539	41.6	LOS D	6.9	50.6	0.94	0.83	34.9
East: Kuringa Dr											
4	L2	480	5.0	0.563	14.5	LOS B	10.9	79.6	0.62	0.77	48.7
5	T1	687	5.0	0.563	13.6	LOS B	14.5	105.5	0.72	0.69	48.4
Approach		1167	5.0	0.563	14.0	LOS B	14.5	105.5	0.68	0.72	48.5
West: Kuringa Dr											
11	T1	304	5.0	0.202	10.5	LOS B	3.9	28.1	0.51	0.43	51.0
12	R2	13	5.0	0.202	35.9	LOS D	2.3	16.9	0.88	0.69	38.6
Approach		317	5.0	0.202	11.5	LOS B	3.9	28.1	0.53	0.44	50.4
All Vehicles		1680	5.0	0.563	16.7	LOS B	14.5	105.5	0.68	0.68	46.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
All Pedestrians		53	34.3	LOS D			0.93	0.93	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY
 **Site: 2031 - Kuringa Drive/ Owen Dixon Drive - PM Peak - Owen Dixon Drive single lane**

2015

Signals - Fixed Time Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m		per veh	km/h
South: Owen Dixon Dr											
1	L2	11	5.0	0.450	23.2	LOS C	9.9	72.3	0.69	0.80	42.9
3	R2	384	5.0	0.450	23.1	LOS C	9.9	72.3	0.69	0.80	42.4
Approach		395	5.0	0.450	23.1	LOS C	9.9	72.3	0.69	0.80	42.4
East: Kuringa Dr											
4	L2	149	5.0	0.488	31.7	LOS C	6.8	49.3	0.89	0.87	39.9
5	T1	243	5.0	0.488	30.8	LOS C	6.8	49.3	0.93	0.80	39.3
Approach		393	5.0	0.488	31.1	LOS C	6.8	49.3	0.91	0.83	39.5
West: Kuringa Dr											
11	T1	549	5.0	0.429	21.6	LOS C	8.7	63.6	0.81	0.69	44.2
12	R2	7	5.0	0.429	27.9	LOS C	8.1	58.8	0.82	0.70	42.6
Approach		557	5.0	0.429	21.7	LOS C	8.7	63.6	0.81	0.69	44.2
All Vehicles		1344	5.0	0.488	24.8	LOS C	9.9	72.3	0.81	0.76	42.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue		Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	Distance m		per ped	
P4	West Full Crossing	53	16.3	LOS B	0.1	0.1	0.64	0.64	
All Pedestrians		53	16.3	LOS B			0.64	0.64	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.