AGENDA
INFRASTRUCTURE, PLANNING AND ENVIRONMENT COMMITTEE
11 JULY 2024

MEMBERSHIP: Councillors J Black, L Burns, S Chowdhury, M Dickerson, V Etheridge, J Gough, R Ivey, D Mahon, P Wells and M Wright.

The meeting is scheduled to commence at 5.30 pm.

ACKNOWLEDGEMENT OF COUNTRY:
"I would like to acknowledge the Wiradjuri People who are the Traditional Custodians of the Land. I would also like to pay respect to the Elders past, present and emerging of the Wiradjuri Nation and extend that respect to other Aboriginal peoples from other nations who are present".

Page

DUBBO REGIONAL COUNCIL

REPORT: Building Summary - June 2024

DIVISION: Development and Environment
REPORT DATE: 30 June 2024
TRIM REFERENCE: ID24/1276

EXECUTIVE SUMMARY

Purpose	• Provide review and update	

Issue	• Statistical overview of the number and type of development approvals for the Dubbo Regional Local Government Area (LGA) for the Financial Year 2023/2024.
	• The 'total number of dwellings' approved for the Financial Year 2023/2024 was 356.
	   o This is just below the 10 year annual average of 378 approved dwellings.
	   o 45% were single dwellings.
	   o 55% were 'other residential dwellings.
	• The value of development applications approved for the Financial Year 2023/2024 was over $331M.
	   o This is down 12% on the previous financial year.
	• The total number of approved applications for the Financial Year 2023/2024 was 645, down 15% on the previous financial year.
	• The month of June included approval of:
	   o D2023-500 Commercial Premises (Shopping Centre) – 2 Stream Avenue Dubbo valued at $24.8M
	   o D2024-80 Wiradjuri Tourism Centre – 2 Coronation Drive Dubbo valued at $14.4M
	   o D2023-492 School building (Dubbo Christian School) – 141 Sheraton Road Dubbo - $6M	

Reasoning	• Provide data relating to approved Development Applications. • Provide specific statistics of the number of dwellings and other residential development approved. • Provide comparative data for corresponding period.	
Financial Implications	Budget Area	There are no financial implications arising from this report.
Policy Implications	Policy Title	There are no policy implications arising from this report.

STRATEGIC DIRECTION

The Towards 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes six principal themes and a number of objectives and strategies. This report is aligned to:

Theme:	1 Housing
CSP Objective:	1.1 Housing meets the current and future needs of our community
Delivery Program Strategy:	1.1.1 A variety of housing types and densities are located close to appropriate services and facilities
Theme:	3 Economy
CSP Objective:	3.3 A strategic framework is in place to maximise the realisation of economic development opportunities for the region
Delivery Program Strategy:	3.3.1 Land is suitably zoned, sized and located to facilitate a variety of development and employment generating activities

RECOMMENDATION

That the report of the Director Development and Environment dated 30 June 2024, be noted.

Stephen Wallace	*SW*
Director Development and Environment	Director Development and Environment

REPORT

Consultation

Council's Statutory Planning and Building and Development Certification staff assess Development Applications in accordance with Section 4.15 of the *Environmental Planning and Assessment Act 1979* and consult in accordance with Council's adopted Community Participation Plan.

Resourcing Implications

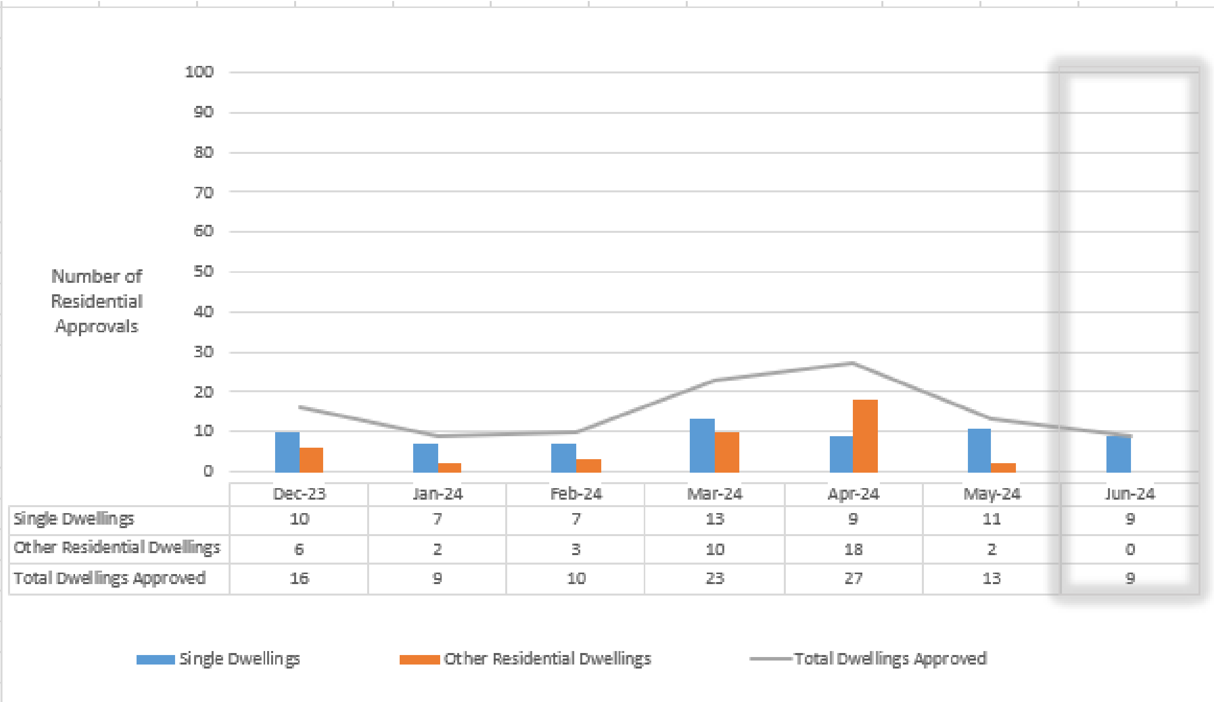
Council employ staff to receipt, lodge, assess, determine and monitor compliance of the determinations referred to in this report.

Building Summary

Provided, for information, are the latest statistics (as at the time of production of this report) for development and complying development approvals for Dubbo Regional Council.

Residential Building Summary

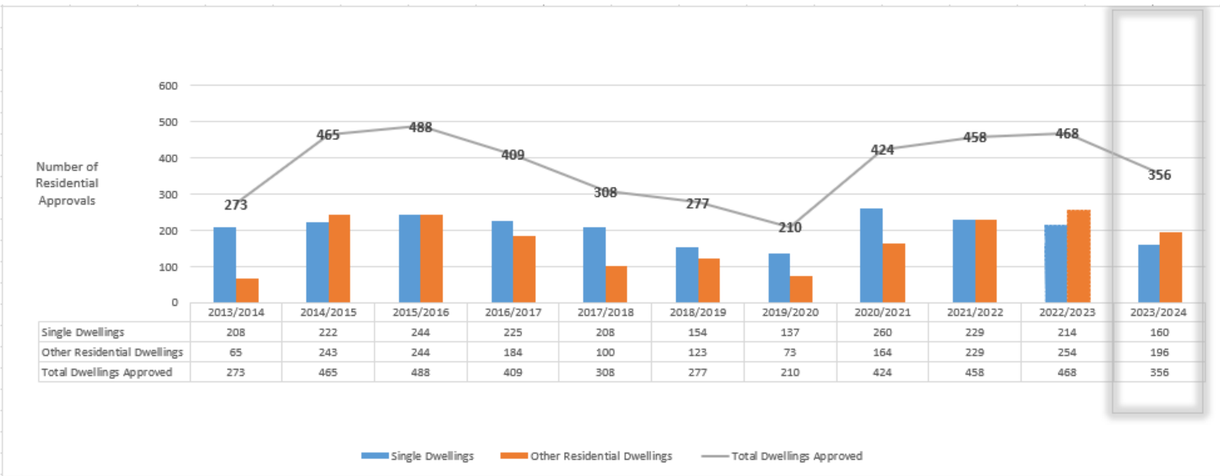
Dwellings and other residential developments approved during June 2024, and for comparison purposes, the six month prior are shown in graph 1.



	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24
Single Dwellings	10	7	7	13	9	11	9
Other Residential Dwellings	6	2	3	10	18	2	0
Total Dwellings Approved	16	9	10	23	27	13	9

Graph 1: Residential Approvals Summary – December 2023 to June 2024

A summary of residential approvals for financial years from 2013-2014 are shown in graph 2.



	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
Single Dwellings	208	222	244	225	208	154	137	260	229	214	160
Other Residential Dwellings	65	243	244	184	100	123	73	164	229	254	196
Total Dwellings Approved	273	465	488	409	308	277	210	424	458	468	356

Graph 2: Residential Approvals Summary – Comparative Financial Years

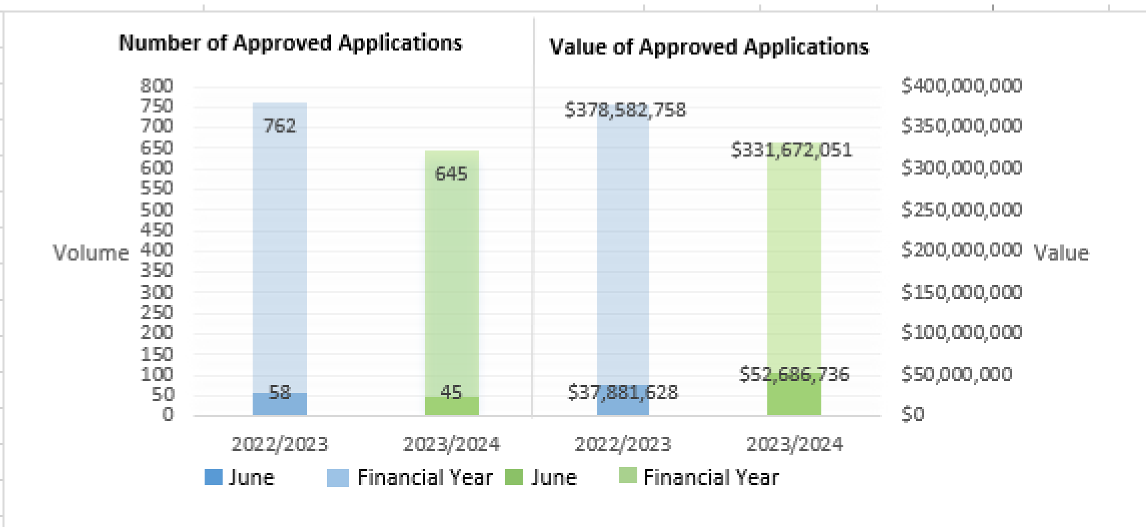
For consistency with land use definitions included in the Local Environmental Plan (LEP), residential development has been separated into ‘Single Dwellings’ (defined in the LEP as ‘dwelling house’) and ‘Other residential development’ (comprising ‘dual occupancies’, ‘secondary dwellings’, ‘multi dwelling housing’, ‘seniors housing’, ‘shop top housing’ and ‘residential flat buildings’).

These figures include development applications approved by private certifying authorities (in the form of Complying Development Certificates).

A numerical summary of residential approvals for the former Dubbo City Council area since 2013/2014 is included in **Appendix 1.** However, it should be noted that the figures from July 2017 onwards include the approvals within the former Wellington Local Government Area as a consequence of the commencement of the merged application system.

Approved Development Applications

The total number of approved Development Applications (including Complying Development Certificates) for June 2024, a comparison with figures 12 months prior, together with the total for the respective financial years to date, are as follows:



A summary breakdown of the figures is included in **Appendices 2-5**.

Online Application Tracking

All development applications, construction certificates and complying development certificates are tracked online and can be accessed at any time. A link is available on Councillor iPads for assistance (https://planning.dubbo.nsw.gov.au/Home/Disclaimer).

What information is available:

- All development applications, construction certificates and complying development certificates submitted from 1 November 2015 will provide access to submitted plans and supporting documents as well as tracking details of the progress of the application.
- More limited information is provided for applications submitted from 1 January 2001 to 31 October 2015.
- Occupation certificates (where issued) are provided from 2010.

What information is not available:

- Application forms.
- Documentation associated with privately certified applications.
- Internal assessment reports.

The information included in this report is provided for notation.

APPENDICES:

1⇩ Building Summary - June 2024

2⇩ Approved Applications - 1 June 2024 to 30 June 2024

3⇩ Approved Applications - 1 June 2023 to 30 June 2023

4⇩ Approved Applications - 1 July 2023 to 30 June 2024

5⇩ Approved Applications - 1 July 2022 to 30 June 2023

STATISTICAL INFORMATION ON SINGLE DWELLINGS AND OTHER RESIDENTIAL DEVELOPMENTS

	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	**TOTAL**
2013/2014													
Single Dwellings	23	17	25	20	14	15	19	10	18	14	19	14	**208**
Other Residential Developments	0	1	1	0	0	1	4	2	1	2	0	3	**15**
(No of units)	0	2	2	0	0	2	46	1	2	4	0	6	**65**
2014/2015													
Single Dwellings	19	34	19	21	13	16	14	12	20	19	15	20	**222**
Other Residential Developments	3	1	6	5	6	12	0	4	2	1	9	5	**54**
(No of units)	6	2	31	50	6	21	0	87	4	1	25	10	**243**
2015/2016													
Single Dwellings	27	20	26	19	21	26	19	14	16	17	17	22	**244**
Other Residential Developments	6	8	8	4	1	3	3	3	3	5	3	8	**55**
(No of units)	50	98	12	7	2	5	18	4	5	14	6	23	**244**
2016/2017													
Single Dwellings	24	13	17	18	12	21	16	18	18	14	18	36	**225**
Other Residential Developments	8	5	7	4	6	5	3	2	1	5	4	7	**57**
(No of units)	10	10	13	7	10	16	6	75	2	8	13	14	**184**
2017/2018													
Single Dwellings	26	21	13	12	16	19	4	22	16	21	22	16	**208**
Other Residential Developments	6	9	2	1	9	1	5	5	11	1	3	5	**58**
(No of units)	11	16	3	2	16	2	8	5	23	2	3	9	**100**
2018/2019													
Single Dwellings	15	26	13	7	17	8	19	5	8	11	19	6	**154**
Other Residential Developments	3	4	3	0	6	2	2	1	5	7	9	5	**47**
(No of units)	4	7	5	0	11	29	4	1	12	25	15	10	**123**
2019/2020													
Single Dwellings	16	11	8	18	27	14	4	5	10	8	8	8	**137**
Other Residential Developments	4	4	3	4	11	6	1	4	2	1	1	1	**42**
(No of units)	8	7	6	7	19	10	2	7	2	2	2	1	**73**

	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	**TOTAL**
2020/2021													
Single Dwellings	7	17	21	12	20	46	18	25	30	27	17	20	**260**
Other Residential Developments	5	2	5	6	3	15	2	6	5	5	7	9	**70**
(No of units)	7	4	11	10	4	35	5	10	8	9	47	14	**164**
2021/2022													
Single Dwellings	31	17	17	13	16	40	9	17	23	14	19	13	**229**
Other Residential Developments	9	7	3	4	5	8	9	9	7		3	4	**68**
(No of units)	84	63	5	6	13	12	12	16	9		4	5	**229**
2022/2023													
Single Dwellings	15	32	46	8	28	13	19	15	15	11	6	6	**214**
Other Residential Developments	4	3	3	4	9	4	7	13	2	6	5	4	**64**
(No of units)	7	3	5	6	84	8	14	19	3	8	62	35	**254**
2023/2024													
Single Dwellings	17	25	12	15	25	10	7	7	13	9	11	9	**160**
Other Residential Developments	5	7	5	5	19	4	2	2	5	3	1	0	**58**
(No of units)	45	12	9	44	45	6	2	3	10	18	2	0	**196**

Note 1. Single Dwellings = Single “Dwelling House’

Note 2. Other Residential Developments = Dual occupancies, secondary dwellings, multi dwelling housing, seniors housing, shop top housing and residential flat buildings

DUBBO REGIONAL COUNCIL

Approved Development and Complying Development Applications by Dubbo Regional Council and Private Certifiers - Period 1/6/2024 - 30/6/2024

Development Type	Number Of Applications	Estimate $	Developments	Estimate $	New Dwellings
Ancillary Structures	3	424,502	3	424,502	0
Balconies, decks patios terraces or verandah	2	106,816	2	106,816	0
Commerical Facility	2	39,225,717	2	39,225,717	0
Demolition	1	35,000	1	35,000	0
Dwelling House	12	5,596,081	12	5,596,081	9
Educational establishment	1	6,040,000	1	6,040,000	0
Farm buildings	1	105,840	1	105,840	0
Garages carports and car parking spaces	1	11,340	1	11,340	0
Industrial Development	2	173,601	2	173,601	0
Pools / decks / fencing	13	709,419	13	709,419	0
Retail Premises	1	50,000	1	50,000	0
Shed	8	206,420	8	206,420	0
Signage	1	2,000	1	2,000	0
Total Value		52,686,736			

Total Number of Applications for this period: 45

1/7/2024

DUBBO REGIONAL COUNCIL

Approved Development and Complying Development Applications by Dubbo Regional Council and Private Certifiers - Period 1/6/2023 - 30/6/2023

Development Type	Number Of Applications	Estimate $	Developments	Estimate $	New Dwellings
Alterations and additions to commercial	2	135,000	0	0	0
Alterations and additions to industrial	2	105,639	0	0	0
Balconies, decks patios terraces or verandah	1	12,138	1	12,138	0
Centre based childcare	1	2,975,500	1	2,975,500	0
Demolition	1	0	1	0	0
Dwelling House	10	3,587,957	6	2,693,463	6
Educational establishment	1	480,000	1	480,000	0
Food and drink premises	1	241,120	1	241,120	0
Garages carports and car parking spaces	4	119,435	4	119,435	0
Industrial Development	4	9,218,787	4	9,218,787	0
Multi-dwelling housing	1	19,010,420	1	19,010,420	32
Pools / decks / fencing	12	655,600	12	655,600	0
Recreational uses	1	291,686	1	291,686	0
Secondary Dwelling	3	571,729	3	571,729	3
Shed	12	438,717	12	438,717	0
Signage	1	30,000	1	30,000	0
Subdivision of land	4	7,900	4	7,900	0
Total Value		**37,881,628**			

Total Number of Applications for this period: 58

1/7/2024

DUBBO REGIONAL COUNCIL

Approved Development and Complying Development Applications by Dubbo Regional Council and Private Certifiers - Period 1/7/2023 - 30/6/2024

Development Type	Number Of Applications	Estimate $	Developments	Estimate $	New Dwellings
Agriculture	1	176,100	1	176,100	0
Alterations and additions to commercial	7	5,817,878	0	0	0
Alterations and additions to industrial	1	145,000	0	0	0
Ancillary Structures	13	1,232,589	13	1,232,589	0
Balconies, decks patios terraces or verandah	43	1,262,266	43	1,262,266	0
Business Premises	5	1,825,694	5	1,825,694	0
Car park	1	0	1	0	0
Centre based childcare	1	3,175,000	1	3,175,000	0
Change of Use	5	52,000	5	52,000	0
Civic Infrastructure	1	35,200	1	35,200	0
Commerical Facility	3	39,395,717	3	39,395,717	0
Demolition	11	88,000	11	88,000	0
Dual Occupancy	27	17,050,556	27	17,050,556	52
Dwelling House	200	96,334,069	185	94,409,340	156
Earthworks / change in levels	1	440,000	1	440,000	0
Educational establishment	6	16,971,272	6	16,971,272	0
Emergency services facility and bush fir	2	524,159	2	524,159	0
Farm buildings	1	105,840	1	105,840	0
Food and drink premises	3	4,417,928	3	4,417,928	0
Garages carports and car parking spaces	22	629,738	22	629,738	0
Group homes	1	1,760,000	1	1,760,000	3
Health services facilities	6	2,865,000	6	2,865,000	0
Industrial Development	19	17,435,985	19	17,435,985	0
Mixed use development	2	73,665,000	2	73,665,000	41
Multi-dwelling housing	5	13,808,126	5	13,808,126	71
Office Premises	5	3,376,801	5	3,376,801	0
Other	3	1,685,000	3	1,685,000	0
Place of public worship	1	45,000	1	45,000	0
Pools / decks / fencing	115	5,787,712	115	5,787,712	0
Recreational uses	1	20,000	1	20,000	0
Restaurant or cafe	3	460,000	3	460,000	0
Retail Premises	14	3,056,186	14	3,056,186	0
Retaining walls, protection of trees	1	0	1	0	0
Secondary Dwelling	23	4,123,173	23	4,123,173	23
Seniors housing	1	1,584,066	1	1,584,066	6

1/7/2024

Shed	117	3,528,853	117	3,528,853	0
Signage	10	680,857	10	680,857	0
Stratum / community title subdivision	3	1,355,463	3	1,355,463	0
Subdivision - Strata	3	5,000	3	5,000	0
Subdivision - Torrens	19	190,000	19	190,000	0
Subdivision of land	27	5,107,824	27	5,107,824	0
Take-away food and drink premises	1	9,999	1	9,999	0
Telecommunications and communication facility	6	1,443,000	6	1,443,000	0
Total Value		331,672,051			

Total Number of Applications for this period: 645

1/7/2024

DUBBO REGIONAL COUNCIL

Approved Development and Complying Development Applications by Dubbo Regional Council and Private Certifiers - Period 1/7/2022 - 30/6/2023

Development Type	Number Of Applications	Estimate $	Developments	Estimate $	New Dwellings
Alterations and additions to commercial	23	21,187,353	0	0	0
Alterations and additions to industrial	5	1,013,639	0	0	0
Balconies, decks patios terraces or verandah	36	883,363	36	883,363	0
Boarding house	2	134,000	2	134,000	13
Business Premises	2	650,000	2	650,000	0
Centre based childcare	4	9,703,491	4	9,703,491	0
Change of Use	6	16,001	6	16,001	0
Demolition	12	1,073,702	12	1,073,702	0
Dual Occupancy	27	14,093,148	27	14,093,148	50
Dwelling House	272	109,887,988	215	99,111,171	216
Earthworks / change in levels	8	274,560	8	274,560	0
Educational establishment	9	16,252,392	9	16,252,392	0
Emergency services facility and bush fir	1	165,000	1	165,000	0
Farm buildings	3	7,916,500	3	7,916,500	0
Food and drink premises	3	281,620	3	281,620	0
Garages carports and car parking spaces	33	940,473	33	940,473	0
Group homes	1	868,500	1	868,500	2
Health services facilities	3	855,461	3	855,461	0
Industrial Development	16	20,393,837	16	20,393,837	0
Mixed use development	2	991,440	2	991,440	0
Multi-dwelling housing	5	50,681,586	5	50,681,586	159
Office Premises	2	42,937,134	2	42,937,134	0
Other	6	11,279,024	6	11,279,024	0
Pools / decks / fencing	117	5,491,734	117	5,491,734	0
Pub	1	60,000	1	60,000	0
Recreational uses	4	28,174,343	4	28,174,343	0
Retail Premises	7	2,608,311	7	2,608,311	0
Retaining walls, protection of trees	3	12,320	3	12,320	0
Secondary Dwelling	26	5,404,372	26	5,404,372	26
Shed	115	4,614,165	115	4,614,165	0
Shop top housing	3	2,590,400	3	2,590,400	4
Signage	14	849,802	14	849,802	0
Stratum / community title subdivision	4	5,000	4	5,000	0
Subdivision - Torrens	1	0	1	0	0
Subdivision Of Land	57	9,371,900	57	9,371,900	0

1/7/2024

Take-away food and drink premises	6	3,896,645	6	3,896,645	0
Telecommunications and communication facility	3	3,023,554	3	3,023,554	0
Total Value		**378,582,758**			

Total Number of Applications for this period: 762

1/7/2024

DUBBO REGIONAL COUNCIL

REPORT: 2024 Dubbo Stampede Running Festival - Temporary Road Closure

DIVISION: Infrastructure
REPORT DATE: 2 July 2024
TRIM REFERENCE: ID24/1338

EXECUTIVE SUMMARY

Purpose	• Seek endorsement	• Fulfil legislated requirement/ compliance
Issue	• The 2024 Dubbo Stampede Running Festival is to be held on Sunday 25 August 2024 utilising a section of Obley Road, Tracker Riley Cycleway, and a section of Macquarie Street and the Regand Park Track, between Macquarie Street and Tamworth Street, via the Park's southern access, adjacent to Council's John Gilbert Water Treatment Plant (JGWTP). • The Stampede proposes temporary road closures of Obley Road, between the Newell Highway and Camp Road intersections, and Tamworth Street, on the western side of South Street, for the purposes of facilitating the 2024 Dubbo Stampede Running Festival. The running event will be undertaken from 6.15am to 1.00pm consisting of a marathon (42.2km), half marathon (21.1km), 10km run, 5.3km run and Wallaby Wheel and 1km inclusive event. • As the event requires temporary closures of roads that will impact local traffic and transport systems, but does not impact major traffic and transport systems, it can be classified as a Class 2 Special Event based on the *Guide to Traffic and Transport Management for Special Events* and thus it is recommended that this special event be referred to the Local Traffic Committee for consideration.	
Reasoning	• The Committee concur with the events as proposed and conditioned by Council and NSW Police.	
Financial Implications	Budget Area	There are no financial implications as a result of this report. The cost associated with organising the running events will be borne by the Dubbo Running Festival.
Policy Implications	Policy Title	There are no policy implications arising from this report.

STRATEGIC DIRECTION

The 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes five principal themes and a number of strategies and outcomes. This report is aligned to:

Theme:	2 Infrastructure
CSP Objective:	2.1 The road transportation network is safe, convenient and efficient
Delivery Program Strategy:	2.1.1 Traffic management facilities enhance the safety and efficiency of the road network

Theme:	2 Infrastructure
CSP Objective:	2.1 The road transportation network is safe, convenient and efficient
Delivery Program Strategy:	2.1.2 The road network meets the needs of the community in terms of traffic capacity, functionality and economic and social connectivity

RECOMMENDATION

1. **That the application of the Dubbo Running Festival Committee Incorporated be approved for the undertaking of the 2024 Dubbo Stampede Running Event on Sunday, 25 August 2024, between 6.15am and 1pm, on condition of the NSW Police, Transport for NSW (TfNSW) and subject to the following conditions of Dubbo Regional Council (Council):**
    a. **A temporary road closure will be implemented between 6am and 10.15am on Obley Road, commencing on the southern side of Taronga Western Plains Zoo (Zoo) access south of the intersection on Camp Road, including the implementation of a Traffic Guidance Scheme and detour via the Newell Highway and Camp Road intersection. The Zoo's 'local traffic access' only will be available at the intersection of the Newell Highway and Obley Road.**
    b. **That temporary road closures be implemented between 6am and 12noon in Tamworth Street, west of the intersection of South Street, to its conclusion and changed traffic conditions for Macquarie Street between 6am and 10.15am and Huckel Street between 7am and 11.45am.**
    c. **The submissions of a Traffic Management Plan (TMP) and Traffic Guidance Scheme (TGS) for Council approval in accordance with AS 1742.3 and TfNSW's Guide to Traffic Control at Worksites, prepared by an accredited person. Council's TGS TM7052 is to be implemented for the event.**
    d. **The concurrence of TfNSW, Special Events and Operational Planning - Transport Management Centre for the implementation of event and detour of Obley Road signage on the Newell Highway.**
    e. **Traffic controllers and trained course marshals are to be provided at all road closure points, and other locations as identified in the Event Management Plan,**

with restricted access only to emergency and authorised vehicles. All traffic controllers are to be specifically authorised for the event with current TfNSW certification.

f. **That Council's Governance Team Leader must sight a copy of the current Public Liability Insurance Policy, for a minimum amount of $20 million, on which Dubbo Regional Council, TfNSW and NSW Police are specifically noted to be indemnified against any action resulting from the event.**

g. **That the applicant is responsible for the provision of all traffic control required for the event in accordance with the TGS.**

h. **That the applicant is responsible for all costs associated with the placement of a public notification and advice to the residents within the closed and affected roads, prior to the event, advising of the 2024 Dubbo Stampede Running Festival.**

i. **That all traffic advisory signs are to be placed in accordance with the approved TGS and the Traffic and Event Management Plan.**

j. **That the NSW Police consent and conditions for the running of the event as considered necessary.**

k. **That the applicant is to provide Council with a signed and dated copy of the Traffic and Event Management Plan.**

l. **That the applicant to submit to Council all the appropriate documentation required, accepting the above terms and conditions, before final approval will be granted.**

m. **That all costs associated with implementing these event conditions are to be met by the event organiser.**

n. **That in the event of the Tamworth Street footbridge being closed due to flooding; the 'Contingency Plan' as detailed in the Event and Traffic Management Plan shall be invoked requiring the closure of Tamworth and South streets, and the use of Huckel Street in accordance with Appendices 7, 8 and 9 of the TMP and the Traffic Guidance Scheme TM 7052 (Appendix 1 – page 23).**

Luke Ryan	*DV*
Director Infrastructure	Senior Traffic Engineer

BACKGROUND

Council has received an Event Application (**Appendix 1**) from the Dubbo Running Festival Committee Incorporated seeking Council approval to conduct the 2024 Dubbo Stampede Running Festival that incorporates temporary road closures on several urban and rural roads. The 2024 Dubbo Stampede will include the Regand Park Track, consequently Macquarie Street will only be partially used, and Tamworth and South streets will not need to be fully closed. However, in the event that the Tamworth Street footbridge is closed due to flooding, a ‘Contingency Plan’ has been developed that will revert back to the original course along Macquarie Street from Margaret Crescent, including Huckel to Tamworth and South streets, continuing north along the Tracker Riley Cycleway back to the Zoo.

The event organisers have undertaken to ensure that all risks have been addressed to provide the optimum road safety environment for competitors and the general public (refer to Risk Management Plan in **Appendix 2**).

REPORT

Consultation

- Local Traffic Committee, including representatives from NSW Police, the Local State Member of Parliament, TfNSW and Council will review and discuss all matters put to the Committee.

Resourcing Implications

- The Dubbo Running Festival will bear the costs associated with organising the races.

Event Description/Traffic Management Plan and Traffic Guidance Scheme

The 2024 Dubbo Stampede Running Festival is proposed for Sunday, 25 August 2024, between the hours of 6.15 am to 1 pm that involves five separate events:
- 1km
- 5.5km run
- 10km run
- Half marathon - 21.1km
- Full marathon - 42.2km

The start and finish of the five separate races will be within the Taronga Western Plains Zoo. The Zoo will accommodate the event parking onsite, and on Zoo land on the northern side of Obley Road, east of the Newell Highway intersection. Descriptions of each run route can be viewed in the Event and Traffic Management Plan **(Appendix 1)**.

1km

From the start point 1km from the finish line, entrants run in a clockwise direction through/around the Zoo to the finish line opposite the public play area.

5.5km Run

This run is undertaken wholly within the Zoo incorporating a single lap of the internal loop road, in a clockwise direction around the Zoo.

10km Run

This event commences in the Zoo, continues northbound within the Zoo to Obley Road, then south to the 10km turnaround point towards Camp Road and return to the Zoo entrance and follows the internal 5.5km route to the start/finish point within the Zoo.

21.1km Half Marathon

The half marathon follows the same route as the 10km run, however on the return leg, (northbound from Camp Road) runners will proceed east to the Dundullimal turnoff and the Tracker Riley Cycleway to Macquarie Street. Runners will then join Macquarie Street (north of Huckel Street and the JGWTP); turn left into the Regand Park Track to Tamworth Street; continue across Tamworth Street to connect with the off-road Tracker Riley Cycleway along the eastern side of the River corridor, west over the Serisier Bridge, continuing south on the Tracker Riley Cycleway (along the River corridor) to Obley Road to the Zoo's main entrance; and follow the internal 5.5km route concluding at the start/finish point within the Zoo.

42.2km Full Marathon

The full marathon follows the initial route as the 10km and half marathon. However, in the Obley Road section runners will return northbound past the Dundullimal turnoff to the Council Weir road turnoff, then return southbound on the cycleway to the Dundullimal turnoff, and follow the cycleway across Shibble's Bridge to Macquarie Street. Runners will then continue north on the course and complete the first loop of the River circuit to Serisier Bridge and return to the Zoo, then continue on the shortened second loop. This time the runners will turn left at the bottom of Tamworth Street; cross the Yabang Gee Footbridge and then turn left at the 'Y' junction; and follow the running track southbound along the western side of the River back to the Zoo for the last time, to then complete an internal shortened Zoo loop back to the finish line.

Race Start Times

Marathon	6.30am, cut off time 1pm
Half Marathon	7.45am, cut off time 11.45am
10km	8.15am, cut off time 10.15am
5.3km	7.30am, cut off time 9am
1km	7.28am, cut off time 8am.

Road Closures

Temporary road closures and appropriate traffic control will be required to provide optimum safety for competitors, spectators, officials and the general public throughout the course (**Appendix 1** provides details for each closure).

Temporary Road Closures

1. It is proposed to temporarily close Obley Road between 6am and 10.15am, commencing on the northern side of the pedestrian refuge (centre of the Zoo entrance) on Obley Road, south to the intersection of Camp Road. Obley Road will be opened to traffic at 10.15am. The half marathon cut off is 11.45am and 1pm for the full marathon. It is expected that there will be a minimal number of runners who may still be on the course who are required to cross Obley Road at the existing pedestrian refuge and give way to traffic. Marshals will be assisting to reinforce the requirements.

   Obley Road from the Newell Highway south to the Zoo entrance will be designated for 'Zoo Local Traffic Only' to facilitate traffic to the Zoo for the event and subsequent visitors to the Zoo following the 9am opening time. Closure of Obley Road will require a detour via the Newell Highway and Camp Road. There are two private access points along the Obley Road closure, being to a separate Zoo property and at Dundullimal. The organisers will again consult with Dundullimal Homestead regarding the event. Enquiries have been made with TfNSW and NSW Police with respect to the closure of Obley Road and detour via Camp Road. No concerns have been raised subject to the implementation of an approved TCP. Obley Road is a B-double route to the intersection of Benolong Road. TfNSW have raised no concerns with a temporary B-double route along Camp Road between the Newell Highway and Obley Road. Accredited traffic controllers and trained course marshals will be stationed at all road closure points and along the course.

2. The 21.1km half and 42.2km full marathon course will utilise the western side of Macquarie Street between Margaret Crescent and the Regand Park Track access. Runners will compete in an anti-clockwise direction along the 2m wide on road cycleway, and adjacent parking lane that will be delineated by traffic cones along the traffic lane edge line. Temporary warning signs will be strategically placed at intervals along Macquarie Street advising motorists of the 'Running Race in Progress'.

   The flood contingency course for the Tamworth Street Footbridge closure will utilise Macquarie Street between Margaret Crescent and Tamworth Street.

3. Huckel Street will only be used in the event that the Flood Contingency Plan is implemented with runners proceeding to its conclusion and return to Macquarie Street as part of the half and full marathon. Local resident access would be permitted under traffic control conditions. Huckel Street is a 'No Through' road accessing several properties. Runners will utilise the left-hand side of the carriageway with a turn-around at its southern end.

4. Tamworth Street, west of South Street, is to be temporarily closed between 6am and 12pm to allow runners to exit the Regand Park Track and continue northbound across Tamworth Street and join the existing Tracker Riley Cycleway.

   In the event of implementing the 'Flood Contingency Course' Tamworth Street (western end) will be temporarily closed between 6am and 12pm, west from the intersection of Macquarie Street to its conclusion and South Street (south of Bligh Street) to the intersection of Tamworth Street, to permit the uninhibited movement of runners to transition from the public road system to the off road Tracker Riley Cycleway in a northerly direction along the eastern side of the Macquarie River corridor. There are two property access points in Tamworth Street and resident access will be available under traffic control conditions if required. There is no considered traffic impact on the competitors.

   The event organiser will undertake a letterbox drop along Macquarie Street, some two weeks in advance of the event date to advise of the course and runners utilising the western side of the Macquarie Street carriageway and associated traffic management within Macquarie Street, Huckel Street, Regand Park Boulevard and Tamworth Street.

5. An additional off-road parking area will be established on Zoo property, on the northern side of Obley Road east of the Newell Highway that can accommodate approximately 400 vehicles. Vehicles will be directed to the area at the start of the half marathon at 7.45am and the 10km event at 8.15am and be controlled by traffic controllers.

Options Considered

- Option 1: Not approve this application. This annual event is organised for the wellbeing of the Dubbo community. If this application is not approved then the interest of the community will not be adhered to, depriving Dubbo of an event that gives an opportunity to enhance unity, bonding, mental and physical wellbeing, and will deprive Dubbo from local and regional tourism.

- Option 2: Approve this application. The Dubbo Running Festival has been organising this annual race for the 12 years and therefore, in the interest of the Dubbo community, it is recommended to approve the event because as stated previously, it gives the Dubbo community an opportunity to enhance their unity, bonding, mental and physical wellbeing, and also promotes local and regional tourism.

Preferred Option

- Option 2: It is recommended that approval be granted to the Dubbo Running Festival to conduct the 2024 Dubbo Stampede Running Festival on the nominated roads in Dubbo in accordance with the Event and Traffic Management Plan as conditioned by the NSW Police and Council.

APPENDICES:

1⇩ 2024 Dubbo Stampede - Traffic Management Plan

2⇩ 2024 Dubbo Stampede - Risk Management Plan

The Dubbo Stampede Running Festival 2024
Traffic and Event Management Plan

Event Location:	Taronga Western Plains Zoo, Dubbo
Event date and time:	Sunday 25 August 2024 from 6.15 am – 1.00 pm
Event Organiser:	Dubbo Running Festival Committee Incorporated

Approval

This Traffic Management Plan is approved by:

Name	Signature	Date of signing	Title
Natalie Davis	N Davis	15.04.2024	Logistics Dubbo Running Festival
Rob Dickerson		20.05.2024.	Logistics Dubbo Running Festival
		....../....../20....	
Dennis Valantine		....../....../20....	Dubbo Regional Council Events

Authority of the Event / Traffic Management Plan

This Traffic Management Plan (TMP) when approved by the relevant authorities becomes the prime document detailing the traffic and transport arrangements under which an event is to proceed.

Changes to the TMP require the approval of the Police, and Council. All functional or single agency supporting plans are to recognise the primacy of the TMP and nothing contained on those plans may contravene any aspect of the TMP.

Signatories to this TMP should normally be the agency's senior officer appointed to the operational command team for the event on the day.

In case of emergencies, or for the management of incidents, the Police are not subject to the conditions of the TMP but will make every effort to inform the other agencies of the nature of the incident and the Police response.

Contents

Purpose Of This Traffic Management Plan

The purpose of this TMP is to ensure that the traffic management aspects of the Dubbo Stampede Running Festival:

1. Provide maximum safety for event participants, spectators and volunteers.
2. Reduce as far as possible the traffic impact on the rest of the community.

Contact Names of Those Responsible for Organising and Approving the Event.

Event Organiser	Dubbo Running Festival (Stampede) **Rob Dickerson** Logistics- Dubbo Running Festival Incorporated Mob. 0414 966 504 Email: rdickerson@bigpond.com **Cameron Coggan** President - Dubbo Running Festival Incorporated mob. 0429 845 034 Email: cpcoggan@bigpond.com **Bec Farrell** Vice President - Dubbo Running Festival Incorporated Mob. 0428 845 822 Email: beccamay09@hotmail.com
Police LAC	Informed by
Council	Clare Weeks Event Support Officer (w) 02 6801 4129

Description Of Event

The Dubbo Stampede Running Festival 2024 will consist of the following events:

- Marathon (42.2 km)
- Half marathon (21.1km);
- 10km run; and
- 5.3km run and Wallaby Wheel.
- 1km inclusive event

Description of Courses

The start and finish of four of the five separate races will be inside the Taronga Western Plains Zoo (zoo) on the roadway near the finish of the zoo loop; directly adjacent to the Cobb & Co Shed, West of the flying fox and public play area of the zoo. The Marathon event will start at 6:30 am directly at the front of Western Plains Taronga Zoo on the entrance/exit walkway.

The Obley Rd section from the Zoo entrance down to the Camp Rd intersection will be closed to traffic from 6:00am until 10:15am.

1km

- From the start point 1km from the finish line, entrants run in a clockwise direction through around the zoo to the finish line opposite the public play area.
- Runners will follow the road in a clockwise direction to finish at the start/finish arch.
- Wheelchair participants follow the same course.

5.3km

- From the start point at the Cobb & Co Shed, entrants run in a clockwise direction through the ticket booths, around the zoo to the finish line opposite the public play area.
- Runners will follow the road in a clockwise direction to finish at the start/finish arch.
- Wheelchair participants follow the same course.

10km

- From the start point near the Cobb & Co Shed, entrants run towards the Zoo entrance passing through the left hand side of the zoo roundabout, move into the eastern most lane (RHS) of the zoo internal road and continue North to the main zoo entrance gates. No Traffic will be using the lane at this stage.
- From the main entrance gates, runners continue in the Eastern most lane (RHS) and turn right onto Obley Road.
- Runners continue running down Obley Road on the right hand side of the road, past Dundullimal turn-off, around the bend toward Camp Road intersection before getting to the turn-around point for the 10km event.
- Runners will keep right at the turn around point and head back toward the zoo entrance, keeping in the right hand lane of Obley Road.
- Runners turn into the zoo entrance, through the main gates in the easternmost lane which will be closed to traffic. Then 55 metres past the main entrance gates runners will take a sharp left at the flag poles and follow the path toward the bike hire shed.

- Runners continue past the bike shed and circumvent the zoo carpark before turning right at the end of the car park and then left to continue running through the toll booths at the start of the fee paying section of the zoo.
- Runners run a loop of the zoo circuit in a clockwise direction to finish at the start/finish arch.

21.1km Half Marathon

- Runners start at the Cobb & Co Shed and then follow the initial route as the 10km, past Dundullimal turn-off for approx 500m where they will turn around, keeping to their right, and return along Obley Road to the Dundullimal turn-off.
- Runners will then turn right off Obley Rd onto the Dundullimal Mountain Bike Trail (Dundullimal Homestead) and follow the sealed running track across Shibble Bridge to Macquarie Street.
- At Macquarie Street runners will turn left and run along the left side of the road which will have red Witches Hats placed along it for separation with vehicles.
- Immediately past the Water Treatment Works, runners will turn left through the entrance to the Regand Park Trail (past South Dubbo Weir). Volunteers will be at this point to direct runners.
- At the bottom of Tamworth St, runners will cross over the bitumen car park onto the Tracker Riley trail and will continue on this track in a Northern direction, keeping the river on their left.
- Runners will continue on the river track down to Serisier Bridge, turn left onto the bridge pedestrian lane and cross the Macquarie River.
- Once on the Western side of the river, runners will turn left and head in a Southern direction along the Tracker Riley trail, keeping the river on their left.
- Participants will run under the LH Ford Bridge and continue running on the concrete river track past Sir Roden Cutler Park, across Tracker Riley Bridge and then turn right at the "y" junction on the concrete path and head in a Southern direction up towards the zoo.
- Runners will stay on the concrete path veering left at the intersection of the Newell Highway and Obley Road, and continue to the zoo entrance.
- **Prior to 10:15am while Obley Rd is closed to traffic**, Runners will leave the concrete path directly opposite the zoo entrance at Zoo Gate 11 turning towards the zoo entrance and running through the main gates in the Left hand lane. Then 55 metres past the main entrance gates runners will take a sharp left (near the flagpoles) and follow the path toward the bike hire shed.
- **(After 10:15 when Obley Road reopens**, runners will go approx 20m further down Obley Rd and cross at the Pedestrian Crossing and normal traffic rules will apply.)
- From the bike shed, runners will cross the zoo carpark before turning right at the end of the car park, then left through the toll booths at the start of the fee paying section of the zoo.
- Runners run a loop of the zoo circuit in a clockwise direction to finish at the start/finish arch.

Marathon (42.2 km)

- Runners start directly at the front of Western Plains Taronga Zoo and follow as the 10km and 21.1km runnersdown Obley Road and keep running past Dundullimal turn-off for approx 500m where they will turn around.

- Keeping to the RHS, return back up along Obley Road past the Dundullimal turnoff to the Council Weir Rd turnoff where runners will turn right onto the sealed running track and then right again. (Approx half way between the Dundullimal turn-off and the Zoo Entrance.)
- Once on the running track, continue back to and turn left at the Dundullimal turnoff and follow the sealed running track across Shibble Bridge to Macquarie Street.
- At Macquarie Street runners will turn left and run along the left side of the road which will have red Witches Hats placed along it for separation with vehicles.
- Immediately past the Water Treatment Works, runners will turn left through the entrance onto the Regand Park Trail (past South Dubbo Weir).
- At the bottom of Tamworth St, runners will cross over the bitumen car park onto the Tracker Riley Trail and will continue on this track in a Northern direction, keeping the river on their left.
- Runners will continue on the river track down to Serisier Bridge, turn left onto the bridge pedestrian lane and cross the Macquarie River.
- Once on the Western side of the river, runners will turn left and head in a Southern direction along the Tracker Riley path, keeping the river on their left.
- Participants will run under the LH Ford Bridge and continue running on the concrete river track past Sir Roden Cutler Park, across Tracker Riley Bridge and then turn right at the “y” junction on the concrete path and head in a Southern direction up towards the zoo.
- From outside the Zoo entrance, runners will continue along Obley Road to the Dundullimal Turn Off and back around the river for another full loop back to the Zoo.
- Runners will then start another loop albeit a shorter one this time.
- This time the Marathon runners will turn left at the bottom of Tamworth Street and cross the footbridge (Gobang Fee Footbridge).
- They will then turn left at the “Y” junction and follow the running track back to the Zoo for the last time.
- This time they will enter the Zoo.
- **Prior to 10:15am while Obley Rd is closed to traffic**, Runners will leave the concrete path directly opposite the zoo entrance at Zoo Gate 11 turning towards the zoo entrance and running through the main gates in the left hand lane. Then 55 metres past the main entrance gates runners will take a sharp left (near the flagpoles) and follow the path toward the bike hire shed.
- **(After 10:15 when Obley Road reopens**, runners will go approx 20m further down Obley Rd and cross at the Pedestrian Crossing and normal traffic rules will apply.)
- Approx 55m in from the main Zoo Gates, turn left and go in through the bike shed area and on down through the car park, turning right then left through the toll booths at the start of the fee paying section of the zoo.
- The Marathon runners will then turn right at the wild dog exhibit, running around the back of the lake to the boom gate and then finish at the start/finish arch.

Race Start and Cut-off Times

Event	Start time	Cut-off time
Marathon	6:30am	1.00 pm
Half marathon	7.45am	11.45am
10km	8.15am	10.15am
5.3km	7.30am	9.00am
1km	7.28am	8.00am

Road Closures / Changed Traffic Conditions

Road Section:	Obley Road – South of zoo entrance to just prior to Camp Road intersection.
Estimated closure time:	6.00am – 10.15am
Comments:	After the last runner has reached the turnaround point on Obley Road, and has run back toward the zoo, past Dundullimal turn-off, signage at the intersection of Obley Road and Camp Road will be changed to include 'Local Traffic Only' to permit vehicles to enter Dundullimal. This is expected to occur at 8.45am. Newell Highway traffic heading north from Tomingley intending to turn onto Obley Road will be directed by VMS to turn right onto Camp Road and head east onto Obley Road. Newell Highway traffic heading south from Dubbo toward Obley Rd will be directed to continue past the zoo and turn left down Camp Rd to meet up with Obley Rd. Obley Rd traffic travelling into Dubbo will be directed to divert left onto Camp Road to meet up with the Newell Highway where they will turn right towards Dubbo.
Road Section:	Macquarie Street between Margaret Crescent & Water Treatment Works
Estimated time of changed traffic conditions:	6.00am – 10.15am
Comments:	Witches hats will be positioned along the left hand road edge on Macquarie Street to delineate the separation of vehicles from runners. A traffic marshall will be located at the pinch point adjacent to Fitzroy St to warn of potential hazards there. Road signs will be located on Old Dubbo Rd notifying traffic coming into Dubbo of the running event.
Road Section:	Huckel Street
Estimated time of changed traffic conditions:	7.00am – 11.45am
Comments:	Signage to slow vehicles will be installed either side of the intersection of Macquarie St and Huckel St to notify vehicles of runners crossing Huckel Street. Residents of Huckel Street will be notified by letter drop of the running event in the weeks prior to the event day.
Road Section:	Tamworth Street Carpark at the river end.
Estimated closure time:	6.00am – 12.00pm
Comments:	Car Park will be closed off at the South St intersection in line with the Drink Bubbler Road closure signs will be removed after the last runner has reached this point.

Finish and Opening of Roads

Obley Road will close at 6:00am and be reopened to traffic at 10.15am. After 10.15am and until 12.30pm, any marathon and half marathon entrants that are still running will be able to cross Obley Road from the running path on the northern side of the road, across to the zoo entrance, using the normal pedestrian and pushbike crossing area highlighted in red in the image below which will be marshalled to ensure safe pedestrian passage over this crossing.

Traffic Management Details

The Route

Marshalling is to be undertaken by a combination of Accredited Traffic Controllers (ATC) from Dubbo Traffic Control and Trained Course Marshals (CM). The CM will simply direct runners and alert traffic of the presence of runners. They will not be directing vehicles. ATC will be responsible for positioning of signage as per Transport for NSW and Council requirements.

Appropriate warning signage will be placed to notify vehicles of changed traffic conditions and runners on the roadways. This will include the driveway of 21 Obley Road (Lot 9 DP 753233) located on the northern side of Obley Road between the zoo entrance and Dundullimal entrance. This property with residence is owned by the zoo.

The Running Festival Committee will be responsible to notify residents that may be affected by the event of the planned traffic changes. This will include residents on the western side of Macquarie Street from Margaret Crescent to the river track entrance just past the Water Treatment Works. A letterbox drop will be done for all affected residents two weeks prior to the event date.

Route Mapping

Each year the use of a motor-bike/scooter will be used around the Tracker Riley runway to help map out the course with the use of GPS systems. A motor-bike may also be used on race day to help monitor and offer assistance to runners and volunteers if necessary.

Volunteers and Event Marshals

- Volunteers who will be donating their time and skills to assist in the smooth running of the Dubbo Stampede Running Festival include:
- Various Dubbo Rotary Clubs
- Various sporting clubs
- Various Church committees
- State Emergency Service (using accredited traffic controllers)
- Taronga Western Plains Zoo staff and volunteers

The festival committee will produce locations and lists of traffic control duties for event marshals, including where cones and barriers are to be installed. There will be allocated personnel and trucks to install these items on the morning of the event, and retrieve them at the close of each particular running leg.

- A motor vehicle will be used at approx 4am race day along the pathway on the Eastern side of Macquarie river to put out and then later collect all of the red Witches Hats and various signage.
- Motor vehicles will also be used on the Western side.

Public Safety

Waterways:	No waterways are used in this event.
Food:	• The zoo café will be open to cater for the participants and observers. • Outlets will be scattered around the public staging area on the zoo grounds.

	All necessary approvals will be obtained through Council's Environmental Health Services for the provision of food.
Crowds	2024 is the 12th year of the Dubbo Stampede event and in 2019 (2020 being a virtual event) saw 2,800 entrants register for the event. There was also a solid increase in crowd numbers over the past two years, and it is envisaged a crowd of up to 800 will be gathered around the finish chute, on the grassed areas within the zoo, and along the footpath grassed area at the entrance to the zoo, and all cheering on the participants. Spectators will also position themselves around the river circuit, which is along the route of the full and half marathon. This is a public area that provides safe vantage points for spectators with no interaction with motor vehicles. Small numbers of spectators are expected along the running track paralleling Obley Road between the zoo entrance and Dundullimal entrance, as the runners will be using Obley Road itself and the sealed track as well. Of the runners expected to participate in the four events, the majority of those will enter the 5.3km event which involves a loop of the zoo road and is contained within the zoo boundaries.
First Aid	NSW Ambulance Paramedics will be present for the event at the start and finish area. There will also be Dubbo Regional Event Medics present and are capable of providing First Aid during the event if required.
Space and Resource Requirements	The existing 'Cobb & Co' stables in the zoo recreation area will be used to store equipment and baggage. Between 3 & 5 marquees will be erected on the grassed area of the zoo grounds, near the café. These will be provided by sponsors. Council will also be asked to supply traffic cones, road barriers, and slow/changed traffic signage for roadways. If Council is not forthcoming these items will be hired. Dubbo Traffic Control will be supplying the Witches Hats.
Waste	Impacts on the environment are expected to be minimal. Sufficient garbage bins will be provided and located at each drink station along the route. Volunteers manning the drink stations will collect discarded cups and any other rubbish within their vicinity progressively during the race. A sweep vehicle will collect any cups and waste after the race.

Insurance	Public Liability Insurance to the amount of $20M has been sourced and Dubbo Regional Council will be listed as an interested party on the certificate of currency. Council will be provided with a copy.
Noise	The PA system is being provided and installed by Audio Plus. This will be set up on the road verge adjoining the 'Cobb & Co stables' in the public playground area. This is in excess of 500m from the nearest dwelling and the volume of the system will have minimal impact on surrounding land owners. The zoo is familiar with hosting events including bands and jazz festivals.
Parking	Participant and spectator vehicles will be primarily parked within the zoo grounds in the visitor car parking areas. Entrants will also be parked within the paid section of the zoo, approximately 250m past the ticket booths. This overflow parking area is used by the zoo for all their large events including Easter weekend and the Jazz Festival. Zoo Parking officers will be located within the zoo grounds to guide vehicles and buses. Vehicles will be directed to enter from Obley Road onto the 2nd road lane from the west, to enable cars leaving the zoo to exit along the western most lane. This will ensure vehicles are separated from runners. A map of traffic control within the zoo is included as **Appendix 1.** If required, cars may also be parked in the zoo owned farm land on the North side of Obley Road, just prior to the zoo entrance, as highlighted in the image below. (**Appendix 2**) This paddock is estimated to be able to accommodate 400 vehicles and vehicles will only be directed into this area at times when deemed required so as to ensure runner and vehicle interaction is minimised. The directing of vehicles into and out of the paddock area will be controlled by Zoo Staff and/or other accredited traffic controllers. Vehicles leaving the overflow parking section in the zoo grounds prior to 9.30 am (runners that have finished their event and are leaving the zoo) will follow the zoo circuit until the Bison Exhibit where they will then be directed left onto the service road. These vehicles will exit into the main western car parking area, thereby not having to pass through the start / finish precinct. **Designated Drop off zone**: Taxis and vehicles dropping off runners will be able to drop off runners at a designated drop off area just inside the main Zoo Gates. They will be controlled and directed by Zoo staff.
Barriers	Road closure barriers will be erected on Obley Road just after the zoo entrance and just prior to the Camp Road intersection, and any other locations as directed by Dubbo City Council. Further barriers will be used to designate the finish area and specific parts of the run courses to ensure the safe and continuous flow of competitors throughout the races. Changed Traffic Conditions and other traffic signage will be prominently displayed in accordance with the approved Traffic Control Plan.

Control of Entry Points	All road entry points along the running route will have ATC and/or CM and signage, to alert vehicles of the event. This includes the following: ● Obley Rd / Zoo entrance, ● Obley Rd / Dundullimal Entrance, ● Obley Rd / Camp Rd intersection, ● Huckle St ● Tamworth St / South St carpark intersection.

Pedestrian Management	Spectators will be mainly situated within the zoo grounds and some along the river circuit route. The river circuit will remain open to the general public during the half and full marathon events. Competitors will be advised during the pre-race briefing to be aware of other track users and provide them the relevant courtesy.
Security	The race compound, including marquee area, is located entirely within the secure perimeter fence of the zoo. Committee members will be on site Saturday afternoon until zoo closing time. The zoo is closed to the public outside of normal operating hours.
Toilets	Twelve (12) portaloos, including one disabled toilet will be positioned near the race marshalling area to supplement the existing zoo toilet facilities. There are toilets available to participants and spectators at the 2km, 3km and 4km marks within the zoo grounds, as well as public and mobile toilets for the half and full marathon competitors at Dundullimal entrance, Tamworth St car park, Sandy Beach, Ollie Robbins and the Lions Club Park in West Dubbo.
Emergency Management Procedures	Key CM and ATC will have Mobile Phone contact and possibly two way radio communication with the race precinct supervisors and the Race Director. All emergencies will be reported to the RD and appropriate emergency services will be deployed. CM will be advised not to render medical assistance outside of their training. In the event of an emergency, vehicles will be able to access the course, (mindful of the safety of other competitors) to collect injured competitors where their injury permits and transport them back to the zoo First Aid room for further treatment / assessment. Where an ambulance is required, the trained First Aid Officer will render initial assistance at the site and stabilise the patient until the arrival of the ambulance.

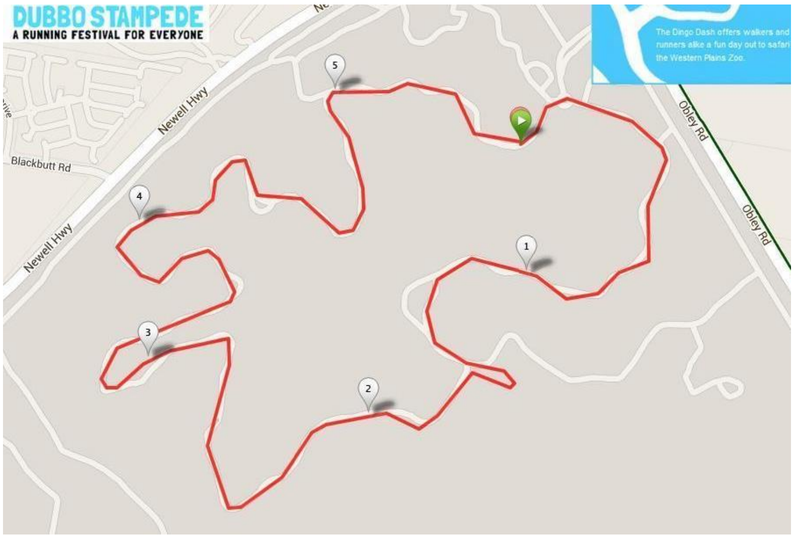
Appendices

1. Map of parking arrangements within the zoo
2. Map of parking area in paddock opposite Obley Road
3. Map of 5.3km ‘Dingo Dash and Wallaby Wheel’ and 1km circuit
4. Map of 10km ‘Cheetah Chase’ circuit
5. Map of 21.1km ‘Zebra Zoom’ circuit
6. Map of 42.2km ‘Rhino Ramble’ circuit
7. Contingency Road Closures/Changed Traffic conditions in the event of a flood.
8. Contingency 21.1km circuit in the event of a flood.
9. Contingency 42.2km circuit in the event of a flood.

Appendix 1. *Map of parking arrangements within the zoo*

Appendix 2. *Map of parking area in paddock opposite Obley Road*

Appendix 3. *5.3km 'Dingo Dash and Wallaby Wheel' Circuit*



Map of 1km 'Bilby Bolt'

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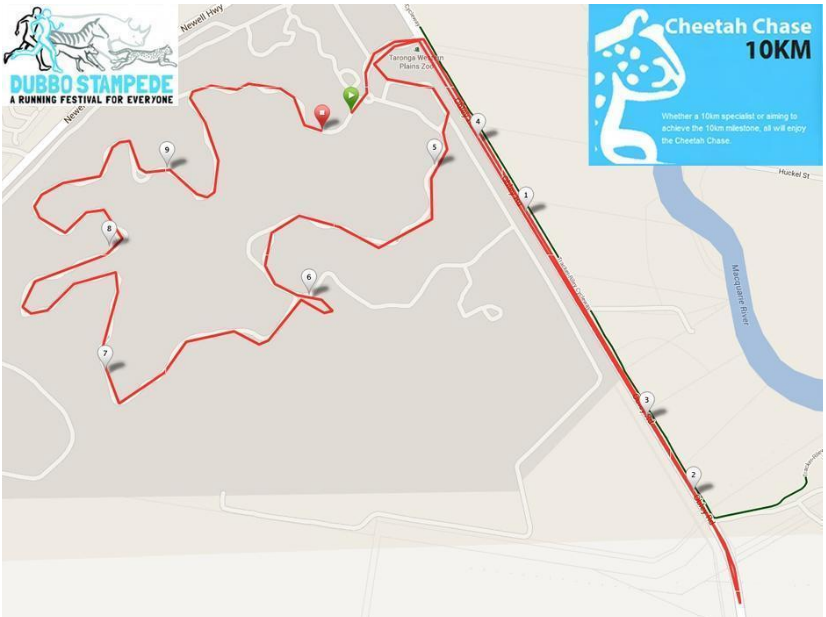
Appendix 4. *Map of 10km 'Cheetah Chase' Circuit*

Video: https://www.youtube.com/watch?v=CDwKIfb1GpI



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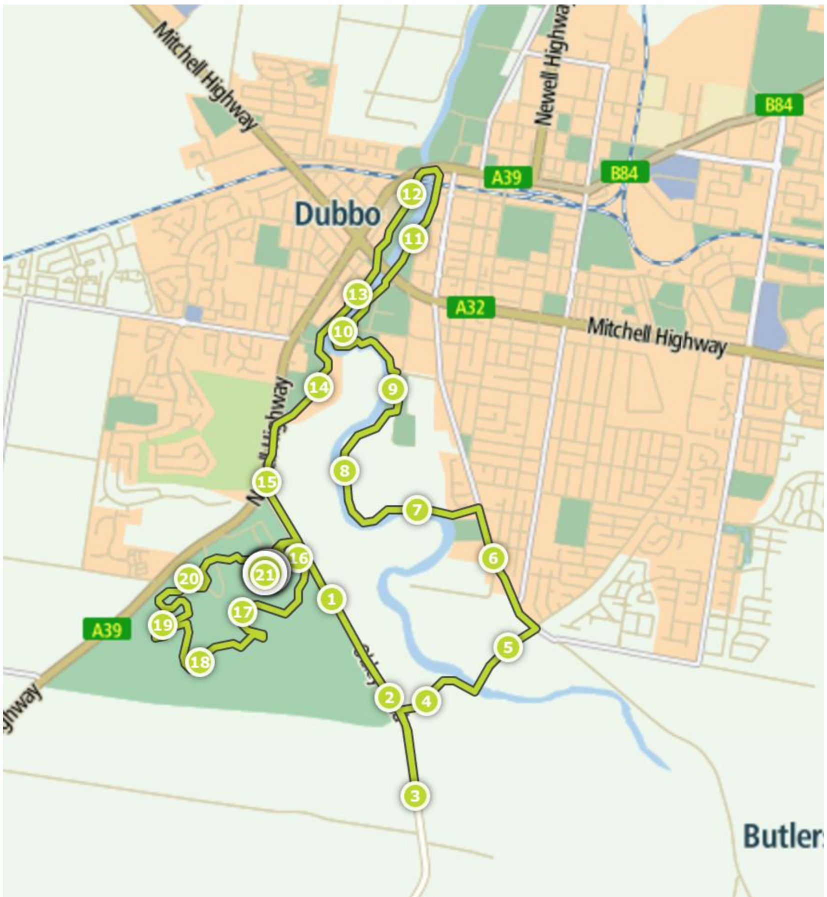
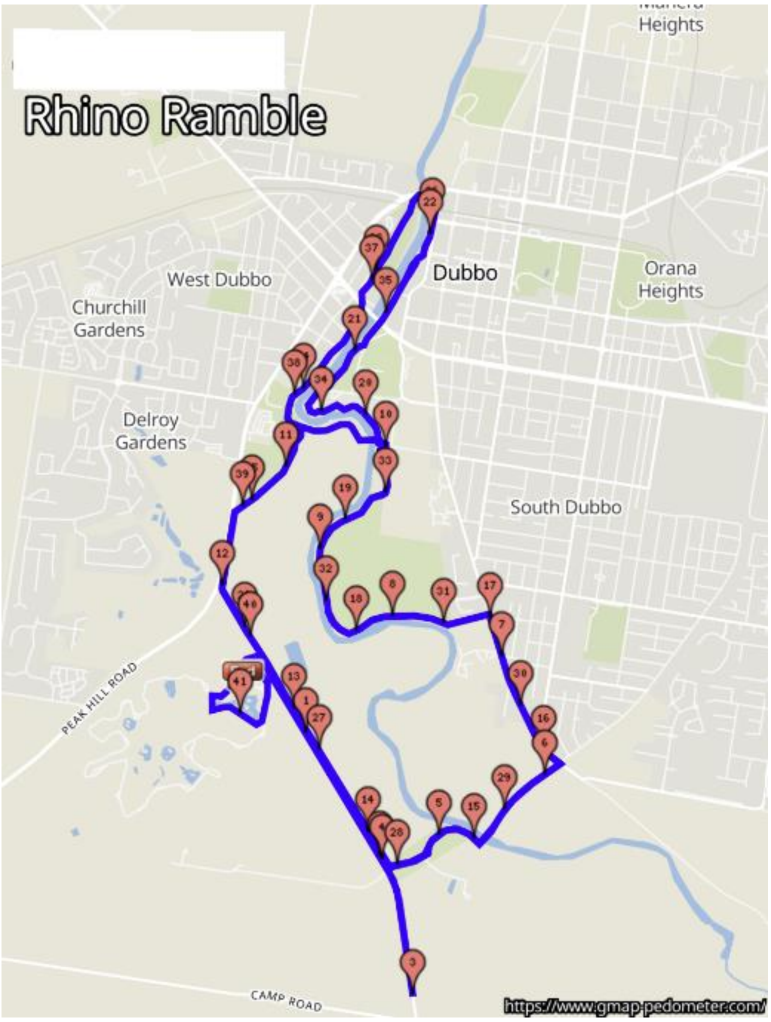
Appendix 5. *Map of 21.1km 'Zebra Zoom' Circuit*

Video: https://www.youtube.com/watch?v=WmgBrvPDqVI



Appendix 6. *Map of 42.2km 'Rhino Ramble' Circuit*

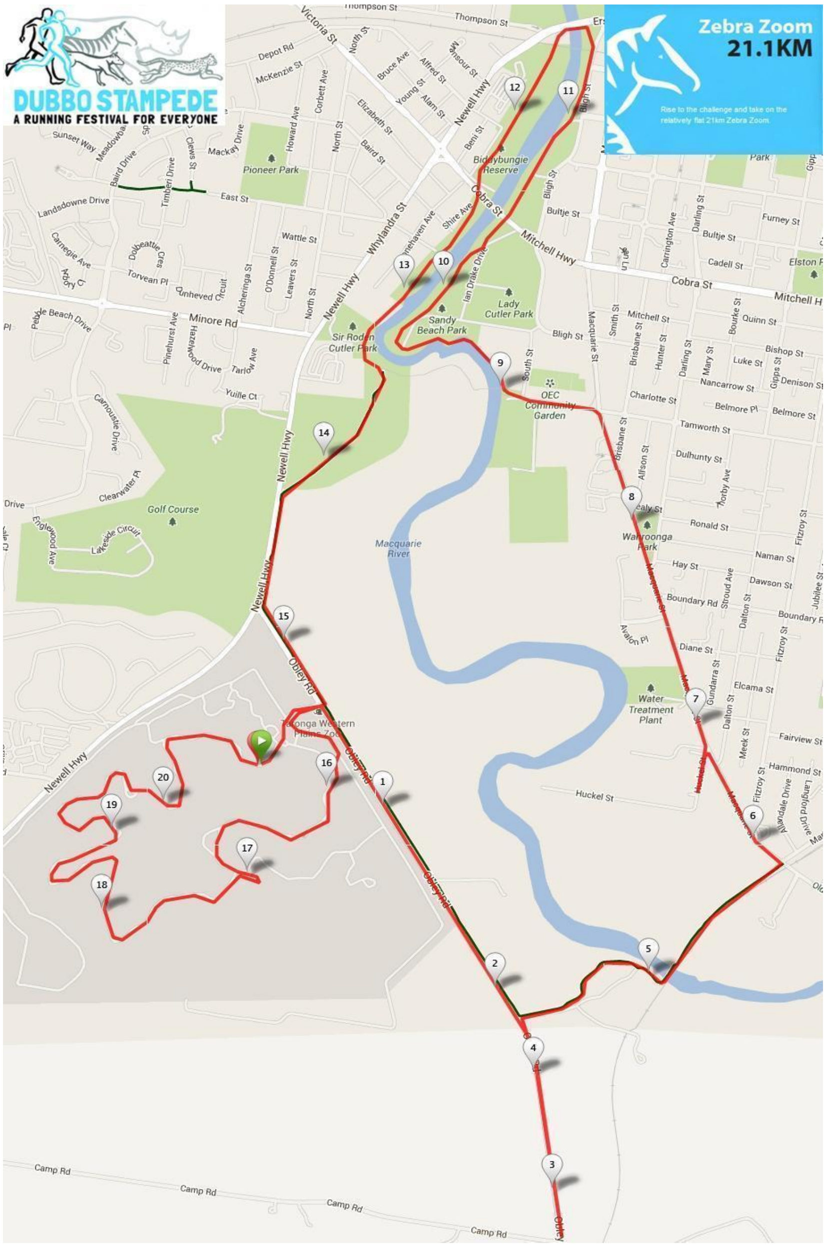
Video: https://www.youtube.com/watch?v=nYrotXmQWN0



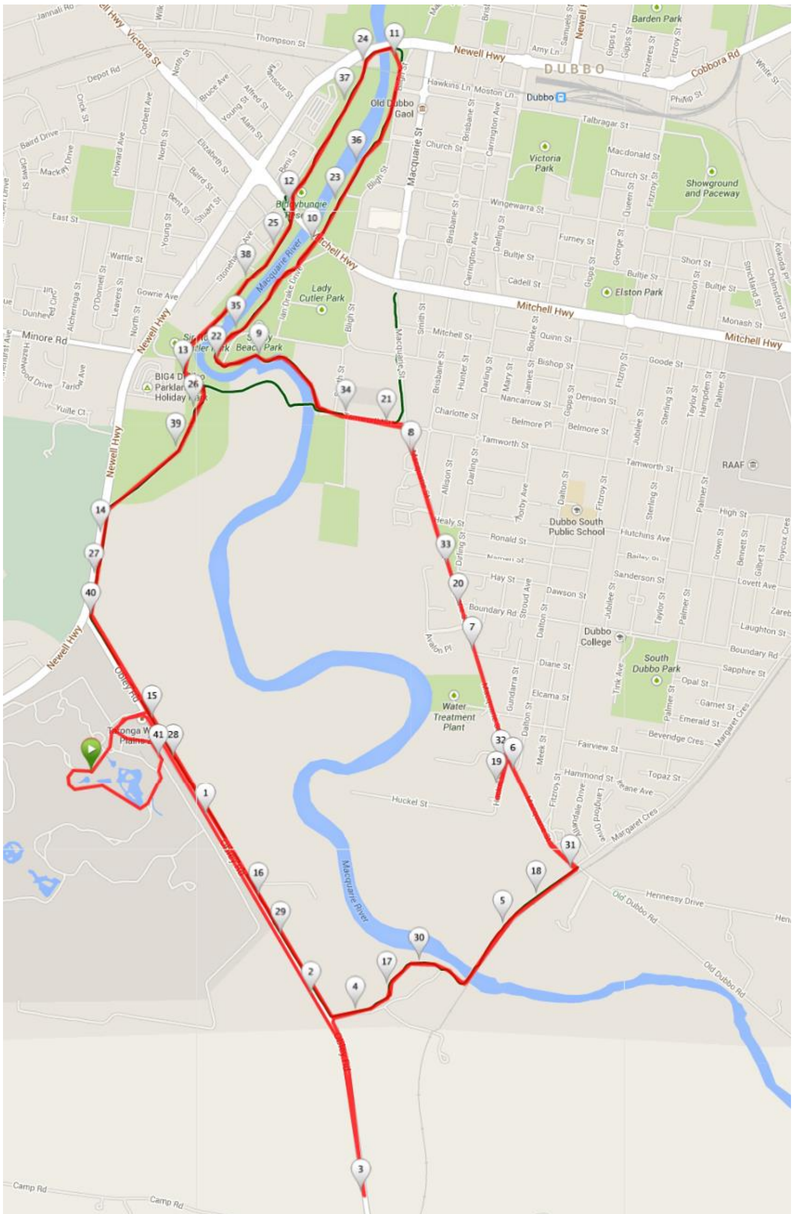
Appendix 7. Contingency Road Closures/Changed traffic conditions in the event of a flood closing the Tamworth St footbridge.

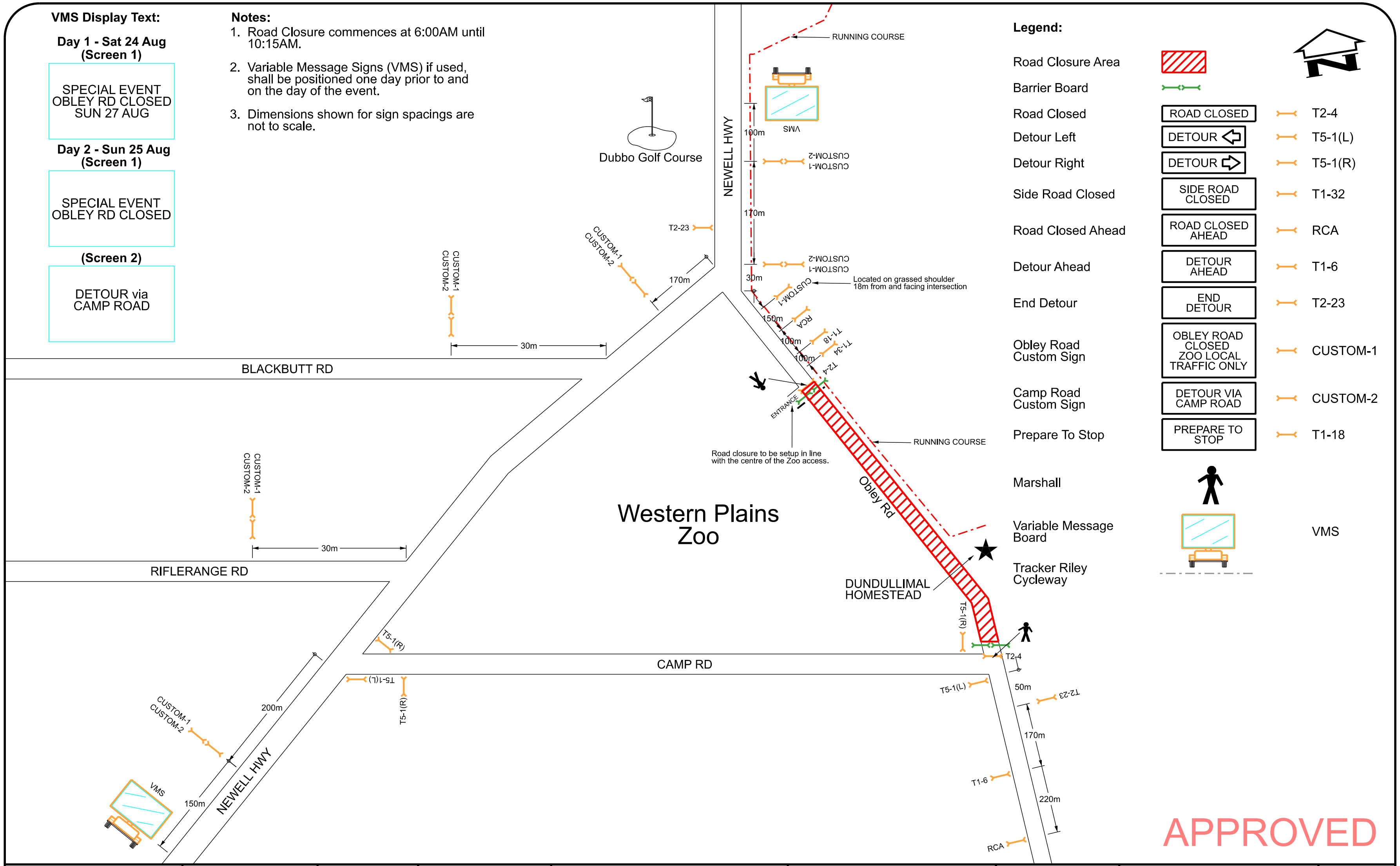
Road Section:	Obley Road – south of zoo entrance to just prior to Camp Road intersection.
Estimated closure time	6.00am – 10.15am
Comments:	After the last runner has reached the turnaround point on Obley Road, and has run back past Dundullimal turn-off, signage at the intersection of Obley Road and Camp Road will be changed to permit vehicles to enter Dundullimal. This is expected to occur at 8.45am. Am in contact with National Trust with regard to building work being carried out on the site. SES personnel will direct and control the traffic on the road.
Road Section:	Macquarie Street between Margaret Crescent & Tamworth St
Estimated time of changed traffic conditions:	7.00am – 11.30am
Comments:	Witches hats will be positioned along the left hand road edge on Macquarie Street to delineate the separation of vehicles from runners. Road signs will be located on Old Dubbo Rd notifying traffic coming into Dubbo of the running event.
Road Section:	Huckel Street
Estimated time of changed traffic conditions:	7.00am – 11.45am
Comments:	Runners will turn left down Huckel St and run to the end of bitumen sealed road before turning around and running back onto Macquarie St. Signage and Lollypop Marshals will be present to notify and slow traffic. Residents of Huckel Street will be notified by letter drop of the running event in the weeks prior to the event day.
Road Section	Regan Park Blvd
Estimated time of changed conditions	7.00am - 11.45am
Comments	Runners will cross the turnoff. Signage and Lollypop Marshals will be present to notify and slow traffic.
Road Section:	Tamworth Street from Macquarie Street, West to Macquarie River . South Street between Bligh St (North) and Tamworth Street (South).
Estimated closure time	7.00am – 12.00pm
Comments:	Road closure signs on Macquarie Street and South Street will be removed after the last runner has reached the river running track, West of South Street / Tamworth St intersection.

Appendix 8. Contingency *Map of 21.1km Circuit*



Appendix 9. Contingency *Map of 42.2km Circuit*


Newell Hwy
Mitchell Hwy
Macquarie River
Old Dubbo Gaol
Victoria Park
Showground and Paceway
Lady Cutler Park
Elston Park
Dubbo South Public School
Dubbo College
South Dubbo Park
Water Treatment Plant



TRAFFIC MANAGEMENT PLAN AUTHORISATION: MARK JOHNSTON DATE 13/07/2023; APPROVED BY TCT0046706 EXPIRY N/A; ACCREDITATION NUMBER; APPROVED DATE; MANAGER INFRASTRUCTURE STRATEGY	SURVEY DATE; DESIGN KM DATE 05/04/2019; DRAWING KM, WA, SM DATE 13/07/2023; CHECKED DATE; SENIOR DESIGN ENGINEER	FIELD BOOK/SURVEY FILES; DESIGN FILES; DRAWING FILES	SCALES: NOT TO SCALE; ORIGINAL SIZE A1	PERMANENT MARK: N/A; RL: N/A; DATUM: AHD & MGA55; STATUS: APPROVED; PRINT DATE: 13/07/2023

No.	DATE	APP'D	DETAILS OF AMENDMENTS
1.	05/04/2019	KM	DRAFT ISSUE
2.	08/04/2019	KM	APPROVED
3.	25/05/2021	WA	AMENDED

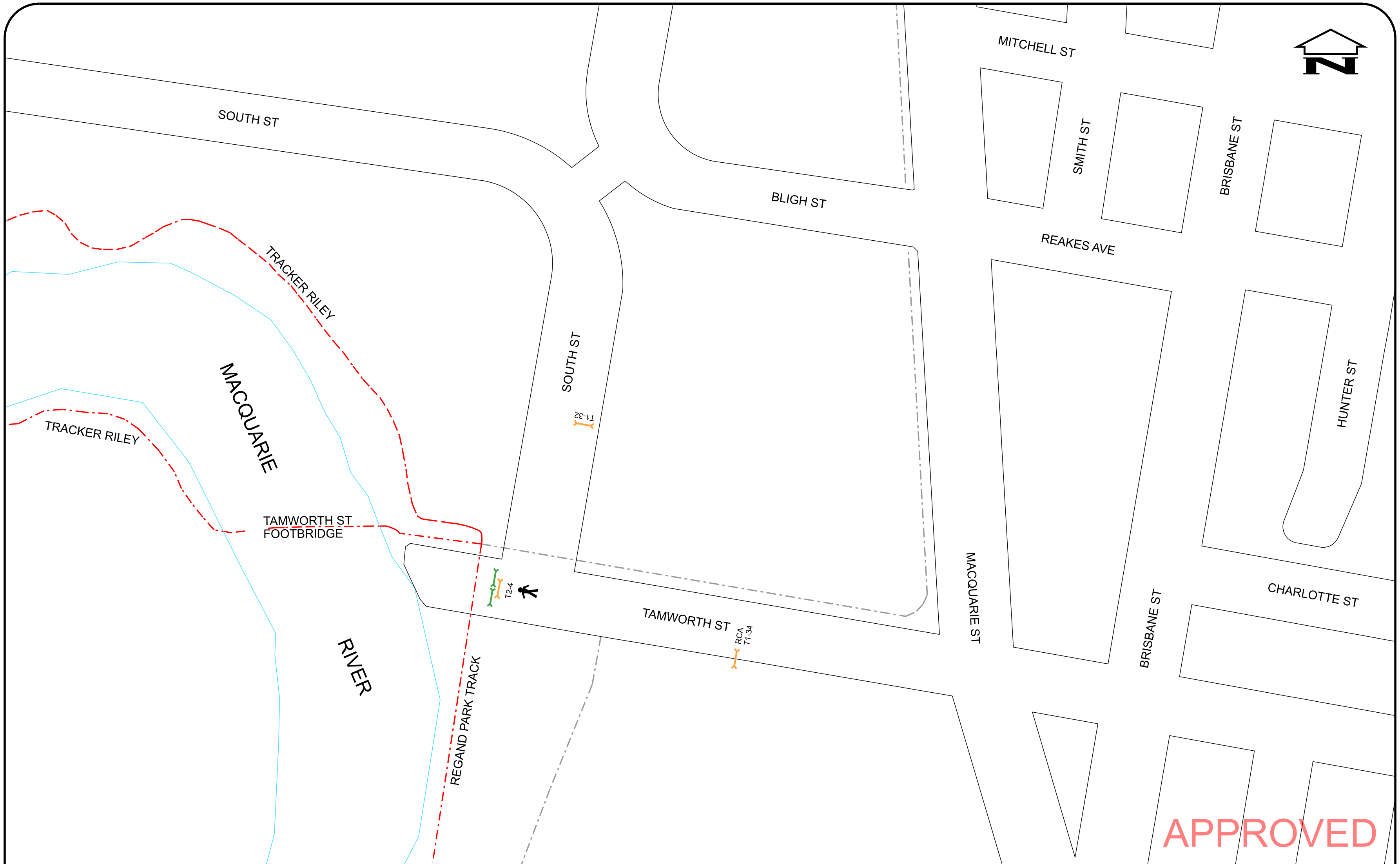
DUBBO REGIONAL COUNCIL

DRAWING TITLE: OBLEY ROAD TEMPORARY CLOSURE

JOB: DUBBO STAMPEDE RUNNING FESTIVAL 2024 TRAFFIC GUIDANCE SCHEME

SHEET NO. 1 OF 3 SHEETS

PLAN NO. TM 7052



TRAFFIC MANAGEMENT PLAN AUTHORISATION
MARK JOHNSTON DATE 13/07/2023
APPROVED BY
TCT0046706
ACCREDITATION NUMBER
APPROVED
DATE
MANAGER INFRASTRUCTURE STRATEGY

SURVEY DATE
DESIGN KM DATE 05/04/2019
DRAWING KM, WA, SM DATE 13/07/2023
CHECKED
DATE
SENIOR DESIGN ENGINEER

FIELD BOOK/SURVEY FILES
DESIGN FILES
DRAWING FILES
N:\Design Section\Projects\2022-2023\Traffic\Dubbo Stampede 2023\Microstation Drafting Files\Drafting.dgn

SCALES
NOT TO SCALE
ORIGINAL SIZE A1
0 1 2 3 4 5 cm

PERMANENT MARK: N/A RL: N/A DATUM: AHD & MGA55
STATUS: APPROVED PRINT DATE: 13/07/2023

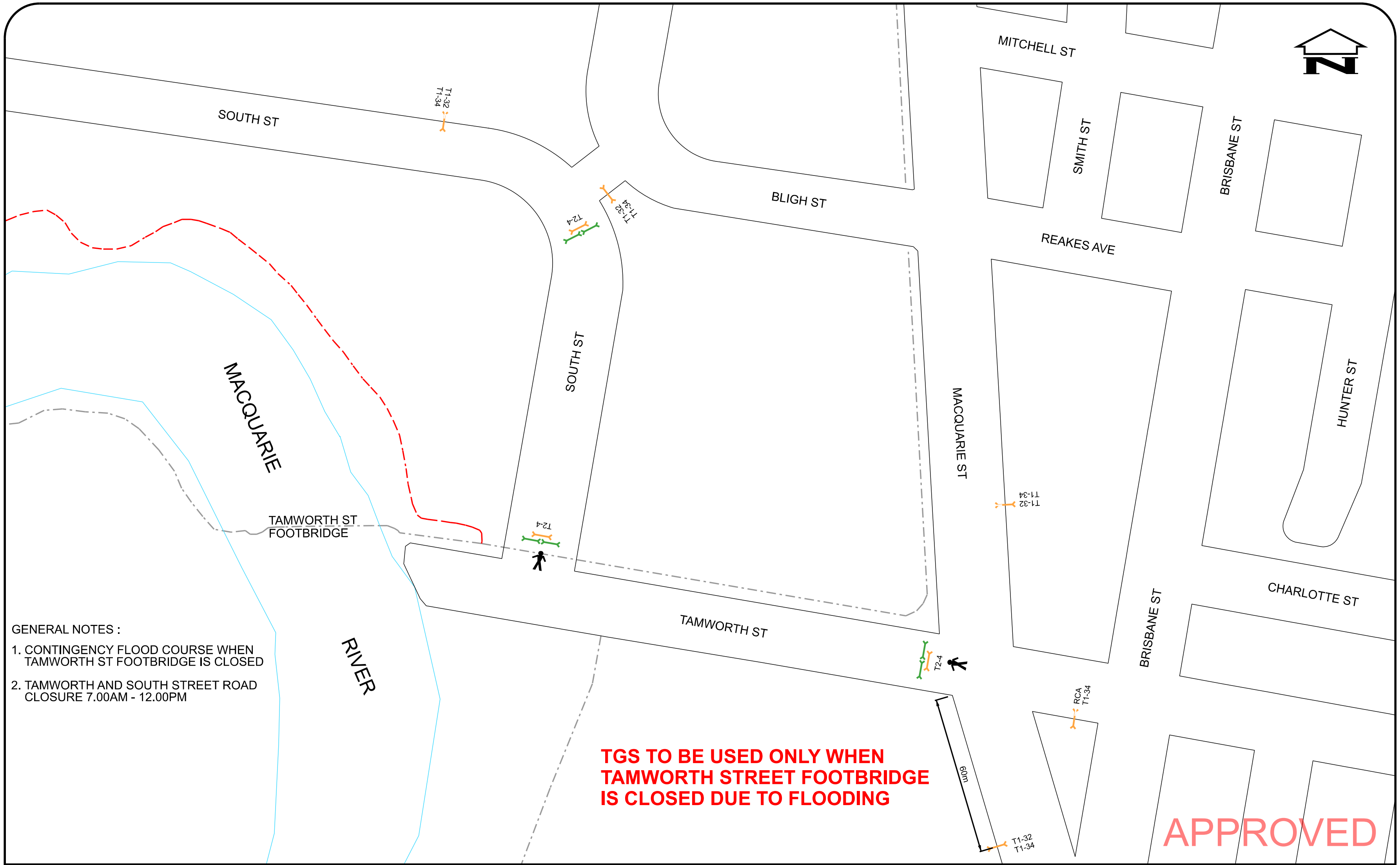
No.	DATE	APP'D	DETAILS OF AMENDMENTS
1.	05/04/2019	KM	DRAFT ISSUE
2.	08/04/2019	KM	APPROVED
3.	25/05/2021	WA	AMENDED

DUBBO REGIONAL COUNCIL

DRAWING TITLE
LOWER TAMWORTH STREET TEMPORARY CLOSURE

JOB
DUBBO STAMPEDE RUNNING FESTIVAL 2024 TRAFFIC GUIDANCE SCHEME

SHEET NO. 2
OF 3 SHEETS
PLAN NO.
TM 7052



TRAFFIC MANAGEMENT PLAN AUTHORISATION
MARK JOHNSTON DATE 13/07/2023
APPROVED BY
TCT0046706
ACCREDITATION NUMBER
APPROVED
DATE
MANAGER INFRASTRUCTURE STRATEGY

SURVEY DATE
DESIGN KM DATE 05/04/2019
DRAWING KM, WA, SM DATE 13/07/2023
CHECKED DATE
SENIOR DESIGN ENGINEER

FIELD BOOK/SURVEY FILES
DESIGN FILES
DRAWING FILES

SCALES
NOT TO SCALE
ORIGINAL SIZE A1
0 1 2 3 4 5 cm

PERMANENT MARK: N/A RL: N/A DATUM: AHD & MGA55
STATUS: APPROVED PRINT DATE: 13/07/2023

No.	DATE	APP'D	DETAILS OF AMENDMENTS
1.	05/04/2019	KM	DRAFT ISSUE
2.	08/04/2019	KM	APPROVED
3.	25/05/2021	WA	AMENDED

DUBBO REGIONAL COUNCIL

DRAWING TITLE
TAMWORTH AND SOUTH STREET TEMPORARY CLOSURE WHEN BRIDGE FLOODED

JOB
DUBBO STAMPEDE RUNNING FESTIVAL 2024 TRAFFIC GUIDANCE SCHEME

SHEET NO. 3 OF 3 SHEETS
PLAN NO. TM 7052

RISK MANAGEMENT PLAN

FOR:

Dubbo Stampede Running Festival

25/08/2024

Taronga Western Plains Zoo and Tracker Riley Cycleway

Risk Management Plan prepared by:

Natalie Davis, Jodie Cowen

2/05/2024

RISK MANAGEMENT

As the event organiser you have a responsibility to ensure that your event is undertaken in a safe manner and that you minimise wherever possible harm to people or property.

Under OH&S legislation and other related law, the event organiser is obliged to ensure that reasonable steps are taken to ensure that events are conducted in a manner which provides for the safety of everyone that might be present at any time, including the general public, volunteers, staff, independent contractors and their employees and sub-contractors.

Liability arises where a person is “exposed” to the risk of injury to health and safety, it is not necessary for a person to have been actually injured but merely “exposed to risk”. Therefore, an event management plan must focus on the risk to health and safety rather than the consequences of an injury or accident.

During your planning process it is essential to develop a Risk Management Plan so potential hazards are identified early and appropriate measures are put in place to reduce the likelihood of an incident occurring.

In order to create a thorough Risk Management Plan below are the key things that you’ll need to consider:

Risk Assessment

Your event Risk Assessment should be developed in conjunction with all parties involved in the undertaking of the event including paid and volunteer staff, venues and contractors.

The Risk Assessment should identify what hazards or risks are associated with the event, and what measures are in place to reduce/eliminate that hazard/risk occurring.

Risks should also be prioritised based on the most significant risks, and a staff member allocated to the management of each risk area to ensure ownership of its management. Some specific areas of attention your Risk Assessment should consider addressing are:

1. **Health and Safety** (identify any potential hazards that could compromise health and safety of your event visitors, suppliers and the general public)
2. **Financial Risks** (from poor attendance, cancellations etc.)
3. **Reputational Risk** (could you or your organisation receive poor publicity as a result of something happening at your event)
4. **Environmental Risk** (impacts your event present the local environment)

If you are looking to hold your event on public land, Council will require a copy of your risk assessment. Council will use this assessment to assist in determining whether the land is fit for the proposed activity. It is important therefore that you consider and document all risks relevant to the event and how you propose to manage those risks.

To develop your Risk Management Plan;

STEP ONE: Establishing the context

1. Identify the specific details of your event.
2. Identify the list of all your event stakeholders and relevant contact details.

STEP TWO: Identify risks

1. Hold a brainstorming session with your stakeholders to identify all potential risks
2. Log these risks in your risk assessment matrix

STEP THREE: Analyse risks

1. A risk is the combination of the **likelihood** (Table 1) and **consequence** (Table 2) of an incident occurring. The levels and descriptors in these tables may change and the descriptions will vary greatly depending upon your event under consideration. At the risk analysis stage risks should be evaluated with existing or known controls in place; unlike the identification phase (Step Two) where known treatments are ignored.

STEP FOUR: Evaluate risks

2. For risk evaluation it is recommended Table 3 is used. By comparing the likelihood (Table 1) and consequence (Table 2) values, Table 3 identifies a risk rating of either:
    1. Low
    2. Moderate
    3. High
    4. Extreme

Table 1**: Likelihood of Risk Criteria**

Level	**Description**	**Examples**
A	Almost Certain	Expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur, only in exceptional circumstances

Table 2**: Consequence of Risk Criteria**

	Description	**Financial Impact**	**Health**	**Reputation**	**Operations**
1	Negligible	Insignificant Less than $1,000	No injuries	Unsubstantiated, low impact, low profile or no news item	Little Impact
2	Minor	$1,000 - $10,000	First aid treatment on site	Substantiated, low impact, low news profile	Inconvenient delays
3	Moderate	$10,000 - $50,000	Medical treatment - on or off site	Substantiated, public embarrassment, moderate impact, moderate news profile	Significant delays to major deliverables

	Description	Financial Impact	Health	Reputation	Operations
4	Major	$50,000 - $150,000	Accidental death, extensive injuries or permanent disability	Substantiated, public embarrassment, high impact news profile, third party actions	Non achievement of major deliverables
5	Catastrophic	More than $150,000	Multiple deaths or severe permanent disablements	Substantiated, public embarrassment, very high multiple impacts, high widespread multiple news profiles, third party actions	Non achievement of key deliverables

Table 3: **Level of Risk**

		CONSEQUENCE				
LIKELIHOOD		**Negligible**	**Minor**	**Moderate**	**Major**	**Catastrophic**
		1	**2**	**3**	**4**	**5**
Almost Certain	**A**	High	High	Extreme	Extreme	Extreme
Likely	**B**	Moderate	High	High	Extreme	Extreme
Possible	**C**	Low	Moderate	High	Extreme	Extreme
Unlikely	**D**	Low	Low	Moderate	High	Extreme
Rare	**E**	Low	Low	Moderate	High	High

Table 4: **Treatment of the risk rating**

Extreme	Discontinue the activity and/or implement immediate corrective actions(s)
High	Corrective action needed, to be implemented as soon as possible
Moderate	Attention indicated
Low	Implement practical short / medium term control measures

RISK ASSESSMENT

	Hazard	Possible Outcome	Risk Score	Risk Rating	Risk Controls
1	Vehicle on course	Injury to Public or volunteer	E5	High	3. Dubbo Traffic Control supplying trained traffic marshals on course where runners cross roads 4. Follow DTC approved Traffic Management Plan 5. Obley Road and internal Western Plains Zoo roads closed during event 6. Residents living near course notified prior to event to reduce traffic
2	Medical emergency	Injury to Public or volunteer	C3	High	7. NSW Ambulance situated in Start/Finish precinct for entirety of race 8. First aid at finish line and with mobile units on course 9. Develop and train all staff in emergency management processes for medical emergencies.

	Hazard	Possible Outcome	Risk Score	Risk Rating	Risk Controls
					10. First Aid trained committee on finish line 11. Emergency contacts given to volunteers and committee
3	Live electrical wires or faulty equipment	Injury to Public, personal injury	E3	Moderate	12. Suppliers asked if all electrical equipment is tested and tagged 13. In the case of wet weather, electrical cables are to be managed appropriately including covers and off ground where possible
4	Extreme weather - wind, lightning, flood, etc.	Injury to Public, personal injury	E3	Moderate	14. Race director to immediately enact Lightning Policy when Lightning seen on course. 15. If lightning is within 15km prior to start, start is to be delayed until lightning is at a further distance 16. Monitor weather conditions before and during event
5	Motor vehicle and pedestrian collisions	Personal injury	C3	High	1. Provide all staff with appropriate hi vis clothing if on course 2. Clearly identify work site areas and monitor with volunteers or bunting 3. Ensure all contractors are qualified and/or experienced in the work being undertaken 4. Traffic and pedestrian plan developed to manage movement in and around the site 5. Strict bump in and bump out times are established and timed prior to arrival and after departure of crowds
6	Volunteers carrying large or awkward objects	Personal injury	C2	Moderate	6. Ensure all members of the organising committee and volunteers are aware of safe manual handling

	Hazard	Possible Outcome	Risk Score	Risk Rating	Risk Controls
					7. Use vehicles and trollies to assist with heavy items when possible
8	Missing Person/Lost Child	Trauma to those concerned	E3	Moderate	8. Establish and train committee/volunteers on process for lost children 9. Establish point of contact and have access to a public address system
9	Unstable marquees, stages, tiered seating, etc	Injury to Public, personal injury	E3	Moderate	10. Ensure equipment contractors are appropriately licensed/qualified 11. Marquees are erected to manufacturer's specifications 12. Use weights provided to hold down Marquees
10	Heat / Cold distress	Personal injury	D3	Moderate	13. Monitor weather conditions prior to event 14. Ensure appropriate sun protection and water is available for committee/volunteers 15. First aid and ambulance available on course 16. Emergency contacts given to volunteers and committee
12	Unclean / inadequate waste management facilities	Reputation	E2	Minor	17. Provide adequate quantities of clean facilities 18. Engage commercial cleaner during event
13	Unclean / inadequate toilet facilities	Reputation	E2	Minor	19. Provide adequate quantities of cleaned facilities 20. Engage cleaning contractor
14	Trip hazards	Injury to Public	C2	Moderate	21. Serious trip hazards removed or treated with cones/paint/bunting to prevent injury

	Hazard	Possible Outcome	Risk Score	Risk Rating	Risk Controls
					22. Rubber mats & cable traps over cables 23. Barriers placed around protruding equipment 24. Changes in height and edges highlighted with paint 25. Guy ropes and stakes checked for trip hazards and are clearly marked
15	Emergency situation resultant from injury, Fire, explosion, bomb threats, chemical releases, etc.	Injury to Public, personal injury	D4	High	26. Employ Emergency Management Plan
16	Slip hazards due to wet water	Injury to public, personal injury	E3	Moderate	27. Identify slip areas 28. Isolate where possible and place warning signage
17	Emergency service vehicle cannot access site	Injury to public, personal injury	E4	High	29. Emergency ingress and egress established
19	Wheelchair and prams unable to access event site	Reputation	E2	Minor	30. Create accessibility plan 31. Work with race partner Live Better Community Services to ensure Wallaby Wheel entrants have ease of access
20	Event parking overspill	Reputation	E2	Minor	32. Have a contingency within the parking and pedestrian plan 33. Work with Western Plains Zoo staff to minimise parking stress

	Hazard	Possible Outcome	Risk Score	Risk Rating	Risk Controls
21	Fire or burn incidents	Injury to public, personal injury	E3	Moderate	34. Fire extinguishers available 35. First Aid Box location established 36. NSW Ambulance and Event Medics engaged
26	Welfare of committee and volunteers	Reputation	C1	Moderate	37. Dedicated resource to manage volunteers and undertake actions to heighten engagement
27	COVID-19	Illness to public, personal illness	C2	Moderate	1. Event briefings will include relevant information on current guidelines and restrictions 2. Unwell participants will be asked not to participate in event 3. Hand sanitiser will be provided at events 4. If restrictions advise, social gatherings after events will not be encouraged 5. Enough space will be made available so that participants can easily maintain distance during events, training and briefings if the health guidelines dictate this measure 6. The situation will be assessed prior to every event and training session and as this is a changing landscape, the current NSW Government and Health guidelines will be followed in relation to COVID-19 controls.

DUBBO REGIONAL COUNCIL

REPORT: Proposed Heavy Vehicle Haulage Route for South East Dubbo

DIVISION: Infrastructure
REPORT DATE: 28 June 2024
TRIM REFERENCE: ID24/1319

EXECUTIVE SUMMARY

Purpose	• Seek direction or decision	
Issue	• Road safety issues associated with heavy haulage vehicles on Sheraton Road during peak school drop off and pick up times. • Adoption of a suitable interim and long term haulage route for heavy vehicles generated from three heavy industry developments on Sheraton Road. • Summary of findings from further analysis and road safety audits undertaken on both Sheraton Road and the currently proposed Blueridge haulage route. • Summary of consultation undertaken with owners and businesses within Blueridge Estate.	
Reasoning	• Road safety findings associated with heavy haulage vehicles on Sheraton Road and the currently proposed Blueridge haulage route.	
Financial Implications	Budget Area	Infrastructure
	Funding Source	Infrastructure Strategy and Design
	Proposed Cost	$5,000
	Ongoing Costs	Nil
Policy Implications	Policy Title	There are no policy implications arising from this report.
	Impact on Policy	N/A
Consultation	Infrastructure Strategy and Design	Council's Your Say page, letters and staff information sessions.

STRATEGIC DIRECTION

The Towards 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes six principle themes and a number of objectives and strategies. This report is aligned to:

Theme: 2 Infrastructure

CSP Objective: 2.1 The road transportation network is safe, convenient and efficient

Delivery Program Strategy:	2.1.1 Traffic management facilities enhance the safety and efficiency of the road network
Theme:	2 Infrastructure
CSP Objective:	2.1 The road transportation network is safe, convenient and efficient
Delivery Program Strategy:	2.1.5 Council works collaboratively with the government and stakeholders on transport-related issues

RECOMMENDATION

1. **That due to recent road safety findings outlined in this report, Council adopt Sheraton Road (between Boundary Road and Wellington Road) as the primary haulage route for the three heavy industry developments located on Sheraton Road, outside of peak school drop off and pick up times.**
2. **That a report be prepared for Local Traffic Committee for the installation of regulatory 'trucks prohibited' signage on Sheraton Road as described in the body of this report, to prohibit heavy vehicles on Sheraton Road during peak school drop off and pick up times.**
3. **That should Council successfully receive funding under stream two of the Regional Precincts and Partnership Program for the construction of stages 1 and 2 of the Southern Distributor Road, Council restrict haulage on Boundary Road/Wheelers Lane and adopt the Blueridge Haulage Route (as described in the body of this report) for haulage trucks during school peak times when trucks are prohibited on Sheraton Road.**
4. **That Council adopt the Southern Distributor alignment from Sheraton Road to the Mitchell Highway (as described in the body of this report) as the long term haulage route for the heavy industry developments located on Sheraton Road.**

Luke Ryan
Director Infrastructure

MJ
Manager Infrastructure
Strategy and Design

BACKGROUND

Current Issue

The main issue that this report aims to address is the management of heavy vehicle traffic generated by three heavy industry developments located on Sheraton Road (see Figure 1 below), including the Regional Hardrock Quarry, South Keswick Concrete Works and the Holcim Quarry. The current approved haulage route for these developments is via Sheraton Road to the Mitchell Highway.

Figure 1: Location of three heavy industry developments on Sheraton Road (indicated by black polygons)

Council's Long Term Strategy for Southern Distributor

The Dubbo Transportation Strategy 2020 was adopted by Dubbo Regional Council in 2021, which identifies critical road infrastructure links required to support future growth in the City of Dubbo. One of the key road projects identified in the strategy is the Southern Distributor, which links with the future South Bridge on Macquarie Street and runs along the southern urban edge of Dubbo. The purpose of the Southern Distributor is to provide another strong link into the CBD from South East Dubbo, relieving future traffic congestion on Cobra Street. The Southern Distributor also plays a key role in distributing traffic from the South West and central-west Dubbo urban release areas around the southern edge of Dubbo, once the South Bridge is in place.

The eastern alignment of the Southern Distributor can be seen in Figure 2 below. The alignment of which is represented by the 'red' and 'blue' lines combined (stage 1 and 2). The alignment shown runs through future undeveloped stages of the Blueridge Estate precinct and connects with the Mitchell Highway. The combination of stages 1 and 2 of the Southern Distributor is the most suitable long term route for heavy haulage, servicing the three heavy industry developments located on Sheraton Road.

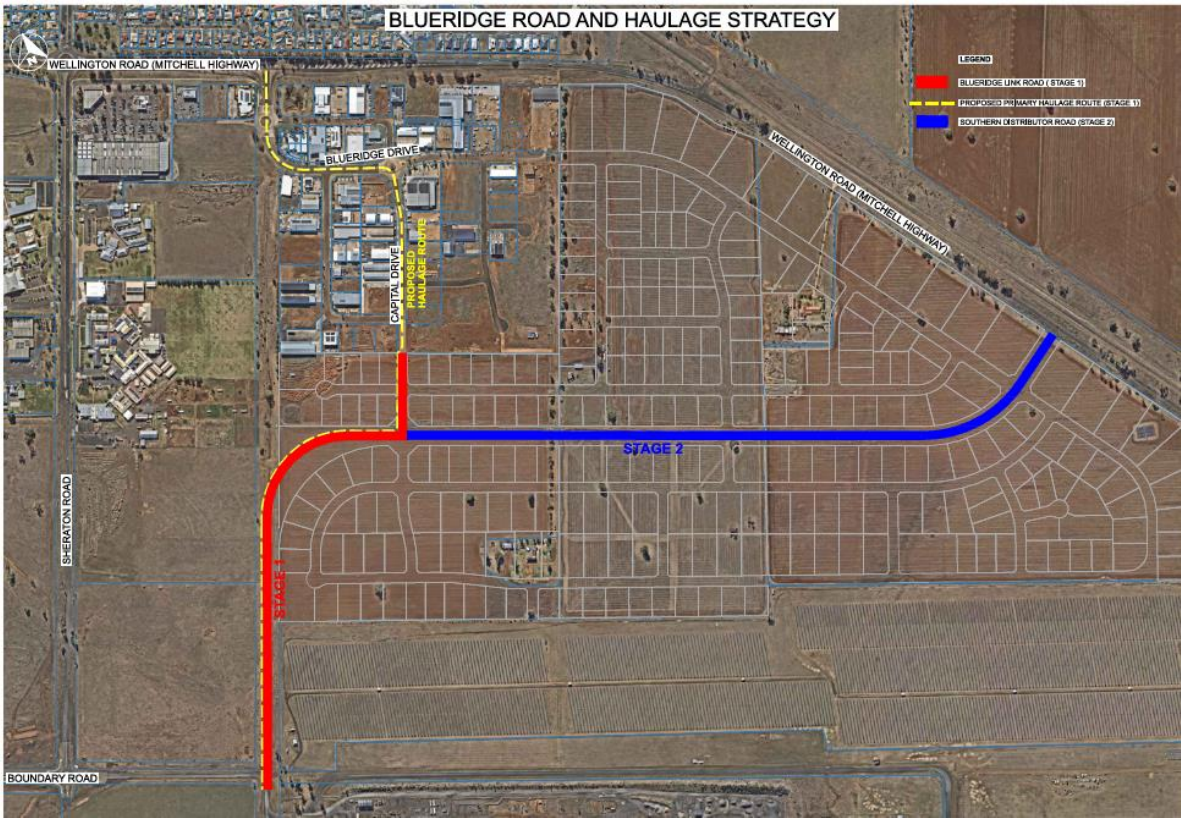


Figure 2: Southern Distributor stage 1 and 2, including the proposal of an interim haulage route

Council adoption of Southern Distributor Stage 1

Due to safety concerns associated with the presence of heavy vehicles on Sheraton Road, Council considered more suitable alternative haulage routes. One of the options considered by Council was the construction of stage 1 of the Southern Distributor (also known as the Blueridge Link Road), which has been identified as the 'red' alignment in Figure 2. The construction of this road would provide Council an opportunity to re-route haulage vehicles through Blueridge Estate, along the route indicated by the 'yellow' dashed line in Figure 2. Council considered the stage 1 option as the most suitable interim option for a haulage route, enabling the trucks to be removed from Sheraton Road and the school precinct. As such, Council resolved at the November 2022 Ordinary Council Meeting to adopt the alignment of the stage 1 road and to acquire land to secure a road corridor for the future road.

Consultation and Further Assessment

Following Council's resolution on November 2022 to adopt the alignment of stage 1 of the Southern Distributor, Council staff carried out consultation with the Blueridge businesses. Council invited the Blueridge businesses and owners to provide feedback via written or electronic means. Staff also conducted two information sessions at the Devils Hollow Brewery with the Blueridge businesses and owners to discuss the proposal. Further detail about the method of consultation and feedback provided can be found later in this report.

Council engaged SCT Consulting to undertake a high level multicriteria assessment of five potential haulage routes, which included an assessment of traffic capacity for roads and key intersections on each route using SIDRA software. This report can be found in **Appendix 1**, and further detail on the key outcomes of the analysis can be found later in this report.

Council also engaged WaySafe to undertake a road safety audit for the proposed haulage route through Blueridge, and a number of high risk findings were reported. This report can be found in **Appendix 2**, and a summary of the findings can be found later in this report.

Following the road safety findings for the proposed haulage route through Blueridge Estate, Council engaged WaySafe a second time to conduct a similar road safety audit for Sheraton Road, including the assessment of the risk associated with it being utilised as a heavy haulage route. This report can be found in **Appendix 3**, and a summary of the findings can be found later in this report.

Application for Funding

At the Ordinary Council meeting held on 15 February 2024, Council resolved to submit an application for funding the construction of the Southern Distributor Road (stage 1 and 2) through stream two of the Regional Precincts and Partnerships Program. The application included the construction of stages 1 and 2 of the southern distributor roads, but excluded the intersection on the Mitchell Highway, due to the complexity and timeframes associated with obtaining Transport for NSW approvals and delivering the intersection. The results of that application are still pending.

REPORT

Following Council resolution in November 2022 to adopt the stage 1 Southern Distributor alignment, Council undertook further assessment of this route.

Findings of the SCT Report

Council engaged SCT Consulting in September 2023 to undertake a high level assessment of five potential haulage routes in South East Dubbo, for the purpose of managing heavy haulage traffic generated from the three heavy industry developments on Sheraton Road, including the Regional Hardrock Quarry, Holcim Quarry and Keswick Concrete Works. The final report prepared by SCT can be found in **Appendix 1**.

The main criteria for a haulage route is conveying heavy haulage vehicles from Sheraton Road to the Mitchell Highway in a safe and effective manner. The five options assessed can be found in Figure 3 below and include:

Option 1: Boundary Road and Wheelers Lane
Option 2: Sheraton Road
Option 3: Southern Distributor Stage 1 via Capital Drive and Blueridge Drive
Option 4: Long term southern distributor route through undeveloped Blueridge Estate
Option 5: New road in paper road corridor, which runs parallel to Sheraton Road and is located immediately east of the St Johns College School boundary, connecting with the Mitchell Highway at Blueridge Drive.

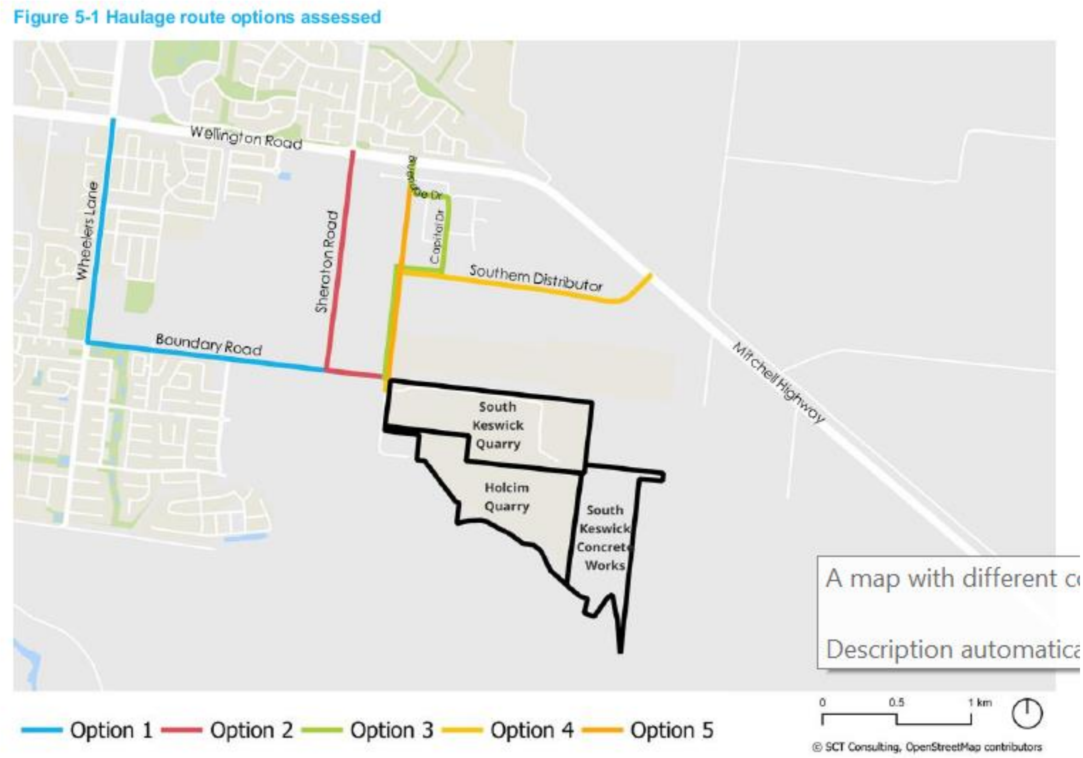


Figure 3: Five haulage route options assessed by SCT Consulting

Each of the route options were assessed against eight different criteria, the summary of which can be found in the multicriteria matrix shown in Figure 4 below. More detailed commentary for each criteria can be found in the attached SCT report **(Appendix 1)**. Option 3 was the highest performing option when assessed against the below criteria. A road safety audit was not undertaken to inform the findings of the SCT report however, road safety audits were undertaken at a later stage and can be found in Appendices 2 and 3.

Table 5-1 Assessment of haulage route options

Criteria / Options	Option 1: Boundary Rd & Wheelers Ln	Option 2: Sheraton Rd	Option 3: Connect to Capital Dr & Blueridge Dr	Option 4: Southern Distributor	Option 5: New road to Blueridge Dr
Land use, social, community or stakeholder impacts					
Noise and air quality implications					
Traffic and safety impacts					
Travel time impacts					
Engineering and pavement considerations					
Construction cost, including upgrades to existing road network and utilities impacts					
Ease of construction / program					
Suitability as a long-term haulage route					

Figure 4: Multicriteria assessment matrix for five different haulage routes

The total cost to establish each option as a suitable haulage route can be found in Figure 5 below:

Table 5-2 Preliminary cost estimates

Haulage route options	Preliminary cost estimate
Option 1 (Boundary Road + Wheelers Lane)	$16,922,763
Option 2 (Sheraton Road)	$13,850,328
Option 3 (Blueridge Link Road + Capital Drive + Blueridge Drive)	$10,391,878
Option 4 (Blueridge Link Road + Southern Distributor Road)	$25,323,191
Option 5 (New road + Blueridge Drive)	$17,972,658

Source: Dubbo Regional Council, 27 February 2024

Figure 5: Total cost for delivery of each haulage route option

A review of intersection performance was undertaken on each haulage route option by SCT to gain an understanding of the existing and future capacity of key intersections and the likely impact of introducing the heavy haulage traffic being generated from the three heavy industry developments on Sheraton Road.

Intersection performance is typically measured based on the average delay of vehicles at an intersection. Figure 6 below shows the different level of service (LOS) measures used to indicate intersection performance.

Table 4-1 Level of Service Categories

Level of Service	Average delay per vehicle (seconds)	Performance explanation
A	Less than 14.5	Good operation
B	14.5 to 28.4	Good with acceptable delays and spare capacity
C	28.5 to 42.4	Satisfactory
D	42.5 to 56.4	Operating near capacity
E	56.5 to 70.4	At capacity. At signals, incidents will cause excessive delays. Roundabouts require other control method.
F	70.5 or greater	At capacity. At signals incidents will cause excessive delays. Roundabouts require other control method.

Source: Guide to Traffic Generating Development, TfNSW

Figure 6: Level of service categories for intersection performance

A summary of intersection performance for each haulage option can be found in Figure 7 below. This analysis was carried out by SIDRA modelling software and includes the projected traffic generation from the three heavy industry developments on Sheraton Road. The analysis shows that the Wheelers Lane/Wellington Road intersection reaches capacity by 2036, which was assessed to occur anyway without the heavy haulage traffic. As can be seen from the figure below, all other intersections were assessed to perform well by the future 2036 year, with plenty of spare capacity.

Table 4-7 Summary of future levels of service (2036)

Intersection	AM peak hour				PM peak hour			
	Existing routes	Option 1	Option 2	Option 3/5	Existing routes	Option 1	Option 2	Option 3/5
Sheraton Road / Boundary Road	A	A	A	A	A	A	A	A
Wheelers Lane / Boundary Road	A	A	A	A	A	A	A	A
Wellington Road / Wheelers Lane	F	F	F	F	F	F	F	F
Wellington Road / Sheraton Road	B	B	B	B	B	A	B	B
Wellington Road / Blueridge Drive	A	A	A	A	A	A	A	A

Figure 7: Summary of intersection performance in future including addition of haulage vehicles

A sensitivity test was undertaken for the Wellington Road/Blueridge Drive intersection to determine the amount of spare capacity available within the intersection to accommodate additional development growth from Blueridge Estate, as well as additional growth from the heavy industry precinct on Sheraton Road. Analysis shows that the intersection has the capacity to accommodate an additional 1,100 vehicles per hour, which equates to around

45.3 hectares of Blueridge development. The intersection also has spare capacity to accommodate an additional 95 heavy vehicle movements per hour if required.

Blueridge Link Road Haulage Route Road Safety

Council engaged WaySafe to undertake a road safety audit for the proposed Blueridge Link Road haulage route alignment, as indicated by the ‘yellow’ line in Figure 8 below. The road safety audit report can be found in **Appendix 2** of this report.

Figure 8: Blueridge Link Road alignment assessed in road safety audit

There were a total of seven safety findings reported by WaySafe, some were found as high risk with potential for a fatality if an incident occurred. Many of the safety findings can be mitigated through the implementation of appropriate design and traffic measures, however the findings summarised below are much harder to mitigate.

Finding 7 – Seagull treatment on Mitchell Highway controlling right turns

See Figure 9 below, which visually summarises the high risk finding associated with the seagull intersection located at the intersection of Blueridge Drive and the Mitchell Highway, accompanied with the extract below taken from the WaySafe report:

“*A driver heading north and intending to turn right (F7.1, Red rectangle) may have sighting of through vehicles approaching from the right obscured due to vehicles in the adjoining left turn lane. The Yellow triangle provides an indication of the potential sighting to the right, whereas* *the Purple triangle represents sighting to the right interrupted by left turn vehicles in the turning lane. The Green vehicle may be obscured by a left turning vehicle. Research suggests that driver 'search time' applicable to looking from centre to one side, to the other side and back to centre takes around 2 seconds. At 70 km/h the Green vehicle, which is located around 70 m from the T-junction, will have travelled almost 40 m in that time. Should the Red driver fail to look right again and move out, the driver of the Green vehicle will not have sufficient distance to stop before a collision. In this scenario, the Green vehicle may collide with the driver side of the Red vehicle, resulting in serious or fatal injuries to the Red vehicle occupants and probably serious injuries to occupants of the Green vehicle."*

Figure 9: Visual representation of sight line limitations and potential crash types at the Mitchell Highway seagull intersection

The risk of this type of crash occurring at this intersection is exacerbated due to the high volume of through traffic on the highway, and in/out traffic to and from Blueridge Estate during the peak hours. With limited availability of gaps for the red vehicle in the peak hour, the frustrated driver is more likely to make poor decisions. The addition of haulage trucks to this route will increase the exposure to the risk of an incident occurring at this intersection, potentially resulting in a fatality.

The above risk is an inherent design flaw of many seagull intersections, and research has found that this type of crash at seagull intersections is more likely to occur as traffic volumes increase. **Appendix 4** includes a research paper and case study for seagull intersections, where these types of design flaws and crash statistics are discussed at length. Below is an extract from the research paper titled '*The crash performance of seagull intersections and intersections with left turn slip lanes*':

"*While in theory these layouts should be safer, the experience is that some have high numbers of JA crashes and LB (right turn against or right turn versus opposing through vehicle) crashes, possibly due to poor design and intersection complexity."*

See Figure 10 below, which includes the coding for common crash types at a seagull intersections (as referenced in above extract).

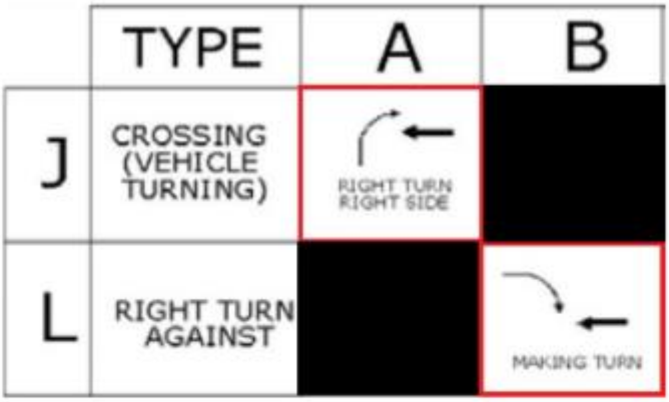


Figure 10: Common crash types at seagull intersections

Potential mitigation measure

Mitigating this risk is costly, as it requires increasing the separation of the left turn lane from the westbound through traffic lane. Increased separation will ensure a right turn out vehicle (Red vehicle in Figure 9) has a good field of view to see vehicles in the westbound through lane. Figure 11 below shows an example of where this type of treatment has been implemented. This particular intersection example is located near Cromwell in New Zealand.

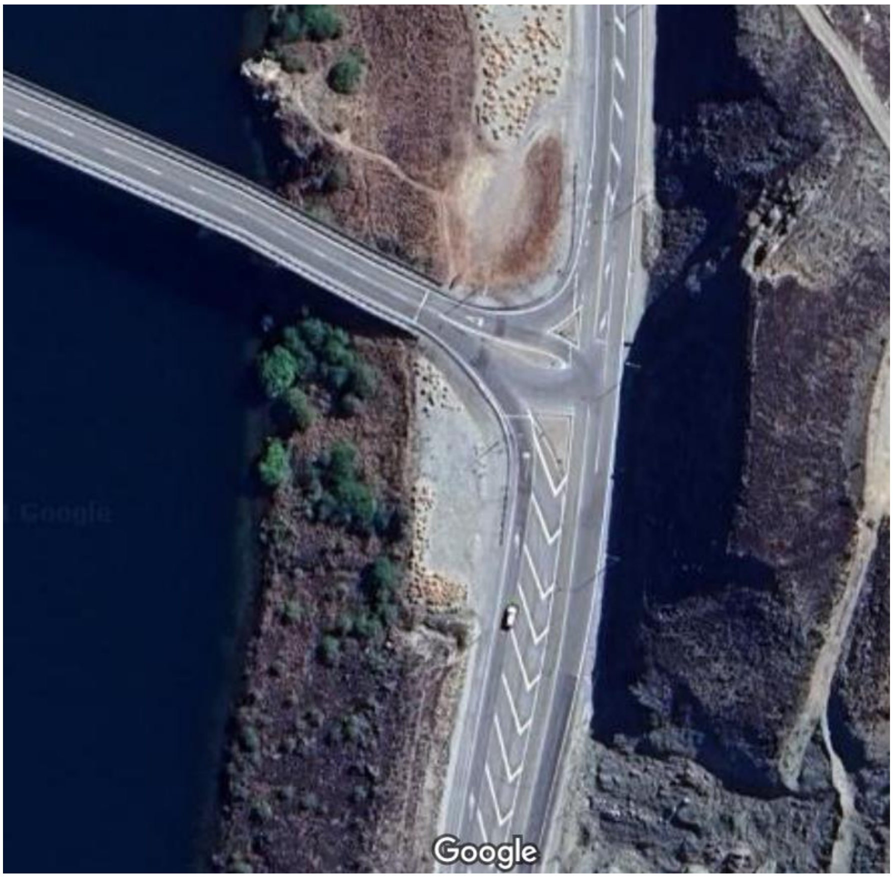


Figure 11: Example of seagull intersection with left turn lane separated from through lane

Finding 1 – Errant vehicle entering preschool premises

Figure 12 below visually demonstrates the potential risk associated with an errant vehicle from the roundabout entering the preschool premises. See WaySafe report **(Appendix 2)** for further discussion around this risk finding.

Potential mitigation measure

As the childcare boundary is located only 3.5 m from the back of kerb, options for design and installation of vehicle barriers are limited, especially if they were to be designed to withstand the impact of a heavy vehicle. Further design and investigation would be needed to determine the feasibility for installing an appropriate road safety barrier.

F1.2: Aerial photograph of the roundabout and southern approach. Blue arrow, straight through on Blueridge Dr, Red dotted line potential path of an off-road crash. *(Aerial photograph: Google Maps)*

Figure 12: Image showing path a vehicle could take when exiting the roundabout

Sheraton Road Safety Audit

Council engaged WaySafe a second time to undertake a road safety audit on Sheraton Road. The extent of the audit can be seen in Figure 13 below. The road safety audit report can be found in **Appendix 3** of this report.

Figure 13: Extent of road safety audit conducted for Sheraton Road

There were a total of fourteen road safety findings for Sheraton Road, the majority of which can be mitigated through the redesign and reconstruction of Sheraton Road. A large portion of the road safety findings related to vehicle and pedestrian movements and congestion during peak school drop off and pick up times.

Section 12.2 of the WaySafe report discusses the risk associated with heavy haulage vehicles on Sheraton Road. As the number of heavy vehicles increase, especially during the peak hours from 8 am to 9 am and 3 pm to 4 pm, the risk exposure for an incident to occur increases. The report notes that the risk would drop significantly outside of those peak times.

Potential mitigation measure for heavy vehicles on Sheraton Road

The risk associated with heavy vehicles on Sheraton Road can be significantly reduced by eliminating those heavy vehicles during the peak school drop off and pick up times on Sheraton Road. This can be achieved by installing 'Trucks Prohibited' signage on Sheraton Road with a time restriction only applied to the peak traffic hours in the morning and afternoon. Trucks can return to Sheraton Road outside peak times when the risk is significantly lower. Council would need to consider allowing trucks to utilise Boundary Road and Wheelers Lane during those peak times.

Refer to Figure 14 below for example of regulatory 'Trucks Prohibited' signage taken from the Transport for NSW library of regulatory signage. This sign would be accompanied by an additional signage plate advising the peak times for restriction. Under the NSW Road Regulation, Road Rule 104 stipulates that this signage does not apply to buses. As this signage is regulatory, heavy vehicle compliance can be enforced by local police patrolling the school zone during peak times. Council contacted the local representative for NSW Police Service Highway Patrol Dubbo, confirming that local Dubbo Police can enforce heavy vehicle compliance if this signage is installed and endorsed by Council.

R6-10-2 – Truck Prohibited (symbolic)

Figure 14: 'Trucks Prohibited Signage' example

Where the destination for a truck is within the prohibited zone, and there is no alternative route, trucks are allowed to pass the 'Trucks Prohibited' sign. This means that heavy vehicles accessing the schools, or another site located on Sheraton Road within the prohibited area, can do so under this regulatory signage. Signage will also be required on the Mitchell Highway and Boundary Road to provide drivers advanced warning that trucks are prohibited on the side road.

Council have consulted with appropriate staff at Transport for NSW about the potential for implementing such a regulatory truck signage scheme on Sheraton Road, and Transport for NSW expressed their support, including the installation of signage on the Mitchell Highway.

This scheme on Sheraton Road will not impact the operation of oversize/over mass (OSOM) vehicles, as OSOM vehicles are under permit and are access restricted during school peak times.

If this scheme was to be endorsed by Council, a report would need to be put forward to the Local Traffic Committee for adoption. Consultation would also need to be undertaken with the schools on Sheraton Road and appropriate heavy haulage operators that are likely to be impacted by the scheme.

Conclusions and Recommendations

The WaySafe Road Safety Audit reported a number of high risk road safety findings for the proposed Blueridge haulage route, some of which are either difficult to mitigate or very costly. Whilst the Sheraton Road safety audit also reported a number of high risk findings, those findings can be mitigated through the design and reconstruction of Sheraton Road, which is already programmed to occur and is included in Council's forward budget. As outlined earlier, the safety issues associated with heavy vehicles on Sheraton Road during peak hours can be mitigated through the implementation of regulatory truck signage.

It is therefore recommended that Sheraton Road (from Boundary Road to the Mitchell Highway) be adopted as the primary haulage route outside of peak school times, and that regulatory truck signage be installed to prohibit trucks on Sheraton Road during peak school times. It is also recommended that Council allow heavy haulage vehicles to utilise Boundary Road and Wheelers Lane during peak school times.

If Council receives funding under stream two of the Regional Precincts and Partnership Program for the construction of stages 1 and 2 of the Southern Distributor Road, it is recommended that Council adopt the Blueridge Haulage Route for haulage trucks **only** during peak school drop off and pick up times. Council will work with the three heavy industry developments on Sheraton Road, to ensure right turns at the seagull intersection are prohibited in their driver code of conduct. Heavy vehicles travelling to Wellington will be required to undertake a left turn at the seagull intersection and then proceed to carry out a U-turn at the Sheraton Road/Wellington Road roundabout. A reduction in the total number of heavy vehicles at the seagull intersection, as well as the restriction of right turn movements will significantly reduce the risk of incidents occurring at this intersection.

If Council is unsuccessful in obtaining funding under stream two of the Regional Precincts and Partnership Program, it is recommended that Council commit to progressing the design of the long term Southern Distributor alignment, including the design of the intersection at the Mitchell Highway. Council will continue to seek future funding opportunities once designs are completed and shovel ready, giving Council a greater chance of successfully receiving funding.

Consultation

Council consulted with owners and businesses within the Blueridge Business Park about the proposed construction of the Blueridge Link Road Stage 1, including the adoption of a haulage route through Blueridge Estate to the Mitchell Highway via Capital Drive and Blueridge Drive. Information about the project was provided on Council's Your Say page. Council also sent out letters to businesses and owners and carried out a physical letter box drop prior to information sessions that were conducted by Council staff at the Devils Hollow Brewery on 30 August 2023. Council's Engagement Team followed up with phone calls to all businesses within Blueridge prior to the information sessions, ensuring they had every opportunity to attend the sessions and provide feedback.

Two information sessions were held on 30 August 2023, including one from 11 am to 1 pm and the other from 5 pm to 6 pm. Council encouraged businesses and owners to provide written submissions addressed to Council, or electronic submissions on Council's Your Say page or via email. Submissions closed on 28 September 2023.

A total of 19 electronic submissions were received from businesses and owners within the Blueridge Estate. The majority of businesses and owners supported the proposed long term (stage 2) route however, they were not supportive of the proposal for an interim haulage route to be adopted through Blueridge Estate via the stage 1 route. A summary of concerns are provided below:

1. There is no guarantee or timeframe for funding or delivering stage 2 of the Southern Distributor, meaning that trucks could be utilising the interim haulage route through Blueridge Estate for an extended time period.
2. Concern for safety of the two early childhood centres located on the proposed haulage route, including drop off and pick up activities carried out in the morning and afternoon.
3. Concern for the safety of children when the Dubbo Early Learning Centre conducts excursions for children along the proposed haulage route alignment.
4. Concern about adding to the congestion of traffic on Blueridge Drive at the Mitchell Highway during peak traffic times.
5. Concern that the adoption of the proposed haulage route through Blueridge will reduce the amenity of Blueridge Estate, resulting in the devaluation of properties and loss of rental income.
6. Concern that a vehicle may breach the boundary of Imagine Childcare Centre when exiting the roundabout located at the intersection of Blueridge Drive and Commercial Avenue
7. Environmental impact of proposed haulage route, including noise and air pollution.
8. Lack of traffic studies to assess capacity of the road network and key intersections to accommodate the increase in traffic.
9. Concern about sight line issues at certain locations on the proposed haulage route and the manoeuvrability of heavy vehicles along the route.

Following consultation carried out in August and September 2023, Council engaged SCT Consulting to prepare a high level assessment of the haulage options considered in South East Dubbo (as detailed earlier in this report), including a traffic capacity assessment for the options proposed. Council staff also carried out a survey of the drop off and pick up activities on two separate days at the Dubbo Early Learning Centre to better understand how these activities interact with the Blueridge Road environment. On 15 February 2024, Council resolved to submit an application for funding the construction of the Southern Distributor Road (stage 1 and 2) through stream two of the Regional Precincts and Partnership Program. The results of that application are still pending.

Council staff conducted a second round of information sessions at the Devils Hollow Brewery, one at lunch time and another in the evening on 10 April 2024. The purpose of these sessions was to provide an update on the progress of the project, including the various actions (outlined above) carried out by Council following the first session. The overall sentiment from the second round of information sessions was that the Blueridge businesses and owners still strongly oppose the proposal of an interim haulage route through Blueridge Estate to the Mitchell Highway.

Council has also held a number of collaboration group meetings with the four education centres on Sheraton Road including Dubbo Christian School, St Johns College, St Johns Primary and Skillset over the last twelve months. The main agenda for those meetings was to discuss the various road and pedestrian safety concerns on Sheraton Road in the vicinity of the four education centres. One particular focus area for discussion was the number of heavy vehicles travelling on Sheraton Road during school drop off and pick up times.

Other items discussed with the education facilities included pedestrian access from Boundary Road, the condition of Sheraton Road, drainage, secondary pedestrian crossing on Sheraton Road, signage and traffic congestion. A number of these items have been addressed with the installation of a footpath from Boundary Road to the existing footpath on Sheraton Road, drainage works undertaken, major patching works particularly along the two lane section of road south of the schools and amended signage.

Resourcing Implications

The preparation of signage plans, endorsement by the Local Traffic Committee and implementation of regulatory signage on Sheraton Road will be managed internally by the Infrastructure Strategy and Design Team. Cost to implement signage on Sheraton Road will be approximately $5,000 and will be installed by Council signage crews.

Total Financial Implications	Current year ($)	Current year + 1 ($)	Current year + 2 ($)	Current year + 3 ($)	Current year + 4 ($)	Ongoing ($)
a. Operating revenue	0	0	0	0	0	0
b. Operating expenses	5,000	0	0	0	0	0
c. Operating budget impact (a – b)	-5,000	0	0	0	0	0
d. Capital Expenditure	0	0	0	0	0	0
e. Total net impact (c – d)	-5,000	0	0	0	0	0

Does the proposal require ongoing funding?	No
What is the source of this funding?	Infrastructure Strategy and Design – Traffic improvements – Signs and Markings

Table 1. Ongoing Financial Implications

Planned Communications

- Council to undertake further consultation with the schools on Sheraton Road and heavy haulage operators on Sheraton Road.

Next Steps

- Signage plans to be prepared for regulatory truck signage on Sheraton Road.
- Regulatory signage scheme for Sheraton Road to be put forward to the Local Traffic Committee for endorsement.
- Council to consult with the schools on Sheraton Road to advise the new scheme and strategy proposed.
- Council to consult with heavy haulage operators on Sheraton Road to encourage compliance with regulatory scheme proposed for Sheraton Road.

APPENDICES:

1⇩ SCT Consulting Report - South East Dubbo Haulage Routes

2⇩ Capital Drive Dubbo - Temporary Haulage Rout - Road Safety Audit - Stage 6 Existing Road

3⇩ Sheraton Road Dubbo - Temporary Haulage Route - Road Safety Audit - Stage 6 Existing Road

4⇩ Seagull Intersection Layout

SCT Consulting

SOUTH-EAST DUBBO HAULAGE ROUTES

Options Study

22 MARCH 2024

SCT Consulting acknowledges the traditional owners of the lands on which we work.
We pay our respects to Elders past, present and emerging.

Quality Assurance

Project:	South-east Dubbo Haulage Routes		
Project Number:	SCT_00505		
Client:	Dubbo Regional Council	**ABN:**	53 539 070 928
Prepared by:	SCT Consulting PTY. LTD. (SCT Consulting)	**ABN:**	53 612 624 058

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Version	Date	Details
1.0	20 December 2023	Draft for review
2.0	28 February 2024	Updated draft report
3.0	19 March 2024	Final report
4.0	22 March 2024	Updated final report

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Executive Summary

Background

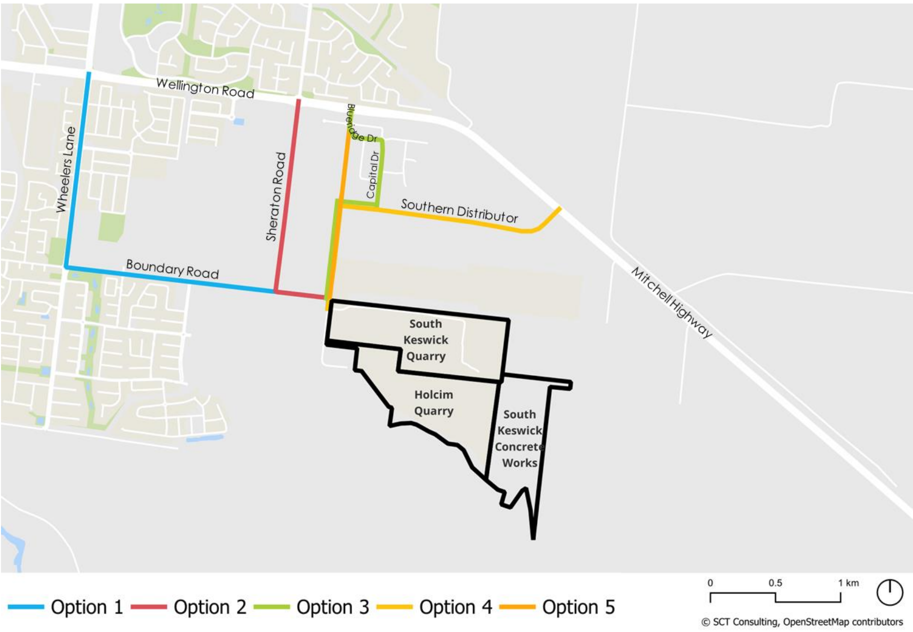
Currently, industrial sites in south-east Dubbo are hauling their material along existing roads, such as Sheraton Road, Boundary Road and Wheelers Lane, to access the Mitchell Highway. Concern around this routing has been expressed by the local community, especially around mixing of haulage vehicles with school traffic (St Johns Primary, St Johns College, Skillset High School and Dubbo Christian School) during drop-off and pick-up times along Sheraton Road. Haulage vehicles are also currently travelling on roads that were not designed and constructed for the heavy vehicle loadings that they are carrying. The industrial sites are forecast to increase their production, and therefore their haulage demand, over the next few years.

Purpose of study

This options study was undertaken to provide an assessment of potential haulage options, with a specific focus on the impacts on intersection performance, to inform Dubbo Regional Council in the development of a haulage strategy for this part of Dubbo.

A total of five haulage route options, presented in **Figure ES-1**, were assessed. These consisted of two existing routes and three future route options.

Figure ES-1 Existing and future haulage route options



Road network performance

A review of the performance of the intersections on the haulage route options was undertaken to gain an understanding of the existing and future capacity of the intersections and the likely impacts of future use of the haulage route options.

The results of the intersection modelling indicate that, except for the Wellington Road / Wheelers Lane roundabout, the intersections are forecast to still perform at a good level of service in the 2036 AM and PM peak hours. At the Wellington Road / Wheelers Lane roundabout, the growth in background traffic by 2036 is forecast to exceed the capacity of the roundabout and future upgrades may be required, irrespective of which haulage route option is chosen.

The route option modelling indicated that the different route options do not have a significant impact on the overall intersection performance, and that, aside from the Wellington Road / Wheelers Lane roundabout, the intersections have spare capacity to accommodate the industrial site traffic. The main impact is on the delay and queue length on the southern leg of the Wellington Road / Wheelers Lane roundabout in the AM peak hour for haulage route Option 1.

The traffic assessment is considered a worst-case scenario, as some quarry and cement trucks would serve local construction demand for the Southlakes sub-division development. Local deliveries would be taken via Boundary Road if the destination is south of Boundary Road and therefore reduce truck volumes on routes to Wellington Road.

Crash data from 2017 to 2021 was analysed to determine if any safety issues exist at the intersections. No fatal crashes occurred at any of the intersections over this five-year period. The intersection with the highest number of crashes was the Wellington Road / Wheelers Lane with 6 injury crashes and 1 non-injury crash, a significantly higher number than the other intersections. Other intersections had between zero and one crash occurring during the five-year period.

Multi-criteria assessment

A multi-criteria assessment (MCA) of the options was undertaken using criteria such as land use, social, community or stakeholder impacts, noise and air quality implications, traffic impacts, travel time impacts, engineering and pavement considerations, construction cost, including upgrades to existing road network and utilities impacts, ease of construction / program and suitability as a long-term haulage route.

Based on the analysis and MCA undertaken, the best performing option in the short term is **Option 3** (along new Blueridge Link Road, left into Capital Drive, left into Blueridge Drive and onto the highway at the Wellington Road / Blueridge Drive seagull intersection).

- It performs best or equal best against 5 of the 8 assessment criteria.
- The criteria that it performs equal worst against is noise and air quality due to the route generating new impacts. However, the noise and air quality impacts would be confined to land that is zoned as industrial, compared to other options, which currently impact residential zoned land.

In the longer term, **Option 4** (along new Blueridge Link Road, onto new Southern Distributor Road, onto the highway at a new Mitchell Highway / Southern Distributor intersection) would be the most appropriate haulage route as recognised in the Blueridge Business Park Road and Haulage Strategy and the draft Blueridge Precinct DCP (2023).

1.0 Introduction

1.1 Background

Currently, industrial sites in south-east Dubbo, indicated on **Figure 1-1**, are hauling their material along existing roads, such as Sheraton Road, Boundary Road and Wheelers Lane, to access the Mitchell Highway. Concern around this routing has been expressed by the local community, especially around mixing of haulage vehicles with school traffic (St Johns Primary, St Johns College, Skillset High School and Dubbo Christian School) during drop-off and pick-up times along Sheraton Road.

The haulage vehicles are also currently travelling on roads that were not designed and constructed for the heavy vehicle loadings that they are carrying. The industrial sites are forecast to increase their production, and therefore their haulage demand, over the next few years.

A Road and Haulage Strategy is being developed by Dubbo Regional Council (Council) for the Blueridge Business Park, which includes Stage 1 of the Blueridge Link Road (Southern Distributor), as shown in **Figure 1-2**. The Stage 1 alignment was adopted by Council in November 2022. Also shown on the figure, Stage 2 of the Southern Distributor is planned to be constructed in the future when required to support traffic generated by future developments.

Figure 1-1 Context of south-east Dubbo industrial sites

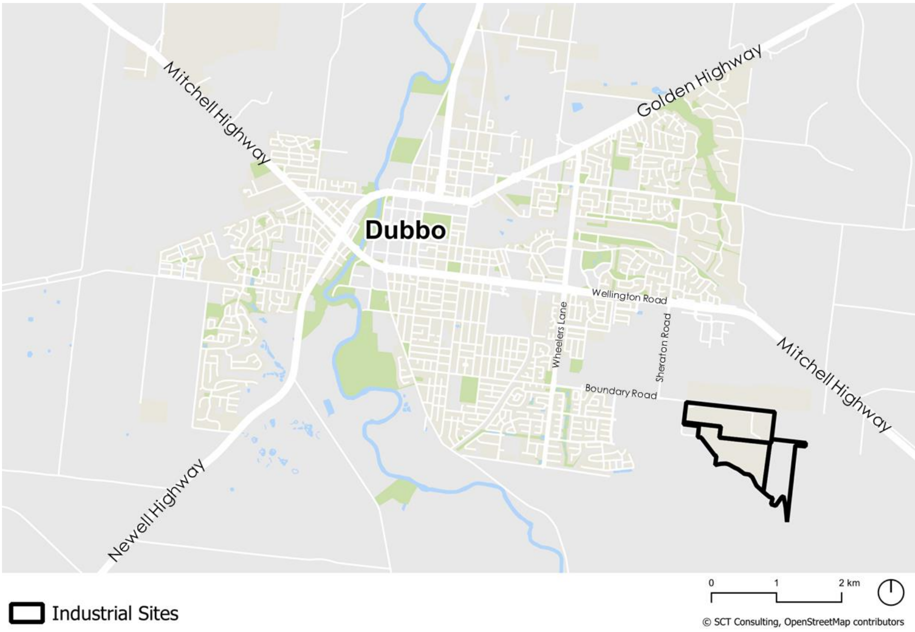
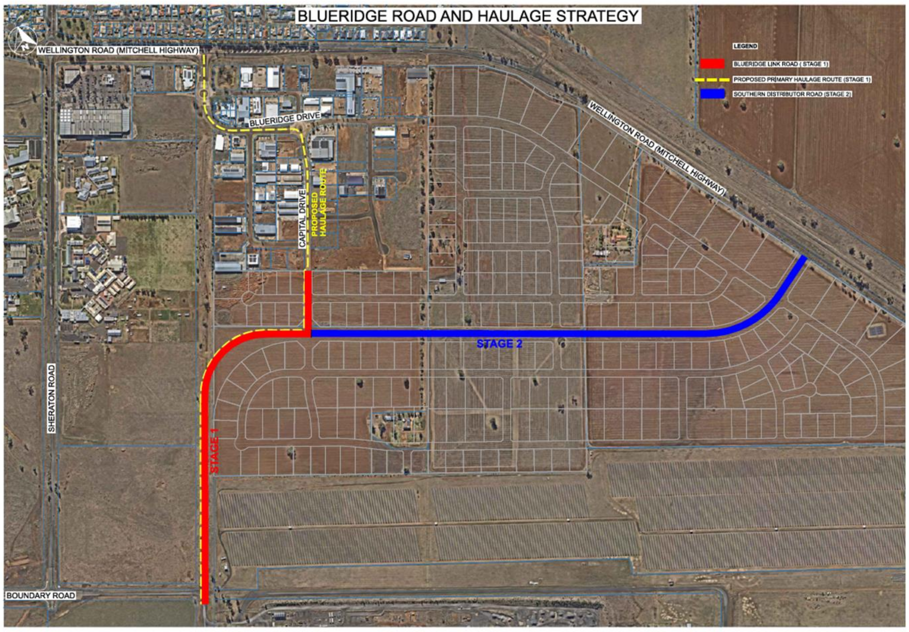


Figure 1-2 Blueridge Link Road (Southern Distributor)



Source: https://yoursay.dubbo.nsw.gov.au/blueridge-business-park-road-and-haulage-strategy

1.2 Purpose and report structure

The use and staging of the haulage routes in and out of the area is still to be confirmed. This options study was undertaken to provide an assessment of the potential haulage options, with a specific focus on the impacts on intersection performance, to inform Council in the development of a haulage strategy for this part of Dubbo.

The study has reviewed the following, which forms the structure of the report:

- **Chapter 2** provides a summary of the existing and future haulage demand.
- **Chapter 3** presents the existing and future route options.
- **Chapter 4** discusses the existing and future road network performance, including intersection performance and road safety.
- **Chapter 5** presents a high-level multi-criteria analysis of the options.
- **Chapter 6** provides a summary of the study conclusions.

2.0 Haulage demand

A review of the existing and future haulage traffic from the three industrial sites in south-east Dubbo, namely South Keswick Quarry, South Keswick Concrete Works and the Holcim Quarry, was undertaken.

2.1 Existing demand

Table 2-1 presents the currently maximum allowable heavy vehicle traffic from the three sites, based on a review of the planning approvals.

Table 2-1 Existing approved haulage traffic generated by the three sites

Sites	Daily truck movements	Peak hour truck movements
South Keswick Quarry (495k tpa*)	220	20
South Keswick Concrete Works (250 tpa)	170	11
Holcim Quarry (500 tpa) – on peak days	242	40
Total	**632**	**71**

*tpa = tonnes per annum

2.2 Future demand

Table 2-2 presents the forecast allowable heavy vehicle traffic from the three sites, based on a review of the current planning approvals. There may be further applications for increase in production volumes in the future, so these should not be taken as the maximum heavy traffic volumes that may be generated by the sites in the long term.

Table 2-2 Future haulage traffic generated by the three sites

Sites	Daily truck movements	Peak hour truck movements
South Keswick Quarry (application to increase from 495k tpa to 750k tpa*)	300	20
South Keswick Concrete Works (no change)	170	11
Holcim Quarry (no change) – on peak days	242	40
Total	**712**	**71**

*Note: This is based on the Scoping Report, and is not yet approved

3.0 Haulage routes

This section presents the existing and potential future haulage route options. The existing roads that could be used on the route options are:

– **Mitchell Highway**: A State Road, the highway forms part of the National Land Transport Network (a network of nationally important road and rail infrastructure links and their intermodal connections) and is the major east-west route through Dubbo. The highway is called Wellington Road in this part of Dubbo, and it generally has a two-way, four-lane divided configuration with a posted speed limit of 70km/h. This becomes 60km/h about 500m east of Wheelers Lane and becomes 110km/h about 270m east of Blueridge Drive.

– **Wheelers Lane**: A local road with a posted speed limit of 60km/h. The road has a two-way, four-lane undivided configuration and primarily provides residential access to Wellington Road. It connects to Wellington Road via a roundabout with two circulating lanes.

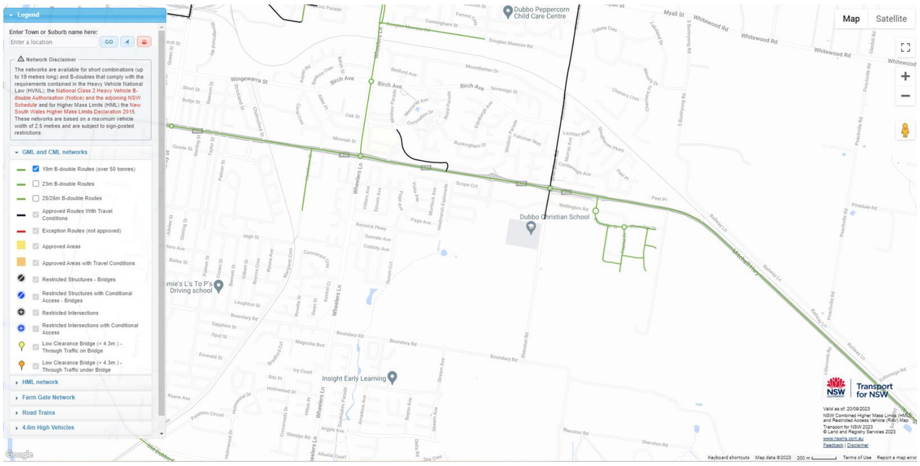
– **Boundary Road**: A local road with a posted speed limit of 60km/h. The road has a two-way, two-lane divided configuration and primarily provides for residential access. It connects to Wheelers Lane via a roundabout with two circulating lanes. While Boundary Road was recently constructed by Council from Wheelers Lane to Sheraton Road and is therefore a new pavement, the Boundary Road pavement was not designed for a haulage route, and a further review would be required to determine if the pavement has adequate strength to cater for the additional loading and whether an upgrade would be warranted.

– **Sheraton Road**: A local road with a posted speed limit of 60km/h, it has a 40mk/h school zone operating at the northern end providing access to St Johns Primary School, St Johns College, Skillset High School and Dubbo Christian School, and has a two-way, four-lane divided configuration. South of the schools, the road continues as a two-way, two-lane undivided configuration connecting to Boundary Road at its southern end. It connects to Wellington Road via a roundabout with two circulating lanes.

– **Blueridge Drive**: A local road, which is built to industrial standards, Blueridge Drive has a varied cross-section configuration. It provides access for businesses in the Blueridge Business Park to Wellington Road and connects to Wellington Road via an urban seagull give-way controlled intersection.

As shown in **Figure 3-1**, the Mitchell Highway (Wellington Road) and the roads within the Blueridge Business Park, including Blueridge Drive, are all Restricted Access Vehicle (RAV) approved routes. Other existing or potential future haulage routes are not RAV approved routes.

Figure 3-1 Restricted Access Vehicle (RAV) route map – 19m B-double routes



Source: TfNSW, 2023

3.1 Existing routes

The following two routes are currently used by haulage vehicles to access the Mitchell Highway (Wellington Road):

– Option 1 – along Boundary Road, right into Wheelers Lane and onto the highway at the Wellington Road / Wheelers Lane roundabout (shown in blue in **Figure 3-2**).

– Option 2 – along Sheraton Road and onto the highway at the Wellington Road / Sheraton Road roundabout (shown in red in **Figure 3-2**).

3.2 Future route options

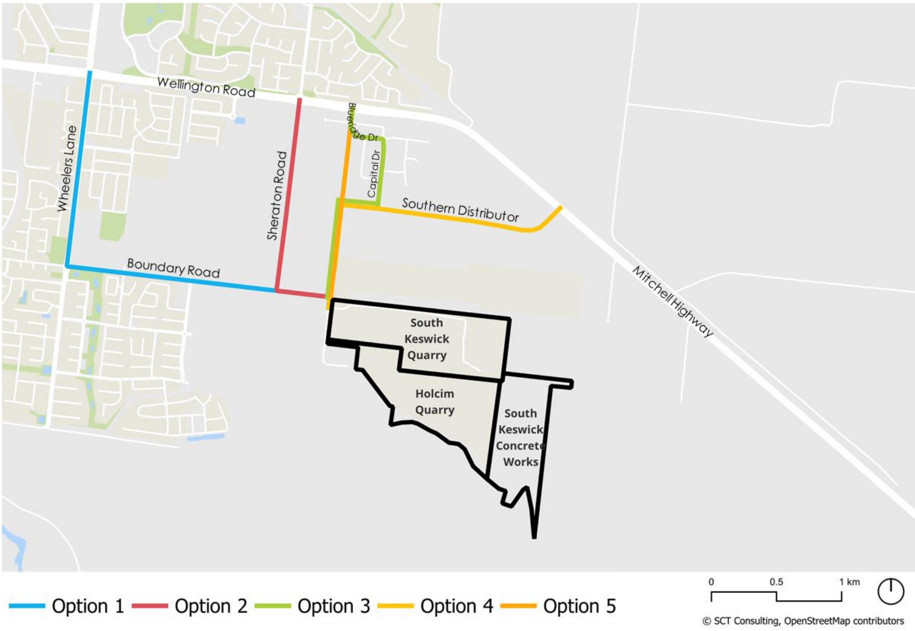
The following three route options could be used by haulage vehicles to access the Mitchell Highway (Wellington Road) in the future:

– Option 3 – along new Blueridge Link Road, left into Capital Drive, left into Blueridge Drive and onto the highway at the Wellington Road / Blueridge Drive seagull intersection (shown in green in **Figure 3-2**).

– Option 4 – along new Blueridge Link Road, onto new Southern Distributor Road, onto the highway at a new Mitchell Highway / Southern Distributor intersection (shown in green and yellow in **Figure 3-2**).

– Option 5 – new road along drainage channel alignment, linking into Blueridge Drive and onto the highway at the Wellington Road / Blueridge Drive seagull intersection (shown in orange in **Figure 3-2**).

Figure 3-2 Existing and future haulage route options



3.3 Initial review of route options

An initial review of the route options highlighting the main advantages and disadvantages was undertaken and is summarised in **Table 3-1**.

Table 3-1 Initial review of route options

Haulage route options	Advantages	Disadvantages
Option 1 (Boundary Road + Wheelers Lane)	– Avoids the schools precinct on Sheraton Road.	– Runs through a residential zoned area, including two existing early learning centres on Wheelers Lane. – Proposed night-time quarry operations would be a significant noise issue for residents living adjacent to these roads. – Requires significant pavement upgrade on Wheelers Lane – the pavement is already poor. Significant cost to upgrade. – Impacts on the Wheelers Lane / Wellington Road roundabout performance.
Option 2 (Sheraton Road)	– Although zoned residential, there is no existing residential development adjacent to Sheraton Road.	– Runs through a residential zoned area and schools precinct. – Proposed night-time quarry operations could be a significant noise issue for residents living adjacent to the road in the future. – Heavy industry operations are restricted, as sites are conditioned not to operate during school peak times. This can be hard to enforce, as the condition does not apply to customers for the quarry and therefore some truck and dog traffic still use Sheraton Road during school times. – Sheraton Road is not designed to cater for heavy haulage traffic. Requires significant pavement upgrade – the pavement is already poor. Significant cost to upgrade.
Option 3 (Blueridge Link Road + Capital Drive + Blueridge Drive)	– Avoids the schools precinct on Sheraton Road and residential area along Boundary Road and Wheelers Lane. Compatible with zoned industrial land use. – Capital Drive and Blueridge Drive have pavement design to support heavy vehicles.	– Impacts on existing businesses in Blueridge Business Park, including two existing early learning centres. – Impacts on Blueridge Drive / Wellington Road seagull intersection performance. – Significant cost of new road construction.
Option 4 (Blueridge Link Road + Southern Distributor Road)	– Avoids the schools precinct on Sheraton Road. Compatible with zoned industrial land use. – Roads would have pavement design to support heavy vehicles.	– Significant cost of new road construction – New intersection on the highway, which would introduce new conflicting traffic movements.
Option 5 (New road + Blueridge Drive)	– Avoids the schools precinct on Sheraton Road, though does run along the back of the school playing fields. Compatible with zoned industrial land use. – New road would have pavement design to support heavy vehicles	– Significant cost of new road construction and need for augmenting existing drainage channel on the alignment. – Impacts on some businesses at the northern end of Blueridge Business Park, including one existing early learning centre. – Impacts on Blueridge Drive / Wellington Road seagull intersection performance.

4.0 Road network performance

4.1 Intersection performance

A review of the performance of the intersections on the haulage route options was undertaken to gain an understanding of the existing and future capacity of the intersections and the likely impacts of future use of the haulage route options.

The following intersections were reviewed to inform the options assessment:

– Sheraton Road /Boundary Road roundabout

– Wheelers Lane / Boundary Road roundabout

– Wellington Road / Wheelers Lane roundabout.

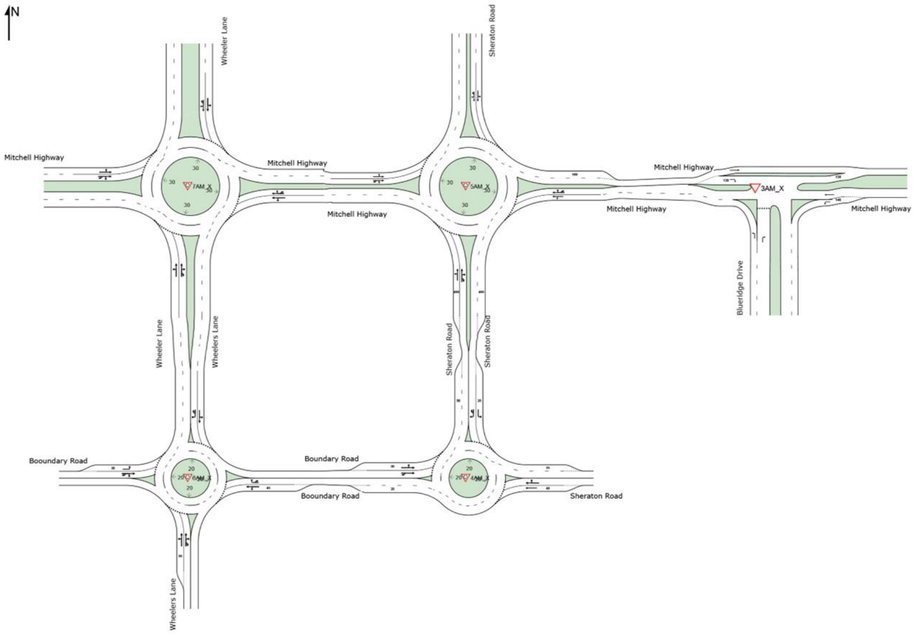
– Wellington Road / Sheraton Road roundabout

– Wellington Road / Blueridge Drive seagull intersection.

4.1.1 Existing intersection performance

Traffic data was sourced from publicly available reports and baselined to 2023, using a two per cent per annum growth factor, and the intersections were modelled in SIDRA. The SIDRA network layout is illustrated in **Figure 4-1**.

Figure 4-1 Intersection network layout in SIDRA



Intersection performance is typically assessed based on the average delay of vehicles. The average delay relates to a Level of Service (LoS) index, which characterises the intersection's operational performance, as seen in **Table 4-1**.

Intersection performance is also measured using the degree of saturation (DoS), which is a measure of the spare capacity of each intersection. A degree of DoS greater than 1.0 implies that the turning movement is at capacity and not acceptable.

For priority and roundabout intersections, the DoS, delay and LoS for the worst performing movement is reported.

Table 4-1 Level of Service Categories

Level of Service	Average delay per vehicle (seconds)	Performance explanation
A	Less than 14.5	Good operation
B	14.5 to 28.4	Good with acceptable delays and spare capacity
C	28.5 to 42.4	Satisfactory
D	42.5 to 56.4	Operating near capacity
E	56.5 to 70.4	At capacity. At signals, incidents will cause excessive delays. Roundabouts require other control method.
F	70.5 or greater	At capacity. At signals incidents will cause excessive delays. Roundabouts require other control method.

Source: Guide to Traffic Generating Development, TfNSW

The performances of the intersections in the 2023 AM and PM peak hours are presented in **Table 4-2**.

The results illustrate that the intersections are currently performing at a good level of service. The DoS at the Wellington Road / Wheelers Lane roundabout is higher than the other intersections, especially in the PM peak hour, indicating that it is starting to approach capacity during this peak hour.

There is traffic congestion observed at school drop-off and pick-up times, especially at the Wellington Road / Sheraton Road intersection but generally this is fairly short-lived (about 15 minutes). SIDRA is an analytical traffic modelling software that provides metrics that represent the average performance over the peak one-hour period. While short increases in delays and lower levels of service are incorporated into this average delay over the one-hour period, SIDRA does not model and report these spikes in delay.

Table 4-2 Existing level of service (2023)

Intersection	AM peak hour				PM peak hour			
	Total throughput	DoS	Delay (s)	LoS	Total throughput	DoS	Delay (s)	LoS
Sheraton Road / Boundary Road	408	0.144	10.3	A	345	0.114	10.3	A
Wheelers Lane / Boundary Road	1,488	0.253	10.7	A	1,392	0.275	12.8	A
Wellington Road / Wheelers Lane	3,451	0.684	16.6	B	3,475	0.783	25.0	B
Wellington Road / Sheraton Road	2,653	0.472	15.8	B	2,477	0.506	14.9	B
Wellington Road / Blueridge Drive	1,215	0.203	8.0	A	1,181	0.178	7.6	A

4.1.2 Future intersection performance

For the future intersection performance, the 2023 traffic volumes were grown to 2036, using a two per cent per annum growth factor.

4.1.2.1 Existing haulage routes – 2036 intersection performance

For this scenario, no changes in haulage routing were made and the intersections were remodelled in SIDRA to provide a future year baseline against which to measure the other options. The performances of the intersections in the 2036 AM and PM peak hours are presented in **Table 4-3**.

The results illustrate that, except for the Wellington Road / Wheelers Lane roundabout, the intersections are forecast to still perform at a good level of service. At the Wellington Road / Wheelers Lane roundabout, the growth in background traffic by 2036 is forecast to exceed the capacity of the roundabout and future upgrades may be required, irrespective of which haulage route option is chosen.

Table 4-3 Future level of service (2036) – Existing haulage routes

Intersection	AM peak hour				PM peak hour			
	Total throughput	DoS	Delay (s)	LoS	Total throughput	DoS	Delay (s)	LoS
Sheraton Road / Boundary Road	557	0.194	10.8	A	480	0.151	11.0	A
Wheelers Lane / Boundary Road	1,933	0.359	11.5	A	1,804	0.373	14.1	A
Wellington Road / Wheelers Lane	4,485	1.097	121.0	F	4,517	1.482	460.8	F
Wellington Road / Sheraton Road	3,459	0.751	25.4	B	3,231	0.762	21.1	B
Wellington Road / Blueridge Drive	1,580	0.302	9.2	A	1,536	0.231	7.9	A

4.1.2.2 Option 1 – 2036 intersection performance

For haulage route option 1, all the industrial site traffic was reallocated to use Boundary Road and Wheelers Lane. The performances of the intersections in the 2036 AM and PM peak hours are presented in **Table 4-4**.

Table 4-4 Future level of service (2036) – Haulage route option 1

Intersection	AM peak hour				PM peak hour			
	Total throughput	DoS	Delay (s)	LoS	Total throughput	DoS	Delay (s)	LoS
Sheraton Road / Boundary Road	586	0.196	10.9	A	508	0.165	11.2	A
Wheelers Lane / Boundary Road	1,988	0.366	12.0	A	1,861	0.411	15.1	A
Wellington Road / Wheelers Lane	4,510	1.137	153.5	F	4,542	1.500	477.2	F
Wellington Road / Sheraton Road	3,446	0.751	24.9	B	3,225	0.762	20.5	A
Wellington Road / Blueridge Drive	1,573	0.298	9.1	A	1,532	0.231	7.9	A

As noted above, the Wellington Road / Wheelers Lane roundabout is forecast to be overcapacity in 2036. In the AM peak period, the worst forecast queue is on the southern leg of Wheelers Lane. Haulage route option 1 adds more traffic to this southern leg in the morning and is forecast to extend the queue from about 400m to about 500m. The other intersections are forecast to still perform at a good level of service.

4.1.2.3 Option 2 – 2036 intersection performance

For haulage route option 2, all the industrial site traffic was reallocated to use Sheraton Road. The performances of the intersections in the 2036 AM and PM peak hours are presented in **Table 4-5**.

As before, except for the Wellington Road / Wheelers Lane roundabout, the intersections are forecast to still perform at a good level of service. The impact on the Wellington Road / Sheraton Road intersection is forecast to be small.

Table 4-5 Future level of service (2036) – Haulage route option 2

Intersection	AM peak hour				PM peak hour			
	Total throughput	DoS	Delay (s)	LoS	Total throughput	DoS	Delay (s)	LoS
Sheraton Road / Boundary Road	561	0.196	10.9	A	480	0.148	11.1	A
Wheelers Lane / Boundary Road	1,925	0.358	11.5	A	1,801	0.375	13.8	A
Wellington Road / Wheelers Lane	4,483	1.093	118.5	F	4,515	1.481	461.4	F
Wellington Road / Sheraton Road	3,466	0.754	25.6	B	3,238	0.768	21.4	B
Wellington Road / Blueridge Drive	1,580	0.302	9.2	A	1,536	0.231	7.9	A

4.1.2.4 Option 3/5 – 2036 intersection performance

For haulage route option 3, all the industrial site traffic was reallocated to use Blueridge Link Road, Capital Drive and Blueridge Drive to access Wellington Road. For haulage route option 5, all the industrial site traffic was reallocated to use a new north-south road that connects to Blueridge Drive, south of Wellington Road. Therefore, from an intersection performance perspective, the main impact of both option 3 and option 5 would at the same intersection – the Wellington Road / Blueridge Drive seagull. The performances of the intersections in the 2036 AM and PM peak hours are presented in **Table 4-6**.

As before, except for the Wellington Road / Wheelers Lane roundabout, the intersections are forecast to still perform at a good level of service. The impact on the Wellington Road / Blueridge Drive intersection is forecast to be quite small. There is only minor queuing forecast on the Blueridge Drive approach to the intersection and it is not forecast to extend back to the roundabout 80m south of the intersection.

Table 4-6 Future level of service (2036) – Haulage route option 3/5

Intersection	AM peak hour				PM peak hour			
	Total throughput	DoS	Delay (s)	LoS	Total throughput	DoS	Delay (s)	LoS
Sheraton Road / Boundary Road	522	0.196	11.3	A	449	0.148	11.2	A
Wheelers Lane / Boundary Road	1,924	0.357	11.5	A	1,802	0.374	13.8	A
Wellington Road / Wheelers Lane	4,478	1.090	116.3	F	4,518	1.476	455.6	F
Wellington Road / Sheraton Road	3,441	0.754	25.5	B	3,224	0.755	20.4	B
Wellington Road / Blueridge Drive	1,621	0.324	11.1	A	1,593	0.252	8.2	A

4.1.2.4.1 *Wellington Road / Blueridge Drive intersection – sensitivity test*

A sensitivity test was undertaken that assessed the available capacity of the Wellington Road / Blueridge Drive intersection in the AM peak hour with the further development of the Blueridge Estate.

The intersection is forecast to operate at or near capacity with about 1,100 additional vehicles from the Blueridge Estate area in the AM peak hour, assuming the same mix of light and heavy vehicles as existing. This equates to 680 vehicles in and 420 vehicles out in the AM peak hour.

Based on the trip generation rates from the Blueridge East Business Park TIA (Intersect Traffic, August 2023), the 1,100 vehicles would equate to about 45.3 ha of development. From the draft Blueridge Precinct Development Control Plan (DCP) (2023) and aerial imagery (Nov 2023), it is estimated that about 35 ha remains to be developed within Stage 1 of the precinct (equating to about 850 vehicles per hour), meaning the Blueridge Drive intersection would have spare capacity after completion of Stage 1 of the precinct.

SIDRA modelling indicates that this spare capacity could accommodate an extra 95 truck movements from the three quarries, in addition to the current truck movements per hour. This would accommodate additional growth in haulage demand from the three industrial sites.

4.1.2.5 Option 4 – 2036 intersection performance

For haulage route option 4, all the industrial site traffic would be allocated to a new link, the Southern Distributor, which would connect to the Mitchell Highway at a new intersection.

The configuration of this new intersection would depend on the staged development of the Blueridge Industrial Estate and the land connecting to the new road. Modelling would be undertaken once this information was known, and the intersection layout designed to accommodate the forecast demand and perform at a good level of service. Modelling has therefore not been undertaken as part of this study.

The rerouting of the industrial site traffic would mean that any trucks would remain on the Mitchell Highway, once connecting along the Southern Distributor, and not use the local road network.

4.1.3 Summary of intersection performance

Table 4-7 presents a summary of the level of service at each modelled intersection for the haulage route options. This indicates that the different options do not have a significant impact on the overall intersection performance, and that, aside from the Wellington Road / Wheelers Lane roundabout, the intersections have spare capacity to accommodate the industrial site traffic. The main impact is on the delay and queue length on the southern leg of the Wellington Road / Wheelers Lane roundabout in the AM peak hour for haulage route option 1.

This assessment is considered a worst-case scenario, as some quarry and cement trucks would serve local construction demand for the Southlakes sub-division development. Local deliveries would be taken via Boundary Road if the destination is south of Boundary Road and therefore reduce truck volumes on routes to Wellington Road.

Table 4-7 Summary of future levels of service (2036)

Intersection	AM peak hour				PM peak hour			
	Existing routes	Option 1	Option 2	Option 3/5	Existing routes	Option 1	Option 2	Option 3/5
Sheraton Road / Boundary Road	A	A	A	A	A	A	A	A
Wheelers Lane / Boundary Road	A	A	A	A	A	A	A	A
Wellington Road / Wheelers Lane	F	F	F	F	F	F	F	F
Wellington Road / Sheraton Road	B	B	B	B	B	A	B	B
Wellington Road / Blueridge Drive	A	A	A	A	A	A	A	A

4.2 Road safety

Crash data from 2017 to 2021 has been analysed to determine if any safety issues exist at the intersections. These results are presented in **Figure 4-2** and **Table 4-8**.

No fatal crashes occurred at any of the intersections over this five-year period. The intersection with the highest number of crashes was the Wellington Road / Wheelers Lane with 6 injury crashes and 1 non-injury crash, a significantly higher number than the other intersections. Other intersections had between zero and one crash occurring during the five-year period.

Figure 4-2 Crashes in the vicinity of the south-east Dubbo industrial sites (2017-2021)

Source: Transport for NSW

Table 4-8 Crash data 2017-2021

Intersection	Fatal crashes	Injury crashes	Non-injury crashes
Sheraton Road / Boundary Road	0	0	0
Wheelers Lane / Boundary Road	0	1	0
Wellington Road / Wheelers Lane	0	6	1
Wellington Road / Sheraton Road	0	0	0
Wellington Road / Blueridge Drive	0	1	0

Source: Transport for NSW

A review of the acceleration and deceleration lane lengths of the Wellington Road / Blueridge Drive seagull intersection was undertaken and is presented in **Table 4-9**.

Based on the signposted speed limit of 70km/h (design speed of 80km/h), all lane lengths were found to comply with the guidance in Austroads *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*.

Table 4-9 Compliance of lane lengths at Wellington Road / Blueridge Drive seagull intersection

Lane	Existing length (including taper and storage)	Required length from AGRD Part 4A	Compliant?
Right turn deceleration lane into Blueridge Drive	157m	100m	Yes
Left turn deceleration lane into Blueridge Drive	211m	95m	Yes
Acceleration lane into Wellington Road eastbound	245m	220m	Yes

5.0 Assessment of options

5.1 Criteria

The following criteria were selected for use in a multi-criteria assessment (MCA) of the options:

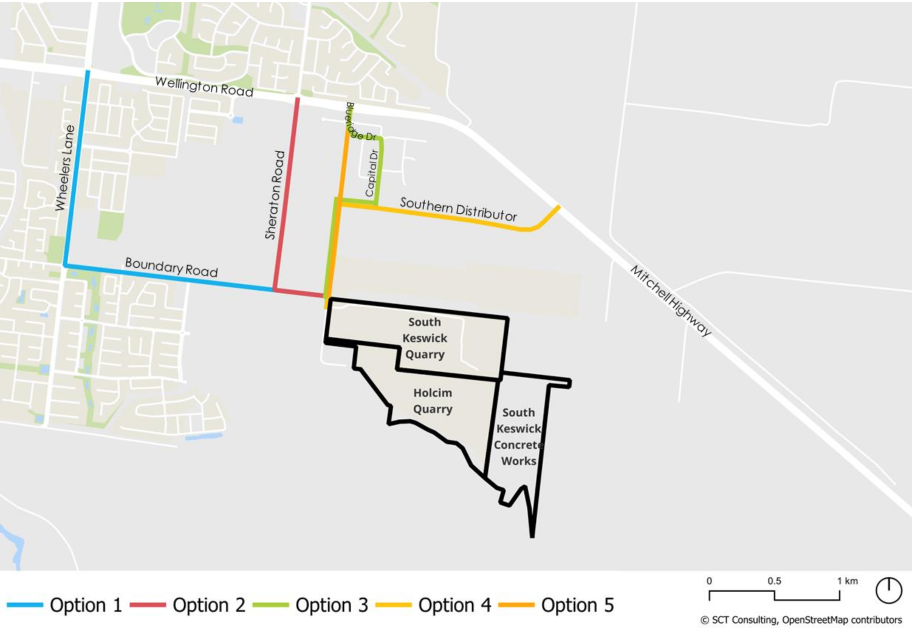
- Land use, social, community or stakeholder impacts – measured as negative impact on the community, primarily from a safety perspective
- Noise and air quality implications – measured as an increase in the noise and air quality impacts from existing traffic volumes
- Traffic impacts – measured as a significant increase in delay
- Travel time impacts – measured as a significant increase in travel time from the sites to their destinations.
- Engineering and pavement considerations – measured as compatibility with road design for heavy vehicles.
- Construction cost, including upgrades to existing road network and utilities impacts – measured as cost required to construct the route to the required standard.
- Ease of construction / program – measured as length or complexity of construction required.
- Suitability as a long-term haulage route – appropriateness for use as a haulage route in the long term.

The following criteria were not considered relevant for this study:

- Environmental / ecological / heritage impacts or constraints – areas were considered to already be highly disturbed, and Council has not identified any heritage issues.

The options are presented again for reference in **Figure 5-1**.

Figure 5-1 Haulage route options assessed



5.2 Assessment

Table 5-1 provides a summary of the assessment of the options using the above criteria.

Table 5-1 Assessment of haulage route options

Criteria / Options	Option 1: Boundary Rd & Wheelers Ln	Option 2: Sheraton Rd	Option 3: Connect to Capital Dr & Blueridge Dr	Option 4: Southern Distributor	Option 5: New road to Blueridge Dr
Land use, social, community or stakeholder impacts					
Noise and air quality implications					
Traffic and safety impacts					
Travel time impacts					
Engineering and pavement considerations					
Construction cost, including upgrades to existing road network and utilities impacts					
Ease of construction / program					
Suitability as a long-term haulage route					

The main reasons for the above assessment were:

– **Land use, social, community or stakeholder impacts**

Options 1 and 2 were considered to have the largest impacts as the routes run through a residential zoned area. While Option 3 and 5 would have some impact, they would run through area zoned as industrial and would therefore have a lower comparative impact. With Option 4, a new road designated in the Blueridge Business Park Road and Haulage Strategy as a haulage route, future developments and businesses would be forewarned about the purpose of the road and therefore impacts would not be rated as high as the others.

– **Noise and air quality implications**

Options 1 and 2 have existing noise and air quality impacts, while Options 3 and 5 would show a larger impact from a lower base. Option 4, as a new road corridor, would be designed to accommodate heavy vehicles (40m wide corridor) and as noted above, future developments and businesses would be forewarned about the purpose of this new road as a haulage route.

– **Traffic and safety impacts**

As noted in section 4.1, Option 1 would cause the largest traffic impact (at the Wellington Road / Wheelers Lane roundabout in the AM peak hour) and the Wellington Road / Wheelers Lane roundabout has the highest number of crashes over past five years. Option 4 introduces a new intersection into the network and would therefore, by default, introduce traffic delays and a safety impact.

- **Travel time impacts**

  The distance travelled by the industrial sites' trucks are similar for all options, except for Option 4, where those trucks travelling to and from the west, the main destination for the haulage trucks, have more of a significant detour to the east to the new Mitchell Highway intersection before travelling back west. This would likely incur an additional 2 minutes of travel time on an existing travel time of about 3 minute 30 seconds. While not the main destination direction, there would be travel time savings for haulage traffic to and from the east.

- **Engineering and pavement considerations**

  Option 3, 4 and 5 have roads that are, or would be, designed to industrial standards and so perform better compared to Options 1 and 2, which are already showing pavement degradation.

- **Construction cost, including upgrades to existing road network and utilities impacts**

  Preliminary cost estimates were produced by Council for each of the options. Estimated quantities were based on preliminary assessments and concept plans. Rates were estimated based on available previous project data and assumptions, and the cost estimates include a 25% contingency. A summary of the cost estimates for the options is provided in **Table 5-2**. Based on these estimates, Option 3 is forecast to cost the least and so performs the best against this criterion.

Table 5-2 Preliminary cost estimates

Haulage route options	Preliminary cost estimate
Option 1 (Boundary Road + Wheelers Lane)	$16,922,763
Option 2 (Sheraton Road)	$13,850,328
Option 3 (Blueridge Link Road + Capital Drive + Blueridge Drive)	$10,391,878
Option 4 (Blueridge Link Road + Southern Distributor Road)	$25,323,191
Option 5 (New road + Blueridge Drive)	$17,972,658

Source: Dubbo Regional Council, 27 February 2024

- **Ease of construction / program**

  Options 3 and 4 would be able to be constructed offline without having to accommodate existing traffic operations, and so would have an easier construction program.

- **Suitability as a long-term haulage route**

  Option 1 and 2 are not designed to industrial standards, while Option 3 and 5 may present conflicts with existing business park traffic during the AM and PM peak periods. In the long term, Option 4 provides the most suitable route for haulage traffic.

5.3 Conclusions

Based on the analysis and MCA undertaken, the best performing option in the short term is **Option 3** (along new Blueridge Link Road, left into Capital Drive, left into Blueridge Drive and onto the highway at the Wellington Road / Blueridge Drive seagull intersection).

- It performs best or equal best against 5 of the 8 assessment criteria.
- The criteria that it performs equal worst against is noise and air quality due to the route generating new impacts. However, the noise and air quality impacts would be confined to land that is zoned as industrial, compared to Options 1 and 2, which currently impact residential zoned land.

In the longer term, **Option 4** (along new Blueridge Link Road, onto new Southern Distributor Road, onto the highway at a new Mitchell Highway / Southern Distributor intersection) would be the most appropriate haulage route as recognised in the Blueridge Business Park Road and Haulage Strategy and the draft Blueridge Precinct DCP (2023).

APPENDIX A

SIDRA MODELLING RESULTS

MOVEMENT SUMMARY

Site: 4AM_X [SHE_BOU_23_AM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	10	44.0	10	44.0	0.025	5.6	LOS A	0.1	1.2	0.30	0.47	0.30	52.0
6	R2	All MCs	20	68.4	20	68.4	0.025	10.3	LOS A	0.1	1.2	0.28	0.56	0.28	48.5
Approach			30	60.6	30	60.6	0.025	8.8	LOS A	0.1	1.2	0.29	0.54	0.29	49.6
North: Sheraton Road															
7	L2	All MCs	31	65.5	31	65.5	0.039	4.8	LOS A	0.2	1.7	0.07	0.48	0.07	52.3
9	R2	All MCs	116	1.9	116	1.9	0.077	8.8	LOS A	0.3	2.4	0.05	0.64	0.05	50.7
9u	U	All MCs	5	0.0	5	0.0	0.077	10.9	LOS A	0.3	2.4	0.05	0.64	0.05	50.8
Approach			152	14.8	152	14.8	0.077	8.0	LOS A	0.3	2.4	0.06	0.61	0.06	51.0
West: Boundary Road															
10	L2	All MCs	217	1.5	217	1.5	0.144	4.3	LOS A	0.6	4.6	0.11	0.47	0.11	54.2
11	T1	All MCs	6	16.7	6	16.7	0.010	4.5	LOS A	0.0	0.3	0.13	0.49	0.13	52.9
12u	U	All MCs	2	0.0	2	0.0	0.010	11.1	LOS A	0.0	0.3	0.13	0.49	0.13	52.4
Approach			225	1.9	225	1.9	0.144	4.4	LOS A	0.6	4.6	0.11	0.47	0.11	54.1
All Vehicles			408	11.0	408	11.0	0.144	6.1	LOS A	0.6	4.6	0.11	0.53	0.11	52.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 4PM_X [SHE_BOU_23_PM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	11	20.0	11	20.0	0.032	5.9	LOS A	0.1	1.3	0.36	0.48	0.36	52.5
6	R2	All MCs	28	46.2	28	46.2	0.032	10.3	LOS A	0.1	1.3	0.33	0.59	0.33	48.8
Approach			39	38.9	39	38.9	0.032	9.1	LOS A	0.1	1.3	0.34	0.56	0.34	49.8
North: Sheraton Road															
7	L2	All MCs	21	75.0	21	75.0	0.028	5.0	LOS A	0.1	1.2	0.08	0.48	0.08	52.0
9	R2	All MCs	180	1.8	180	1.8	0.114	8.8	LOS A	0.5	3.7	0.06	0.63	0.06	50.8
9u	U	All MCs	1	0.0	1	0.0	0.114	10.9	LOS A	0.5	3.7	0.06	0.63	0.06	50.8
Approach			203	9.5	203	9.5	0.114	8.4	LOS A	0.5	3.7	0.06	0.62	0.06	50.9
West: Boundary Road															
10	L2	All MCs	92	1.2	92	1.2	0.064	4.3	LOS A	0.3	2.0	0.12	0.47	0.12	54.2
11	T1	All MCs	9	25.0	9	25.0	0.013	4.6	LOS A	0.1	0.4	0.15	0.47	0.15	52.8
12u	U	All MCs	2	0.0	2	0.0	0.013	11.1	LOS A	0.1	0.4	0.15	0.47	0.15	52.5
Approach			103	3.1	103	3.1	0.064	4.5	LOS A	0.3	2.0	0.12	0.47	0.12	54.0
All Vehicles			345	10.9	345	10.9	0.114	7.3	LOS A	0.5	3.7	0.11	0.57	0.11	51.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 6AM_X [WHE_BOU_23_AM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	125	0.0	125	0.0	0.253	5.8	LOS A	1.3	9.2	0.52	0.58	0.52	49.0
2	T1	All MCs	307	2.8	307	2.8	0.253	6.1	LOS A	1.3	9.2	0.52	0.60	0.52	52.4
3	R2	All MCs	78	0.0	78	0.0	0.253	10.7	LOS A	1.3	9.1	0.53	0.62	0.53	51.2
3u	U	All MCs	1	0.0	1	0.0	0.253	12.8	LOS A	1.3	9.1	0.53	0.62	0.53	51.2
Approach			511	1.7	511	1.7	0.253	6.7	LOS A	1.3	9.2	0.52	0.60	0.52	51.3
East: Booundary Road															
4	L2	All MCs	15	7.1	15	7.1	0.115	5.7	LOS A	0.5	3.8	0.48	0.55	0.48	52.4
5	T1	All MCs	104	1.0	104	1.0	0.115	5.6	LOS A	0.5	3.8	0.48	0.55	0.48	49.3
6	R2	All MCs	75	2.9	75	2.9	0.089	10.6	LOS A	0.4	2.9	0.49	0.69	0.49	49.4
6u	U	All MCs	4	0.0	4	0.0	0.089	12.6	LOS A	0.4	2.9	0.49	0.69	0.49	49.5
Approach			199	2.2	199	2.2	0.115	7.6	LOS A	0.5	3.8	0.48	0.61	0.48	49.6
North: Wheelers Lane															
7	L2	All MCs	45	2.4	45	2.4	0.163	5.5	LOS A	0.8	6.2	0.45	0.52	0.45	52.8
8	T1	All MCs	117	5.5	117	5.5	0.163	5.6	LOS A	0.8	6.2	0.45	0.52	0.45	53.2
9	R2	All MCs	221	6.8	221	6.8	0.204	10.1	LOS A	1.1	8.3	0.45	0.64	0.45	46.4
9u	U	All MCs	2	0.0	2	0.0	0.204	12.0	LOS A	1.1	8.3	0.45	0.64	0.45	49.7
Approach			385	5.8	385	5.8	0.204	8.2	LOS A	1.1	8.3	0.45	0.58	0.45	49.0
West: Booundary Road															
10	L2	All MCs	217	2.5	217	2.5	0.220	5.0	LOS A	1.1	8.0	0.55	0.59	0.55	49.2
11	T1	All MCs	133	1.6	133	1.6	0.197	5.0	LOS A	1.0	6.9	0.55	0.60	0.55	48.5
12	R2	All MCs	42	0.0	42	0.0	0.197	9.5	LOS A	1.0	6.9	0.55	0.60	0.55	47.9
12u	U	All MCs	1	0.0	1	0.0	0.197	11.3	LOS A	1.0	6.9	0.55	0.60	0.55	44.9
Approach			393	1.9	393	1.9	0.220	5.5	LOS A	1.1	8.0	0.55	0.60	0.55	48.8
All Vehicles			1488	2.9	1488	2.9	0.253	6.9	LOS A	1.3	9.2	0.50	0.60	0.50	49.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6PM_X [WHE_BOU_23_PM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	86	7.5	86	7.5	0.161	5.8	LOS A	0.8	5.8	0.47	0.56	0.47	49.1
2	T1	All MCs	207	6.7	207	6.7	0.161	5.9	LOS A	0.8	5.8	0.48	0.57	0.48	52.7
3	R2	All MCs	28	7.7	28	7.7	0.161	10.6	LOS A	0.8	5.7	0.48	0.58	0.48	51.4
3u	U	All MCs	1	0.0	1	0.0	0.161	12.4	LOS A	0.8	5.7	0.48	0.58	0.48	51.7
Approach			322	7.0	322	7.0	0.161	6.3	LOS A	0.8	5.8	0.48	0.57	0.48	51.5
East: Booundary Road															
4	L2	All MCs	43	2.5	43	2.5	0.140	6.3	LOS A	0.7	4.6	0.56	0.62	0.56	52.3
5	T1	All MCs	89	0.0	89	0.0	0.140	6.2	LOS A	0.7	4.6	0.56	0.62	0.56	49.1
6	R2	All MCs	45	9.5	45	9.5	0.080	12.8	LOS A	0.3	2.5	0.59	0.77	0.59	48.1
6u	U	All MCs	1	0.0	1	0.0	0.080	14.3	LOS A	0.3	2.5	0.59	0.77	0.59	48.4
Approach			178	3.0	178	3.0	0.140	8.0	LOS A	0.7	4.6	0.56	0.66	0.56	49.6
North: Wheelers Lane															
7	L2	All MCs	61	6.9	61	6.9	0.275	5.2	LOS A	1.6	11.7	0.41	0.48	0.41	52.7
8	T1	All MCs	266	3.6	266	3.6	0.275	5.2	LOS A	1.6	11.7	0.41	0.48	0.41	53.3
9	R2	All MCs	224	6.2	224	6.2	0.220	10.0	LOS A	1.2	8.8	0.41	0.63	0.41	46.5
9u	U	All MCs	3	0.0	3	0.0	0.220	11.9	LOS A	1.2	8.8	0.41	0.63	0.41	49.8
Approach			555	5.0	555	5.0	0.275	7.2	LOS A	1.6	11.7	0.41	0.54	0.41	50.2
West: Booundary Road															
10	L2	All MCs	173	6.8	173	6.8	0.161	4.4	LOS A	0.8	5.9	0.44	0.52	0.44	49.3
11	T1	All MCs	76	2.8	76	2.8	0.158	4.1	LOS A	0.8	5.6	0.44	0.57	0.44	48.3
12	R2	All MCs	85	3.8	85	3.8	0.158	8.7	LOS A	0.8	5.6	0.44	0.57	0.44	47.6
12u	U	All MCs	3	0.0	3	0.0	0.158	10.4	LOS A	0.8	5.6	0.44	0.57	0.44	44.7
Approach			337	5.1	337	5.1	0.161	5.5	LOS A	0.8	5.9	0.44	0.54	0.44	48.6
All Vehicles			1392	5.2	1392	5.2	0.275	6.6	LOS A	1.6	11.7	0.45	0.56	0.45	50.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7AM_X [MIT_WHE_23_AM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wheeler Lane															
1	L2	All MCs	278	1.2	278	1.2	0.654	9.3	LOS A	5.3	37.5	0.85	0.92	1.13	51.2
2	T1	All MCs	498	2.8	498	2.8	0.654	9.9	LOS A	5.3	37.5	0.85	0.94	1.14	50.4
3	R2	All MCs	221	2.9	221	2.9	0.654	16.4	LOS B	4.8	34.6	0.85	0.97	1.16	48.1
3u	U	All MCs	1	0.0	1	0.0	0.654	18.6	LOS B	4.8	34.6	0.85	0.97	1.16	48.2
Approach			999	2.4	999	2.4	0.654	11.2	LOS A	5.3	37.5	0.85	0.94	1.14	50.1
East: Mitchell Highway															
4	L2	All MCs	114	12.3	114	12.3	0.502	7.2	LOS A	3.5	25.6	0.75	0.72	0.83	51.8
5	T1	All MCs	630	3.9	630	3.9	0.502	7.2	LOS A	3.5	25.6	0.75	0.75	0.85	51.9
6	R2	All MCs	110	8.8	110	8.8	0.502	13.7	LOS A	3.4	24.6	0.76	0.78	0.87	50.2
6u	U	All MCs	4	0.0	4	0.0	0.502	15.6	LOS B	3.4	24.6	0.76	0.78	0.87	50.5
Approach			858	5.6	858	5.6	0.502	8.1	LOS A	3.5	25.6	0.75	0.75	0.85	51.6
North: Wheeler Lane															
7	L2	All MCs	89	15.7	89	15.7	0.485	9.8	LOS A	3.5	25.8	0.87	0.85	1.01	50.9
8	T1	All MCs	269	3.6	269	3.6	0.485	9.3	LOS A	3.5	25.8	0.87	0.86	1.02	51.2
9	R2	All MCs	233	5.5	233	5.5	0.485	16.6	LOS B	3.2	23.5	0.86	0.92	1.03	46.7
9u	U	All MCs	9	0.0	9	0.0	0.485	18.6	LOS B	3.2	23.5	0.86	0.92	1.03	46.8
Approach			600	6.1	600	6.1	0.485	12.4	LOS A	3.5	25.8	0.87	0.88	1.02	49.2
West: Mitchell Highway															
10	L2	All MCs	210	4.6	210	4.6	0.684	12.1	LOS A	5.8	42.4	0.90	0.97	1.25	49.2
11	T1	All MCs	662	7.0	662	7.0	0.684	11.1	LOS A	6.2	45.8	0.90	0.95	1.23	49.8
12	R2	All MCs	108	2.0	108	2.0	0.684	15.9	LOS B	6.2	45.8	0.90	0.94	1.21	49.2
12u	U	All MCs	13	8.3	13	8.3	0.684	18.6	LOS B	6.2	45.8	0.90	0.94	1.21	49.0
Approach			994	5.9	994	5.9	0.684	11.9	LOS A	6.2	45.8	0.90	0.96	1.23	49.6
All Vehicles			3451	4.9	3451	4.9	0.684	10.8	LOS A	6.2	45.8	0.84	0.89	1.07	50.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7PM_X [MIT_WHE_23_PM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	170	3.8	170	3.8	0.465	8.0	LOS A	3.0	22.2	0.81	0.81	0.92	51.7
2	T1	All MCs	301	5.7	301	5.7	0.465	8.4	LOS A	3.0	22.2	0.80	0.84	0.92	51.1
3	R2	All MCs	188	5.7	188	5.7	0.465	14.9	LOS B	2.8	20.5	0.80	0.89	0.94	48.5
3u	U	All MCs	1	0.0	1	0.0	0.465	17.0	LOS B	2.8	20.5	0.80	0.89	0.94	48.7
Approach			659	5.2	659	5.2	0.465	10.2	LOS A	3.0	22.2	0.80	0.85	0.93	50.5
East: Mitchell Highway															
4	L2	All MCs	165	9.7	165	9.7	0.659	11.6	LOS A	5.5	40.4	0.92	0.98	1.25	49.6
5	T1	All MCs	545	4.7	545	4.7	0.659	12.4	LOS A	5.5	40.4	0.92	0.99	1.26	49.0
6	R2	All MCs	65	4.9	65	4.9	0.659	19.2	LOS B	5.0	36.1	0.91	1.01	1.27	47.2
6u	U	All MCs	12	0.0	12	0.0	0.659	21.3	LOS B	5.0	36.1	0.91	1.01	1.27	47.4
Approach			788	5.7	788	5.7	0.659	13.0	LOS A	5.5	40.4	0.92	0.99	1.26	49.0
North: Wheeler Lane															
7	L2	All MCs	126	8.5	126	8.5	0.783	16.3	LOS B	8.5	61.2	0.98	1.12	1.61	46.9
8	T1	All MCs	435	2.0	435	2.0	0.783	16.0	LOS B	8.5	61.2	0.98	1.12	1.61	47.1
9	R2	All MCs	356	6.0	356	6.0	0.783	25.0	LOS B	7.4	54.5	0.96	1.16	1.63	42.2
9u	U	All MCs	33	0.0	33	0.0	0.783	26.9	LOS B	7.4	54.5	0.96	1.16	1.63	42.4
Approach			950	4.3	950	4.3	0.783	19.8	LOS B	8.5	61.2	0.97	1.14	1.62	44.9
West: Mitchell Highway															
10	L2	All MCs	164	2.6	164	2.6	0.602	8.7	LOS A	4.8	34.5	0.80	0.81	0.98	51.6
11	T1	All MCs	633	3.7	633	3.7	0.602	8.2	LOS A	5.0	35.8	0.80	0.81	0.96	51.2
12	R2	All MCs	264	2.0	264	2.0	0.602	13.3	LOS A	5.0	35.8	0.79	0.81	0.94	49.7
12u	U	All MCs	16	0.0	16	0.0	0.602	15.6	LOS B	5.0	35.8	0.79	0.81	0.94	49.8
Approach			1078	3.1	1078	3.1	0.602	9.7	LOS A	5.0	35.8	0.80	0.81	0.96	50.9
All Vehicles			3475	4.4	3475	4.4	0.783	13.3	LOS A	8.5	61.2	0.87	0.95	1.20	48.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5AM_X [MIT_SHE_23_AM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	332	9.1	332	9.1	0.399	6.6	LOS A	2.4	18.2	0.73	0.71	0.74	55.1
2	T1	All MCs	220	7.8	220	7.8	0.399	7.3	LOS A	2.4	18.2	0.73	0.75	0.77	51.2
3	R2	All MCs	69	6.3	69	6.3	0.399	13.0	LOS A	2.3	17.3	0.74	0.75	0.77	51.5
3u	U	All MCs	26	0.0	26	0.0	0.399	15.1	LOS B	2.3	17.3	0.74	0.75	0.77	50.4
Approach			646	8.0	646	8.0	0.399	7.9	LOS A	2.4	18.2	0.73	0.73	0.75	53.1
East: Mitchell Highway															
4	L2	All MCs	68	15.9	68	15.9	0.448	12.1	LOS A	2.9	20.8	0.82	0.84	0.95	52.8
5	T1	All MCs	461	0.2	461	0.2	0.448	10.4	LOS A	3.1	21.9	0.82	0.83	0.93	56.3
6	R2	All MCs	106	5.1	106	5.1	0.448	15.8	LOS B	3.1	21.9	0.82	0.82	0.91	52.3
6u	U	All MCs	1	0.0	1	0.0	0.448	16.4	LOS B	3.1	21.9	0.82	0.82	0.91	52.5
Approach			636	2.7	636	2.7	0.448	11.5	LOS A	3.1	21.9	0.82	0.83	0.93	55.2
North: Sheraton Road															
7	L2	All MCs	134	3.2	134	3.2	0.430	8.1	LOS A	2.9	21.2	0.80	0.76	0.86	54.4
8	T1	All MCs	364	6.5	364	6.5	0.430	8.5	LOS A	2.9	21.2	0.80	0.79	0.88	51.2
9	R2	All MCs	123	4.3	123	4.3	0.430	14.9	LOS B	2.8	20.2	0.81	0.83	0.90	50.7
9u	U	All MCs	2	0.0	2	0.0	0.430	17.0	LOS B	2.8	20.2	0.81	0.83	0.90	49.2
Approach			624	5.3	624	5.3	0.430	9.7	LOS A	2.9	21.2	0.80	0.79	0.88	51.7
West: Mitchell Highway															
10	L2	All MCs	63	10.2	63	10.2	0.336	7.9	LOS A	2.0	15.3	0.66	0.64	0.66	54.9
11	T1	All MCs	292	8.1	292	8.1	0.472	8.2	LOS A	3.4	25.2	0.68	0.66	0.68	57.3
12	R2	All MCs	391	7.4	391	7.4	0.472	13.4	LOS A	3.4	25.2	0.71	0.70	0.71	51.6
12u	U	All MCs	1	0.0	1	0.0	0.472	14.1	LOS A	3.4	25.2	0.71	0.70	0.71	51.9
Approach			747	7.9	747	7.9	0.472	10.9	LOS A	3.4	25.2	0.69	0.68	0.69	54.0
All Vehicles			2653	6.1	2653	6.1	0.472	10.0	LOS A	3.4	25.2	0.76	0.75	0.81	53.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5PM_X [MIT_SHE_23_PM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	339	9.8	339	9.8	0.401	6.6	LOS A	2.4	17.9	0.71	0.70	0.72	55.2
2	T1	All MCs	237	7.2	237	7.2	0.401	7.2	LOS A	2.4	17.9	0.72	0.74	0.75	51.4
3	R2	All MCs	50	10.6	50	10.6	0.401	13.1	LOS A	2.3	17.1	0.72	0.75	0.75	50.8
3u	U	All MCs	40	0.0	40	0.0	0.401	14.9	LOS B	2.3	17.1	0.72	0.75	0.75	50.5
Approach			667	8.4	667	8.4	0.401	7.8	LOS A	2.4	17.9	0.71	0.72	0.74	53.1
East: Mitchell Highway															
4	L2	All MCs	31	3.4	31	3.4	0.360	8.6	LOS A	2.1	14.4	0.73	0.72	0.73	54.5
5	T1	All MCs	410	0.3	410	0.3	0.360	8.4	LOS A	2.2	15.4	0.73	0.73	0.73	57.4
6	R2	All MCs	159	4.7	159	4.7	0.360	14.0	LOS A	2.2	15.4	0.72	0.74	0.72	52.5
6u	U	All MCs	1	0.0	1	0.0	0.360	14.7	LOS B	2.2	15.4	0.72	0.74	0.72	52.7
Approach			601	1.6	601	1.6	0.360	9.9	LOS A	2.2	15.4	0.73	0.73	0.73	55.9
North: Sheraton Road															
7	L2	All MCs	84	12.8	84	12.8	0.311	7.9	LOS A	1.9	14.6	0.76	0.70	0.76	54.2
8	T1	All MCs	247	15.2	247	15.2	0.311	7.9	LOS A	1.9	14.6	0.76	0.73	0.76	51.4
9	R2	All MCs	101	5.3	101	5.3	0.311	13.7	LOS A	1.8	13.5	0.76	0.77	0.76	50.8
9u	U	All MCs	3	33.3	3	33.3	0.311	17.8	LOS B	1.8	13.5	0.76	0.77	0.76	48.5
Approach			435	12.6	435	12.6	0.311	9.3	LOS A	1.9	14.6	0.76	0.73	0.76	51.7
West: Mitchell Highway															
10	L2	All MCs	132	4.1	132	4.1	0.360	8.2	LOS A	2.2	16.2	0.70	0.67	0.70	55.0
11	T1	All MCs	332	7.1	332	7.1	0.506	8.8	LOS A	3.9	29.1	0.73	0.71	0.76	56.6
12	R2	All MCs	309	6.6	309	6.6	0.506	14.3	LOS A	3.9	29.1	0.75	0.73	0.81	51.8
12u	U	All MCs	1	0.0	1	0.0	0.506	15.0	LOS B	3.9	29.1	0.75	0.73	0.81	52.0
Approach			774	6.4	774	6.4	0.506	10.9	LOS A	3.9	29.1	0.73	0.71	0.77	54.3
All Vehicles			2477	6.8	2477	6.8	0.506	9.5	LOS A	3.9	29.1	0.73	0.72	0.75	53.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 3AM_X [MIT_BLU_23_AM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	212	3.0	212	3.0	0.116	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	33	3.0	33	3.0	0.045	7.5	LOS A	0.1	1.0	0.50	0.69	0.50	49.4
Approach			244	3.0	244	3.0	0.116	4.8	LOS A	0.1	1.0	0.07	0.50	0.07	46.8
East: Mitchell Highway															
3	L2	All MCs	65	3.0	65	3.0	0.036	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.7
4	T1	All MCs	385	3.0	385	3.0	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			451	3.0	451	3.0	0.189	1.0	NA	0.0	0.0	0.00	0.08	0.00	68.0
West: Mitchell Highway															
5	T1	All MCs	191	6.0	191	6.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	329	6.0	329	6.0	0.203	8.0	LOS A	1.1	8.3	0.50	0.64	0.50	50.3
Approach			520	6.0	520	6.0	0.203	5.1	NA	1.1	8.3	0.32	0.40	0.32	56.0
All Vehicles			1215	4.3	1215	4.3	0.203	3.5	NA	1.1	8.3	0.15	0.30	0.15	57.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▽ Site: 3PM_X [MIT_BLU_23_PM_X (Site Folder: Existing Conditions)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Blueridge Drive															
1	L2	All MCs	326	2.0	326	2.0	0.178	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	61	2.0	61	2.0	0.063	6.1	LOS A	0.2	1.4	0.40	0.60	0.40	50.3
Approach			387	2.0	387	2.0	0.178	4.7	LOS A	0.2	1.4	0.06	0.49	0.06	47.0
East: Mitchell Highway															
3	L2	All MCs	21	2.0	21	2.0	0.011	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.9
4	T1	All MCs	281	2.0	281	2.0	0.137	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			302	2.0	302	2.0	0.137	0.5	NA	0.0	0.0	0.00	0.04	0.00	69.0
West: Mitchell Highway															
5	T1	All MCs	319	8.0	319	8.0	0.172	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	173	8.0	173	8.0	0.097	7.6	LOS A	0.5	3.9	0.40	0.57	0.40	50.6
Approach			492	8.0	492	8.0	0.172	2.7	NA	0.5	3.9	0.14	0.20	0.14	61.6
All Vehicles			1181	4.5	1181	4.5	0.178	2.8	NA	0.5	3.9	0.08	0.25	0.08	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 4AM_F [SHE_BOU_36_AM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road																
5	T1	All MCs	11	37.7	11	37.7	0.046	6.2	LOS A	0.2	2.3	0.36	0.46	0.36	52.6
6	R2	All MCs	39	78.6	39	78.6	0.046	10.8	LOS A	0.2	2.3	0.34	0.59	0.34	47.5
Approach			50	69.5	50	69.5	0.046	9.8	LOS A	0.2	2.3	0.34	0.56	0.34	48.6
North: Sheraton Road																
7	L2	All MCs	54	74.3	54	74.3	0.067	5.1	LOS A	0.3	3.3	0.11	0.47	0.11	51.9
9	R2	All MCs	150	1.9	150	1.9	0.102	8.8	LOS A	0.5	3.3	0.08	0.63	0.08	50.7
9u	U	All MCs	7	0.0	7	0.0	0.102	10.9	LOS A	0.5	3.3	0.08	0.63	0.08	50.7
Approach			211	20.3	211	20.3	0.102	7.9	LOS A	0.5	3.3	0.09	0.59	0.09	51.0
West: Boundary Road																
10	L2	All MCs	281	1.5	281	1.5	0.194	4.5	LOS A	0.9	6.7	0.18	0.47	0.18	53.9
11	T1	All MCs	13	44.6	13	44.6	0.020	5.0	LOS A	0.1	0.7	0.20	0.47	0.20	52.0
12u	U	All MCs	3	0.0	3	0.0	0.020	11.2	LOS A	0.1	0.7	0.20	0.47	0.20	52.2
Approach			296	3.3	296	3.3	0.194	4.6	LOS A	0.9	6.7	0.18	0.47	0.18	53.8
All Vehicles			557	15.7	557	15.7	0.194	6.3	LOS A	0.9	6.7	0.16	0.52	0.16	52.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 4PM_F [SHE_BOU_36_PM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Sheraton Road																
5	T1	All MCs	18	38.6	18	38.6	0.062	6.9	LOS A	0.3	2.9	0.43	0.53	0.43	51.8
6	R2	All MCs	49	60.1	49	60.1	0.062	11.0	LOS A	0.3	2.9	0.40	0.62	0.40	48.2
Approach			67	54.3	67	54.3	0.062	9.9	LOS A	0.3	2.9	0.41	0.60	0.41	49.1
North: Sheraton Road																
7	L2	All MCs	41	83.2	41	83.2	0.057	5.2	LOS A	0.2	2.6	0.11	0.48	0.11	51.6
9	R2	All MCs	233	1.8	233	1.8	0.151	8.8	LOS A	0.7	5.2	0.09	0.62	0.09	50.7
9u	U	All MCs	1	0.0	1	0.0	0.151	10.9	LOS A	0.7	5.2	0.09	0.62	0.09	50.7
Approach			276	14.0	276	14.0	0.151	8.3	LOS A	0.7	5.2	0.10	0.60	0.10	50.8
West: Boundary Road																
10	L2	All MCs	119	1.2	119	1.2	0.087	4.5	LOS A	0.4	2.7	0.17	0.47	0.17	54.0
11	T1	All MCs	15	45.6	15	45.6	0.024	5.0	LOS A	0.1	0.9	0.22	0.46	0.22	52.1
12u	U	All MCs	3	0.0	3	0.0	0.024	11.3	LOS A	0.1	0.9	0.22	0.46	0.22	52.3
Approach			138	6.1	138	6.1	0.087	4.7	LOS A	0.4	2.7	0.18	0.47	0.18	53.7
All Vehicles			480	17.4	480	17.4	0.151	7.5	LOS A	0.7	5.2	0.16	0.56	0.16	51.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 6AM_F [WHE_BOU_36_AM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	161	0.0	161	0.0	0.359	6.5	LOS A	2.0	14.0	0.62	0.64	0.62	48.6
2	T1	All MCs	397	2.8	397	2.8	0.359	6.8	LOS A	2.0	14.0	0.62	0.67	0.62	52.0
3	R2	All MCs	101	0.0	101	0.0	0.359	11.5	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
3u	U	All MCs	1	0.0	1	0.0	0.359	13.6	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
Approach			661	1.7	661	1.7	0.359	7.5	LOS A	2.0	14.0	0.62	0.66	0.62	50.9
East: Booundary Road															
4	L2	All MCs	19	7.1	19	7.1	0.160	6.2	LOS A	0.8	5.5	0.55	0.60	0.55	52.1
5	T1	All MCs	135	1.0	135	1.0	0.160	6.0	LOS A	0.8	5.5	0.55	0.60	0.55	49.0
6	R2	All MCs	101	6.9	101	6.9	0.135	11.3	LOS A	0.6	4.6	0.56	0.73	0.56	49.1
6u	U	All MCs	6	0.0	6	0.0	0.135	13.1	LOS A	0.6	4.6	0.56	0.73	0.56	49.3
Approach			261	3.7	261	3.7	0.160	8.2	LOS A	0.8	5.5	0.55	0.65	0.55	49.3
North: Wheelers Lane															
7	L2	All MCs	63	9.0	63	9.0	0.233	6.3	LOS A	1.3	9.6	0.53	0.56	0.53	52.2
8	T1	All MCs	151	5.5	151	5.5	0.233	6.2	LOS A	1.3	9.6	0.53	0.56	0.53	52.8
9	R2	All MCs	286	6.8	286	6.8	0.282	10.7	LOS A	1.7	12.4	0.54	0.66	0.54	46.2
9u	U	All MCs	3	0.0	3	0.0	0.282	12.6	LOS A	1.7	12.4	0.54	0.66	0.54	49.4
Approach			503	6.6	503	6.6	0.282	8.8	LOS A	1.7	12.4	0.54	0.62	0.54	48.7
West: Booundary Road															
10	L2	All MCs	281	2.5	281	2.5	0.314	5.7	LOS A	1.7	12.2	0.65	0.66	0.65	48.9
11	T1	All MCs	172	1.6	172	1.6	0.287	5.8	LOS A	1.5	10.6	0.65	0.67	0.65	48.2
12	R2	All MCs	54	0.0	54	0.0	0.287	10.3	LOS A	1.5	10.6	0.65	0.67	0.65	47.5
12u	U	All MCs	1	0.0	1	0.0	0.287	12.1	LOS A	1.5	10.6	0.65	0.67	0.65	44.5
Approach			508	1.9	508	1.9	0.314	6.2	LOS A	1.7	12.2	0.65	0.66	0.65	48.5
All Vehicles			1933	3.3	1933	3.3	0.359	7.6	LOS A	2.0	14.0	0.60	0.65	0.60	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6PM_F [WHE_BOU_36_PM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	111	7.5	111	7.5	0.228	6.4	LOS A	1.2	8.6	0.56	0.61	0.56	52.3
2	T1	All MCs	268	6.7	268	6.7	0.228	6.5	LOS A	1.2	8.6	0.56	0.62	0.56	48.7
3	R2	All MCs	36	7.7	36	7.7	0.228	11.3	LOS A	1.1	8.4	0.57	0.63	0.57	51.0
3u	U	All MCs	1	0.0	1	0.0	0.228	13.1	LOS A	1.1	8.4	0.57	0.63	0.57	51.3
Approach			417	7.0	417	7.0	0.228	6.9	LOS A	1.2	8.6	0.56	0.62	0.56	49.8
East: Booundary Road															
4	L2	All MCs	56	2.5	56	2.5	0.202	6.9	LOS A	1.0	7.0	0.64	0.68	0.64	52.0
5	T1	All MCs	115	0.0	115	0.0	0.202	6.9	LOS A	1.0	7.0	0.64	0.68	0.64	48.8
6	R2	All MCs	63	15.6	63	15.6	0.129	14.1	LOS A	0.5	4.3	0.65	0.82	0.65	47.2
6u	U	All MCs	1	0.0	1	0.0	0.129	15.1	LOS B	0.5	4.3	0.65	0.82	0.65	47.7
Approach			235	4.8	235	4.8	0.202	8.9	LOS A	1.0	7.0	0.64	0.72	0.64	49.0
North: Wheelers Lane															
7	L2	All MCs	78	5.4	78	5.4	0.373	5.6	LOS A	2.4	17.5	0.52	0.52	0.52	52.3
8	T1	All MCs	344	3.6	344	3.6	0.373	5.6	LOS A	2.4	17.5	0.52	0.52	0.52	52.8
9	R2	All MCs	290	6.2	290	6.2	0.302	10.5	LOS A	1.8	13.1	0.50	0.64	0.50	46.3
9u	U	All MCs	4	0.0	4	0.0	0.302	12.4	LOS A	1.8	13.1	0.50	0.64	0.50	49.5
Approach			717	4.9	717	4.9	0.373	7.6	LOS A	2.4	17.5	0.51	0.57	0.51	49.9
West: Booundary Road															
10	L2	All MCs	224	6.8	224	6.8	0.223	4.8	LOS A	1.2	8.5	0.52	0.57	0.52	49.1
11	T1	All MCs	99	2.8	99	2.8	0.221	4.6	LOS A	1.1	8.1	0.52	0.62	0.52	48.1
12	R2	All MCs	110	3.8	110	3.8	0.221	9.2	LOS A	1.1	8.1	0.52	0.62	0.52	47.3
12u	U	All MCs	4	0.0	4	0.0	0.221	10.9	LOS A	1.1	8.1	0.52	0.62	0.52	44.5
Approach			436	5.1	436	5.1	0.223	5.9	LOS A	1.2	8.5	0.52	0.59	0.52	48.4
All Vehicles			1804	5.4	1804	5.4	0.373	7.2	LOS A	2.4	17.5	0.54	0.61	0.54	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7AM_F [MIT_WHE_36_AM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	363	2.0	363	2.0	1.097	111.1	LOS F	55.3	395.3	1.00	3.33	7.60	21.3
2	T1	All MCs	644	2.8	644	2.8	1.097	112.8	LOS F	55.3	395.3	1.00	3.18	7.33	21.2
3	R2	All MCs	287	3.3	287	3.3	1.097	121.0	LOS F	42.9	308.4	1.00	2.97	6.95	20.8
3u	U	All MCs	1	0.0	1	0.0	1.097	123.1	LOS F	42.9	308.4	1.00	2.97	6.95	20.8
Approach			1296	2.7	1296	2.7	1.097	114.2	LOS F	55.3	395.3	1.00	3.17	7.32	21.1
East: Mitchell Highway															
4	L2	All MCs	148	12.9	148	12.9	0.768	12.1	LOS A	7.9	58.7	0.94	1.01	1.37	49.4
5	T1	All MCs	822	4.7	822	4.7	0.768	12.5	LOS A	7.9	58.7	0.94	1.03	1.39	49.0
6	R2	All MCs	142	8.8	142	8.8	0.768	19.6	LOS B	7.4	54.2	0.94	1.05	1.42	46.9
6u	U	All MCs	6	0.0	6	0.0	0.768	21.3	LOS B	7.4	54.2	0.94	1.05	1.42	47.1
Approach			1117	6.3	1117	6.3	0.768	13.4	LOS A	7.9	58.7	0.94	1.03	1.39	48.7
North: Wheeler Lane															
7	L2	All MCs	115	15.7	115	15.7	0.789	20.7	LOS B	8.6	63.4	1.00	1.17	1.70	44.4
8	T1	All MCs	349	3.6	349	3.6	0.789	20.1	LOS B	8.6	63.4	1.00	1.17	1.70	44.6
9	R2	All MCs	301	5.5	301	5.5	0.789	29.3	LOS C	7.4	54.3	0.99	1.17	1.71	40.4
9u	U	All MCs	11	0.0	11	0.0	0.789	31.2	LOS C	7.4	54.3	0.99	1.17	1.71	40.5
Approach			776	6.1	776	6.1	0.789	23.9	LOS B	8.6	63.4	1.00	1.17	1.70	42.8
West: Mitchell Highway															
10	L2	All MCs	272	4.6	272	4.6	1.086	107.4	LOS F	42.2	311.3	1.00	2.87	6.34	21.8
11	T1	All MCs	863	7.7	863	7.7	1.086	104.6	LOS F	52.1	386.8	1.00	3.05	6.64	22.3
12	R2	All MCs	143	4.1	143	4.1	1.086	108.5	LOS F	52.1	386.8	1.00	3.15	6.80	22.3
12u	U	All MCs	17	8.3	17	8.3	1.086	111.2	LOS F	52.1	386.8	1.00	3.15	6.80	22.3
Approach			1296	6.6	1296	6.6	1.086	105.7	LOS F	52.1	386.8	1.00	3.03	6.60	22.2
All Vehicles			4485	5.3	4485	5.3	1.097	71.0	LOS F	55.3	395.3	0.98	2.25	4.66	27.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7PM_F [MIT_WHE_36_PM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	223	5.2	223	5.2	0.706	12.1	LOS A	6.2	45.1	0.94	1.01	1.33	49.2
2	T1	All MCs	389	5.7	389	5.7	0.706	12.7	LOS A	6.2	45.1	0.93	1.03	1.33	48.5
3	R2	All MCs	244	6.1	244	6.1	0.706	19.8	LOS B	5.4	40.0	0.92	1.06	1.34	45.6
3u	U	All MCs	1	0.0	1	0.0	0.706	21.8	LOS B	5.4	40.0	0.92	1.06	1.34	45.8
Approach			857	5.7	857	5.7	0.706	14.6	LOS B	6.2	45.1	0.93	1.03	1.33	47.8
East: Mitchell Highway															
4	L2	All MCs	215	10.2	215	10.2	0.861	19.8	LOS B	10.7	79.7	1.00	1.25	1.91	44.8
5	T1	All MCs	712	5.6	712	5.6	0.861	21.2	LOS B	10.7	79.7	0.99	1.26	1.92	44.0
6	R2	All MCs	85	4.9	85	4.9	0.861	28.7	LOS C	9.5	69.6	0.99	1.26	1.94	42.2
6u	U	All MCs	15	0.0	15	0.0	0.861	30.7	LOS C	9.5	69.6	0.99	1.26	1.94	42.3
Approach			1027	6.4	1027	6.4	0.861	21.7	LOS B	10.7	79.7	0.99	1.26	1.92	44.0
North: Wheeler Lane															
7	L2	All MCs	162	8.5	162	8.5	1.482	451.5	LOS F	155.4	1119.7	1.00	6.34	16.17	7.3
8	T1	All MCs	563	2.0	563	2.0	1.482	451.0	LOS F	155.4	1119.7	1.00	6.33	16.15	7.3
9	R2	All MCs	461	6.0	461	6.0	1.482	460.8	LOS F	110.6	810.6	1.00	5.22	13.81	7.3
9u	U	All MCs	43	0.0	43	0.0	1.482	462.5	LOS F	110.6	810.6	1.00	5.22	13.81	7.4
Approach			1229	4.3	1229	4.3	1.482	455.2	LOS F	155.4	1119.7	1.00	5.88	15.19	7.3
West: Mitchell Highway															
10	L2	All MCs	213	2.6	213	2.6	0.912	22.9	LOS B	14.4	104.0	1.00	1.36	2.16	43.1
11	T1	All MCs	826	4.5	826	4.5	0.912	21.4	LOS B	15.6	112.9	1.00	1.35	2.11	43.6
12	R2	All MCs	345	2.9	345	2.9	0.912	25.3	LOS B	15.6	112.9	1.00	1.33	2.07	43.3
12u	U	All MCs	21	0.0	21	0.0	0.912	27.5	LOS B	15.6	112.9	1.00	1.33	2.07	43.4
Approach			1404	3.7	1404	3.7	0.912	22.7	LOS B	15.6	112.9	1.00	1.34	2.11	43.5
All Vehicles			4517	4.9	4517	4.9	1.482	138.6	LOS F	155.4	1119.7	0.98	2.50	5.48	18.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5AM_F [MIT_SHE_36_AM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	435	10.4	435	10.4	0.645	10.7	LOS A	5.5	42.3	0.91	0.93	1.19	52.3
2	T1	All MCs	288	8.8	288	8.8	0.645	12.1	LOS A	5.5	42.3	0.90	0.96	1.21	48.5
3	R2	All MCs	92	9.5	92	9.5	0.645	18.1	LOS B	5.1	38.5	0.90	0.97	1.22	48.2
3u	U	All MCs	33	0.0	33	0.0	0.645	19.8	LOS B	5.1	38.5	0.90	0.97	1.22	47.7
Approach			849	9.3	849	9.3	0.645	12.3	LOS A	5.5	42.3	0.90	0.95	1.20	50.3
East: Mitchell Highway															
4	L2	All MCs	92	19.7	92	19.7	0.751	24.8	LOS B	6.9	50.8	0.96	1.13	1.65	45.0
5	T1	All MCs	597	0.4	597	0.4	0.751	20.9	LOS B	8.1	57.7	0.98	1.11	1.64	48.7
6	R2	All MCs	138	5.1	138	5.1	0.751	25.4	LOS B	8.1	57.7	0.99	1.10	1.64	46.5
6u	U	All MCs	1	0.0	1	0.0	0.751	26.0	LOS B	8.1	57.7	0.99	1.10	1.64	46.6
Approach			827	3.3	827	3.3	0.751	22.1	LOS B	8.1	57.7	0.98	1.11	1.64	47.9
North: Sheraton Road															
7	L2	All MCs	174	3.2	174	3.2	0.723	15.8	LOS B	7.3	53.7	0.98	1.06	1.48	49.4
8	T1	All MCs	474	7.1	474	7.1	0.723	16.8	LOS B	7.3	53.7	0.98	1.07	1.49	46.2
9	R2	All MCs	160	4.3	160	4.3	0.723	24.2	LOS B	6.5	47.9	0.97	1.09	1.50	45.1
9u	U	All MCs	3	0.0	3	0.0	0.723	26.2	LOS B	6.5	47.9	0.97	1.09	1.50	43.9
Approach			810	5.7	810	5.7	0.723	18.1	LOS B	7.3	53.7	0.98	1.07	1.49	46.6
West: Mitchell Highway															
10	L2	All MCs	82	10.2	82	10.2	0.499	10.5	LOS A	3.7	27.8	0.81	0.77	0.92	53.6
11	T1	All MCs	378	8.1	378	8.1	0.700	11.5	LOS A	8.0	59.8	0.84	0.81	1.01	55.4
12	R2	All MCs	512	8.6	512	8.6	0.700	18.1	LOS B	8.0	59.8	0.92	0.89	1.21	49.0
12u	U	All MCs	1	0.0	1	0.0	0.700	18.6	LOS B	8.0	59.8	0.92	0.89	1.21	49.2
Approach			973	8.5	973	8.5	0.700	14.9	LOS B	8.0	59.8	0.88	0.85	1.11	51.6
All Vehicles			3459	6.8	3459	6.8	0.751	16.7	LOS B	8.1	59.8	0.93	0.99	1.35	49.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5PM_F [MIT_SHE_36_PM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	445	11.1	445	11.1	0.635	10.1	LOS A	5.2	40.1	0.88	0.92	1.14	52.7
2	T1	All MCs	310	8.2	310	8.2	0.635	11.3	LOS A	5.2	40.1	0.88	0.95	1.17	49.1
3	R2	All MCs	68	14.8	68	14.8	0.635	17.7	LOS B	4.9	36.6	0.88	0.95	1.17	47.8
3u	U	All MCs	51	0.0	51	0.0	0.635	19.1	LOS B	4.9	36.6	0.88	0.95	1.17	48.2
Approach			875	9.7	875	9.7	0.635	11.6	LOS A	5.2	40.1	0.88	0.93	1.16	50.7
East: Mitchell Highway															
4	L2	All MCs	44	12.6	44	12.6	0.567	14.0	LOS A	4.3	30.4	0.87	0.91	1.14	51.5
5	T1	All MCs	532	0.5	532	0.5	0.567	12.5	LOS A	4.6	33.0	0.87	0.91	1.13	54.6
6	R2	All MCs	206	4.7	206	4.7	0.567	17.5	LOS B	4.6	33.0	0.88	0.90	1.11	50.7
6u	U	All MCs	1	0.0	1	0.0	0.567	18.2	LOS B	4.6	33.0	0.88	0.90	1.11	50.8
Approach			783	2.3	783	2.3	0.567	13.9	LOS A	4.6	33.0	0.87	0.91	1.12	53.3
North: Sheraton Road															
7	L2	All MCs	108	12.8	108	12.8	0.526	12.1	LOS A	4.1	32.1	0.92	0.90	1.12	51.8
8	T1	All MCs	323	16.0	323	16.0	0.526	12.3	LOS A	4.1	32.1	0.91	0.91	1.13	48.8
9	R2	All MCs	131	5.3	131	5.3	0.526	18.6	LOS B	3.8	28.8	0.91	0.94	1.14	47.7
9u	U	All MCs	4	33.3	4	33.3	0.526	23.3	LOS B	3.8	28.8	0.91	0.94	1.14	45.7
Approach			566	13.1	566	13.1	0.526	13.8	LOS A	4.1	32.1	0.91	0.92	1.13	49.0
West: Mitchell Highway															
10	L2	All MCs	171	4.1	171	4.1	0.543	11.7	LOS A	4.3	31.6	0.85	0.83	1.03	52.6
11	T1	All MCs	429	7.1	429	7.1	0.762	14.2	LOS A	9.9	73.6	0.92	0.92	1.27	52.8
12	R2	All MCs	406	8.0	406	8.0	0.762	21.1	LOS B	9.9	73.6	0.97	0.99	1.45	47.8
12u	U	All MCs	1	0.0	1	0.0	0.762	21.6	LOS B	9.9	73.6	0.97	0.99	1.45	48.0
Approach			1007	7.0	1007	7.0	0.762	16.6	LOS B	9.9	73.6	0.93	0.93	1.30	50.6
All Vehicles			3231	7.6	3231	7.6	0.762	14.1	LOS A	9.9	73.6	0.90	0.92	1.19	51.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▽ Site: 3AM_F [MIT_BLU_36_AM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	274	3.0	274	3.0	0.151	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	42	3.0	42	3.0	0.076	9.2	LOS A	0.2	1.7	0.62	0.80	0.62	48.3
Approach			316	3.0	316	3.0	0.151	5.1	LOS A	0.2	1.7	0.08	0.51	0.08	46.7
East: Mitchell Highway															
3	L2	All MCs	84	3.0	84	3.0	0.046	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.6
4	T1	All MCs	504	4.0	504	4.0	0.248	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			588	3.9	588	3.9	0.248	1.0	NA	0.0	0.0	0.00	0.08	0.00	68.0
West: Mitchell Highway															
5	T1	All MCs	250	7.2	250	7.2	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	426	6.0	426	6.0	0.302	8.7	LOS A	1.7	12.3	0.60	0.71	0.60	50.0
Approach			676	6.4	676	6.4	0.302	5.5	NA	1.7	12.3	0.38	0.45	0.38	55.8
All Vehicles			1580	4.8	1580	4.8	0.302	3.8	NA	1.7	12.3	0.18	0.32	0.18	57.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 3PM_F [MIT_BLU_36_PM_F (Site Folder: 2036 Existing Routes)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	422	2.0	422	2.0	0.231	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	79	2.0	79	2.0	0.094	6.9	LOS A	0.3	2.2	0.47	0.68	0.47	50.0
Approach			501	2.0	501	2.0	0.231	4.8	LOS A	0.3	2.2	0.07	0.50	0.07	46.9
East: Mitchell Highway															
3	L2	All MCs	27	2.0	27	2.0	0.015	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.9
4	T1	All MCs	369	3.4	369	3.4	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			396	3.3	396	3.3	0.181	0.5	NA	0.0	0.0	0.00	0.04	0.00	69.0
West: Mitchell Highway															
5	T1	All MCs	416	8.7	416	8.7	0.225	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	223	8.0	223	8.0	0.137	7.9	LOS A	0.7	5.5	0.47	0.62	0.47	50.3
Approach			639	8.5	639	8.5	0.225	2.8	NA	0.7	5.5	0.16	0.22	0.16	61.5
All Vehicles			1536	5.0	1536	5.0	0.231	2.9	NA	0.7	5.5	0.09	0.26	0.09	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 4AM_O1 [SHE_BOU_36_AM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Sheraton Road															
5	T1	All MCs	40	82.4	40	82.4	0.080	6.5	LOS A	0.4	4.3	0.35	0.53	0.35	50.7
6	R2	All MCs	43	80.7	43	80.7	0.080	10.9	LOS A	0.4	4.3	0.35	0.56	0.35	48.3
Approach			83	81.5	83	81.5	0.080	8.8	LOS A	0.4	4.3	0.35	0.54	0.35	49.4
North: Sheraton Road															
7	L2	All MCs	22	37.5	22	37.5	0.029	5.1	LOS A	0.1	1.2	0.22	0.48	0.22	52.7
9	R2	All MCs	150	1.9	150	1.9	0.112	9.0	LOS A	0.5	3.7	0.17	0.61	0.17	50.4
9u	U	All MCs	7	0.0	7	0.0	0.112	11.1	LOS A	0.5	3.7	0.17	0.61	0.17	50.5
Approach			179	6.2	179	6.2	0.112	8.6	LOS A	0.5	3.7	0.18	0.59	0.18	50.7
West: Boundary Road															
10	L2	All MCs	281	1.5	281	1.5	0.196	4.5	LOS A	1.0	6.8	0.19	0.47	0.19	53.9
11	T1	All MCs	41	82.9	41	82.9	0.063	5.5	LOS A	0.3	2.9	0.23	0.44	0.23	51.1
12u	U	All MCs	3	0.0	3	0.0	0.063	11.3	LOS A	0.3	2.9	0.23	0.44	0.23	52.1
Approach			324	11.7	324	11.7	0.196	4.7	LOS A	1.0	6.8	0.19	0.47	0.19	53.5
All Vehicles			586	19.9	586	19.9	0.196	6.5	LOS A	1.0	6.8	0.21	0.52	0.21	52.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 4PM_O1 [SHE_BOU_36_PM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	45	75.4	45	75.4	0.097	7.3	LOS A	0.4	5.0	0.42	0.57	0.42	50.4
6	R2	All MCs	53	63.3	53	63.3	0.097	11.2	LOS A	0.4	5.0	0.42	0.60	0.42	48.4
Approach			98	68.8	98	68.8	0.097	9.4	LOS A	0.4	5.0	0.42	0.58	0.42	49.3
North: Sheraton Road															
7	L2	All MCs	10	28.6	10	28.6	0.012	5.0	LOS A	0.1	0.5	0.22	0.47	0.22	53.0
9	R2	All MCs	233	1.8	233	1.8	0.165	9.0	LOS A	0.8	5.7	0.18	0.61	0.18	50.4
9u	U	All MCs	1	0.0	1	0.0	0.165	11.1	LOS A	0.8	5.7	0.18	0.61	0.18	50.5
Approach			244	2.8	244	2.8	0.165	8.9	LOS A	0.8	5.7	0.19	0.60	0.19	50.5
West: Boundary Road															
10	L2	All MCs	119	1.2	119	1.2	0.087	4.5	LOS A	0.4	2.8	0.18	0.47	0.18	53.9
11	T1	All MCs	43	80.8	43	80.8	0.063	5.5	LOS A	0.3	3.0	0.23	0.44	0.23	51.3
12u	U	All MCs	3	0.0	3	0.0	0.063	11.2	LOS A	0.3	3.0	0.23	0.44	0.23	52.2
Approach			166	22.0	166	22.0	0.087	4.9	LOS A	0.4	3.0	0.20	0.46	0.20	53.2
All Vehicles			508	21.8	508	21.8	0.165	7.7	LOS A	0.8	5.7	0.23	0.55	0.23	51.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6AM_O1 [WHE_BOU_36_AM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wheelers Lane															
1	L2	All MCs	161	0.0	161	0.0	0.366	6.6	LOS A	2.0	14.0	0.63	0.66	0.63	48.6
2	T1	All MCs	397	2.8	397	2.8	0.366	7.0	LOS A	2.0	14.0	0.63	0.68	0.63	51.9
3	R2	All MCs	101	0.0	101	0.0	0.366	11.6	LOS A	1.9	13.7	0.64	0.70	0.64	50.6
3u	U	All MCs	1	0.0	1	0.0	0.366	13.7	LOS A	1.9	13.7	0.64	0.70	0.64	50.6
Approach			661	1.7	661	1.7	0.366	7.6	LOS A	2.0	14.0	0.63	0.68	0.63	50.9
East: Booundary Road															
4	L2	All MCs	19	7.1	19	7.1	0.160	6.2	LOS A	0.8	5.5	0.55	0.60	0.55	52.1
5	T1	All MCs	134	0.8	134	0.8	0.160	6.0	LOS A	0.8	5.5	0.55	0.60	0.55	49.0
6	R2	All MCs	129	26.7	129	26.7	0.185	12.0	LOS A	0.9	7.3	0.58	0.73	0.58	48.1
6u	U	All MCs	6	0.0	6	0.0	0.185	13.0	LOS A	0.9	7.3	0.58	0.73	0.58	49.0
Approach			288	12.8	288	12.8	0.185	8.8	LOS A	0.9	7.3	0.56	0.66	0.56	48.8
North: Wheelers Lane															
7	L2	All MCs	91	37.4	91	37.4	0.276	7.2	LOS A	1.6	12.6	0.56	0.58	0.56	51.3
8	T1	All MCs	151	5.5	151	5.5	0.276	6.2	LOS A	1.6	12.6	0.56	0.58	0.56	52.7
9	R2	All MCs	286	6.8	286	6.8	0.282	10.7	LOS A	1.7	12.4	0.54	0.66	0.54	46.2
9u	U	All MCs	3	0.0	3	0.0	0.282	12.5	LOS A	1.7	12.4	0.54	0.66	0.54	49.4
Approach			531	11.6	531	11.6	0.282	8.8	LOS A	1.7	12.6	0.55	0.62	0.55	48.7
West: Booundary Road															
10	L2	All MCs	281	2.5	281	2.5	0.322	5.9	LOS A	1.8	12.6	0.67	0.67	0.67	48.8
11	T1	All MCs	172	1.4	172	1.4	0.295	6.1	LOS A	1.5	10.9	0.66	0.68	0.66	48.1
12	R2	All MCs	54	0.0	54	0.0	0.295	10.5	LOS A	1.5	10.9	0.66	0.68	0.66	47.4
12u	U	All MCs	1	0.0	1	0.0	0.295	12.3	LOS A	1.5	10.9	0.66	0.68	0.66	44.5
Approach			508	1.8	508	1.8	0.322	6.5	LOS A	1.8	12.6	0.67	0.68	0.67	48.4
All Vehicles			1988	6.0	1988	6.0	0.366	7.8	LOS A	2.0	14.0	0.61	0.66	0.61	49.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6PM_O1 [WHE_BOU_36_PM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	111	7.5	111	7.5	0.233	6.5	LOS A	1.2	8.6	0.57	0.63	0.57	48.7
2	T1	All MCs	268	6.7	268	6.7	0.233	6.7	LOS A	1.2	8.6	0.57	0.64	0.57	52.2
3	R2	All MCs	36	7.7	36	7.7	0.233	11.5	LOS A	1.1	8.4	0.58	0.65	0.58	50.9
3u	U	All MCs	1	0.0	1	0.0	0.233	13.2	LOS A	1.1	8.4	0.58	0.65	0.58	51.2
Approach			417	7.0	417	7.0	0.233	7.1	LOS A	1.2	8.6	0.57	0.64	0.57	51.1
East: Booundary Road															
4	L2	All MCs	56	2.5	56	2.5	0.205	7.0	LOS A	1.0	7.2	0.64	0.69	0.64	52.0
5	T1	All MCs	116	0.9	116	0.9	0.205	6.9	LOS A	1.0	7.2	0.64	0.69	0.64	48.8
6	R2	All MCs	90	41.3	90	41.3	0.196	15.1	LOS B	0.8	7.8	0.68	0.83	0.68	46.0
6u	U	All MCs	1	0.0	1	0.0	0.196	14.6	LOS B	0.8	7.8	0.68	0.83	0.68	47.3
Approach			263	15.0	263	15.0	0.205	9.8	LOS A	1.0	7.8	0.66	0.73	0.66	48.4
North: Wheelers Lane															
7	L2	All MCs	106	30.7	106	30.7	0.411	6.4	LOS A	2.8	21.0	0.54	0.53	0.54	51.5
8	T1	All MCs	344	3.6	344	3.6	0.411	5.7	LOS A	2.8	21.0	0.54	0.53	0.54	52.7
9	R2	All MCs	290	6.2	290	6.2	0.307	10.5	LOS A	1.8	13.4	0.51	0.65	0.51	46.3
9u	U	All MCs	4	0.0	4	0.0	0.307	12.4	LOS A	1.8	13.4	0.51	0.65	0.51	49.5
Approach			745	8.5	745	8.5	0.411	7.7	LOS A	2.8	21.0	0.53	0.58	0.53	49.8
West: Booundary Road															
10	L2	All MCs	224	6.8	224	6.8	0.229	5.0	LOS A	1.2	8.7	0.54	0.58	0.54	49.1
11	T1	All MCs	98	2.5	98	2.5	0.227	4.8	LOS A	1.2	8.3	0.54	0.63	0.54	48.0
12	R2	All MCs	110	3.8	110	3.8	0.227	9.4	LOS A	1.2	8.3	0.54	0.63	0.54	47.2
12u	U	All MCs	4	0.0	4	0.0	0.227	11.1	LOS A	1.2	8.3	0.54	0.63	0.54	44.4
Approach			436	5.0	436	5.0	0.229	6.1	LOS A	1.2	8.7	0.54	0.60	0.54	48.3
All Vehicles			1861	8.3	1861	8.3	0.411	7.5	LOS A	2.8	21.0	0.56	0.62	0.56	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7AM_O1 [MIT_WHE_36_AM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	376	5.3	376	5.3	1.137	143.9	LOS F	69.9	506.1	1.00	3.94	9.27	17.9
2	T1	All MCs	644	2.8	644	2.8	1.137	145.2	LOS F	69.9	506.1	1.00	3.74	8.90	17.9
3	R2	All MCs	302	8.0	302	8.0	1.137	153.5	LOS F	53.4	391.7	1.00	3.46	8.37	17.6
3u	U	All MCs	1	0.0	1	0.0	1.137	155.3	LOS F	53.4	391.7	1.00	3.46	8.37	17.7
Approach			1323	4.7	1323	4.7	1.137	146.8	LOS F	69.9	506.1	1.00	3.73	8.88	17.9
East: Mitchell Highway															
4	L2	All MCs	163	20.8	163	20.8	0.778	13.0	LOS A	8.2	60.9	0.95	1.03	1.41	48.9
5	T1	All MCs	807	2.9	807	2.9	0.778	12.9	LOS A	8.2	60.9	0.95	1.05	1.43	48.6
6	R2	All MCs	142	8.8	142	8.8	0.778	20.1	LOS B	7.6	55.5	0.94	1.06	1.45	46.7
6u	U	All MCs	6	0.0	6	0.0	0.778	21.9	LOS B	7.6	55.5	0.94	1.06	1.45	46.9
Approach			1117	6.3	1117	6.3	0.778	13.9	LOS A	8.2	60.9	0.95	1.05	1.43	48.4
North: Wheeler Lane															
7	L2	All MCs	115	15.7	115	15.7	0.796	21.6	LOS B	8.8	65.3	1.00	1.19	1.73	44.0
8	T1	All MCs	349	3.6	349	3.6	0.796	21.1	LOS B	8.8	65.3	1.00	1.19	1.73	44.1
9	R2	All MCs	301	5.5	301	5.5	0.796	30.4	LOS C	7.6	55.9	0.99	1.19	1.74	40.0
9u	U	All MCs	11	0.0	11	0.0	0.796	32.3	LOS C	7.6	55.9	0.99	1.19	1.74	40.1
Approach			776	6.1	776	6.1	0.796	25.0	LOS B	8.8	65.3	1.00	1.19	1.74	42.3
West: Mitchell Highway															
10	L2	All MCs	272	4.6	272	4.6	1.069	94.1	LOS F	38.3	280.5	1.00	2.67	5.77	23.6
11	T1	All MCs	847	5.9	847	5.9	1.069	91.3	LOS F	46.3	344.9	1.00	2.82	5.99	24.2
12	R2	All MCs	157	12.5	157	12.5	1.069	95.8	LOS F	46.3	344.9	1.00	2.90	6.11	24.2
12u	U	All MCs	17	8.3	17	8.3	1.069	97.9	LOS F	46.3	344.9	1.00	2.90	6.11	24.2
Approach			1293	6.5	1293	6.5	1.069	92.5	LOS F	46.3	344.9	1.00	2.80	5.96	24.1
All Vehicles			4510	5.8	4510	5.8	1.137	77.3	LOS F	69.9	506.1	0.99	2.36	4.97	26.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7PM_O1 [MIT_WHE_36_PM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	235	10.3	235	10.3	0.736	13.2	LOS A	6.8	50.4	0.95	1.04	1.40	48.6
2	T1	All MCs	389	5.7	389	5.7	0.736	13.5	LOS A	6.8	50.4	0.94	1.06	1.40	47.9
3	R2	All MCs	259	11.5	259	11.5	0.736	21.1	LOS B	5.9	44.8	0.93	1.08	1.41	44.9
3u	U	All MCs	1	0.0	1	0.0	0.736	22.8	LOS B	5.9	44.8	0.93	1.08	1.41	45.1
Approach			884	8.6	884	8.6	0.736	15.7	LOS B	6.8	50.4	0.94	1.06	1.40	47.1
East: Mitchell Highway															
4	L2	All MCs	230	15.9	230	15.9	0.863	20.8	LOS B	10.8	81.5	1.00	1.27	1.94	44.3
5	T1	All MCs	697	3.6	697	3.6	0.863	21.7	LOS B	10.8	81.5	0.99	1.27	1.96	43.7
6	R2	All MCs	85	4.9	85	4.9	0.863	29.2	LOS C	9.8	70.4	0.99	1.27	1.97	42.1
6u	U	All MCs	15	0.0	15	0.0	0.863	31.2	LOS C	9.8	70.4	0.99	1.27	1.97	42.2
Approach			1027	6.4	1027	6.4	0.863	22.3	LOS B	10.8	81.5	1.00	1.27	1.95	43.7
North: Wheeler Lane															
7	L2	All MCs	162	8.5	162	8.5	1.500	467.9	LOS F	159.1	1146.9	1.00	6.42	16.40	7.1
8	T1	All MCs	563	2.0	563	2.0	1.500	467.4	LOS F	159.1	1146.9	1.00	6.41	16.39	7.1
9	R2	All MCs	461	6.0	461	6.0	1.500	477.2	LOS F	112.9	827.6	1.00	5.27	13.98	7.1
9u	U	All MCs	43	0.0	43	0.0	1.500	478.9	LOS F	112.9	827.6	1.00	5.27	13.98	7.1
Approach			1229	4.3	1229	4.3	1.500	471.6	LOS F	159.1	1146.9	1.00	5.94	15.40	7.1
West: Mitchell Highway															
10	L2	All MCs	213	2.6	213	2.6	0.925	25.2	LOS B	15.6	111.3	1.00	1.42	2.31	42.1
11	T1	All MCs	810	2.6	810	2.6	0.925	23.6	LOS B	16.9	122.5	1.00	1.42	2.27	42.6
12	R2	All MCs	359	6.6	359	6.6	0.925	27.7	LOS B	16.9	122.5	1.00	1.41	2.23	42.1
12u	U	All MCs	21	0.0	21	0.0	0.925	29.7	LOS C	16.9	122.5	1.00	1.41	2.23	42.3
Approach			1402	3.6	1402	3.6	0.925	25.0	LOS B	16.9	122.5	1.00	1.41	2.26	42.4
All Vehicles			4542	5.4	4542	5.4	1.500	143.4	LOS F	159.1	1146.9	0.99	2.54	5.58	18.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5AM_O1 [MIT_SHE_36_AM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	421	7.3	421	7.3	0.619	10.2	LOS A	5.1	38.3	0.90	0.92	1.16	52.8
2	T1	All MCs	279	6.0	279	6.0	0.619	11.6	LOS A	5.1	38.3	0.89	0.95	1.17	48.9
3	R2	All MCs	85	1.6	85	1.6	0.619	17.2	LOS B	4.8	34.7	0.89	0.95	1.18	50.0
3u	U	All MCs	33	0.0	33	0.0	0.619	19.5	LOS B	4.8	34.7	0.89	0.95	1.18	48.0
Approach			818	5.9	818	5.9	0.619	11.8	LOS A	5.1	38.3	0.90	0.93	1.17	50.9
East: Mitchell Highway															
4	L2	All MCs	83	11.7	83	11.7	0.751	23.2	LOS B	7.0	50.8	0.96	1.12	1.64	45.6
5	T1	All MCs	614	3.2	614	3.2	0.751	20.6	LOS B	8.0	57.8	0.98	1.10	1.63	49.0
6	R2	All MCs	138	5.1	138	5.1	0.751	24.9	LOS B	8.0	57.8	0.99	1.09	1.62	46.7
6u	U	All MCs	1	0.0	1	0.0	0.751	25.5	LOS B	8.0	57.8	0.99	1.09	1.62	46.8
Approach			836	4.3	836	4.3	0.751	21.6	LOS B	8.0	57.8	0.98	1.10	1.63	48.2
North: Sheraton Road															
7	L2	All MCs	174	3.2	174	3.2	0.721	15.9	LOS B	7.4	53.5	0.99	1.05	1.48	49.5
8	T1	All MCs	465	5.4	465	5.4	0.721	16.6	LOS B	7.4	53.5	0.98	1.07	1.49	46.3
9	R2	All MCs	167	8.6	167	8.6	0.721	24.7	LOS B	6.5	48.1	0.97	1.09	1.50	44.3
9u	U	All MCs	3	0.0	3	0.0	0.721	26.3	LOS B	6.5	48.1	0.97	1.09	1.50	43.8
Approach			809	5.5	809	5.5	0.721	18.2	LOS B	7.4	53.5	0.98	1.07	1.49	46.5
West: Mitchell Highway															
10	L2	All MCs	89	17.6	89	17.6	0.500	10.9	LOS A	3.7	28.9	0.80	0.77	0.92	53.2
11	T1	All MCs	397	12.6	397	12.6	0.703	11.8	LOS A	8.1	60.2	0.84	0.81	1.02	54.8
12	R2	All MCs	496	5.6	496	5.6	0.703	17.7	LOS B	8.1	60.2	0.91	0.88	1.20	49.3
12u	U	All MCs	1	0.0	1	0.0	0.703	18.4	LOS B	8.1	60.2	0.91	0.88	1.20	49.5
Approach			984	9.5	984	9.5	0.703	14.7	LOS B	8.1	60.2	0.87	0.84	1.10	51.8
All Vehicles			3446	6.5	3446	6.5	0.751	16.5	LOS B	8.1	60.2	0.93	0.98	1.33	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5PM_O1 [MIT_SHE_36_PM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	431	8.1	431	8.1	0.611	9.8	LOS A	4.9	36.6	0.88	0.90	1.12	53.1
2	T1	All MCs	301	5.5	301	5.5	0.611	11.0	LOS A	4.9	36.6	0.87	0.94	1.14	49.4
3	R2	All MCs	61	4.5	61	4.5	0.611	16.8	LOS B	4.6	33.4	0.87	0.94	1.14	49.9
3u	U	All MCs	51	0.0	51	0.0	0.611	18.8	LOS B	4.6	33.4	0.87	0.94	1.14	48.5
Approach			844	6.4	844	6.4	0.611	11.2	LOS A	4.9	36.6	0.87	0.92	1.13	51.1
East: Mitchell Highway															
4	L2	All MCs	46	14.6	46	14.6	0.580	14.1	LOS A	4.4	32.0	0.87	0.92	1.15	51.3
5	T1	All MCs	547	3.3	547	3.3	0.580	12.7	LOS A	4.8	34.6	0.87	0.91	1.14	54.4
6	R2	All MCs	206	4.7	206	4.7	0.580	17.5	LOS B	4.8	34.6	0.88	0.90	1.12	50.7
6u	U	All MCs	1	0.0	1	0.0	0.580	18.2	LOS B	4.8	34.6	0.88	0.90	1.12	50.8
Approach			799	4.3	799	4.3	0.580	14.0	LOS A	4.8	34.6	0.87	0.91	1.14	53.2
North: Sheraton Road															
7	L2	All MCs	108	12.8	108	12.8	0.523	12.1	LOS A	4.1	31.8	0.92	0.89	1.12	51.9
8	T1	All MCs	314	13.7	314	13.7	0.523	12.1	LOS A	4.1	31.8	0.91	0.91	1.12	49.0
9	R2	All MCs	138	10.4	138	10.4	0.523	19.0	LOS B	3.7	28.8	0.91	0.94	1.13	46.7
9u	U	All MCs	4	33.3	4	33.3	0.523	23.3	LOS B	3.7	28.8	0.91	0.94	1.13	45.6
Approach			564	12.9	564	12.9	0.523	13.9	LOS A	4.1	31.8	0.91	0.91	1.12	48.9
West: Mitchell Highway															
10	L2	All MCs	178	8.0	178	8.0	0.542	11.9	LOS A	4.3	32.2	0.84	0.83	1.03	52.4
11	T1	All MCs	447	10.9	447	10.9	0.762	14.3	LOS A	9.9	73.7	0.92	0.92	1.27	52.7
12	R2	All MCs	390	4.3	390	4.3	0.762	20.5	LOS B	9.9	73.7	0.97	0.98	1.43	48.2
12u	U	All MCs	1	0.0	1	0.0	0.762	21.2	LOS B	9.9	73.7	0.97	0.98	1.43	48.3
Approach			1017	7.8	1017	7.8	0.762	16.3	LOS B	9.9	73.7	0.92	0.93	1.29	50.8
All Vehicles			3225	7.5	3225	7.5	0.762	14.0	LOS A	9.9	73.7	0.90	0.92	1.18	51.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 3AM_O1 [MIT_BLU_36_AM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	274	3.0	274	3.0	0.151	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	42	3.0	42	3.0	0.075	9.1	LOS A	0.2	1.6	0.62	0.80	0.62	48.3
Approach			316	3.0	316	3.0	0.151	5.1	LOS A	0.2	1.6	0.08	0.51	0.08	46.7
East: Mitchell Highway															
3	L2	All MCs	84	3.0	84	3.0	0.046	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.6
4	T1	All MCs	497	2.8	497	2.8	0.243	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			582	2.8	582	2.8	0.243	1.0	NA	0.0	0.0	0.00	0.08	0.00	68.0
West: Mitchell Highway															
5	T1	All MCs	249	7.1	249	7.1	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	426	6.0	426	6.0	0.298	8.7	LOS A	1.7	12.2	0.59	0.70	0.59	50.0
Approach			676	6.4	676	6.4	0.298	5.5	NA	1.7	12.2	0.37	0.44	0.37	55.9
All Vehicles			1573	4.4	1573	4.4	0.298	3.8	NA	1.7	12.2	0.18	0.32	0.18	57.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 3PM_O1 [MIT_BLU_36_PM_O1 (Site Folder: 2036 Option 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	422	2.0	422	2.0	0.231	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	79	2.0	79	2.0	0.093	6.9	LOS A	0.3	2.1	0.46	0.67	0.46	50.1
Approach			501	2.0	501	2.0	0.231	4.8	LOS A	0.3	2.1	0.07	0.50	0.07	46.9
East: Mitchell Highway															
3	L2	All MCs	27	2.0	27	2.0	0.015	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.9
4	T1	All MCs	365	2.3	365	2.3	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			392	2.3	392	2.3	0.178	0.5	NA	0.0	0.0	0.00	0.04	0.00	69.0
West: Mitchell Highway															
5	T1	All MCs	416	8.7	416	8.7	0.225	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	223	8.0	223	8.0	0.136	7.9	LOS A	0.7	5.5	0.47	0.62	0.47	50.4
Approach			639	8.4	639	8.4	0.225	2.8	NA	0.7	5.5	0.16	0.22	0.16	61.5
All Vehicles			1532	4.8	1532	4.8	0.231	2.9	NA	0.7	5.5	0.09	0.26	0.09	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 4AM_O2 [SHE_BOU_36_AM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	11	37.7	11	37.7	0.016	6.2	LOS A	0.1	0.7	0.37	0.46	0.37	52.6
6	R2	All MCs	43	80.7	43	80.7	0.051	10.9	LOS A	0.2	2.6	0.34	0.60	0.34	47.4
Approach			54	71.9	54	71.9	0.051	9.9	LOS A	0.2	2.6	0.34	0.57	0.34	48.4
North: Sheraton Road															
7	L2	All MCs	58	76.1	58	76.1	0.068	5.0	LOS A	0.3	3.4	0.08	0.48	0.08	51.9
9	R2	All MCs	150	1.9	150	1.9	0.100	8.8	LOS A	0.5	3.2	0.06	0.63	0.06	50.7
9u	U	All MCs	7	0.0	7	0.0	0.100	10.9	LOS A	0.5	3.2	0.06	0.63	0.06	50.8
Approach			215	21.9	215	21.9	0.100	7.8	LOS A	0.5	3.4	0.07	0.59	0.07	51.0
West: Boundary Road															
10	L2	All MCs	281	1.5	281	1.5	0.196	4.5	LOS A	1.0	6.7	0.19	0.47	0.19	53.9
11	T1	All MCs	8	16.7	8	16.7	0.013	4.7	LOS A	0.1	0.4	0.20	0.49	0.20	52.6
12u	U	All MCs	3	0.0	3	0.0	0.013	11.3	LOS A	0.1	0.4	0.20	0.49	0.20	52.2
Approach			292	1.9	292	1.9	0.196	4.6	LOS A	1.0	6.7	0.19	0.47	0.19	53.9
All Vehicles			561	16.3	561	16.3	0.196	6.3	LOS A	1.0	6.7	0.16	0.53	0.16	52.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 4PM_O2 [SHE_BOU_36_PM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road																
5	T1	All MCs	14	20.0	14	20.0	0.021	6.8	LOS A	0.1	0.7	0.42	0.50	0.42	52.8
6	R2	All MCs	53	63.3	53	63.3	0.063	11.1	LOS A	0.3	3.0	0.40	0.63	0.40	47.8
Approach			67	54.3	67	54.3	0.063	10.2	LOS A	0.3	3.0	0.40	0.60	0.40	48.7
North: Sheraton Road																
7	L2	All MCs	46	84.8	46	84.8	0.062	5.1	LOS A	0.2	2.9	0.09	0.48	0.09	51.6
9	R2	All MCs	233	1.8	233	1.8	0.148	8.8	LOS A	0.7	5.1	0.08	0.63	0.08	50.7
9u	U	All MCs	1	0.0	1	0.0	0.148	10.9	LOS A	0.7	5.1	0.08	0.63	0.08	50.8
Approach			280	15.3	280	15.3	0.148	8.2	LOS A	0.7	5.1	0.08	0.60	0.08	50.9
West: Boundary Road																
10	L2	All MCs	119	1.2	119	1.2	0.087	4.5	LOS A	0.4	2.8	0.18	0.47	0.18	53.9
11	T1	All MCs	11	25.0	11	25.0	0.017	4.9	LOS A	0.1	0.6	0.22	0.48	0.22	52.5
12u	U	All MCs	3	0.0	3	0.0	0.017	11.3	LOS A	0.1	0.6	0.22	0.48	0.22	52.3
Approach			133	3.1	133	3.1	0.087	4.7	LOS A	0.4	2.8	0.19	0.47	0.19	53.8
All Vehicles			480	17.4	480	17.4	0.148	7.5	LOS A	0.7	5.1	0.15	0.57	0.15	51.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 6AM_O2 [WHE_BOU_36_AM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	161	0.0	161	0.0	0.358	6.5	LOS A	2.0	14.0	0.62	0.64	0.62	48.6
2	T1	All MCs	397	2.8	397	2.8	0.358	6.8	LOS A	2.0	14.0	0.62	0.66	0.62	52.0
3	R2	All MCs	101	0.0	101	0.0	0.358	11.5	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
3u	U	All MCs	1	0.0	1	0.0	0.358	13.6	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
Approach			661	1.7	661	1.7	0.358	7.5	LOS A	2.0	14.0	0.62	0.66	0.62	50.9
East: Booundary Road															
4	L2	All MCs	19	7.1	19	7.1	0.160	6.2	LOS A	0.8	5.5	0.55	0.60	0.55	52.1
5	T1	All MCs	135	1.0	135	1.0	0.160	6.0	LOS A	0.8	5.5	0.55	0.60	0.55	49.0
6	R2	All MCs	97	2.9	97	2.9	0.127	11.2	LOS A	0.6	4.2	0.55	0.73	0.55	49.2
6u	U	All MCs	6	0.0	6	0.0	0.127	13.1	LOS A	0.6	4.2	0.55	0.73	0.55	49.3
Approach			257	2.2	257	2.2	0.160	8.1	LOS A	0.8	5.5	0.55	0.65	0.55	49.3
North: Wheelers Lane															
7	L2	All MCs	58	2.4	58	2.4	0.227	6.1	LOS A	1.3	9.2	0.53	0.56	0.53	52.4
8	T1	All MCs	151	5.5	151	5.5	0.227	6.2	LOS A	1.3	9.2	0.53	0.56	0.53	52.8
9	R2	All MCs	286	6.8	286	6.8	0.282	10.7	LOS A	1.7	12.4	0.54	0.66	0.54	46.2
9u	U	All MCs	3	0.0	3	0.0	0.282	12.6	LOS A	1.7	12.4	0.54	0.66	0.54	49.4
Approach			499	5.8	499	5.8	0.282	8.8	LOS A	1.7	12.4	0.54	0.62	0.54	48.7
West: Booundary Road															
10	L2	All MCs	281	2.5	281	2.5	0.313	5.7	LOS A	1.7	12.2	0.65	0.66	0.65	48.9
11	T1	All MCs	172	1.6	172	1.6	0.286	5.8	LOS A	1.5	10.5	0.65	0.67	0.65	48.2
12	R2	All MCs	54	0.0	54	0.0	0.286	10.2	LOS A	1.5	10.5	0.65	0.67	0.65	47.5
12u	U	All MCs	1	0.0	1	0.0	0.286	12.1	LOS A	1.5	10.5	0.65	0.67	0.65	44.5
Approach			508	1.9	508	1.9	0.313	6.2	LOS A	1.7	12.2	0.65	0.66	0.65	48.5
All Vehicles			1925	2.9	1925	2.9	0.358	7.6	LOS A	2.0	14.0	0.60	0.65	0.60	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6PM_O2 [WHE_BOU_36_PM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	111	7.5	111	7.5	0.228	6.4	LOS A	1.2	8.6	0.56	0.61	0.56	48.8
2	T1	All MCs	268	6.7	268	6.7	0.228	6.5	LOS A	1.2	8.6	0.56	0.62	0.56	52.3
3	R2	All MCs	36	7.7	36	7.7	0.228	11.3	LOS A	1.1	8.4	0.57	0.63	0.57	51.0
3u	U	All MCs	1	0.0	1	0.0	0.228	13.1	LOS A	1.1	8.4	0.57	0.63	0.57	51.3
Approach			417	7.0	417	7.0	0.228	6.9	LOS A	1.2	8.6	0.56	0.62	0.56	51.2
East: Booundary Road															
4	L2	All MCs	56	2.5	56	2.5	0.202	6.9	LOS A	1.0	7.0	0.64	0.68	0.64	52.0
5	T1	All MCs	115	0.0	115	0.0	0.202	6.9	LOS A	1.0	7.0	0.64	0.68	0.64	48.8
6	R2	All MCs	58	9.5	58	9.5	0.117	13.8	LOS A	0.5	3.7	0.65	0.82	0.65	47.5
6u	U	All MCs	1	0.0	1	0.0	0.117	15.2	LOS B	0.5	3.7	0.65	0.82	0.65	47.8
Approach			231	3.0	231	3.0	0.202	8.7	LOS A	1.0	7.0	0.64	0.72	0.64	49.1
North: Wheelers Lane															
7	L2	All MCs	79	6.9	79	6.9	0.375	5.7	LOS A	2.4	17.7	0.52	0.52	0.52	52.3
8	T1	All MCs	344	3.6	344	3.6	0.375	5.6	LOS A	2.4	17.7	0.52	0.52	0.52	52.8
9	R2	All MCs	290	6.2	290	6.2	0.302	10.5	LOS A	1.8	13.1	0.50	0.65	0.50	46.3
9u	U	All MCs	4	0.0	4	0.0	0.302	12.4	LOS A	1.8	13.1	0.50	0.65	0.50	49.5
Approach			718	5.0	718	5.0	0.375	7.6	LOS A	2.4	17.7	0.51	0.57	0.51	49.9
West: Booundary Road															
10	L2	All MCs	224	6.8	224	6.8	0.223	4.8	LOS A	1.1	8.5	0.52	0.56	0.52	49.1
11	T1	All MCs	99	2.8	99	2.8	0.220	4.6	LOS A	1.1	8.1	0.52	0.61	0.52	48.1
12	R2	All MCs	110	3.8	110	3.8	0.220	9.2	LOS A	1.1	8.1	0.52	0.61	0.52	47.3
12u	U	All MCs	4	0.0	4	0.0	0.220	10.9	LOS A	1.1	8.1	0.52	0.61	0.52	44.5
Approach			436	5.1	436	5.1	0.223	5.9	LOS A	1.1	8.5	0.52	0.59	0.52	48.4
All Vehicles			1801	5.2	1801	5.2	0.375	7.2	LOS A	2.4	17.7	0.54	0.61	0.54	49.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 7AM_O2 [MIT_WHE_36_AM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	Demand Flows HV] %	Arrival Flows [Total veh/h	Arrival Flows HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	95% Back Of Queue Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	360	1.2	360	1.2	1.093	108.5	LOS F	54.1	385.5	1.00	3.27	7.46	21.7
2	T1	All MCs	644	2.8	644	2.8	1.093	110.2	LOS F	54.1	385.5	1.00	3.13	7.20	21.5
3	R2	All MCs	286	2.9	286	2.9	1.093	118.5	LOS F	42.0	300.8	1.00	2.92	6.82	21.0
3u	U	All MCs	1	0.0	1	0.0	1.093	120.6	LOS F	42.0	300.8	1.00	2.92	6.82	21.1
Approach			1291	2.4	1291	2.4	1.093	111.6	LOS F	54.1	385.5	1.00	3.12	7.19	21.4
East: Mitchell Highway															
4	L2	All MCs	147	12.3	147	12.3	0.768	12.0	LOS A	8.0	58.9	0.94	1.01	1.37	49.4
5	T1	All MCs	825	5.0	825	5.0	0.768	12.5	LOS A	8.0	58.9	0.94	1.03	1.39	49.0
6	R2	All MCs	142	8.8	142	8.8	0.768	19.5	LOS B	7.4	54.4	0.94	1.05	1.42	46.9
6u	U	All MCs	6	0.0	6	0.0	0.768	21.3	LOS B	7.4	54.4	0.94	1.05	1.42	47.1
Approach			1119	6.4	1119	6.4	0.768	13.3	LOS A	8.0	58.9	0.94	1.03	1.39	48.8
North: Wheeler Lane															
7	L2	All MCs	115	15.7	115	15.7	0.789	20.7	LOS B	8.6	63.3	1.00	1.17	1.70	44.4
8	T1	All MCs	349	3.6	349	3.6	0.789	20.1	LOS B	8.6	63.3	1.00	1.17	1.70	44.6
9	R2	All MCs	301	5.5	301	5.5	0.789	29.3	LOS C	7.4	54.2	0.99	1.17	1.71	40.4
9u	U	All MCs	11	0.0	11	0.0	0.789	31.2	LOS C	7.4	54.2	0.99	1.17	1.71	40.5
Approach			776	6.1	776	6.1	0.789	23.9	LOS B	8.6	63.3	1.00	1.17	1.70	42.8
West: Mitchell Highway															
10	L2	All MCs	272	4.6	272	4.6	1.087	107.9	LOS F	42.3	312.2	1.00	2.87	6.36	21.7
11	T1	All MCs	866	8.0	866	8.0	1.087	105.1	LOS F	52.4	388.2	1.00	3.06	6.67	22.2
12	R2	All MCs	140	2.0	140	2.0	1.087	108.8	LOS F	52.4	388.2	1.00	3.16	6.82	22.3
12u	U	All MCs	17	8.3	17	8.3	1.087	111.6	LOS F	52.4	388.2	1.00	3.16	6.82	22.3
Approach			1296	6.6	1296	6.6	1.087	106.2	LOS F	52.4	388.2	1.00	3.03	6.62	22.1
All Vehicles			4483	5.3	4483	5.3	1.093	70.3	LOS E	54.1	388.2	0.98	2.24	4.63	28.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7PM_O2 [MIT_WHE_36_PM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	219	3.8	219	3.8	0.702	12.0	LOS A	6.1	44.5	0.94	1.01	1.32	49.3
2	T1	All MCs	389	5.7	389	5.7	0.702	12.6	LOS A	6.1	44.5	0.93	1.02	1.32	48.6
3	R2	All MCs	243	5.7	243	5.7	0.702	19.7	LOS B	5.4	39.4	0.91	1.05	1.33	45.7
3u	U	All MCs	1	0.0	1	0.0	0.702	21.7	LOS B	5.4	39.4	0.91	1.05	1.33	45.8
Approach			852	5.2	852	5.2	0.702	14.5	LOS B	6.1	44.5	0.93	1.03	1.33	47.9
East: Mitchell Highway															
4	L2	All MCs	214	9.7	214	9.7	0.862	19.8	LOS B	10.8	80.2	1.00	1.25	1.91	44.8
5	T1	All MCs	715	6.0	715	6.0	0.862	21.3	LOS B	10.8	80.2	0.99	1.26	1.93	44.0
6	R2	All MCs	85	4.9	85	4.9	0.862	28.8	LOS C	9.6	70.1	0.99	1.27	1.95	42.2
6u	U	All MCs	15	0.0	15	0.0	0.862	30.7	LOS C	9.6	70.1	0.99	1.27	1.95	42.3
Approach			1029	6.6	1029	6.6	0.862	21.7	LOS B	10.8	80.2	0.99	1.26	1.93	43.9
North: Wheeler Lane															
7	L2	All MCs	162	8.5	162	8.5	1.481	450.4	LOS F	155.1	1117.9	1.00	6.34	16.15	7.3
8	T1	All MCs	563	2.0	563	2.0	1.481	450.0	LOS F	155.1	1117.9	1.00	6.33	16.13	7.3
9	R2	All MCs	461	6.0	461	6.0	1.481	459.7	LOS F	110.5	809.5	1.00	5.21	13.79	7.4
9u	U	All MCs	43	0.0	43	0.0	1.481	461.4	LOS F	110.5	809.5	1.00	5.21	13.79	7.4
Approach			1229	4.3	1229	4.3	1.481	454.1	LOS F	155.1	1117.9	1.00	5.87	15.17	7.3
West: Mitchell Highway															
10	L2	All MCs	213	2.6	213	2.6	0.910	22.7	LOS B	14.3	103.4	1.00	1.35	2.15	43.2
11	T1	All MCs	829	4.8	829	4.8	0.910	21.2	LOS B	15.5	112.0	1.00	1.34	2.10	43.7
12	R2	All MCs	342	2.0	342	2.0	0.910	25.0	LOS B	15.5	112.0	1.00	1.33	2.05	43.4
12u	U	All MCs	21	0.0	21	0.0	0.910	27.3	LOS B	15.5	112.0	1.00	1.33	2.05	43.5
Approach			1404	3.7	1404	3.7	0.910	22.4	LOS B	15.5	112.0	1.00	1.34	2.10	43.6
All Vehicles			4515	4.8	4515	4.8	1.481	138.3	LOS F	155.1	1117.9	0.98	2.50	5.47	18.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 5AM_O2 [MIT_SHE_36_AM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	439	11.0	439	11.0	0.650	10.8	LOS A	5.6	43.1	0.91	0.94	1.20	52.1
2	T1	All MCs	288	8.8	288	8.8	0.650	12.2	LOS A	5.6	43.1	0.90	0.97	1.22	48.5
3	R2	All MCs	93	10.5	93	10.5	0.650	18.3	LOS B	5.2	39.1	0.90	0.97	1.22	47.9
3u	U	All MCs	33	0.0	33	0.0	0.650	19.9	LOS B	5.2	39.1	0.90	0.97	1.22	47.6
Approach			853	9.8	853	9.8	0.650	12.5	LOS A	5.6	43.1	0.91	0.95	1.21	50.2
East: Mitchell Highway															
4	L2	All MCs	93	20.6	93	20.6	0.754	25.3	LOS B	7.0	51.3	0.97	1.13	1.66	44.8
5	T1	All MCs	596	0.2	596	0.2	0.754	21.1	LOS B	8.2	58.2	0.98	1.11	1.66	48.6
6	R2	All MCs	138	5.1	138	5.1	0.754	25.6	LOS B	8.2	58.2	0.99	1.10	1.65	46.3
6u	U	All MCs	1	0.0	1	0.0	0.754	26.2	LOS B	8.2	58.2	0.99	1.10	1.65	46.5
Approach			827	3.3	827	3.3	0.754	22.4	LOS B	8.2	58.2	0.98	1.11	1.66	47.7
North: Sheraton Road															
7	L2	All MCs	174	3.2	174	3.2	0.728	16.0	LOS B	7.4	54.4	0.99	1.06	1.50	49.3
8	T1	All MCs	474	7.1	474	7.1	0.728	17.1	LOS B	7.4	54.4	0.98	1.08	1.50	46.1
9	R2	All MCs	160	4.3	160	4.3	0.728	24.5	LOS B	6.6	48.5	0.97	1.09	1.52	44.9
9u	U	All MCs	3	0.0	3	0.0	0.728	26.5	LOS B	6.6	48.5	0.97	1.09	1.52	43.7
Approach			810	5.7	810	5.7	0.728	18.4	LOS B	7.4	54.4	0.98	1.08	1.50	46.5
West: Mitchell Highway															
10	L2	All MCs	82	10.2	82	10.2	0.502	10.5	LOS A	3.8	28.2	0.81	0.77	0.93	53.5
11	T1	All MCs	378	8.1	378	8.1	0.705	11.6	LOS A	8.1	61.1	0.84	0.81	1.02	55.3
12	R2	All MCs	515	9.1	515	9.1	0.705	18.3	LOS B	8.1	61.1	0.92	0.90	1.23	48.8
12u	U	All MCs	1	0.0	1	0.0	0.705	18.8	LOS B	8.1	61.1	0.92	0.90	1.23	49.1
Approach			976	8.8	976	8.8	0.705	15.0	LOS B	8.1	61.1	0.88	0.85	1.12	51.5
All Vehicles			3466	7.0	3466	7.0	0.754	16.9	LOS B	8.2	61.1	0.93	0.99	1.36	49.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5PM_O2 [MIT_SHE_36_PM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	448	11.7	448	11.7	0.640	10.2	LOS A	5.3	40.8	0.88	0.92	1.15	52.6
2	T1	All MCs	310	8.2	310	8.2	0.640	11.4	LOS A	5.3	40.8	0.88	0.95	1.18	49.0
3	R2	All MCs	69	16.1	69	16.1	0.640	17.8	LOS B	5.0	37.3	0.88	0.96	1.18	47.5
3u	U	All MCs	51	0.0	51	0.0	0.640	19.1	LOS B	5.0	37.3	0.88	0.96	1.18	48.2
Approach			879	10.1	879	10.1	0.640	11.8	LOS A	5.3	40.8	0.88	0.94	1.16	50.5
East: Mitchell Highway															
4	L2	All MCs	46	14.6	46	14.6	0.569	14.2	LOS A	4.3	30.6	0.87	0.92	1.15	51.3
5	T1	All MCs	531	0.3	531	0.3	0.569	12.6	LOS A	4.6	33.2	0.88	0.91	1.13	54.5
6	R2	All MCs	206	4.7	206	4.7	0.569	17.6	LOS B	4.6	33.2	0.88	0.90	1.12	50.6
6u	U	All MCs	1	0.0	1	0.0	0.569	18.3	LOS B	4.6	33.2	0.88	0.90	1.12	50.8
Approach			783	2.3	783	2.3	0.569	14.0	LOS A	4.6	33.2	0.88	0.91	1.13	53.3
North: Sheraton Road															
7	L2	All MCs	108	12.8	108	12.8	0.530	12.2	LOS A	4.1	32.4	0.92	0.90	1.13	51.7
8	T1	All MCs	323	16.0	323	16.0	0.530	12.4	LOS A	4.1	32.4	0.92	0.92	1.14	48.8
9	R2	All MCs	131	5.3	131	5.3	0.530	18.7	LOS B	3.8	29.1	0.91	0.95	1.14	47.6
9u	U	All MCs	4	33.3	4	33.3	0.530	23.4	LOS B	3.8	29.1	0.91	0.95	1.14	45.6
Approach			566	13.1	566	13.1	0.530	13.9	LOS A	4.1	32.4	0.92	0.92	1.14	49.0
West: Mitchell Highway															
10	L2	All MCs	171	4.1	171	4.1	0.547	11.8	LOS A	4.4	32.1	0.85	0.84	1.04	52.5
11	T1	All MCs	429	7.1	429	7.1	0.768	14.4	LOS A	10.1	75.5	0.92	0.93	1.28	52.7
12	R2	All MCs	409	8.8	409	8.8	0.768	21.4	LOS B	10.1	75.5	0.98	1.00	1.48	47.6
12u	U	All MCs	1	0.0	1	0.0	0.768	21.9	LOS B	10.1	75.5	0.98	1.00	1.48	47.8
Approach			1011	7.3	1011	7.3	0.768	16.8	LOS B	10.1	75.5	0.93	0.94	1.32	50.4
All Vehicles			3238	7.8	3238	7.8	0.768	14.3	LOS A	10.1	75.5	0.90	0.93	1.20	50.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 3AM_O2 [MIT_BLU_36_AM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	274	3.0	274	3.0	0.151	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	42	3.0	42	3.0	0.076	9.2	LOS A	0.2	1.7	0.62	0.80	0.62	48.3
Approach			316	3.0	316	3.0	0.151	5.1	LOS A	0.2	1.7	0.08	0.51	0.08	46.7
East: Mitchell Highway															
3	L2	All MCs	84	3.0	84	3.0	0.046	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.6
4	T1	All MCs	504	4.0	504	4.0	0.248	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			588	3.9	588	3.9	0.248	1.0	NA	0.0	0.0	0.00	0.08	0.00	68.0
West: Mitchell Highway															
5	T1	All MCs	250	7.2	250	7.2	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	426	6.0	426	6.0	0.302	8.7	LOS A	1.7	12.3	0.60	0.71	0.60	50.0
Approach			676	6.4	676	6.4	0.302	5.5	NA	1.7	12.3	0.38	0.45	0.38	55.8
All Vehicles			1580	4.8	1580	4.8	0.302	3.8	NA	1.7	12.3	0.18	0.32	0.18	57.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 3PM_O2 [MIT_BLU_36_PM_O2 (Site Folder: 2036 Option 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	422	2.0	422	2.0	0.231	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	R2	All MCs	79	2.0	79	2.0	0.094	6.9	LOS A	0.3	2.2	0.47	0.68	0.47	50.0
Approach			501	2.0	501	2.0	0.231	4.8	LOS A	0.3	2.2	0.07	0.50	0.07	46.9
East: Mitchell Highway															
3	L2	All MCs	27	2.0	27	2.0	0.015	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.9
4	T1	All MCs	369	3.4	369	3.4	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			396	3.3	396	3.3	0.181	0.5	NA	0.0	0.0	0.00	0.04	0.00	69.0
West: Mitchell Highway															
5	T1	All MCs	416	8.7	416	8.7	0.225	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	223	8.0	223	8.0	0.137	7.9	LOS A	0.7	5.5	0.47	0.62	0.47	50.3
Approach			639	8.5	639	8.5	0.225	2.8	NA	0.7	5.5	0.16	0.22	0.16	61.5
All Vehicles			1536	5.0	1536	5.0	0.231	2.9	NA	0.7	5.5	0.09	0.26	0.09	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 4AM_O3 [SHE_BOU_36_AM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	8	13.2	8	13.2	0.011	5.9	LOS A	0.0	0.4	0.35	0.44	0.35	53.3
6	R2	All MCs	43	80.7	43	80.7	0.051	10.9	LOS A	0.2	2.6	0.34	0.60	0.34	47.4
Approach			51	70.2	51	70.2	0.051	10.1	LOS A	0.2	2.6	0.34	0.57	0.34	48.2
North: Sheraton Road															
7	L2	All MCs	22	37.5	22	37.5	0.026	4.6	LOS A	0.1	1.0	0.08	0.47	0.08	53.1
9	R2	All MCs	150	1.9	150	1.9	0.099	8.8	LOS A	0.5	3.2	0.06	0.63	0.06	50.7
9u	U	All MCs	7	0.0	7	0.0	0.099	10.9	LOS A	0.5	3.2	0.06	0.63	0.06	50.8
Approach			179	6.2	179	6.2	0.099	8.3	LOS A	0.5	3.2	0.06	0.61	0.06	51.0
West: Boundary Road															
10	L2	All MCs	281	1.5	281	1.5	0.196	4.5	LOS A	1.0	6.7	0.19	0.47	0.19	53.9
11	T1	All MCs	8	13.2	8	13.2	0.013	4.7	LOS A	0.1	0.4	0.20	0.49	0.20	52.7
12u	U	All MCs	3	0.0	3	0.0	0.013	11.3	LOS A	0.1	0.4	0.20	0.49	0.20	52.2
Approach			291	1.8	291	1.8	0.196	4.6	LOS A	1.0	6.7	0.19	0.47	0.19	53.9
All Vehicles			522	10.0	522	10.0	0.196	6.4	LOS A	1.0	6.7	0.16	0.53	0.16	52.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 4PM_O3 [SHE_BOU_36_PM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Sheraton Road / Boundary Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Sheraton Road															
5	T1	All MCs	14	18.0	14	18.0	0.020	6.8	LOS A	0.1	0.7	0.43	0.50	0.43	52.8
6	R2	All MCs	58	66.4	58	66.4	0.070	11.2	LOS A	0.3	3.4	0.40	0.63	0.40	47.7
Approach			71	57.2	71	57.2	0.070	10.4	LOS A	0.3	3.4	0.41	0.60	0.41	48.6
North: Sheraton Road															
7	L2	All MCs	10	28.6	10	28.6	0.012	4.5	LOS A	0.0	0.4	0.09	0.47	0.09	53.4
9	R2	All MCs	233	1.8	233	1.8	0.148	8.8	LOS A	0.7	5.1	0.07	0.63	0.07	50.7
9u	U	All MCs	1	0.0	1	0.0	0.148	10.9	LOS A	0.7	5.1	0.07	0.63	0.07	50.8
Approach			244	2.8	244	2.8	0.148	8.6	LOS A	0.7	5.1	0.08	0.62	0.08	50.8
West: Boundary Road															
10	L2	All MCs	119	1.2	119	1.2	0.088	4.5	LOS A	0.4	2.8	0.19	0.48	0.19	53.9
11	T1	All MCs	11	22.7	11	22.7	0.017	4.9	LOS A	0.1	0.6	0.23	0.48	0.23	52.5
12u	U	All MCs	3	0.0	3	0.0	0.017	11.4	LOS A	0.1	0.6	0.23	0.48	0.23	52.2
Approach			133	2.9	133	2.9	0.088	4.7	LOS A	0.4	2.8	0.20	0.48	0.20	53.7
All Vehicles			449	11.5	449	11.5	0.148	7.7	LOS A	0.7	5.1	0.16	0.57	0.16	51.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 6AM_O3 [WHE_BOU_36_AM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	161	0.0	161	0.0	0.357	6.5	LOS A	2.0	14.0	0.62	0.64	0.62	48.6
2	T1	All MCs	397	2.8	397	2.8	0.357	6.8	LOS A	2.0	14.0	0.62	0.66	0.62	52.0
3	R2	All MCs	101	0.0	101	0.0	0.357	11.5	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
3u	U	All MCs	1	0.0	1	0.0	0.357	13.6	LOS A	1.9	13.7	0.63	0.68	0.63	50.7
Approach			661	1.7	661	1.7	0.357	7.5	LOS A	2.0	14.0	0.62	0.66	0.62	50.9
East: Booundary Road															
4	L2	All MCs	19	7.1	19	7.1	0.160	6.2	LOS A	0.8	5.5	0.55	0.60	0.55	52.1
5	T1	All MCs	134	0.8	134	0.8	0.160	6.0	LOS A	0.8	5.5	0.55	0.60	0.55	49.0
6	R2	All MCs	97	2.9	97	2.9	0.127	11.2	LOS A	0.6	4.2	0.55	0.72	0.55	49.2
6u	U	All MCs	6	0.0	6	0.0	0.127	13.1	LOS A	0.6	4.2	0.55	0.72	0.55	49.3
Approach			257	2.0	257	2.0	0.160	8.1	LOS A	0.8	5.5	0.55	0.65	0.55	49.3
North: Wheelers Lane															
7	L2	All MCs	58	2.4	58	2.4	0.227	6.1	LOS A	1.3	9.1	0.53	0.56	0.53	52.4
8	T1	All MCs	151	5.5	151	5.5	0.227	6.2	LOS A	1.3	9.1	0.53	0.56	0.53	52.8
9	R2	All MCs	286	6.8	286	6.8	0.282	10.7	LOS A	1.7	12.4	0.54	0.66	0.54	46.2
9u	U	All MCs	3	0.0	3	0.0	0.282	12.5	LOS A	1.7	12.4	0.54	0.66	0.54	49.4
Approach			499	5.8	499	5.8	0.282	8.8	LOS A	1.7	12.4	0.54	0.62	0.54	48.7
West: Booundary Road															
10	L2	All MCs	281	2.5	281	2.5	0.313	5.7	LOS A	1.7	12.2	0.65	0.66	0.65	48.9
11	T1	All MCs	172	1.4	172	1.4	0.285	5.8	LOS A	1.5	10.5	0.65	0.67	0.65	48.2
12	R2	All MCs	54	0.0	54	0.0	0.285	10.2	LOS A	1.5	10.5	0.65	0.67	0.65	47.5
12u	U	All MCs	1	0.0	1	0.0	0.285	12.1	LOS A	1.5	10.5	0.65	0.67	0.65	44.5
Approach			508	1.8	508	1.8	0.313	6.2	LOS A	1.7	12.2	0.65	0.66	0.65	48.5
All Vehicles			1924	2.9	1924	2.9	0.357	7.6	LOS A	2.0	14.0	0.60	0.65	0.60	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 6PM_O3 [WHE_BOU_36_PM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Booundary Road / Wheelers Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheelers Lane															
1	L2	All MCs	111	7.5	111	7.5	0.228	6.4	LOS A	1.2	8.6	0.56	0.61	0.56	48.8
2	T1	All MCs	268	6.7	268	6.7	0.228	6.5	LOS A	1.2	8.6	0.56	0.62	0.56	52.3
3	R2	All MCs	36	7.7	36	7.7	0.228	11.3	LOS A	1.1	8.5	0.57	0.63	0.57	51.0
3u	U	All MCs	1	0.0	1	0.0	0.228	13.1	LOS A	1.1	8.5	0.57	0.63	0.57	51.3
Approach			417	7.0	417	7.0	0.228	6.9	LOS A	1.2	8.6	0.56	0.62	0.56	51.2
East: Booundary Road															
4	L2	All MCs	56	2.5	56	2.5	0.205	7.0	LOS A	1.0	7.1	0.64	0.68	0.64	52.0
5	T1	All MCs	116	0.9	116	0.9	0.205	6.9	LOS A	1.0	7.1	0.64	0.68	0.64	48.8
6	R2	All MCs	58	9.5	58	9.5	0.118	13.8	LOS A	0.5	3.7	0.65	0.82	0.65	47.5
6u	U	All MCs	1	0.0	1	0.0	0.118	15.2	LOS B	0.5	3.7	0.65	0.82	0.65	47.8
Approach			232	3.5	232	3.5	0.205	8.7	LOS A	1.0	7.1	0.64	0.72	0.64	49.1
North: Wheelers Lane															
7	L2	All MCs	79	6.9	79	6.9	0.374	5.7	LOS A	2.4	17.6	0.52	0.52	0.52	52.3
8	T1	All MCs	344	3.6	344	3.6	0.374	5.6	LOS A	2.4	17.6	0.52	0.52	0.52	52.8
9	R2	All MCs	290	6.2	290	6.2	0.302	10.5	LOS A	1.8	13.1	0.50	0.64	0.50	46.3
9u	U	All MCs	4	0.0	4	0.0	0.302	12.4	LOS A	1.8	13.1	0.50	0.64	0.50	49.5
Approach			718	5.0	718	5.0	0.374	7.6	LOS A	2.4	17.6	0.51	0.57	0.51	49.9
West: Booundary Road															
10	L2	All MCs	224	6.8	224	6.8	0.223	4.8	LOS A	1.1	8.5	0.52	0.56	0.52	49.1
11	T1	All MCs	98	2.5	98	2.5	0.220	4.6	LOS A	1.1	8.1	0.52	0.61	0.52	48.1
12	R2	All MCs	110	3.8	110	3.8	0.220	9.2	LOS A	1.1	8.1	0.52	0.61	0.52	47.3
12u	U	All MCs	4	0.0	4	0.0	0.220	10.9	LOS A	1.1	8.1	0.52	0.61	0.52	44.5
Approach			436	5.0	436	5.0	0.223	5.9	LOS A	1.1	8.5	0.52	0.59	0.52	48.4
All Vehicles			1802	5.3	1802	5.3	0.374	7.2	LOS A	2.4	17.6	0.54	0.61	0.54	49.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7AM_O3 [MIT_WHE_36_AM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	360	1.2	360	1.2	1.090	106.3	LOS F	53.3	379.1	1.00	3.24	7.35	21.9
2	T1	All MCs	644	2.8	644	2.8	1.090	108.1	LOS F	53.3	379.1	1.00	3.10	7.10	21.8
3	R2	All MCs	286	2.9	286	2.9	1.090	116.3	LOS F	41.3	296.3	1.00	2.89	6.73	21.3
3u	U	All MCs	1	0.0	1	0.0	1.090	118.5	LOS F	41.3	296.3	1.00	2.89	6.73	21.3
Approach			1291	2.4	1291	2.4	1.090	109.4	LOS F	53.3	379.1	1.00	3.09	7.09	21.7
East: Mitchell Highway															
4	L2	All MCs	147	12.3	147	12.3	0.766	12.0	LOS A	7.9	58.4	0.94	1.01	1.36	49.5
5	T1	All MCs	823	4.8	823	4.8	0.766	12.4	LOS A	7.9	58.4	0.94	1.02	1.38	49.0
6	R2	All MCs	142	8.8	142	8.8	0.766	19.5	LOS B	7.3	53.9	0.93	1.04	1.41	47.0
6u	U	All MCs	6	0.0	6	0.0	0.766	21.2	LOS B	7.3	53.9	0.93	1.04	1.41	47.2
Approach			1117	6.3	1117	6.3	0.766	13.3	LOS A	7.9	58.4	0.94	1.03	1.38	48.8
North: Wheeler Lane															
7	L2	All MCs	115	15.7	115	15.7	0.789	20.7	LOS B	8.6	63.3	1.00	1.17	1.70	44.4
8	T1	All MCs	349	3.6	349	3.6	0.789	20.1	LOS B	8.6	63.3	1.00	1.17	1.70	44.6
9	R2	All MCs	301	5.5	301	5.5	0.789	29.3	LOS C	7.4	54.2	0.99	1.17	1.71	40.4
9u	U	All MCs	11	0.0	11	0.0	0.789	31.2	LOS C	7.4	54.2	0.99	1.17	1.71	40.5
Approach			776	6.1	776	6.1	0.789	23.9	LOS B	8.6	63.3	1.00	1.17	1.70	42.8
West: Mitchell Highway															
10	L2	All MCs	272	4.6	272	4.6	1.085	106.5	LOS F	41.8	308.0	1.00	2.85	6.30	21.9
11	T1	All MCs	864	7.7	864	7.7	1.085	103.7	LOS F	51.7	382.8	1.00	3.03	6.60	22.4
12	R2	All MCs	140	2.0	140	2.0	1.085	107.5	LOS F	51.7	382.8	1.00	3.13	6.75	22.5
12u	U	All MCs	17	8.3	17	8.3	1.085	110.3	LOS F	51.7	382.8	1.00	3.13	6.75	22.5
Approach			1293	6.5	1293	6.5	1.085	104.8	LOS F	51.7	382.8	1.00	3.01	6.55	22.3
All Vehicles			4478	5.2	4478	5.2	1.090	69.3	LOS E	53.3	382.8	0.98	2.22	4.58	28.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 7PM_O3 [MIT_WHE_36_PM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Wheeler Lane
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wheeler Lane															
1	L2	All MCs	219	3.8	219	3.8	0.708	12.2	LOS A	6.2	45.1	0.94	1.02	1.34	49.2
2	T1	All MCs	389	5.7	389	5.7	0.708	12.8	LOS A	6.2	45.1	0.93	1.03	1.34	48.4
3	R2	All MCs	243	5.7	243	5.7	0.708	20.0	LOS B	5.4	40.0	0.92	1.06	1.34	45.5
3u	U	All MCs	1	0.0	1	0.0	0.708	22.0	LOS B	5.4	40.0	0.92	1.06	1.34	45.7
Approach			852	5.2	852	5.2	0.708	14.7	LOS B	6.2	45.1	0.93	1.04	1.34	47.7
East: Mitchell Highway															
4	L2	All MCs	214	9.7	214	9.7	0.873	20.8	LOS B	11.3	84.6	1.00	1.29	1.99	44.2
5	T1	All MCs	721	6.8	721	6.8	0.873	22.5	LOS B	11.3	84.6	1.00	1.29	2.01	43.3
6	R2	All MCs	85	4.9	85	4.9	0.873	30.0	LOS C	10.0	73.8	0.99	1.30	2.03	41.6
6u	U	All MCs	15	0.0	15	0.0	0.873	32.0	LOS C	10.0	73.8	0.99	1.30	2.03	41.7
Approach			1035	7.2	1035	7.2	0.873	22.9	LOS B	11.3	84.6	1.00	1.29	2.00	43.3
North: Wheeler Lane															
7	L2	All MCs	162	8.5	162	8.5	1.476	446.3	LOS F	154.1	1111.0	1.00	6.32	16.08	7.4
8	T1	All MCs	563	2.0	563	2.0	1.476	445.8	LOS F	154.1	1111.0	1.00	6.31	16.07	7.4
9	R2	All MCs	461	6.0	461	6.0	1.476	455.6	LOS F	109.9	805.1	1.00	5.20	13.75	7.4
9u	U	All MCs	43	0.0	43	0.0	1.476	457.3	LOS F	109.9	805.1	1.00	5.20	13.75	7.4
Approach			1229	4.3	1229	4.3	1.476	450.0	LOS F	154.1	1111.0	1.00	5.85	15.12	7.4
West: Mitchell Highway															
10	L2	All MCs	213	2.6	213	2.6	0.908	22.4	LOS B	14.1	101.9	1.00	1.34	2.13	43.4
11	T1	All MCs	827	4.6	827	4.6	0.908	20.9	LOS B	15.3	110.3	1.00	1.33	2.08	43.9
12	R2	All MCs	342	2.0	342	2.0	0.908	24.8	LOS B	15.3	110.3	1.00	1.32	2.03	43.6
12u	U	All MCs	21	0.0	21	0.0	0.908	27.0	LOS B	15.3	110.3	1.00	1.32	2.03	43.6
Approach			1402	3.6	1402	3.6	0.908	22.1	LOS B	15.3	110.3	1.00	1.33	2.07	43.7
All Vehicles			4518	4.9	4518	4.9	1.476	137.3	LOS F	154.1	1111.0	0.99	2.50	5.47	18.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 5AM_O3 [MIT_SHE_36_AM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	421	7.3	421	7.3	0.618	10.2	LOS A	5.1	38.1	0.90	0.92	1.15	52.8
2	T1	All MCs	279	6.0	279	6.0	0.618	11.5	LOS A	5.1	38.1	0.89	0.95	1.17	49.0
3	R2	All MCs	85	1.6	85	1.6	0.618	17.1	LOS B	4.8	34.5	0.89	0.95	1.17	50.0
3u	U	All MCs	33	0.0	33	0.0	0.618	19.4	LOS B	4.8	34.5	0.89	0.95	1.17	48.1
Approach			818	5.9	818	5.9	0.618	11.7	LOS A	5.1	38.1	0.90	0.93	1.16	50.9
East: Mitchell Highway															
4	L2	All MCs	83	11.7	83	11.7	0.754	23.4	LOS B	7.1	51.7	0.97	1.12	1.65	45.5
5	T1	All MCs	612	2.8	612	2.8	0.754	20.8	LOS B	8.1	59.1	0.98	1.11	1.64	48.8
6	R2	All MCs	145	9.9	145	9.9	0.754	25.5	LOS B	8.1	59.1	0.99	1.10	1.64	46.3
6u	U	All MCs	1	0.0	1	0.0	0.754	25.7	LOS B	8.1	59.1	0.99	1.10	1.64	46.6
Approach			841	4.9	841	4.9	0.754	21.9	LOS B	8.1	59.1	0.98	1.11	1.64	48.0
North: Sheraton Road															
7	L2	All MCs	181	7.1	181	7.1	0.714	15.7	LOS B	7.1	52.4	0.98	1.05	1.46	49.5
8	T1	All MCs	465	5.4	465	5.4	0.714	16.3	LOS B	7.1	52.4	0.97	1.06	1.46	46.5
9	R2	All MCs	160	4.3	160	4.3	0.714	23.6	LOS B	6.4	46.7	0.96	1.08	1.48	45.5
9u	U	All MCs	3	0.0	3	0.0	0.714	25.6	LOS B	6.4	46.7	0.96	1.08	1.48	44.3
Approach			809	5.5	809	5.5	0.714	17.6	LOS B	7.1	52.4	0.97	1.06	1.46	46.9
West: Mitchell Highway															
10	L2	All MCs	82	10.2	82	10.2	0.495	10.4	LOS A	3.6	27.9	0.80	0.77	0.91	53.5
11	T1	All MCs	395	12.0	395	12.0	0.695	11.7	LOS A	7.9	58.4	0.84	0.81	1.01	55.0
12	R2	All MCs	496	5.6	496	5.6	0.695	17.7	LOS B	7.9	58.4	0.91	0.88	1.19	49.3
12u	U	All MCs	1	0.0	1	0.0	0.695	18.3	LOS B	7.9	58.4	0.91	0.88	1.19	49.5
Approach			973	8.6	973	8.6	0.695	14.6	LOS B	7.9	58.4	0.87	0.84	1.09	51.8
All Vehicles			3441	6.3	3441	6.3	0.754	16.4	LOS B	8.1	59.1	0.93	0.98	1.33	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 5PM_O3 [MIT_SHE_36_PM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Sheraton Road
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Sheraton Road															
1	L2	All MCs	431	8.1	431	8.1	0.611	9.7	LOS A	4.9	36.6	0.88	0.90	1.11	53.1
2	T1	All MCs	301	5.5	301	5.5	0.611	10.9	LOS A	4.9	36.6	0.87	0.94	1.14	49.4
3	R2	All MCs	61	4.5	61	4.5	0.611	16.7	LOS B	4.6	33.3	0.87	0.94	1.14	49.9
3u	U	All MCs	51	0.0	51	0.0	0.611	18.8	LOS B	4.6	33.3	0.87	0.94	1.14	48.5
Approach			844	6.4	844	6.4	0.611	11.2	LOS A	4.9	36.6	0.87	0.92	1.13	51.2
East: Mitchell Highway															
4	L2	All MCs	47	17.4	47	17.4	0.586	14.4	LOS A	4.5	32.9	0.87	0.92	1.16	51.2
5	T1	All MCs	546	3.1	546	3.1	0.586	12.8	LOS A	4.9	35.7	0.88	0.92	1.15	54.3
6	R2	All MCs	213	8.0	213	8.0	0.586	17.8	LOS B	4.9	35.7	0.88	0.91	1.13	50.4
6u	U	All MCs	1	0.0	1	0.0	0.586	18.3	LOS B	4.9	35.7	0.88	0.91	1.13	50.6
Approach			807	5.3	807	5.3	0.586	14.2	LOS A	4.9	35.7	0.88	0.91	1.15	53.0
North: Sheraton Road															
7	L2	All MCs	116	18.4	116	18.4	0.518	12.3	LOS A	4.0	31.4	0.91	0.89	1.11	51.6
8	T1	All MCs	314	13.7	314	13.7	0.518	12.0	LOS A	4.0	31.4	0.91	0.91	1.11	49.0
9	R2	All MCs	131	5.3	131	5.3	0.518	18.3	LOS B	3.7	28.1	0.90	0.93	1.12	47.9
9u	U	All MCs	4	33.3	4	33.3	0.518	23.0	LOS B	3.7	28.1	0.90	0.93	1.12	45.9
Approach			564	12.9	564	12.9	0.518	13.6	LOS A	4.0	31.4	0.91	0.91	1.11	49.2
West: Mitchell Highway															
10	L2	All MCs	171	4.1	171	4.1	0.538	11.6	LOS A	4.2	31.4	0.84	0.83	1.02	52.6
11	T1	All MCs	446	10.6	446	10.6	0.755	14.3	LOS A	9.7	71.7	0.91	0.91	1.25	52.8
12	R2	All MCs	390	4.3	390	4.3	0.755	20.4	LOS B	9.7	71.7	0.96	0.98	1.42	48.2
12u	U	All MCs	1	0.0	1	0.0	0.755	21.2	LOS B	9.7	71.7	0.96	0.98	1.42	48.3
Approach			1008	7.0	1008	7.0	0.755	16.2	LOS B	9.7	71.7	0.92	0.92	1.28	50.9
All Vehicles			3224	7.5	3224	7.5	0.755	13.9	LOS A	9.7	71.7	0.90	0.92	1.18	51.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 3AM_O3 [MIT_BLU_36_AM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	297	10.6	297	10.6	0.172	4.5	LOS A	0.0	0.0	0.00	0.46	0.00	46.3
2	R2	All MCs	51	19.1	51	19.1	0.113	11.1	LOS A	0.3	2.7	0.67	0.82	0.67	44.5
Approach			347	11.8	347	11.8	0.172	5.5	LOS A	0.3	2.7	0.10	0.51	0.10	46.1
East: Mitchell Highway															
3	L2	All MCs	93	11.8	93	11.8	0.054	6.8	LOS A	0.0	0.0	0.00	0.56	0.00	56.4
4	T1	All MCs	489	1.1	489	1.1	0.237	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			582	2.8	582	2.8	0.237	1.1	NA	0.0	0.0	0.00	0.09	0.00	67.3
West: Mitchell Highway															
5	T1	All MCs	241	3.9	241	3.9	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	450	11.1	450	11.1	0.324	8.9	LOS A	1.9	14.7	0.60	0.71	0.62	49.9
Approach			691	8.5	691	8.5	0.324	5.8	NA	1.9	14.7	0.39	0.46	0.41	55.4
All Vehicles			1621	7.2	1621	7.2	0.324	4.1	NA	1.9	14.7	0.19	0.34	0.19	56.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 3PM_O3 [MIT_BLU_36_PM_O3 (Site Folder: 2036 Option 3)]

Output produced by SIDRA INTERSECTION Version: 9.1.5.224

Mitchell Highway / Blueridge Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Blueridge Drive															
1	L2	All MCs	445	7.1	445	7.1	0.252	4.5	LOS A	0.0	0.0	0.00	0.46	0.00	46.3
2	R2	All MCs	87	11.4	87	11.4	0.119	7.6	LOS A	0.4	2.9	0.50	0.72	0.50	47.8
Approach			533	7.8	533	7.8	0.252	5.0	LOS A	0.4	2.9	0.08	0.50	0.08	46.6
East: Mitchell Highway															
3	L2	All MCs	36	25.2	36	25.2	0.023	7.0	LOS A	0.0	0.0	0.00	0.56	0.00	53.3
4	T1	All MCs	370	3.8	370	3.8	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			406	5.7	406	5.7	0.182	0.6	NA	0.0	0.0	0.00	0.05	0.00	68.0
West: Mitchell Highway															
5	T1	All MCs	407	6.8	407	6.8	0.218	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	All MCs	248	17.0	248	17.0	0.163	8.2	LOS A	0.9	7.0	0.49	0.63	0.49	50.2
Approach			655	10.6	655	10.6	0.218	3.2	NA	0.9	7.0	0.19	0.24	0.19	60.8
All Vehicles			1593	8.4	1593	8.4	0.252	3.1	NA	0.9	7.0	0.10	0.28	0.10	56.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Thoughtful Transport Solutions

Suite 4.03, Level 4, 157 Walker Street, North Sydney NSW 2060
sctconsulting.com.au

CAPITAL DRIVE, DUBBO – TEMPORARY HAULAGE ROUTE

ROAD SAFETY AUDIT

STAGE 6: EXISTING ROAD

WAYSAFE
ROAD SAFETY AND TRAFFIC MANAGEMENT SPECIALISTS

PO Box 272 Parkes NSW 2870 | https://waysafe.au | 0414 769 330

Audit reference: A-241541
Date: 28/06/2024
Version: FINAL
For: Mark Johnston,
Dubbo Regional Council

CONTENTS

FIGURES

TABLES

1. CONTACT DETAILS

CLIENT DETAILS

Client Organisation:	Dubbo Regional Council
Address:	PO Box 81 Dubbo NSW 2830
Risk Manager:	Mark Johnston
Phone | Email:	0477 178 883 | mark.johnston@dubbo.nsw.gov.au

WAYSAFE DETAILS

ABN:	30 603 394 458
Address:	PO Box 272 Parkes NSW 2870
Contact:	Wayde Hazelton
Phone | Email:	0414 769 330 | wayde@waysafe.au
Web:	https://waysafe.au

DOCUMENT VERSION CONTROL

Version	Date	Comment
Draft Version 1	11/04/2024	Initial draft.
Draft Version 2	13/05/2024	Updated draft with current and 2036 traffic data, removed Findings relating to Commercial Ave and added Findings for Blueridge Dr.
Final Version	28/06/2024	Road Safety Audit Report finalised and issued.

2. INTRODUCTION

2.1. Objective of this Stage 6: Existing Road Audit

The objective of this Stage 6: Existing Road, Road Safety Audit is to identify potential risks to safety in the road environment and bring these risks to the attention of the road manager for consideration of remedial actions within the scope of management of all risks managed by the road manager.

2.2. Background to Capital Drive, Dubbo – Temporary Haulage Route

Two quarries and a concrete works are hauling material on existing Local roads to gain access to the Mitchell Hwy (HW7). Dubbo Regional Council plan to construct a new road, the Southern Distributor, which will provide improved access to the Mitchell Hwy for these heavy vehicles and others as the southeast area of Dubbo develops.

An Options Study was undertaken by SCT Consulting of North Sydney, which included five potential routes and the pros and cons of each. Of the five options, Option 3 was selected as the preferred option, maximising the use of existing high-strength roads.

2.3. Scope of Audit

A Road Safety Audit is a formal, systematic assessment of the potential road safety risks associated with a new road project, a road improvement project, or an existing road and is conducted by an independent qualified team. The assessment considers all road users.

This Road Safety Audit has been conducted following the general principles detailed in *Austroads (2022) Guide to Road Safety Part 6: Road Safety Audit*. An Audit Brief was not received however, data was provided by emails dated 5 April 2024.

Figure 1 provides a guide to the location and existing roads proposed to be used for the heavy vehicle temporary route, and of this road safety audit.

Figure 1. Route of the road safety audit, the constructed section of Option 3 (updated).

2.4. Exclusions / Not Assessed

Swept path drawings were not provided, risks associated with heavy vehicles negotiating the road network is discussed in the Findings located in Appendix F: Road Safety Audit Findings.

2.5. The Audit Team

The Audit was undertaken by Wayde Hazelton of WaySafe and the Audit Team with reference to the details provided in the Audit Brief. Table 1 provides information of the Team Members.

Table 1. Audit team member details.

Auditor Number	Name	Role	Organisation	Level
RSA-02-0079	Wayde Hazelton	Lead Auditor	WaySafe	3
RSA-02-0963	Robert Glen Morgan	Team member	WaySafe	3
RSA-02-1700	Durga Routray	Team member	WaySafe	1

2.6. Specialist Advisors and Observers

No others participated in the road safety audit.

2.7. Meetings

COMMENCEMENT MEETING

A commencement meeting was not held due to the short time allotted for the audit.

FINALISATION MEETING

A formal finalisation meeting was not held, summary discussions held by telephone.

OTHER MEETINGS AND CORRESPONDENCE

No other meetings were held. Information was received on Friday 5 April 2024 by email.

2.8. Methodology

The methodology generally followed the recommendations described in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* as follows:

- Site inspections, day and night
- Identifying road safety hazards
- Assessing road safety risks
- Reporting Findings

All the findings described in the 'Items Raised' section of this report are considered by the audit team to require action to improve the road safety outcomes of the project and to minimise the risk of crash occurrence and reduce potential crash severity into the future.

The audit team has examined and reported only on the road safety implications as presented and has not examined or verified the compliance of the road layout to Austroads guides or Australian Standards specifications, or any other criteria.

2.9. Site Inspections

The road safety audit team inspected the project site on 07/04/2024 between 17:00 and 19:30 and 08/04/2024 between 08:30 and 10:00, and 12/04/2024 between 16:45 and 18:45. The weather conditions were fine and dry, and the road environment was as expected, moderately busy during peak periods, generally quiet in the interpeak, and negligible traffic at night except between Mitchell Hwy and the McDonalds store. The general area was being used for learner driver practice in the evening, when traffic volumes were low.

2.10. Previous Safety Audits

ROAD SAFETY AUDITS

No previous road safety audits were provided or requested.

SAFE SYSTEM ASSESSMENTS

No previous safe system assessments were provided or requested.

OTHER ROAD SAFETY REVIEWS

No other road safety reviews were provided or requested.

2.11. Background Data

CRASH HISTORY

See Appendix B: Crash Data.

https://www.transport.nsw.gov.au/roadsafety/statistics/interactive-crash-statistics/road-users-by-crash-lga

TRAFFIC DATA

Traffic data was provided in the SCT Consulting document SCT 00505, South-East Dubbo Haulage Routes Options Study. It was only provided in, and adapted here from, the SIDRA outputs that were used to estimate the 2023 and the 2036 vehicle movements.

Note: *"Traffic data was sourced from publicly available reports and baselined to 2023, using a two per cent per annum growth factor, and the intersections were modelled in SIDRA."* (Source: SCT 00505, South-east Dubbo Haulage Routes Options Study, SCT Consulting Pty. Ltd., 22 March 2024, Section 4.1.1 Existing intersection performance.)

Morning peak traffic volumes, 2023 (estimated)

Afternoon peak traffic volumes, 2023 (estimated)

Morning peak traffic volumes, 2036 (estimated)

Afternoon peak traffic volumes, 2036 (estimated)

Figure 2. Traffic volumes by movement for the morning and afternoon peak periods, estimated for 2023 (top row) and 2036 with haulage route heavy vehicles (bottom row).

For the purposes of scoring the 'Exposure' risk element levels, Table 2 provides the expected levels based on the estimated 2023 and 2036 traffic volumes provided in Table 2 and the SCT Options Study.

Note: Due to data estimations, it is possible that the 2023 and the 2036 traffic data does not include increases in traffic volumes due to the ongoing development of the area. This potential underestimation may have road safety implications due to extended delays and queue lengths on both the Mitchell Hwy and Blueridge Dr. The 'Exposure Score 2036' for Trucks, shown highlighted in Table 2, is increased one level to accommodate potential higher than estimated truck activity.

Table 2. 'Exposure' scoring levels for Blueridge Dr, peak hour traffic volume estimates.

Road User Class	Pedestrian		Bicycle		Motorcycle		Light Vehicles		Buses		Trucks	
Peak Period	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Hourly volume (2023 estimated, no haulage route)	No data	No data	No data	No data	No data	No data	610	558	No data	No data	29	23
Hourly volume (2036 estimated, with haulage route)	No data	No data	No data	No data	No data	No data	891	816	No data	No data	102	93
Exposure Score 2023	2	2	2	2	3	3	3	3	2	2	2	2
Exposure Score 2036	2	2	2	2	3	3	3	3	2	2	**3**	**3**

SPEED DATA

Speed data was not provided. In consideration of the road environment, it is anticipated that the 85th percentile vehicle speed will be near to or above the posted speed limit of 50km/h.

RESTRICTED ACCESS VEHICLES

A review of the TfNSW online interactive Restricted Access Vehicle (RAV) map showed that Blueridge Dr and Capital Dr allow 25/26m B-double vehicles at Higher Mass Limit (HML) and up to 4.6m high.

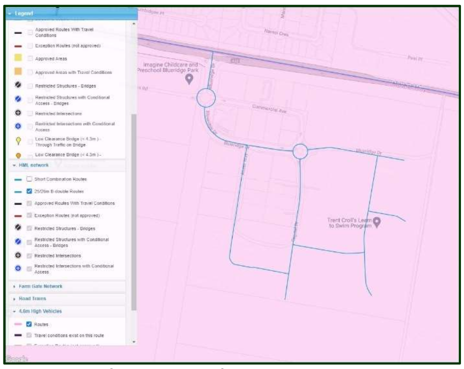

Figure 3. TfNSW map of 25/26m B-double routes, including HML and 4.6m access.

VULNERABLE ROAD USER DATA

Traffic and crash data specific to vulnerable road users, i.e. pedestrians, cyclists, and motorcyclists, was not provided. Vulnerable road users are not specifically addressed.

FRAIL ROAD USER DATA

Traffic and crash data specific to frail road users i.e. the elderly, young, or currently injured, was not provided. A childcare centre is located on the western side of Blueridge Dr between Mitchell Hwy and Commercial Ave (Wellington Rd to the west). There is potential for an increased volume of frail road users in the road environment, above that generally in the road user population.

2.12. Appendices

Appendix A: Audit Location – Plan View

Appendix B: Crash Data

Appendix C: Documents Used for the Audit

Appendix D: Contemporary Road Safety

Appendix E: Risk Scoring and Risk Rating

Appendix F: Road Safety Audit Findings

Appendix G: Audit Team Member Statement of Independence

Appendix H: Risk Manager Actions from Findings

3. ITEMS RAISED IN THIS STAGE 6: EXISTING ROAD AUDIT

This section provides a summary of the features that may **increase the likelihood** of a crash occurring, and the features that may **increase injury severity** should a crash occur. No feature that may increase crash likelihood resides in isolation, potentially there are several features that, if occurring together, may change the risk profile of the road. See Appendix F: Road Safety Audit Findings for background of this section.

The below section provides a summary of the main road safety hazards and risks. It is intended to assist the project manager to prioritise works based on road user class, road location, or level of risk, addressing likelihood (prevent crashes) or consequences (reduce level of harm).

3.1. Hazardous Features

As discussed in Appendix D: *Contemporary Road Safety*, injury severity in a crash in large part is dependent upon the energy in the crash, the angle of collision, and which road user classes are involved. The four Safe System significant crash types are discussed, and threshold speeds are advised; these speeds relate to a 10% probability of fatality and significantly higher probability of serious injury, see Table 4: *Crash category and the 10% likelihood of a fatality at the indicative speed* on page 8.

The proposed design has the potential for all Safe System significant crash types to occur above the Safe System threshold speeds. Each of the Findings in this road safety audit report discusses the potential for at least one Safe System significant crash type.

FEATURES THAT MAY INCREASE CRASH LIKELIHOOD:

- Roundabout geometry
- Proximity of roundabout to footpath and childcare centre
- Concrete blocks on roadway
- Conspicuity of road closure
- Road lighting
- Proximity of pedestrians and cyclists to moving vehicles
- Carriageway widths
- Manoeuvring space for heavy vehicles
- Traffic volumes and delay
- Mix of heavy vehicles, light vehicles, and vulnerable road users sharing the same road space
- High angle intersections
- Shadowing of approaching through vehicles
- Speed of traffic
- Driver fatigue

FEATURES THAT MAY INCREASE CRASH CONSEQUENCE

- Speed of vehicles
- Heavy vehicles
- Infrangible road closure

3.2. Risk Rating Summary

The risk rating summary table (Table 3) provides a snapshot of the risk rating scores for each Finding depending upon different traffic compositions, and suggests the road user class potentially at highest risk for each Finding. See Appendix F: Road Safety Audit Findings for information of the scoring methodology and how it may be used to consider the level of risk identified in each Finding. The 'Exposure' levels used to inform the Risk Ratings are provided in Table 4, and based upon the traffic data used in the SIDRA intersection modelling.

Table 3. Risk rating summary derived from Appendix F: Road Safety Audit Findings

Risk Rating Comparison	2024			2036 without haul road			2036 with haul road		
	Finding Score	User Score	Users	Finding Score	User Score	Users	Finding Score	User Score	Users
Finding 1	5.1	6.2	F,P	5.7	7.2	P	5.8	7.2	P
Finding 2	6.2	8.3	M	6.4	8.3	M			
Finding 3	5.3	7.4	F, P, C	5.5	7.9	P	5.6	7.9	P
Finding 4	4.4	5.7	C	4.7	5.7	C	4.8	5.7	C
Finding 5	6	7.4	P	6.2	7.9	P	6.3	7.9	P
Finding 6	5.7	7.4	M	6	7.4	M	6.1	7.4	M
Finding 7	6.9	7.4	F,C,M,L	7.2	7.9	L	7.2	7.9	L

Table 4. Road user exposure values used to inform the Risk Rating comparison in Table 3, based on the SIDRA traffic data provided in SCT 00505 South-East Dubbo Haulage Routes Options Study v4.0.

Road User Class	2024	2036 without haul road	2036 with haul road
F - Frail	2	2	2
P - Pedestrian	2	3	3
C - Cyclist	2	2	2
M - Motorcycle	2	2	2
L - Light vehicle (Car)	2	3	3
B - Bus	1	2	2
T - Truck	2	2	3

4. AUDIT TEAM LEADER STATEMENT

I hereby certify that the audit team have examined the audit site during both daylight and at night, and the documents listed in Appendix D in undertaking this Road Safety Audit. I also confirm that this audit has been carried out independently of the risk owner following the general principles detailed in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* and NSW *RTA (2011) Guidelines for Road Safety Audit Practices* where appropriate.

The audit has been carried out for the sole purpose of identifying any features within the road safety audit scope that could be altered or removed to improve the safety of the road. The identified issues have been noted in this report and the accompanying findings are offered for consideration by the risk owner / manager.

Audit Team Leader

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Position: Lead Auditor
Organisation: WaySafe
Phone: 0414 769 330
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DISCLAIMER

This report contains Findings and Risk Rating based on examination of the relevant documentation and/or site. The report is based on the conditions viewed on the day and time of each site inspection and provided in Section 2.3 Scope of Audit, and is relevant at the time of production of the report. Information and data contained within this report is prepared with due care by the Road Safety Audit Team. While the information and data provided in this report has been prepared with due care by members of the Audit Team, the Audit Team cannot guarantee its accuracy.

Readers should not solely rely on the contents of this report or draw inferences to other sites. Users must seek appropriate expert advice in relation to their own circumstances.

The Road Safety Audit Team does not warrant, guarantee, or represent that this report is free from errors or omissions or that the information is exhaustive. Information contained within may become inaccurate without notice and may be wholly or partly incomplete or incorrect. Before relying on the information in this report, users should carefully evaluate the accuracy, completeness, and relevance of the data for their purposes.

Subject to any responsibilities implied in law which cannot be excluded, the Road Safety Audit Team is not liable to any party for any losses, expenses, damages, liabilities or claims whatsoever, whether direct, indirect, or consequential, arising out of or referable to the use of this report, howsoever caused whether in contract, tort, statute or otherwise.

APPENDIX A: AUDIT LOCATION – PLAN VIEW

Figure 4 provides a map of the audit locality showing the five routes considered in the Options Study. The preferred option is Option 3, demarcated by the green line, which provides the physical scope of this Stage 6 road safety audit.

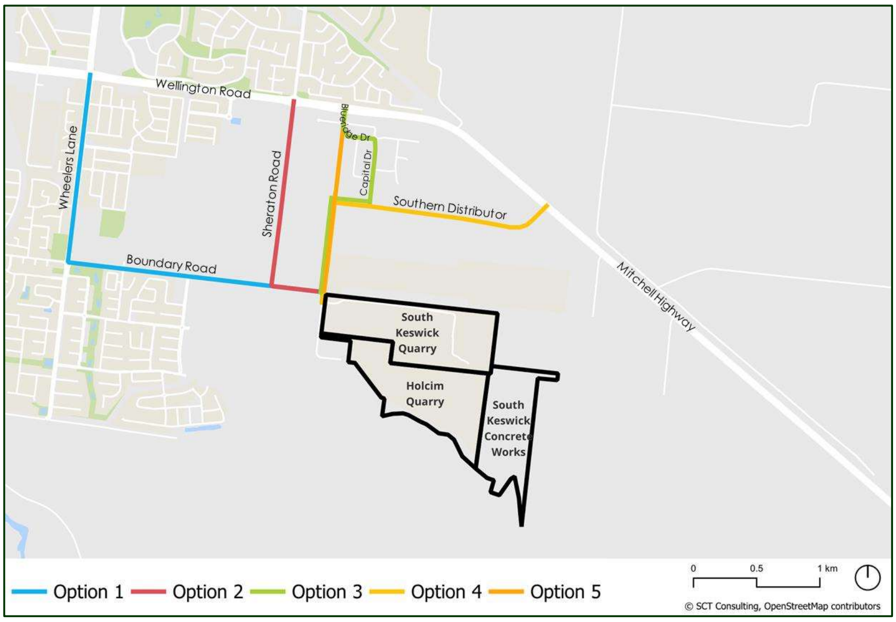


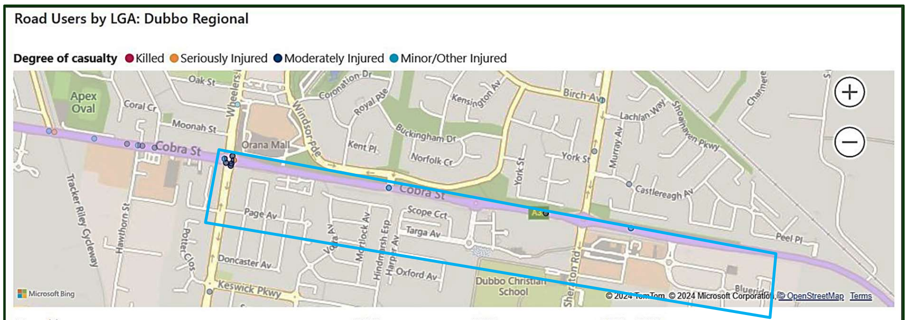
Figure 4. Map of the audit vicinity showing each of the heavy vehicle route options, and the industrial area to the southeast.

(Map snipped from SCT Consulting (2024) South-East Dubbo Haulage Routes Options Study, 22 March 2024, page i.)

APPENDIX B: CRASH DATA

Crash data was sourced from the TfNSW online crash database. The map provides the reported crash data for the calendar years 2018 to 2022 inclusive. The blue rectangle encloses the Mitchell Hwy intersections included in the Options Study.

The data shows one serious injury, at Wheelers Ln in 2021, eight moderate injuries (seven of which were at Wheelers Ln), and four minor injuries. Over the five years, there were 12 injury crashes resulting in 13 people being injured. 58% of the crashes occurred in 2021.



Casualties	2018	2019	2020	2021
Seriously Injured				1
Moderately Injured	1	2		5
Minor/Other Injured		1	2	1

Crashes	2018	2019	2020	2021
Serious Injury				1
Moderate Injury	1	2		5
Minor/Other Injury			2	1

Figure 5. Crash map and crash data for the intersections of the Mitchell Hwy with the haulage route options. No crashes were recorded within the audit area.

APPENDIX C: DOCUMENTS USED FOR THE AUDIT

STANDARDS AND GUIDELINES

Austroads (2016). AP-R509-16 Safe System Assessment Framework

Austroads (2018). Towards Safe System Infrastructure: A Compendium of Current Knowledge

Austroads (2020). Infrastructure Risk Rating Manual for Australian Roads

Austroads (2020). Integrating Safe System with Movement and Place for Vulnerable Road Users

Austroads (2021). Guide to Road Design Part 3: Geometric Design

Austroads (2023). Guide to Road Design Part 4: Intersections and Crossings – General

Austroads (2023). Guide to Road Design Part 4A: Unsignalised and Signalised Intersections

Austroads (2023). The Guide to Road Design Part 4B: Roundabouts

Austroads (2023). Guide to Road Design Part 5B: Drainage-Open Channels, Culverts and Floodway Crossings

Austroads (2022). Guide to Road Design Part 6: Roadside Design, Safety and Barriers

Austroads (2021). Guide to Road Design Part 6A: Paths for Walking and Cycling

Austroads (2021). Guide to Road Design Part 6B: Roadside Environment

Austroads (2021). Guide to Road Safety Part 1: Introduction and The Safe System

Austroads (2021). Guide to Road Safety Part 2: Safe Roads

Austroads (2021). The Guide to Road Safety Part 3: Safe Speed

Austroads (2022). Guide to Road Safety Part 6: Road Safety Audits

RTA (2011). Guidelines for Road Safety Audit Practices

WEB PAGES

Google Maps (2022). https://www.google.com/maps

SIX Maps (2022). https://maps.six.nsw.gov.au

TfNSW (2022). Centre for Road Safety Crash Database
https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=1

TfNSW (2022). https://roads-waterways.transport.nsw.gov.au/cgi-bin/index.cgi

AUDITABLE MATERIALS PROVIDED BY DUBBO REGIONAL COUNCIL

Drawing / Document No.	Version & Date	Drawing Index / Document Title
SCT_00505	22/03/2024	South-East Dubbo Haulage Routes Options Study v4.0
21154-S01_E	E; 03/02/2022	21154-S01. Concept Site Layout
XX XXXX	A; 14/08/2023	Capital Drive Road Extension Project – Overall Drainage Strategy Concept
XXX ####	0; 15/12/2023	Capital Drive Road Extension Project – Road Design Draft Plans
FILE23/213	September 2023	FILE23/213 Provide your feedback/comment Form Submission

APPENDIX D: CONTEMPORARY ROAD SAFETY

D.1. Towards Zero in NSW

BACKGROUND

In 2017, 392 people died due to road trauma on NSW roads, and more than 12,000 suffered serious injuries. To put this in a rural NSW perspective, this equates to every resident of Mudgee being seriously injured on NSW roads, every year.

70% of the NSW road fatalities occurred on country roads; in 2017, 272 people died due to road trauma on country roads. Country people comprise 1/3 of the NSW population yet are 2/3 of the fatalities on NSW roads.

In response the NSW government, through TfNSW, built on to the NSW *Road Safety Strategy 2012-2021* developing the 2026 Road Safety Action Plan, and introduced ambitious road safety targets, through to the aspiration for zero deaths and serious injuries on NSW roads by 2056.

The **Saving Lives on Country Roads** stream of the Road Safety Plan targets "*improving road safety infrastructure, including targeting high-risk roads*···" This is pertinent to the design and construction of roads.

Figure 6: 2026 Road Safety Action Plan and road trauma targets

SAFE SYSTEM PHILOSOPHY

The Safe System adopts a holistic approach to road safety, considering the interaction between the road environment, the road user, the vehicles, and the travel speeds. It acknowledges that road safety is a shared responsibility, that humans are frail, and that humans make mistakes.

Historically, road crashes were generally understood to be due to driver error. The contemporary view is that the error is in the system; the driver may have made an error, but they should not be punished with death or serious injury, the road system should be forgiving of the error.

"*An error is an out of tolerance action, where the limits of tolerable performance are defined by the system."* Swain and Guttman (1983).

The NSW government, along with all States and Territories of Australia, adopted the Safe System principles in the National Road Safety Strategy 2011-2020. Also see the NSW Government submission Joint Select Committee on Road Safety.

TOLERANCE IN THE SYSTEM

The Safe System proposes four major crash categories and accompanying thresholds. The speed thresholds are general case where the road user has a 10% likelihood of death. These speeds have been challenged by other studies and are therefore considered indicative. *Table* 5 provides the crash categories and indicative speeds set out in the Austroads Safe System Assessment Framework.

Table 5: Crash category and the 10% likelihood of a fatality at the indicative speed

Crash Category	**10% Likelihood of Fatality** (speeds are indicative)
Car – Vulnerable road user (pedestrian, motorcyclist, or cyclist)	30 km/h
Car – Tree or Pole (side impact into infrangible object)	40 km/h
Car – Car (side impact, intersections)	50 km/h
Car – Car (head-on)	70 km/h

Note: In NSW, rear end crashes are also a major crash category.

PLANNING FOR 2050 ROAD SAFETY TARGETS

In planning to meet the NSW Government's aspirational 2050 road safety target of zero deaths and serious injuries, a concentrated effort is required to 'design out' the types of road infrastructure that is proven to be of highest risk. This, together with the Saving Lives on Country Roads program of mitigating works and the plethora of other initiatives addressing the four pillars of the Safe System, will aid in approaching the 2050 target. The design and construction of road infrastructure is one of the four keys to reducing road trauma on NSW roads, now and into the future.

In planning, designing, and constructing road infrastructure the following must be considered:

- Vulnerable road users should be protected from high-speed traffic, which in their context is above 30km/h. This would generally be by separating the vulnerable from the vehicles (see *Providing for Walking and Cycling in Transport Projects Policy – CP21001)*

- Vehicles entering an intersection from adjacent approaches should be protected from colliding at 90 degrees. As provided in Table 5 the speed threshold at impact for intersections of this design is 50km/h. "*Design is one way to manage speeds; for example, roundabouts can geometrically constrain vehicles to lower speeds and more favourable conflict angles*."[1]
- Vehicles travelling in opposing directions should be protected from colliding head-on. As per *Table 5* the speed threshold is 70km/h at time of impact – designing to separate opposing vehicles in high-speed road environments may be required.
- Run-off-road crash types may result in a side impact into an infrangible object or a vehicle roll-over. Table 5 provides a threshold of 40km/h for the run-off-road side impact type crash. No data is available for roll-over crash types.

Where the risk cannot be eliminated, a harm minimisation approach is advocated, reducing the trauma suffered to a non-serious level.

D.2. The Safe System in Road Safety Audit

The aim of the Safe System Findings is to focus the Road Safety Audit process on considering safe speeds and by providing forgiving roads and roadsides. This is to be delivered through the Road Safety Audit process by (a) accepting that people make mistakes, and (b) considering the known limits to crash forces the human body can tolerate. This may be achieved by focusing the risk rating findings of the Road Safety Audit on identified crash types that are known to result in higher severity outcomes at relatively lower speeds, with the aim to reduce the risk of fatal and serious injury crashes. See Table 5: Crash category and the 10% likelihood of a fatality at the indicative speed, for the identified thresholds speeds.

The exposure and likelihood of crash occurrence is considered for all findings, focusing on those that have the potential to exceed these threshold speeds.
Adapted from: *Austroads (2019), Guide to Road Safety Part 6: Managing Road Safety Audits*

The indicative speeds provided by the Safe System represent the 10% likelihood of a fatality (or 90% survivability) for the crash type. The likelihood of sustaining serious injuries is significantly higher than the likelihood of a fatality at these speeds. However, the likelihood of a fatal outcome increases exponentially with increased speed.

In this road safety audit report the risk rating of the Findings methodology draws upon the information provided in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audits* and *Austroads (2016), Safe System Assessment Framework*.

[1] Austroads (2016). *Safe System Assessment Framework*, A.1.3 Safe System Speeds, p29.

APPENDIX E: RISK SCORING AND RISK RATING

E.1. Risk Scoring

Scoring the relative level of risk for each risk identified in a road safety audit has historically provided a point of debate between users. In part, this was due to the subjective nature of selecting appropriate levels for the risk elements. The *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* has provided greater clarity on potential crash severity, particularly the use of a Severity Guidance Chart, an adaptation of which is provided in Figure 8, and use of the spread of risk levels in the Austroads (2022) Risk Matrix. Figure 7 provides the risk rating ranges adopted by WaySafe. The risk rating ranges were compared between the Austroads (2022) risk matrix and the TfNSW (2011) risk matrix, revealing negligible difference.

RISK RATING	MINIMAL	LOW	MEDIUM	HIGH	EXTREME
score (x/10)	<3	3 to <4	4 to <5.9	5.9 to 8.1	>8.1

Figure 7. Risk Rating ranges

Influence is drawn from the *Austroads (2016), Safe System Assessment Framework* and includes extending the consideration of all road user classes and Safe System significant crash types.

The Risk Rating method adopted in WaySafe Road Safety Audits incorporates features of the Austroads documents noted above. The following dot points provide where the WaySafe method builds upon and extends elements of the Austroads documents:

- 'Exposure' values are suggested in volume ranges for each road user class in the road environment and scored from one to five. The vehicle classes data is extrapolated from the general percentage of each vehicle class in the Australian road vehicle fleet.
- There is greater definition provided for each 'Likelihood' level. Reference to other road safety predictive techniques may also provide guidance as to the likelihood of a crash occurring.
- The method used to calculate the *Road User Risk Rating* for each road user class, and for the *Finding Risk Rating*, considers 'Exposure', 'Likelihood', and 'Severity' as vectors, and with a constant applied provides a simple risk rating score out of ten.
- A Risk Rating is provided for each road user class, and for the Finding.

It is envisaged that providing a risk rating for the most at-risk road user class(es) will assist the project manager to better target risk reduction measures.

Table 6 provides descriptions for scoring the risk elements, for each road user class. The equations used to calculate the Risk Ratings, based on user input, are below.

Risk Rating score for each Road User Class is calculated by:

$$Risk\ Rating\ Road\ User = ((\sqrt{Exposure^2 + Likelihood^2 + Severity^2}\ ) - 0.95) * 1.29$$

Risk Rating score for each Finding is calculated by:

$$Risk\ Rating\ Finding = \sqrt{Sum\ of\ all\ (Road\ User\ Risk\ Rating^2)} * 3.79795$$

Table 6. Risk scoring guidance table for road user classes.

Level	Exposure	Likelihood	Severity
1	It is **not expected that any road users** of the class would use this section of road, or they are **precluded** from the area.	There are **multiple, overlapping levels of safety controls** in place and **redundancy** is built into the system. Safe System primary treatments are employed. Facilities meet AusRAP 5-star rating. Austroads IRR is <1.4.	**Non-injury** and property damage is the most probable result of the crash type for this road user group.
2	**Low volume** of the road user class. Light vehicles <120 per hour Buses <3 per hour Trucks <20 per hour Pedestrian <8 per hour Motorcycle <8 per hour Bicycle <8 per hour Frail <8%	There are **multiple levels of safety controls** in place. Redundancy is not built into the system. Safe System supporting treatments are employed. Facilities meet AusRAP 4-star rating. Austroads IRR is 1.4 to <1.7.	**Minor injury** (treated at the scene) is the most probable result of the crash type for this road user group.
3	**Moderate volume** of the road user class. Light vehicles 120 to <1,000 per hour Buses 3 to <12 per hour Trucks 20 to <150 per hour Pedestrian 8 to <60 per hour Motorcycle 8 to <60 per hour Bicycle 8 to <60 per hour Frail 8% to <16%	There are **multiple safety controls** in place, e.g., meets minimum of Design Guide and Australian Standards requirements. Redundancy is not built into the system. Safe System treatments are not employed. Facilities meet AusRAP 3-star rating. Austroads IRR is 1.7 to <2.0.	**Moderate injury** (treated at hospital but not admitted) is the most probable result of the crash type for this road user group

Level	Exposure	Likelihood	Severity
4	**High volume** of the road user class. Light vehicles 1,000 to 2,000 per hour Buses 12 to 255 per hour Trucks 150 to 300 per hour Pedestrians 60 to 110 per hour Motorcycle 60 to 110 per hour Cyclist 60 to 110 per hour Frail 16% to 24%	There are **minimal safety controls** in place, e.g., meets some minimum level of Design Guide and Australian Standards, but not all, and/or in poor condition. Redundancy is not built into the system. Safe System treatments are not employed. Facilities meet AusRAP 2-star rating. Austroads IRR is 2.0 to 2.3.	**Serious injury** (admitted to hospital) is the most probable result of the crash type for this road user group
5	**Congested** for the road user class. Light vehicles >2,000 per hour Buses >255 per hour Trucks >300 per hour Pedestrians >110 per hour Motorcycle >110 per hour Cyclist >110 per hour Frail >24%	There are **few, if any, safety controls** in place. Redundancy is not built into the system. Safe System treatments are not employed. Facilities only meet AusRAP 1-star rating. Austroads IRR is >2.3.	**Fatal injury** (dies within 30 days) is the most probable result of the crash type for this road user group
Notes	• *Exposure:* **vehicle** 'volumes' are per lane, per hour, in peak periods; **pedestrian** and **cyclist** volumes are per direction in peak periods. • *Likelihood:* descriptions supply guidance from other road safety predictive methods. These are a guide only. • *Severity:* considers the 'probable' level of (physical) injury severity rather than the worst case, as someone could die in practically any road crash. • *Serious injury:* has a very broad definition, the person is admitted to hospital. This may only be for observation and sent home the next day or it may be for quadriplegia or other life changing injury. • Mental health aspects of road users, witnesses, health workers, and recovery workers are not considered in 'Severity'.		

E.2. Severity Guidance Chart

The severity guidance chart provided in Figure 8 suggests the probable degree of severity for each crash type, should a crash occur at the given speed. **The severity guidance chart is a guide only.** The number of confounding factors in crashes are so great, that, considering the proposed use of this table, it is beyond the scope of a road safety audit to provide a definitive severity outcome for each potential crash.

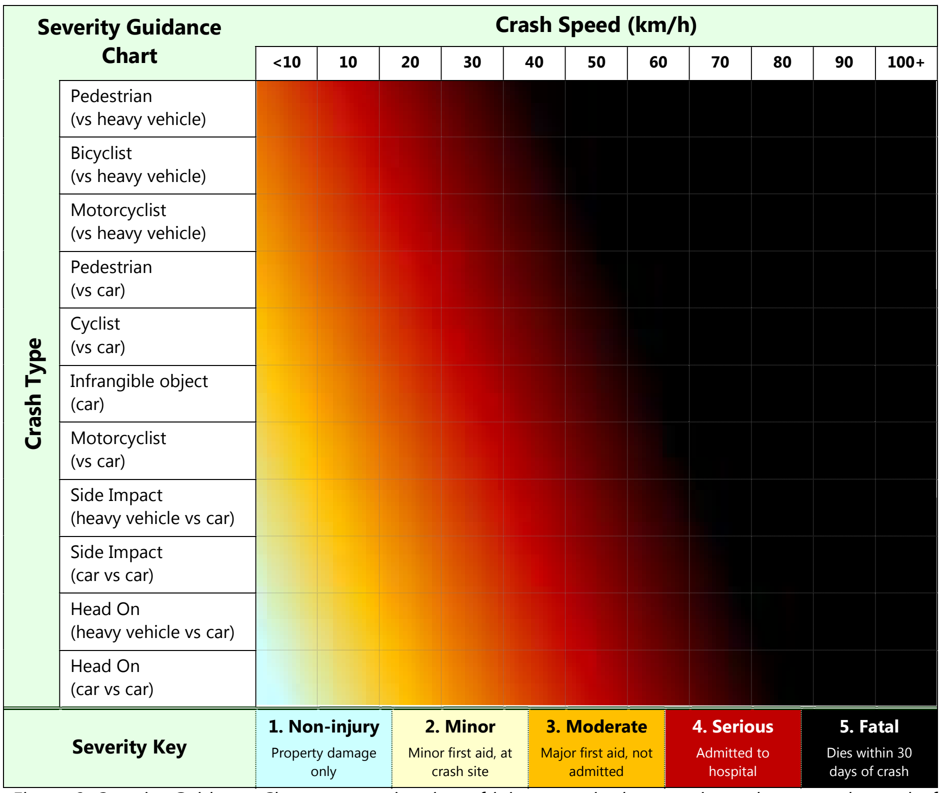


Figure 8. Severity Guidance Chart – approximation of injury severity by generic crash type and speed of crash.

E.3. Risk Rating Tool

Table 6 and Figure 8, are used to inform input into the Risk Rating Tool provided in Appendix F: Road Safety Audit Findings, to 'score' the Exposure, Likelihood and Severity for each road user class, the scores are restricted to whole numbers between 1 and 5 inclusive. Selected check boxes show the Safe System Significant crash types, as described in Appendix D: Contemporary Road Safety.

Note that '**Frail road users**' are included in the road user classes for separate consideration. This acknowledges that some road users are at higher risk of injury from a given event than the general population, and for some a minor injury can lead to their death from complications. Frail road users may be a subset of any of the other road user classes, and include the elderly, very young, and those who are already injured or ill.

Finding:

Risk Rating by Road User Class	Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (out of 10)
	Frail road users				
	Pedestrians				
	Cyclists				
	Motorcyclists				
	Car occupants				
	Bus occupants				
	Truck occupants				

Safe System Significant Crash Types:
- Head-on > 70km/h
- Side impact, car vs car > 50km/h
- Run-off-road (side impact infrangible object) > 40km/h
- Vulnerable road user > 30km/h

Finding Risk Rating Gauge

Potential timing of mitigation measures:

© WaySafe® 2023 - Risk Rating Tool   RRT2311v3.1

RISK RATING score (x/10)	MINIMAL	LOW	MEDIUM	HIGH	EXTREME
	<3	3 to <4	4 to <5.9	5.9 to 8.1	>8.1

Figure 9. Risk Rating Tool – double-click to use, click outside the box to close.

For an identified Risk, the Risk Rating by Road User Class provides for the level of Risk for each road user class in the incident. For example, should the incident be between a pedestrian and a car, the pedestrian would be scored using their Exposure, Likelihood and their 'probable' injury Severity, and the car occupants be scored for their Exposure and Likelihood, and their 'probable' injury Severity. The Risk Rating for each road user class is calculated by Formula 1, on page 17. The Finding Risk Rating is calculated using each of the road user class risk scores in Formula 2.

APPENDIX F: ROAD SAFETY AUDIT FINDINGS

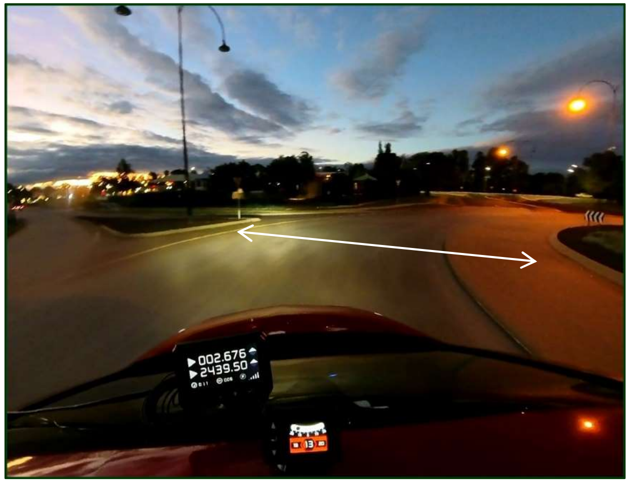
Appendix F provides details of the road safety hazards and risks identified in this road safety audit. It is based on the Austroads 2022 reporting model and risk rating, enhanced through a risk rating system adapted from the Safe System Assessment scoring methodology. It provides a more objective assessment of the level of risk through numeric values for exposure, likelihood, and injury severity. This ensures the audit considers all road user classes and provides a baseline score of the potential level of risk for each road user class and for the Finding.

Similar to Safe System Assessment scoring, each road user class is scored for Exposure, Likelihood and Severity. The risk score for each road user class is calculated as described on page 17, providing a comparison basis for road user classes and potentially the road users at most risk. These road user class risk scores are used to calculate a total risk score for the hazard (Finding) as described on page 17. This provides a baseline score for individual road user classes and total for the hazard, allowing greater targeting of treatments of the hazard, program targeting for funding, and a baseline risk score to assess the potential effectiveness of treatments.

The Safe System Significant Crash Types area in the Tool provides whether the identified crash types and severities are likely to exceed the Safe System injury threshold, that is of the five identified high-risk crash types and a potential for serious injury or fatal severity outcomes. Should the Severity be determined to be severe injury or fatality, Austroads 2022 suggests that the **likelihood level is considered irrelevant**, the level of risk of the hazard should be reduced or eliminated no matter the likelihood.

Finding 1: Errant vehicle entering preschool premises

Location:	Roundabout at the intersection of Blueridge Dr, Wellington Rd and Commercial Ave, Blueridge Park, Dubbo
Rationale for Road Safety Risk and Potential Road Safety Event:	The roundabout is designed to accommodate the swept path of heavy vehicles, noting the wide bitumen travel surface and the raised concrete ring providing additional swept path width, see white arrow in F1.1. The childcare centre fence line is around 3m behind the kerb line and is considered within the errant vehicle run-out zone for a 50km/h area. Austroads (2022) provides a run-out length of 24m. It is highly unlikely that drivers will be turning left or right at this speed but may be physically able to travel straight at 50km/h. The northbound approach carriageway consists of two lanes, see F1.3. Considering the approach and roundabout geometry, it is possible that northbound through drivers on Blueridge Dr will be travelling at a higher speed, closer to 50km/h. The blue arrow in F1.2 provides the likely travel path for northbound through vehicles, suggesting the potential for drivers to 'straighten' the travel path by using all the available road surface and the concrete ring. For a vehicle to strike a person on the footpath or in the childcare centre, it must (1) leave the road; this is noted as being possible, particularly where light vehicle drivers have become desensitised to g-forces in low-speed environments. The vehicle must then (2) travel out-of-control on an alignment towards the footpath and childcare centre, and breach the fencing; both are noted as being possible, the roundabout providing a short section where vehicles are moving directly at the childcare centre, see the red dotted line in F1.2. There must be (3) a person in the path of the errant vehicle; this is also possible with potential for pedestrians on the footpath and people within the grounds of the childcare centre. A loss of control may also lead to the vehicle colliding with roadside objects or rolling over. However, the probability of this occurrence is very low, based on the number of drivers who safely negotiate roundabouts in Dubbo, and the level of vehicular activity at the roundabout. Observed during the site inspections, there was sufficient activity that drivers approaching the roundabout would expect that another vehicle will be in the roundabout.



F1.1: Travelling around the roundabout, facing the childcare centre. Electronic ballbank showing a reading of 13 at 11km/h, providing an advisory speed of 15km/h. (Image: WaySafe 2024.)

Finding 1: Errant vehicle entering preschool premises

Nevertheless, in line with meeting the NSW road safety targets (see Appendix D: Contemporary Road Safety), and as noted on page 22:
"*Should the Severity be determined to be severe injury or fatality, Austroads 2022 suggests that the likelihood level is considered irrelevant, the level of risk of the hazard should be reduced or eliminated no matter the likelihood.*"

F1.3: Blueridge Dr southern approach leg looking north through the roundabout. The Blue arrow provides the approximate path of a speeding vehicle; the dark Green arrow approximates the prescribed travel path. (Image: WaySafe 2024.)

F1.2: Aerial photograph of the roundabout and southern approach. Blue arrow, straight through on Blueridge Dr, Red dotted line potential path of an off-road crash. *(Aerial photograph: Google Maps)*

Finding 1: Errant vehicle entering preschool premises

Risk Ratings for road user classes and overall Finding Risk Rating

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	3	**5**	6.7
Pedestrians	3	3	**5**	7.2
Cyclists	2	3	**4**	5.7
Motorcyclists	2	3	**4**	5.7
Car occupants	3	3	3	5.5
Bus occupants	2	3	2	4.1
Truck occupants	3	3	2	4.8
Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on >70km/h
- ☐ Side impact, car vs car >50km/h
- ☑ Run-off-road (side impact infrangible object) >40km/h
- ☑ Vulnerable road user >30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.8

MEDIUM

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

 RRT 2309 v3.0

Finding 2: Conspicuity of concrete blocks across Capital Dr

Location: Capital Dr, southern extent road closure

Rationale for Road Safety Risk and Potential Road Safety Event:

The southern end of Capital Dr is under construction, the road being closed south of Asset Way by the placement of large concrete blocks on the road, see F2.2.

A driver travelling south on Capital Dr is likely to be unaware of the road closure, and at night the blocks difficult to observe (red arrow in F2.1) until close enough for low beam headlights to illuminate the facing surface. The ability to understand the road closure at night is made more difficult by a row of lights (yellow arrow in F2.1 and F2.2) in the distance that suggest that the road continues. Note this row of lights is also in the distance in F2.2, looking south from the concrete blocks. The road closure is not evident at night until within 30m.

For a driver travelling at the assumed speed limit of 50km/h, stopping distance is greater than 30m, requiring urgent evasive steering to avoid colliding with the blocks. (Note: at this stage of development it is unclear whether the speed limit is the default urban limit of 50km/h or having left the *built-up area*, as defined in the NSW Road Rules, is now the default rural limit of 100km/h.) This may lead to a loss of control, the vehicle sliding sideways into the blocks or another roadside object, or rolling over.

Under the prevailing conditions it is likely that a driver would be travelling at or above 50km/h. A light vehicle colliding with the blocks would most probably result in serious injuries to vehicle occupants. Should the vehicle be a motorcyclist, fatal injuries are the probable outcome. Heavy vehicle occupants would probably have less severe injuries should their vehicle strike the blocks.

F2.1: Travelling south, road closed ahead, red arrow shows the location of the concrete blocks ~30m ahead. (Images: WaySafe 2024.)

F2.2: Looking south at the concrete blocks across the road, note the lights in the distance that suggested the road continues.

Finding 2: Conspicuity of concrete blocks across Capital Dr

F2.3: Capital Dr, road closure in daylight

Risk Ratings for road user classes and overall Finding Risk Rating

To be a haul route, these blocks would be removed. Therefore, this Risk Rating is based on estimated 2036 traffic volumes, no haul route.

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	2	**4**	5.1
Pedestrians	3	1	1	3.1
Cyclists	2	3	3	4.8
Motorcyclists	2	5	**5**	8.3
Car occupants	3	5	**4**	7.9
Bus occupants	2	5	3	6.7
Truck occupants	2	5	3	6.7
Road users at highest risk:	Motorcyclists			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on >70km/h
- ☐ Side impact, car vs car >50km/h
- ☑ Run-off-road (side impact infrangible object) >40km/h
- ☑ Vulnerable road user >30km/h

Finding Risk Rating Gauge Finding Risk Rating Score: 6.4 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

 RRT2309 v3.0

Finding 3: Pedestrians and cyclists travelling along public roads within Blueridge Business Park		
Location:	Public roads in Blueridge Business Park	
Rationale for Road Safety Risk and Potential Road Safety Event:	Safely negotiating the Blueridge Business Park (BBP) road network would be difficult for pedestrians and cyclists, particularly during periods of reduced visibility, such as fog, rain, and at night. Apart from the footpath at the childcare centre, connectivity for pedestrians is provided through kerb ramps at most roundabouts and generally associated with breaks in the splitter islands, which together provide connectivity between the grassed nature strips. Kerb ramps are usually provided to connect the footpath to the road surface, allowing less-ambulant pedestrians to access the road surface to cross the road. In the BBP area, pedestrians may have difficulty travelling on the grassed nature strip and therefore stay on the road surface, particularly those using a wheeled mobility aid. This may result in pedestrians travelling along the road, with the potential to be struck by a vehicle. At night, sighting of a pedestrian on the road may be difficult for drivers and they may not be expecting a pedestrian on the road, increasing the potential for a pedestrian to be struck by a moving vehicle, or the driver crashing attempting to avoid the pedestrian. Similarly, cyclists would probably share the road with vehicles, road shoulders being used by parked vehicles and the verge being incompatible for general cycling. A cyclist on the road may be struck by a moving vehicle, or by the door of a parked car being opened. It could therefore be considered that traffic planning of the business park was focused on passenger cars. This has the effect of precluding or discouraging involvement by a part of the community and increasing the demand for parking on and off the road network. This can already be evidenced by the demand for parking in the Blueridge Dr – Asset Way area. For every vehicle parked on the roads there are at least two on-road pedestrian movements, and around 2% of drivers have mobility issues. These people will also have difficulty travelling to the proposed destination without 'walking' on the road and are therefore at increased risk of being struck by a moving vehicle.	 F3.1: Blueridge Dr north of the Commercial Ave roundabout. Yellow arrows show the pedestrian refuge and kerb ramps. The footpath is visible on the left. The kerb ramp on the eastern side of Blueridge Dr, approximate location shown by the red arrow, provides for pedestrians to gain access to the grassed nature strip.  F3.2: Capital Dr at Blueridge Dr roundabout. Example of kerb ramp connectivity.

Finding 3: Pedestrians and cyclists travelling along public roads within Blueridge Business Park

Road lighting within the area is minimal away from the major roundabouts, increasing the difficulty for drivers to see pedestrians on the road. It is noted that the childcare centre is open from 06:30 to 18:30, which includes hours of darkness during the winter months.
Should a pedestrian or cyclist be struck by a vehicle, the probable outcome for the pedestrian or cyclist is serious injury, with an increased probability of fatality if struck by a heavy vehicle.

Risk Ratings for road user classes and overall Finding Risk Rating

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	4	**5**	7.4
Pedestrians	3	4	**5**	7.9
Cyclists	2	4	**5**	7.4
Motorcyclists	2	2	2	3.2
Car occupants	3	2	2	4.1
Bus occupants	2	1	1	1.9
Truck occupants	3	2	1	3.6
Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [x] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.6 — **MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

 RRT2309 v3.0

Finding 4: Squeeze point

Location: Capital Dr, south of Blueridge Dr

Rationale for Road Safety Risk and Potential Road Safety Event:

The southern Capital Dr approach to the Blueridge Dr roundabout is provided with a left turn only left lane, marked by a left arrow pavement marking, and a through and right turn right lane, marked by a combined pavement arrow. On approach to this, the western kerb 'bumps out' to provide physical separation between the shoulder area used for kerbside parking and the left turn lane, see F4.1.

At this squeeze point the usable road width is reduced to 3.1m northbound and 3.2m southbound (excluding BB centreline marking), as set out below.

Site	Northbound Lane (m)	Lane Separation (m)	Southbound Lane (m)
Squeeze point	3.1	BB – 0.3	3.2
Roundabout, southern leg	7.8	Splitter island – 1.1	8.0

The physical narrowing of the travel lanes reduces the margin for error, most critical for heavy vehicles, which have a maximum width of 2.5m plus 0.2m either side for mirrors, a total width of 2.9m. In effect, the clearance between passing heavy vehicles at this point is little more than the BB centreline marking.

Considering Finding 3, this squeeze point may add to the risk of a cyclist (or pedestrian using a wheeled device) being struck by a moving vehicle; or vehicles colliding head-on should a driver cross the centreline attempting to overtake the cyclist. The results of a vulnerable road user being struck are probable serious injury, with potential for fatality if a heavy vehicle is involved. Should vehicles collide head-on, moderate injury is the probable result for light vehicle occupants, and serious injury for light vehicle occupants if a truck is involved.

F4.1: Capital Dr south of Blueridge Dr, squeeze point. The yellow arrow shows a sign post on the back of the kerb, which may cause heavy vehicle drivers to shy away to avoid striking the post with their left mirror.

Finding 4: Squeeze point

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	2	3	4.1
Pedestrians	3	1	**4**	5.4
Cyclists	2	3	**4**	5.7
Motorcyclists	2	1	**4**	4.7
Car occupants	3	3	3	5.5
Bus occupants	2	2	2	3.2
Truck occupants	3	2	2	4.1
Road users at highest risk:	Cyclists			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 4.8 — **MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

RRT2309 v3.0

Finding 5: Readability of safer travel paths

Location:	Blueridge Dr, between Commercial Ave and Capital Dr
Rationale for Road Safety Risk and Potential Road Safety Event:	This section of Blueridge Dr, southbound from Commercial Ave, is a four-lane road, the carriageway divided by a concrete and gardened median (see F5.1) for around 60m. The road transitions to a three-lane road (see F5.2), which includes a two-way right turn lane (TWRTL). The TWRTL continues for around 180m (see F5.3) where it transitions into a splitter island on approach to the Capital Dr roundabout. • Southbound, the lane drop transition area is unclear, the faded lane linemarking (L1) finishes at an indeterminate point. Unless familiar with the site, drivers would not be aware of the lane drop and the requirement to merge into a single travel lane. Parking is precluded through this area, and extends around the left curve for approximately 50m. A driver in the left lane may not be aware of the need to merge into one lane, or the imminent introduction of parking against the kerb. This could lead to side-swipe type crashes, where a driver does not see another vehicle beside them, potentially in the blind spot, which is exacerbated by the left curve. This effect may be exacerbated by increased road width required on curves for longer vehicles, to accommodate the cut-in while turning. A rear-end with a parked vehicle may also occur where the driver in the left lane is contained by a parked vehicle ahead and another vehicle beside. Probable occupant injury severity for crashes between light vehicles is minor, with a moderate degree of injury should a heavy vehicle be involved. A motorcyclist or cyclist would probably sustain serious injuries if involved in these crash types. • The TWRTL is around 180m long, providing sufficient length for overtaking. Due to the intent of TWRTLs, and the implementation in this case, overtaking in the TWRTL is possible, which may lead to a head-on collision of the overtaking vehicle with an opposing vehicle positioning to turn right. This includes right turn movements at driveways, and at the Asset Way T-junction. A head-on collision between vehicles would probably result in serious injuries for vehicle occupants, or fatality should a motorcyclist and heavy vehicle collide. Should a pedestrian be crossing the road (see F5.4) and sheltering in

F5.1: Southbound on Blueridge Dr, showing the concrete and gardened median, and that linemarking and the transition to one lane is unclear.

F5.2: Southbound, road is/has transitioned to one lane.

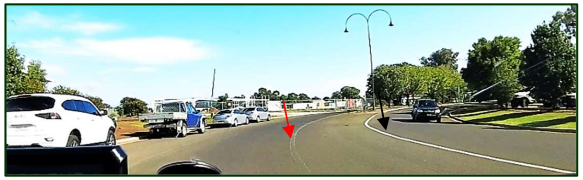
F5.3: Southbound approaching Asset Way, the TWRTL appears to continue through the Asset Way T-junction.

Finding 5: Readability of safer travel paths

the TWRTL when a vehicle is overtaking along the TWRTL, the pedestrian would probably sustain fatal injuries.

- Northbound, the TWRTL terminates at the concrete median (see F5.5). Through this area, the northbound lane alignment is less obvious (see F5.5 and F5.6, red arrow), the southbound TWRTL edge line (F5.5 and F5.6, black arrow) being prominent. A northbound driver may be unable to see the northbound TWRTL edge line and follow the southbound TWRTL edge line into the concrete median and central lighting post. This may be more likely during periods of low visibility, such as the setting sun (see F5.6) or during heavy rain. Should a southbound driver be entering the TWRTL to turn right, the northbound driver may collide head-on, assuming the turning driver would return the southbound driver would return to their side of the road. These crash types would probably result in moderate to serious injuries of vehicle occupants, and probable serious injuries should a motorcyclist be involved.


F5.4: Northbound, showing a pedestrian crossing the road and the TWRTL continuing through the Asset Way T-junction.


F5.5: Northbound, showing lane readability under good conditions.


F5.6: Northbound, showing lane readability under adverse conditions – sun glare.

Finding 5: Readability of safer travel paths

Risk Ratings for road user classes and overall Finding Risk Rating

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Rating by Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	4	**4**	6.5
Pedestrians	3	4	**5**	7.9
Cyclists	2	3	**4**	5.7
Motorcyclists	2	4	**4**	6.5
Car occupants	3	4	3	6.3
Bus occupants	2	4	2	5.1
Truck occupants	3	4	1	5.4
Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 6.3 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

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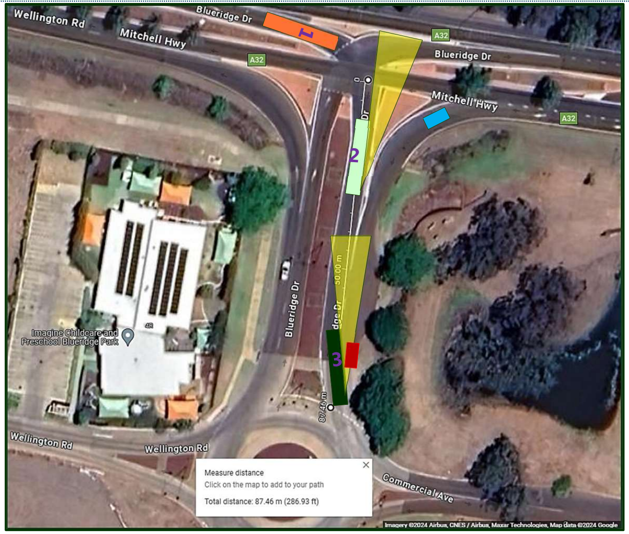
Finding 6: Heavy vehicle manoeuvring space and blind spots

Location:	Blueridge Dr southbound between Mitchell Hwy and Commercial Ave
Rationale for Road Safety Risk and Potential Road Safety Event:	There is around 87m separation between the Mitchell Hwy (HW7) and the Commercial Ave roundabout. A concrete splitter island, separating the left turn in and right turn in traffic, extends around 37m along Blueridge Dr, leaving around 50m for the driver of a long heavy vehicle in the right lane to align the vehicle for the southbound through movement. The separation between HW5 and Commercial Ave, and the extent of the splitter island, can be seen in F6.1. The driver of a heavy vehicle who has entered Blueridge Dr, may be travelling slowly if they were stopped before turning right from HW5 into Blueridge Dr (see F6.1, orange rectangle). To then align the vehicle for the through movement may prove difficult at peak times, with the potential for light vehicle drivers and motorcyclists to attempt to pass the heavy vehicle on the left. Once the right turn into Blueridge Dr is completed (F6.1, light-green rectangle), the heavy vehicle driver must judge the severity of the reverse curves to travel through the roundabout and the available road width, and align the vehicle to negotiate the roundabout, which will likely include covering both the left and right lanes (F6.1, dark-green rectangle) without riding over the curb or leaving sufficient gap between their vehicle and the kerb for a light vehicle (F6.1, red rectangle) to move into the gap. The ability to observe vehicles on the left is a known issue for heavy vehicle drivers, and manoeuvres over short distances can prove difficult. The yellow triangles provide an interpretation of sighting on the left of a heavy vehicle. Motorcyclists are at greatest risk as they are more difficult to see, particularly if not running the headlight whenever moving. A left turn vehicle (F6.1, blue rectangle) would likely be travelling significantly faster than the right turning heavy vehicle, and quickly pass the heavy vehicle on the left (F6.1, red rectangle). This could result in sideswipe type crashes resulting in minor injury of the light vehicle occupants, and serious injuries to a motorcyclist.



F6.1: Aerial photograph, Blueridge Dr northern approach to Commercial Ave. Around 87m separates the Mitchell Hwy and the roundabout, and 50m available to move left to cover both lanes. (Aerial photograph: Google Maps)

F6.2: Looking south on Blueridge Dr towards the roundabout.

Finding 6: Heavy vehicle manoeuvring space and blind spots

Risk Ratings for road user classes and overall Finding Risk Rating

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	3	3	4.8
Pedestrians	3	3	**4**	6.3
Cyclists	2	4	**4**	6.5
Motorcyclists	2	5	**4**	7.4
Car occupants	3	4	3	6.3
Bus occupants	3	4	1	5.4
Truck occupants	3	4	1	5.4
Road users at highest risk:	Motorcyclists			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge Finding Risk Rating Score: 6.1 **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

 RRT2309 v3.0

Finding 7: Seagull treatment on Mitchell Hwy controlling right turns	
Location:	Mitchell Hwy (HW7) at Blueridge Dr T-junction
Rationale for Road Safety Risk and Potential Road Safety Event:	Blueridge Dr northern extent terminates in a T-junction with the Mitchell Hwy, a 'seagull' layout has been constructed to improve safety at the intersection. This intersection is located within a 70km/h zone on the Mitchell Hwy. 1. A driver heading north and intending to turn right (F7.1, Red rectangle) may have sighting of through vehicles approaching from the right obscured due to vehicles in the adjoining left turn lane (also see F7.2). The Yellow triangle in F7.1 provides an indication of the potential sighting to the right, whereas the Purple triangle represents sighting to the right interrupted by left turn vehicles in the turning lane. The Green vehicle may be obscured by a left turning vehicle. Research suggests that driver 'search time' applicable to looking from centre to one side, to the other side and back to centre takes around 2 seconds. At 70km/h the Green vehicle, which is located around 70m from the T-junction, will have travelled almost 40m in that time. Should the Red driver fail to look right again and move out, the driver of the Green vehicle will not have sufficient distance to stop before a collision. In this scenario, the Green vehicle may collide with the driver side of the Red vehicle, resulting in serious or fatal injuries to the Red vehicle occupants and probably serious injuries to occupants of the Green vehicle. See Tolerance in the System on page 15 for key crash types and injury threshold speeds. 2. A driver heading north and intending to turn right (Red rectangle) is required to judge the speed of vehicles approaching from the right and decide if they are turning left or continuing straight, and to look for vehicles approaching on the left and judge their speed, and decide if they can safely clear the westbound through lane. In morning peak period there is an almost contiguous stream of traffic, with an average arrival rate of 1 vehicle every 9 seconds, providing few large gaps suitable for a heavy vehicle to safely turn right. In addition, Mitchell Hwy traffic turning right into Blueridge Dr has priority and, with an average arrival rate on 1 vehicle every 11 seconds, is likely to use most available gaps in westbound traffic. Despite the average arrival rate of vehicles turning right from Blueridge Dr being estimated at around 109 seconds, the availability of gaps in traffic on HW7 may result in queueing of vehicles turning right out of Blueridge Dr, with potential for a long delay if a heavy vehicle is involved, leading to driver frustration and impatience, and poor gap selection when turning. The result being a right-angle crash between the turning vehicle and Mitchell Hwy traffic, with probable serious injuries of light vehicle occupants unless a heavy vehicle or motorcycle is involved with probable fatal injuries resulting.  3. This area of HW7 has the potential for fatigued drivers, as evidenced by the portable Variable Message Sign (VMS) with a fatigue-related road safety message, operating in April 2023. Fatigue has been demonstrated to increase reaction times, which increases stopping distances and creates greater potential for misjudgement of the road environment and other road user actions. 4. A westbound cyclist on HW7 who had a road shoulder available for use, is squeezed onto the travel lane through the seagull treatment, with concrete islands and medians blocking an escape route for the cyclist or

Finding 7: Seagull treatment on Mitchell Hwy controlling right turns

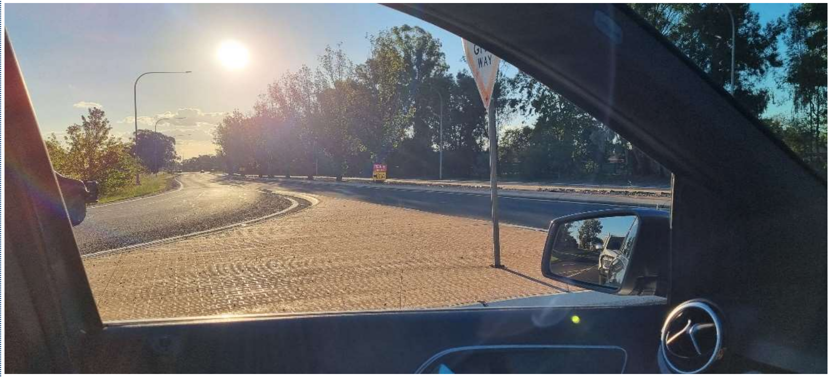
drivers. Should the cyclist misjudge the speed of motor vehicles, or fail to see vehicles approaching from the rear, or a driver misjudge the 1.5m clearance required under NSW Road Rules, a cyclist may be struck by the vehicle with probable fatal injuries sustained.

5. Less ambulant pedestrians will have difficulty crossing HW7 at the seagull, despite separation of vehicle movements by concrete islands. Should a less ambulant pedestrian need to cross either of the roads in this area, they would have to travel along the vehicle travel lanes, with a fatality being the probable result if struck by a through vehicle, and moderate injuries if struck by a turning light vehicle, serious injuries if a truck is involved.

F7.1: Sighting limitations and potential crash types at a seagull T-junction.

Finding 7: Seagull treatment on Mitchell Hwy controlling right turns


F7.2: Looking east, representation of sighting obscured by vehicles (represented by the red rectangles) turning left.


F7.3: Looking west, potential afternoon sun glare.

Finding 7: Seagull treatment on Mitchell Hwy controlling right turns

Risk Ratings for road user classes and overall Finding Risk Rating

This Risk Rating is based on estimated 2036 traffic volumes, with Option 3 haul route.

Risk Rating by Road User Class				
Road User Class	**Exposure** (score 1-5)	**Likelihood** (score 1-5)	**Severity** (score 1-5)	**Risk Rating** (x/10)
Frail road users	2	4	**5**	7.4
Pedestrians	3	3	**5**	7.2
Cyclists	2	4	**5**	7.4
Motorcyclists	2	4	**5**	7.4
Car occupants	3	4	**5**	7.9
Bus occupants	2	4	**4**	6.5
Truck occupants	3	4	3	6.3
Road users at highest risk:	Car occupants			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☑ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 7.2 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

APPENDIX G: AUDIT TEAM MEMBER STATEMENT OF INDEPENDENCE

It is fundamental to the auditing process that no member of the Road Safety Audit Team has had any design or construction involvement with the measures being audited and will maintain this independence throughout the audit process.

Team Leaders / Members shall excuse themselves from participation in the audit if:

- They have had any involvement in planning, design, construction, or maintenance activities of the road infrastructure for the project.
- They perceive any possibility of duress or coercion by their employer or employer's staff in relation to the audit.

It may not always be possible to be unaware of the background, planning or development of the road project being audited. It may not always be possible to be unaffected by the outcomes of the road project being audited. In these cases, the affected Team Leader / Member shall make the other Team Members aware of the level of involvement or effect of the project; the Team Leader will determine strategies to manage potential bias.

TEAM MEMBER CONFIRMATION OF INDEPENDENCE

I, Wayde Hazelton of WaySafe, Lead Auditor, NSW Auditor number RSA-02-0079, confirm that I was involved with the Stage 6: Existing Road, Road Safety Audit, have had no other involvement in this road project, and hold no bias or vested interest in its outcome.

Signed:

Date: 11/04/2024

I, Robert Morgan of WaySafe, Auditor, NSW Auditor number RSA-02-0963, confirm that I was involved with the Stage 6: Existing Road, Road Safety Audit, have had no other involvement in this road project, and hold no bias or vested interest in its outcome.

Signed:

Date:

I, Durga Routray of WaySafe, Auditor, NSW Auditor number RSA-02-1700, confirm that I was involved with the Stage 6: Existing Road, Road Safety Audit, have had no other involvement in this road project, and hold no bias or vested interest in its outcome.

Signed:

Date:

APPENDIX H: RISK MANAGER ACTIONS FROM FINDINGS

Project Name:	Stage 6: Existing Road for Dubbo Regional Council		
Audit No.:	Click or tap here to enter text.	**Audit Stage**:	Stage 6: Existing Road

The manager of the road safety risks identified by this Road Safety Audit must assess the risks in consideration of other risks and priorities to be managed and respond to the Findings outlining the proposed (so far as is reasonably practicable) actions, priority and timing of the actions, and the level of residual risk once these actions are complete. It is important that the Risk Manager details the reasoning behind proposed actions or inaction.

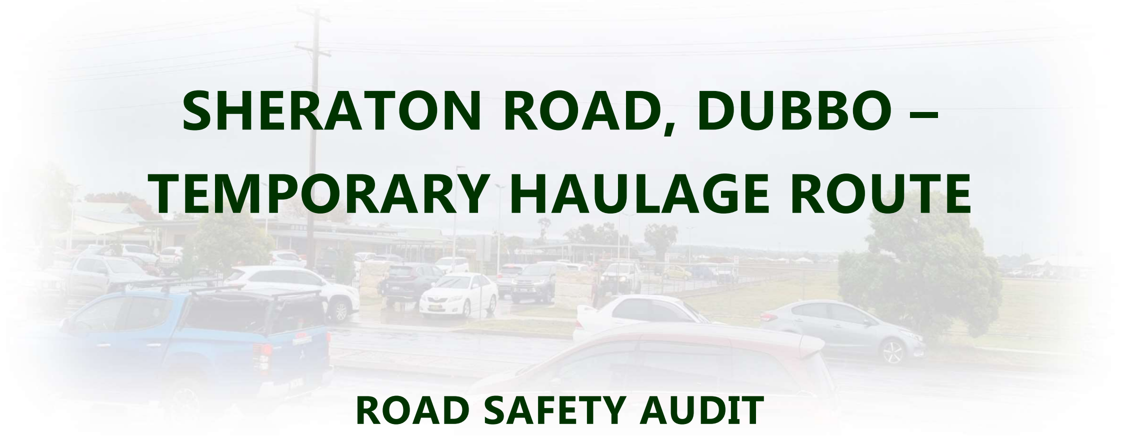
Finding	Risk Rating	Risk Manager Actions	Priority / Timing	Risk level reduced SFAIRP?
Finding 1: Errant vehicle entering preschool premises	**MEDIUM**			☐ Yes ☐ No
Finding 2: Conspicuity of concrete blocks across Capital Dr	**HIGH**			☐ Yes ☐ No
Finding 3: Pedestrians and cyclists travelling along public roads within Blueridge Business Park	**MEDIUM**			☐ Yes ☐ No

Finding	Risk Rating	Risk Manager Actions	Priority / Timing	Risk level reduced SFAIRP?
Finding 4: Squeeze point	MEDIUM			☐ Yes ☐ No
Finding 5: Readability of safer travel paths	HIGH			☐ Yes ☐ No
Finding 6: Heavy vehicle manoeuvring space and blind spots	HIGH			☐ Yes ☐ No
Finding 7: Seagull treatment on Mitchell Hwy controlling right turns	HIGH			☐ Yes ☐ No
	Risk Manager:			
	Signature:		**Date:**	

REAR

COVER

PAGE



SHERATON ROAD, DUBBO – TEMPORARY HAULAGE ROUTE

ROAD SAFETY AUDIT

STAGE 6: EXISTING ROAD

ROAD SAFETY AND TRAFFIC MANAGEMENT SPECIALISTS

PO Box 272 Parkes NSW 2870 | https:/waysafe.au | 0414 769 330

Audit reference: A-242124

Date: 28/06/2024

Version: FINAL

For: Mark Johnston, Dubbo Regional Council.

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FIGURES

TABLES

1. CONTACT DETAILS

CLIENT DETAILS

Client Organisation:	Dubbo Regional Council
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Web:	https://waysafe.au

DOCUMENT VERSION CONTROL

Version	Date	Comment
Draft v1	05/06/2024	Initial draft.
Draft v2	17/06/2024	Drafted remaining Findings. Summary and finalisation yet to be completed. An additional site inspection is scheduled, hopefully with dry weather.
Draft v3	23/06/2024	Additional site inspection (20-21 June 2024) information and associated Findings added. Inclusion of consideration of current vs 2036 traffic provided as requested, see section 2.12.
Final	28/06/2024	Road Safety Audit Report finalised and issued.

2. INTRODUCTION

2.1. Objective of this Stage 6: Existing Road Audit

The objective of this Stage 6: Existing Road, Road Safety Audit is to identify potential risks to safety in the road environment and bring these risks to the attention of the road manager for consideration of remedial actions within the scope of management of all risks managed by the road manager.

2.2. Background to Sheraton Road, Dubbo – Temporary Haulage Route

Two quarries and a concrete works are hauling material on existing Local roads to gain access to the Mitchell Hwy (HW7). Dubbo Regional Council plan to construct a new road, the Southern Distributor, which will provide improved access to the Mitchell Hwy for these heavy vehicles and others as the southeast area of Dubbo develops.

An Options Study was undertaken by SCT Consulting of North Sydney, which included five potential routes and the pros and cons of each. Of the five options, Option 3 was selected as the preferred option, maximising the use of existing high-strength roads.

Seeking to ensure the chosen route maximises safety, Dubbo Regional Council commissioned this road safety audit of Sheraton Rd to allow consideration of the potential safer route for the temporary haulage route.

2.3. Scope of Audit

A Road Safety Audit is a formal, systematic assessment of the potential road safety risks associated with a new road project, a road improvement project, or an existing road and is conducted by an independent qualified team. The assessment considers all road users.

This Road Safety Audit has been conducted following the general principles detailed in *Austroads (2022) Guide to Road Safety Part 6: Road Safety Audit*. An Audit Brief was not received however, data was provided by email for the Capital Dr project, which included traffic data for Sheraton Rd.

Figure 7, provides a guide to the location and the potential Sheraton Rd route under consideration to be used for the heavy vehicle temporary route, and of this road safety audit.

2.4. Exclusions / Not Assessed

Existing road, no exclusions.

2.5. The Audit Team

The Audit was undertaken by Wayde Hazelton of WaySafe and the Audit Team with reference to the details provided in the Audit Brief. Table 1 provides information of the Team Members.

Table 1. Audit team member details

Auditor Number	Name	Role	Organisation	Level
RSA-02-0079	Wayde Hazelton	Lead Auditor	WaySafe	3
RSA-02-0963	Robert Glen Morgan	Team member	WaySafe	3

2.6. Specialist Advisors and Observers

No others participated in the road safety audit.

2.7. Meetings

COMMENCEMENT MEETING

A formal commencement meeting was not held. This request was related to, and used base data provided for the road safety audit of Capital Drive, Dubbo.

FINALISATION MEETING

A formal finalisation meeting was not held, road safety matters discussed by telephone.

OTHER MEETINGS AND CORRESPONDENCE

No other meetings were held.

2.8. Methodology

The methodology generally followed the recommendations described in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* as follows:

- Site inspections, day and night
- Identifying road safety hazards
- Assessing road safety risks
- Reporting of Findings

All the findings described in the 'Items Raised' section of this report are considered by the audit team to require action to improve the road safety outcomes of the project and to minimise the risk of crash occurrence and reduce potential crash severity into the future.

The audit team has examined and reported only on the road safety implications as presented and has not examined or verified the compliance of the road layout to Austroads guides or Australian Standards specifications, or any other criteria.

THREE DISCRETE AREAS

During the site inspections it was clear that there were currently three discrete road use and land use areas on Sheraton Rd within the scope of the road safety audit.

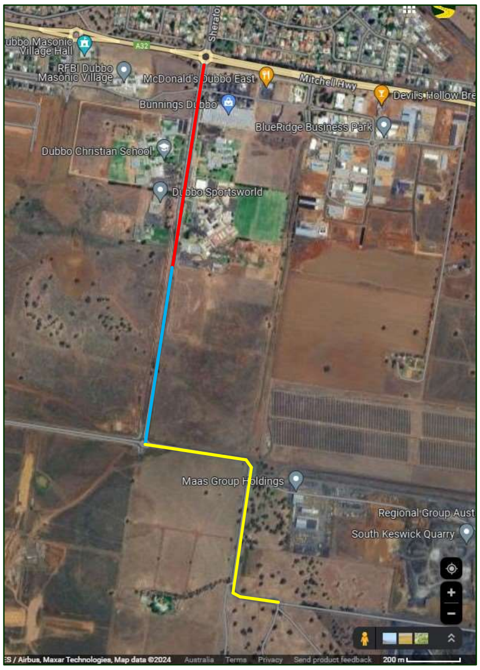


Figure 1. Three discrete sections within the road safety audit area.

- North (red line), 790m between Mitchell Hwy roundabout and the southern extent of the school zone. Short, peak-traffic activity related to the three schools, with high activity of school buses, private cars, and pedestrians, and low-speed manoeuvring during the School Zone peak traffic times. Outside of the peak periods there is bus activity associated with bus route 570, which travels on Sheraton Rd both directions between Mitchell Hwy and Dubbo Sportsworld, there are eleven route 570 services per weekday. Around 650m of the length is a four-lane divided-carriageway road; a further 140m transitions to two-way, two-lane undivided carriageway.
- South (blue line), 640m between the southern extent of the school zone and Boundary Rd roundabout. This section is a two-way, two-lane undivided carriageway with rural land use. With Boundary Rd, this section provides an alternative link between Dubbo south of Mitchell Hwy and the developments in the North section, and access to the quarries to the east.
- East (yellow line), 1,000m between Boundary Rd roundabout and the gated access to Holcim Quarry. Land use is rural and quarrying. Majority of vehicular activity is associated with the quarries, being heavy vehicle movements.

It was therefore decided that identified Risks should be rated recognising these different road environments.

2.9. Site Inspections

The road safety audit team inspected the project site on 30/05/2024 between 16:00 and 18:45 and 31/05/2024 between 08:30 to 10:00 and 13:20 to 16:05. The weather conditions were generally poor, cold with intermittent rain. The road environment was busy during school drop-off and pick-up with congestion around the school gates; it was relatively quiet outside these peak periods. There was a mix of road users, although cyclists were not observed, potentially due to the weather conditions. Extended observation of road user activity was made near the supervised Children's Crossing, 300m south of Mitchell Hwy, during peak school traffic times.

An additional site inspection was conducted near the pedestrian refuge, 510m south of Mitchell Hwy on 20/06/2024 between 14:40 and 16:15, and on 21/06/2024 between 08:15 and 09:15. The purpose of this inspection was to observe road user activity during peak school traffic times.

2.10. Previous Safety Audits

ROAD SAFETY AUDITS

No previous road safety audits were provided.

SAFE SYSTEM ASSESSMENTS

No previous safe system assessments were provided.

OTHER ROAD SAFETY REVIEWS

No other road safety reviews were provided.

2.11. Background Data

CRASH HISTORY

See Appendix B: Crash Data, for a map and basic crash data of the vicinity of the road safety audit site. There were no recorded crashes within the audit area. One non-injury crash occurred on the northern side of the Mitchell Hwy roundabout.

TRAFFIC DATA – 2023 ESTIMATE

Traffic data was provided in the SCT_00505, 22/03/2024, South-East Dubbo Haulage Routes Options Study v4.0, provided by Dubbo Regional Council for this road safety audit. The data was sourced from available traffic data, volumes grown by 2 percent per annum to provide estimated 2023 and 2036 traffic volumes. The 2036 traffic estimate used in this report includes haulage vehicles calculated from the two quarries and the cement works conditions of development consent.

Traffic counts were provided for the two roundabouts, the Sheraton Rd – Mitchell Highway roundabout at the northern end of the road safety audit site, the other at Sheraton Rd – Boundary Rd roundabout near the southern end.

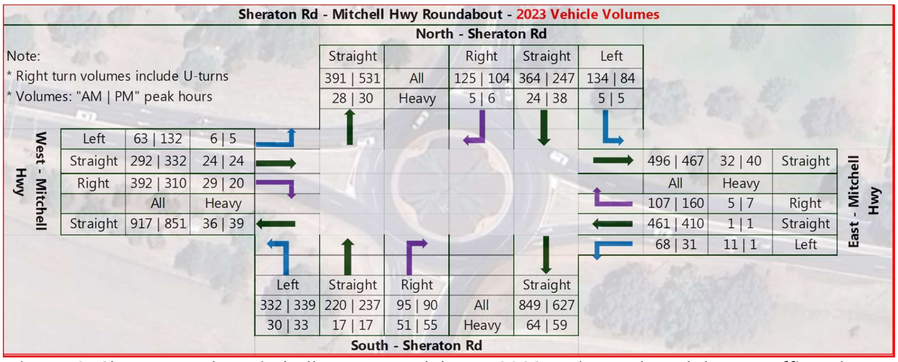


Figure 2. Sheraton Rd – Mitchell Hwy roundabout, 2023 estimated peak hour traffic volumes, per lane.

Table 2. Sheraton Rd – Mitchell Hwy roundabout, 2023 estimated peak hour traffic volumes, per leg.

Sheraton - Mitchell Hwy	Traffic volumes, estimated 2023					
Location	Peak Periods		Light Vehicles		Heavy Vehicles	
	AM	PM	AM	PM	AM	PM
Total North Leg	1014	966	953	881	61	85
Total East Leg	1132	1068	1083	1019	49	49
Total West Leg	1664	1625	1565	1531	99	94
Total South Leg	1496	1293	1381	1179	115	114

Table 3. Estimated traffic growth for Sheraton Rd – Mitchell Hwy roundabout, from 2023 to 2036 including introduction of the haulage route, by roundabout leg.

Sheraton Rd - Mitchell Hwy	Traffic volumes, estimated 2036 - 2023					
Location	Peak Periods		Light Vehicles		Heavy Vehicles	
	AM	PM	AM	PM	AM	PM
Total North Leg	308	291	282	259	26	32
Total East Leg	342	323	199	298	143	25
Total West Leg	508	496	459	448	49	48
Total South Leg	472	414	404	345	68	69

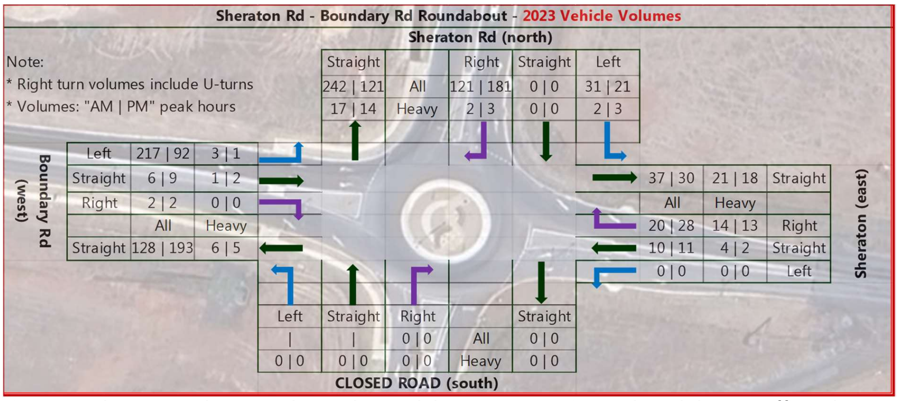


Figure 3. Sheraton Rd – Boundary Rd roundabout, 2023 estimated peak hour traffic volumes, per lane.

Table 4. Sheraton Rd – Boundary Rd roundabout, 2023 estimated peak hour traffic volumes, per leg.

Sheraton-Boundary Rd	**Traffic volumes, estimated 2023**					
Location	**Peak Periods**		**Light Vehicles**		**Heavy Vehicles**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Total North Leg	394	323	355	290	39	33
Total East Leg	67	69	28	36	39	33
Total West Leg	353	296	333	277	20	19
Total South Leg	0	0			0	0

*Note: Southern leg currently closed, traffic data and timing of construction not provided.

Table 5. Estimated traffic growth for Sheraton Rd – Boundary Rd roundabout, from 2023 to 2036 including introduction of the haulage route, by roundabout leg.

Sheraton Rd - Boundary Rd	**Traffic volumes, estimated 2036 - 2023**					
Location	**Peak Periods**		**Light Vehicles**		**Heavy Vehicles**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Total North Leg	152	130	41	34	111	96
Total East Leg	53	55	8	9	45	46
Total West Leg	103	87	16	13	87	74
Total South Leg	0	0	0	0	0	0

*Note: Southern leg currently closed, traffic data and timing of construction not provided.

TRAFFIC DATA – 2036 ESTIMATE WITH HAULAGE VEHICLES

The count data are estimates of traffic movements in 2036 including the Option 2 heavy vehicle traffic estimate.

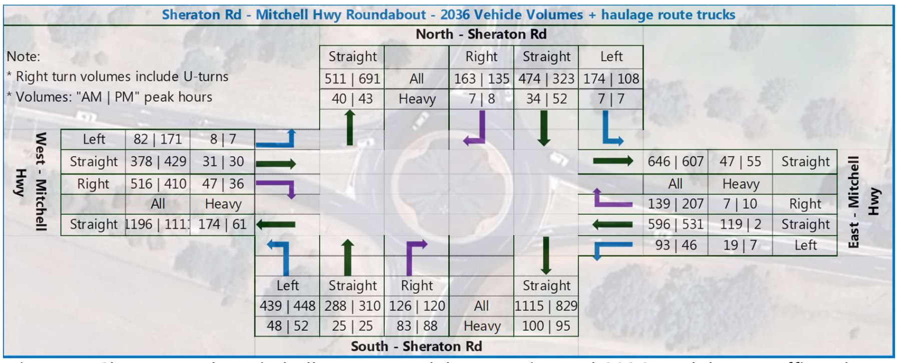


Figure 4. Sheraton Rd – Mitchell Hwy Roundabout, estimated 2036 peak hour traffic volumes including Option 2 traffic, per lane.

Table 6. Sheraton Rd – Mitchell Hwy Roundabout, estimated 2036 two-way peak hour traffic volumes, per roundabout leg.

Sheraton - Mitchell Hwy	**Traffic volumes, estimated 2036 + haulage route trucks**					
Location	**Peak Periods**		**Light Vehicles**		**Heavy Vehicles**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Total North Leg	1322	1257	1235	1140	87	117
Total East Leg	1474	1391	1282	1317	192	74
Total West Leg	2172	2121	2024	1979	148	142
Total South Leg	1968	1707	1785	1524	183	183

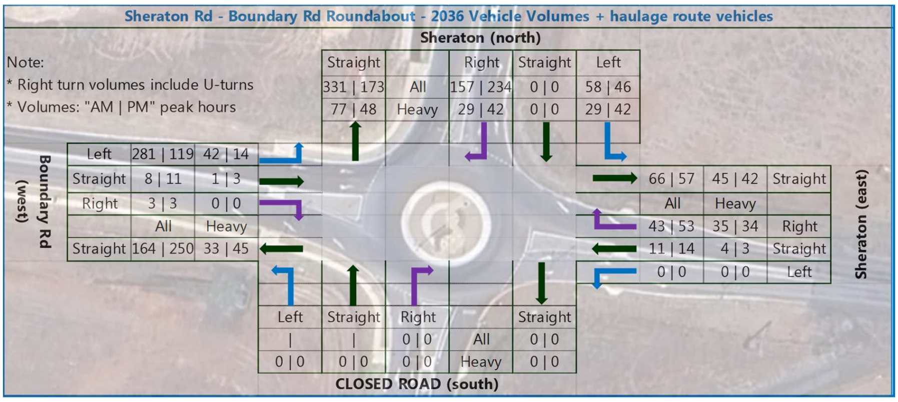


Figure 5. Sheraton Rd – Boundary Rd Roundabout, estimated 2036 traffic volumes including Option 2 traffic.

Table 7. Sheraton Rd – Boundary Rd Roundabout, estimated two-way peak hour traffic volumes, per roundabout leg.

Sheraton-Boundary Rd	**Traffic volumes, estimated 2036 + haulage route trucks**					
Location	**Peak Periods**		**Light Vehicles**		**Heavy Vehicles**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Total North Leg	546	453	396	324	150	129
Total East Leg	120	124	36	45	84	79
Total West Leg	456	383	349	290	107	93
Total South Leg	0	0			0	0

*Note: Southern leg currently closed, traffic data and timing of construction not provided.

For the purposes of scoring the 'Exposure' risk element levels for Sheraton Rd, Table 8 provides the expected levels based on the estimated 2023 and the estimated 2036 (including haulage vehicles) traffic information, as provided. It also provides the approximate percentage of the vehicle classes in the Australian registered vehicle fleet, for reference.

Table 8. 'Exposure' scoring levels for Sheraton Rd, 2023 volumes and (2036) volumes.

Road User Class	**Frail**	**Pedestrian**	**Bicycle**	**Motorcycle**	**Light Vehicles**	**Buses**	**Trucks**
Exposure Score (north)	5 *(5)*	5 *(5)*	2 *(3)*	2 *(2)*	3 *(4)*	4 *(4)*	3 *(3)*
Exposure Score (south)	2 *(2)*	1 *(1)*	2 *(2)*	2 *(2)*	3 *(3)*	2 *(2)*	3 *(3)*
Exposure Score (east)	2 *(2)*	1 *(1)*	1 *(1)*	2 *(2)*	2 *(2)*	1 *(1)*	3 *(3)*
National Vehicle Fleet (%)	-	-	-	4.5	73.0	0.5	22.0

SPEED DATA

Speed data was not provided. The posted speed limit for Sheraton Rd is 60km/h, with a 40km/h School Zone speed limit in force on school days between 08:00 and 09:30, and 14:00 and 16:00. In consideration of the road environment, it is anticipated that the 85th percentile vehicle speed will be below the posted school zone speed limit of 40km/h during peak traffic periods, and potentially over the School Zone speed limit when the peak school-related traffic has dissipated. This was confirmed by random speed checks, suggesting that 50km/h was closer to the 85th percentile speed outside peak periods of school-related traffic activity.

It is also expected that the 85th percentile vehicle speed will be over the 60km/h speed limit outside School Zone times, and particularly in the southern section (see Figure 1), the road being of a more open and rural nature.

RESTRICTED ACCESS VEHICLES

A review of the TfNSW online interactive Restricted Access Vehicle (RAV) map showed that Sheraton Rd provides access for 25/26m B-double vehicles up to 4.6m high between HW7 Mitchell Hwy and 230m south (Homemaker Centre service delivery entry) of HW7. Figure 6 shows the extent of the RAV access. Higher mass limits are precluded, as is travel by RAV vehicles between "8:00-9:30am and 2:30-4:00pm on school days"; travel is also restricted to the southbound direction of travel and entry only to the Homemaker Centre service delivery, RAV exiting by Blueridge Dr. RAV should not be present during school-related peak periods.

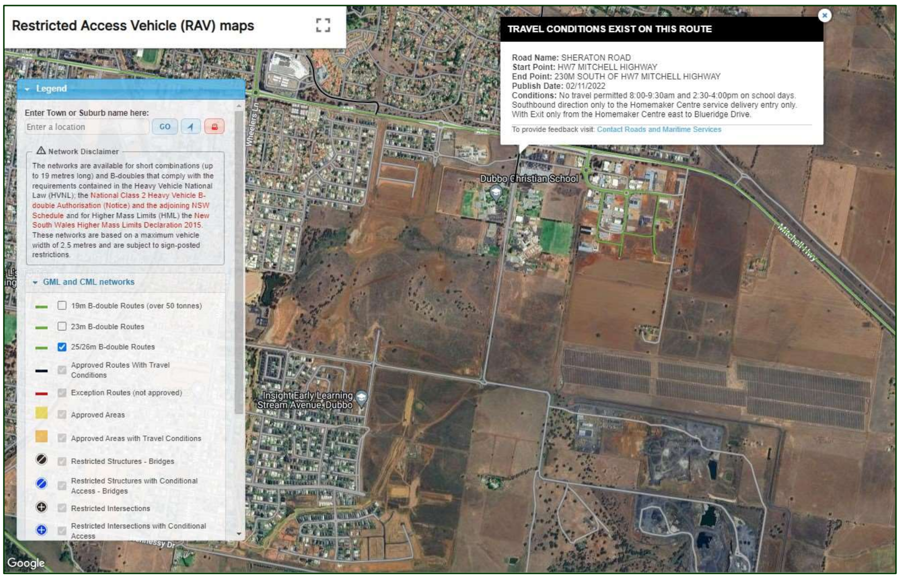


Figure 6. RAV map of Sheraton Rd south of Mitchell Hwy.

VULNERABLE ROAD USER DATA

Traffic and crash data specific to vulnerable road users, i.e. pedestrians, cyclists, and motorcyclists, was not provided. The TfNSW crash data showed no crashes occurred in the road safety audit area. Significant numbers of pedestrians were observed using the footpaths and crossing the road during the school-related peak traffic periods.

FRAIL ROAD USER DATA

Traffic and crash data specific to frail road users i.e. the elderly, young, or currently injured, was not provided. Three schools and a sports centre are within the northern section of the road safety audit area; if struck by a vehicle, small children may sustain more severe injuries than adults.

2.12. Heavy Vehicle Volume Increase – Potential Safety Implications

WaySafe was requested to consider the impact of additional heavy vehicles on Sheraton Rd, Sheraton Rd being one of the routes under consideration as an interim heavy vehicle access measure for two quarries and a concrete batching works to the south.

To consider the potential safety implications, the three components of risk must be understood:
Exposure – how many of each road user class are using the road environment.
Likelihood – what control measures are in the road, vehicle, and road user environments.
Severity – what injury severity has the highest probability of being sustained if a crash occurs.

Increasing the number of heavy vehicles would increase potential **exposure** to crashes with these vehicles; however, it should not increase the **likelihood** of a crash (traffic volumes do not form part of likelihood, they are only considered in Exposure) where likelihood is based on road, vehicle, and road user environment factors; nor should it increase **severity** of being struck by a heavy vehicle.

As discussed in the Findings, the greatest risks are present during peak school-related traffic activity times, around 08:00 to 09:00 and again around 15:00 and 16:00, on School Days. These hazards relate to crashes involving vulnerable road users (pedestrians, cyclists, motorcyclists) being struck by a vehicle, and also to right-angle crashes between vehicles. In both cases, potentially a main causal factor is light vehicle drivers stopping and encouraging pedestrians and bus drivers, and to a lesser extent other light vehicle drivers, to cross or enter the road in contravention to the NSW Road Rules. Outside of these peak school-related traffic times, the road is generally quiet, potentially more so than parallel roads fronted by residential development.

2.13. Appendices

Appendix A: Audit Location – Plan View

Appendix B: Crash Data

Appendix C: Documents Used for the Audit

Appendix D: Contemporary Road Safety

Appendix E: Risk Scoring and Risk Rating

Appendix F: Road Safety Audit Findings

Appendix G: Audit Team Member Statement of Independence

Appendix H: Risk Manager Actions from Findings

3. ITEMS RAISED IN THIS STAGE 6: EXISTING ROAD AUDIT

This section provides a summary of the features that may **increase the likelihood** of a crash occurring, and the features that may **increase injury severity** should a crash occur. No feature that may increase crash likelihood resides in isolation, potentially there are several features that, if occurring together, may change the risk profile of the road. See Appendix F: Road Safety Audit Findings for background of this section.

The below section provides a summary of the main road safety hazards and risks. It is intended to assist the project manager to prioritise works based on road user class, road location, or level of risk, addressing likelihood (prevent crashes) or consequences (reduce level of harm).

3.1. Hazardous Features

As discussed in Appendix D: *Contemporary Road Safety*, injury severity in a crash in large part is dependent upon the energy in the crash, the angle of collision, and which road user classes are involved. The four Safe System significant crash types are discussed, and threshold speeds are advised; these speeds relate to a 10% probability of fatality and significantly higher probability of serious injury, see Table 4: *Crash category and the 10% likelihood of a fatality at the indicative speed* on page 11.

The existing road has the potential for all Safe System significant crash types to occur above the Safe System threshold speeds, as suggested in Figure 11, Severity Guidance Chart.

FEATURES THAT MAY INCREASE CRASH LIKELIHOOD:

- Speeding – excessive and inappropriate
- Cross traffic flows – sighting of other road users
- Vehicle-pedestrian interaction
- Parking area capacity – queueing on Sheraton Rd
- Drivers giving way where not required – to buses and pedestrians
- Bus drivers accepting priority from drivers
- Pedestrians accepting priority from drivers
- Road pavement condition
- Multiple through traffic lanes
    - confusion between turning left and changing lanes
    - drivers overtaking vehicles stopped at the Children's Crossing and the pedestrian refuges
- Readability of the road and traffic lanes
- Radical change to northbound road alignment
- Infrangible, dull object used to close the road
- Water ponding on the road surface

FEATURES THAT MAY INCREASE CRASH CONSEQUENCE

- Speeding – excessive and inappropriate
- Vehicle mass – pedestrians vs cars, buses and trucks
- Vehicle design – pedestrian injury reduction measures bypassed, e.g. bull bars
- Infrangible object on road surface
- Cross traffic flows – 90 degrees crash angles

3.2. Risk Rating Summary

The risk rating summary table (Table 9) provides a snapshot of the risk rating scores for each finding, and the road user class potentially at highest risk for each Finding. See Appendix F: Road Safety Audit Findings for information of the scoring methodology and how it may be used to consider the level of risk identified in each Finding.

Table 9. Risk rating summary derived from Appendix F: Road Safety Audit Findings

Finding No.	Finding Risk Rating Total	Road User Class(es) with Highest Rating	Road User Risk Rating
Finding 1: Vehicular access gap in median	5.6	Frail road users, Pedestrians	7.4
Finding 2: Availability of vehicle parking / waiting spaces during peak demand	5.5	Frail road users, Pedestrians	6.7
Finding 3: Two-way vehicular access driveway	5.3	Frail road users	7.9
Finding 4: Vehicles queueing at or through the Children's Crossing	7.0	Pedestrians	9.3
Finding 5: Road pavement condition	6.2	Pedestrians	7.9
Finding 6: Proximity of Wellington Rd to Mitchell Hwy	5.4	Motorcyclists	6.5

Finding No.	Finding Risk Rating Total	Road User Class(es) with Highest Rating	Road User Risk Rating
Finding 7: Queueing at Mitchell Hwy roundabout	4.9	Car occupants	5.7
Finding 8: Readability of road and traffic lanes	5.1	Frail road users, Cyclists	5.7
Finding 9: Pedestrian refuge	5.1	Pedestrians	6.3
Finding 10: Transition of the road configuration between two lanes and four lanes	5.8	Car occupants	7.7
Finding 12: School bus timetabling and traffic volumes	3.8	Motorcyclists	5.1
Finding 12: School bus timetabling and traffic volumes	6.3	Pedestrians, Bus occupants	7.4
Finding 13: Drivers stopping to allow child pedestrians to cross the road	6.7	Frail road users, Pedestrians	9.3
Finding 14: Speed of vehicles	7.4	Frail road users, Pedestrians	9.3

4. AUDIT TEAM LEADER STATEMENT

I hereby certify that the audit team have examined the audit site during both daylight and at night, and the documents listed in Appendix D in undertaking this Road Safety Audit. I also confirm that this audit has been carried out independently of the risk owner following the general principles detailed in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* and NSW *RTA (2011) Guidelines for Road Safety Audit Practices* where appropriate.

The audit has been carried out for the sole purpose of identifying any features within the road safety audit scope that could be altered or removed to improve the safety of the road. The identified issues have been noted in this report and the accompanying findings are offered for consideration by the risk owner / manager.

Audit Team Leader

Name: Wayde Hazelton
Position: Lead Auditor
Organisation: WaySafe
Phone: 0414 769 330
Email: wayde@waysafe.au

DISCLAIMER

This report contains Findings and Risk Rating based on examination of the relevant documentation and/or site. The report is based on the conditions viewed on the day and time of each site inspection and provided in Section 2.3 Scope of Audit, and is relevant at the time of production of the report. Information and data contained within this report is prepared with due care by the Road Safety Audit Team. While the information and data provided in this report has been prepared with due care by members of the Audit Team, the Audit Team cannot guarantee its accuracy.

Readers should not solely rely on the contents of this report or draw inferences to other sites. Users must seek appropriate expert advice in relation to their own circumstances.

The Road Safety Audit Team does not warrant, guarantee, or represent that this report is free from errors or omissions or that the information is exhaustive. Information contained within may become inaccurate without notice and may be wholly or partly incomplete or incorrect. Before relying on the information in this report, users should carefully evaluate the accuracy, completeness, and relevance of the data for their purposes.

Subject to any responsibilities implied in law which cannot be excluded, the Road Safety Audit Team is not liable to any party for any losses, expenses, damages, liabilities or claims whatsoever, whether direct, indirect, or consequential, arising out of or referable to the use of this report, howsoever caused whether in contract, tort, statute or otherwise.

APPENDIX A: AUDIT LOCATION – PLAN VIEW

Figure 7 provides a map of the audit locality showing the five routes considered in the Options Study for the temporary haulage route. Sheraton Rd is the Option 2 route, demarcated by the pink line, which displays the approximate physical scope of this Stage 6 Road Safety Audit.

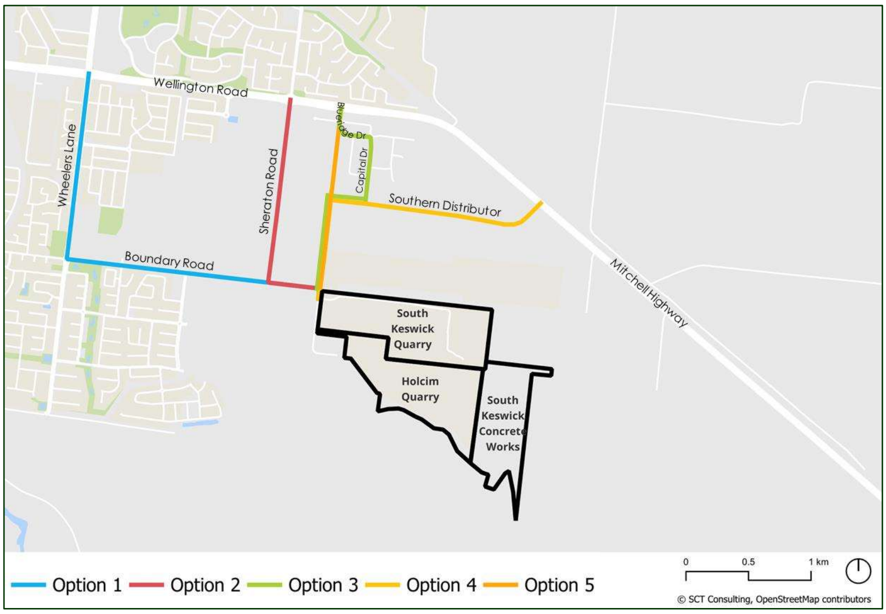


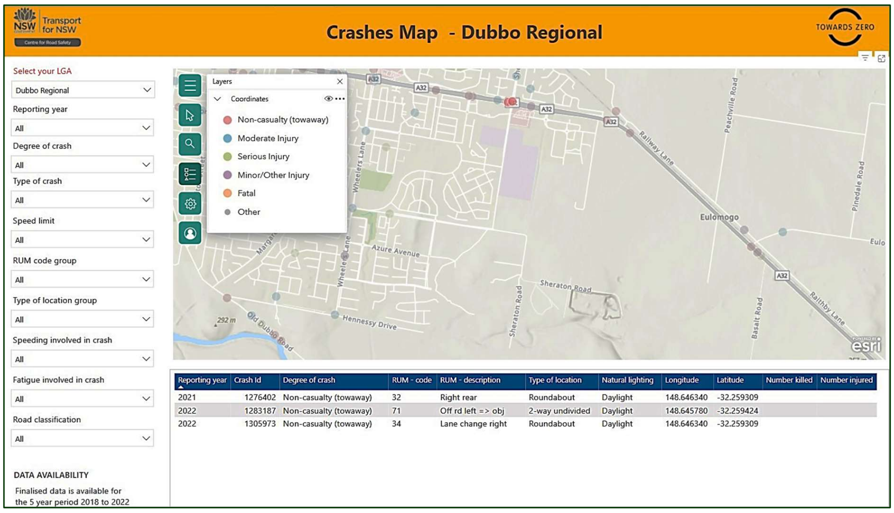
Figure 7. Map of the audit vicinity and approximate physical scope (pink line).

(Map snipped from SCT Consulting (2024) South-East Dubbo Haulage Routes Options Study, 22 March 2024, page i.)

APPENDIX B: CRASH DATA

Crash data was sourced from the TfNSW web page 'LGA view – crashes map', and provides reported crashes for the five year period 01/01/2018 to 31/12/2022.

Of the three crashes near the road safety audit area, shown as coloured dots on the map, and in the data in Figure 8, none occurred within the review section.



Reporting year	Crash Id	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Latitude	Number killed	Number injured
2021	1276402	Non-casualty (towaway)	32	Right rear	Roundabout	Daylight	148.646340	-32.259309		
2022	1283187	Non-casualty (towaway)	71	Off rd left => obj	2-way undivided	Daylight	148.645780	-32.259424		
2022	1305973	Non-casualty (towaway)	34	Lane change right	Roundabout	Daylight	148.646340	-32.259309		

Figure 8. Crash map and crash data of reported crashes for Sheraton Rd between Mitchell Hwy and the southeastern termination of the road. LGA view - crashes map | Transport for NSW

APPENDIX C: DOCUMENTS USED FOR THE AUDIT

STANDARDS AND GUIDELINES

Austroads (2016). AP-R509-16 Safe System Assessment Framework

Austroads (2018). Towards Safe System Infrastructure: A Compendium of Current Knowledge

Austroads (2020). Infrastructure Risk Rating Manual for Australian Roads

Austroads (2020). Integrating Safe System with Movement and Place for Vulnerable Road Users

Austroads (2021). Guide to Road Design Part 3: Geometric Design

Austroads (2023). Guide to Road Design Part 4: Intersections and Crossings – General

Austroads (2023). Guide to Road Design Part 4A: Unsignalised and Signalised Intersections

Austroads (2023). The Guide to Road Design Part 4B: Roundabouts

Austroads (2023). Guide to Road Design Part 5B: Drainage-Open Channels, Culverts and Floodway Crossings

Austroads (2022). Guide to Road Design Part 6: Roadside Design, Safety and Barriers

Austroads (2021). Guide to Road Design Part 6A: Paths for Walking and Cycling

Austroads (2021). Guide to Road Design Part 6B: Roadside Environment

Austroads (2021). Guide to Road Safety Part 1: Introduction and The Safe System

Austroads (2021). Guide to Road Safety Part 2: Safe Roads

Austroads (2021). The Guide to Road Safety Part 3: Safe Speed

Austroads (2022). Guide to Road Safety Part 6: Road Safety Audits

RTA (2011). Guidelines for Road Safety Audit Practices

WEB PAGES

Google Maps (2022). https://www.google.com/maps

SIX Maps (2022). https://maps.six.nsw.gov.au

TfNSW (2022). Centre for Road Safety Crash Database
https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=1

TfNSW (2022). https://roads-waterways.transport.nsw.gov.au/cgi-bin/index.cgi

AUDITABLE MATERIALS PROVIDED BY DUBBO REGIONAL COUNCIL

Drawing No.	Version & Date	Drawing Index
SCT_00505	22/03/2024	South-East Dubbo Haulage Routes Options Study v4.0

APPENDIX D: CONTEMPORARY ROAD SAFETY

D.1. Towards Zero in NSW

BACKGROUND

In 2017, 392 people died due to road trauma on NSW roads, and more than 12,000 suffered serious injuries. To put this in a rural NSW perspective, this equates to every resident of Mudgee being seriously injured on NSW roads, every year.

70% of the NSW road fatalities occurred on country roads; in 2017, 272 people died due to road trauma on country roads. Country people comprise 1/3 of the NSW population yet are 2/3 of the fatalities on NSW roads.

In response the NSW government, through TfNSW, built on to the NSW *Road Safety Strategy 2012-2021* developing the 2026 Road Safety Action Plan, and introduced ambitious road safety targets, through to the aspiration for zero deaths and serious injuries on NSW roads by 2056.

The **Saving Lives on Country Roads** stream of the Road Safety Plan targets "*improving road safety infrastructure, including targeting high-risk roads…*" This is pertinent to the design and construction of roads.

Figure 9: 2026 Road Safety Action Plan and road trauma targets

SAFE SYSTEM PHILOSOPHY

The Safe System adopts a holistic approach to road safety, considering the interaction between the road environment, the road user, the vehicles, and the travel speeds. It acknowledges that road safety is a shared responsibility, that humans are frail, and that humans make mistakes.

Historically, road crashes were generally understood to be due to driver error. The contemporary view is that the error is in the system; the driver may have made an error, but they should not be punished with death or serious injury, the road system should be forgiving of the error.

"*An error is an out of tolerance action, where the limits of tolerable performance are defined by the system.*" Swain and Guttman (1983).

The NSW government, along with all States and Territories of Australia, adopted the Safe System principles in the National Road Safety Strategy 2011-2020. Also see the NSW Government submission Joint Select Committee on Road Safety.

TOLERANCE IN THE SYSTEM

The Safe System proposes four major crash categories and accompanying thresholds. The speed thresholds are general case where the road user has a 10% likelihood of death. These speeds have been challenged by other studies and are therefore considered indicative. *Table* 10 provides the crash categories and indicative speeds set out in the Austroads Safe System Assessment Framework.

Table 10: Crash category and the 10% likelihood of a fatality at the indicative speed

Crash Category	**10% Likelihood of Fatality** (speeds are indicative)
Car – Vulnerable road user (pedestrian, motorcyclist, or cyclist)	30 km/h
Car – Tree or Pole (side impact into infrangible object)	40 km/h
Car – Car (side impact, intersections)	50 km/h
Car – Car (head-on)	70 km/h

Note: In NSW, rear end crashes are also a major crash category.

PLANNING FOR 2050 ROAD SAFETY TARGETS

In planning to meet the NSW Government's aspirational 2050 road safety target of zero deaths and serious injuries, a concentrated effort is required to 'design out' the types of road infrastructure that is proven to be of highest risk. This, together with the Saving Lives on Country Roads program of mitigating works and the plethora of other initiatives addressing the four pillars of the Safe System, will aid in approaching the 2050 target. The design and construction of road infrastructure is one of the four keys to reducing road trauma on NSW roads, now and into the future.

In planning, designing, and constructing road infrastructure the following must be considered:

- Vulnerable road users should be protected from high-speed traffic, which in their context is above 30km/h. This would generally be by separating the vulnerable from the vehicles (see *Providing for Walking and Cycling in Transport Projects Policy – CP21001)*

- Vehicles entering an intersection from adjacent approaches should be protected from colliding at 90 degrees. As provided in Table 10 the speed threshold at impact for intersections of this design is 50km/h. "*Design is one way to manage speeds; for example, roundabouts can geometrically constrain vehicles to lower speeds and more favourable conflict angles*."[1]
- Vehicles travelling in opposing directions should be protected from colliding head-on. As per *Table 10* the speed threshold is 70km/h at time of impact – designing to separate opposing vehicles in high-speed road environments may be required.
- Run-off-road crash types may result in a side impact into an infrangible object or a vehicle roll-over. Table 10 provides a threshold of 40km/h for the run-off-road side impact type crash. No data is available for roll-over crash types.

Where the risk cannot be eliminated, a harm minimisation approach is advocated, reducing the trauma suffered to a non-serious level.

D.2. The Safe System in Road Safety Audit

The aim of the Safe System Findings is to focus the Road Safety Audit process on considering safe speeds and by providing forgiving roads and roadsides. This is to be delivered through the Road Safety Audit process by (a) accepting that people make mistakes, and (b) considering the known limits to crash forces the human body can tolerate. This may be achieved by focusing the risk rating findings of the Road Safety Audit on identified crash types that are known to result in higher severity outcomes at relatively lower speeds, with the aim to reduce the risk of fatal and serious injury crashes. See Table 10: Crash category and the 10% likelihood of a fatality at the indicative speed, for the identified thresholds speeds.

The exposure and likelihood of crash occurrence is considered for all findings, focusing on those that have the potential to exceed these threshold speeds.
Adapted from: *Austroads (2019), Guide to Road Safety Part 6: Managing Road Safety Audits*

The indicative speeds provided by the Safe System represent the 10% likelihood of a fatality (or 90% survivability) for the crash type. The likelihood of sustaining serious injuries is significantly higher than the likelihood of a fatality at these speeds. However, the likelihood of a fatal outcome increases exponentially with increased speed.

In this road safety audit report the risk rating of the Findings methodology draws upon the information provided in *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audits* and *Austroads (2016), Safe System Assessment Framework*.

[1] Austroads (2016). *Safe System Assessment Framework*, A.1.3 Safe System Speeds, p29.

APPENDIX E: RISK SCORING AND RISK RATING

E.1. Risk Scoring

Scoring the relative level of risk for each risk identified in a road safety audit has historically provided a point of debate between users. In part, this was due to the subjective nature of selecting appropriate levels for the risk elements. The *Austroads (2022), Guide to Road Safety Part 6: Road Safety Audit* has provided greater clarity on potential crash severity, particularly the use of a Severity Guidance Chart, an adaptation of which is provided in Figure 11, and use of the spread of risk levels in the Austroads (2022) Risk Matrix. Figure 10 provides the risk rating ranges adopted by WaySafe. The risk rating ranges were compared between the Austroads (2022) risk matrix and the TfNSW (2011) risk matrix, revealing negligible difference.

RISK RATING	MINIMAL	LOW	MEDIUM	HIGH	EXTREME
score (x/10)	<3	3 to <4	4 to <5.9	5.9 to 8.1	>8.1

Figure 10. Risk Rating ranges

Influence is drawn from the *Austroads (2016), Safe System Assessment Framework* and includes extending the consideration of all road user classes and Safe System significant crash types.

The Risk Rating method adopted in WaySafe Road Safety Audits incorporates features of the Austroads documents noted above. The following dot points provide where the WaySafe method builds upon and extends elements of the Austroads documents:

- ‘Exposure’ values are suggested in volume ranges for each road user class in the road environment and scored from one to five. The vehicle classes data is extrapolated from the general percentage of each vehicle class in the Australian road vehicle fleet.
- There is greater definition provided for each ‘Likelihood’ level. Reference to other road safety predictive techniques may also provide guidance as to the likelihood of a crash occurring.
- The method used to calculate the *Road User Risk Rating* for each road user class, and for the *Finding Risk Rating*, considers ‘Exposure’, ‘Likelihood’, and ‘Severity’ as vectors, and with a constant applied provides a simple risk rating score out of ten.
- A Risk Rating is provided for each road user class, and for the Finding.

It is envisaged that providing a risk rating for the most at-risk road user class(es) will assist the project manager to better target risk reduction measures.

Table 11 provides descriptions for scoring the risk elements, for each road user class. The equations used to calculate the Risk Ratings, based on user input, are below.

Risk Rating score for each Road User Class is calculated by:

$$Risk\ Rating\ Road\ User = ((\sqrt{Exposure^2 + Likelihood^2 + Severity^2}\ ) - 0.95) * 1.29$$

Risk Rating score for each Finding is calculated by:

$$Risk\ Rating\ Finding = \sqrt{Sum\ of\ all\ (Road\ User\ Risk\ Rating^2)} * 3.79795$$

Table 11. Risk scoring guidance table for road user classes (reviewed June 2024).

Level	Exposure	Likelihood	Severity
1	It is **not expected that any road users** of the particular class would use this section of road, or they are **precluded** from the area.	There are **multiple, overlapping levels of safety controls** in place and **redundancy** is built into the system. Safe System primary treatments are employed. Facilities are AusRAP 5-star compliant.	**Property damage** is the *most probable* result of the crash type for the road user group.
2	**Low volume** of the road user class. Light vehicles <120 per hour Buses <3 per hour Trucks <20 per hour Pedestrian <8 per hour Motorcycle <8 per hour Bicycle <8 per hour Frail < 8%	There are **multiple levels of safety controls** in place. Redundancy is not built into the system. Safe System supporting treatments are employed. Facilities are AusRAP 4-star compliant.	**Minor injury** (treated at the scene) is the *most probable* result of the crash type for the road user group.
3	**Moderate volume** of the road user class. Light vehicles 120 to <1,000 per hour Buses 3 to <20 per hour Trucks 20 to <150 per hour Pedestrian 8 to <60 per hour Motorcycle 8 to <60 per hour Bicycle 8 to <60 per hour Frail 8% to <16%	There are **multiple safety controls** in place, e.g. exceeds Australian Standards minimum requirements. Redundancy is not built into the system. Safe System treatments are not employed. Facilities are AusRAP 3-star compliant.	**Moderate injury** (treated at hospital but not admitted) is the *most probable* result of the crash type for the road user group.

Level	Exposure	Likelihood	Severity
4	**High volume** of the road user class. Light vehicles 1,000 to 2,000 per hour Buses 20 to 150 per hour Trucks 150 to 300 per hour Pedestrians 60 to 110 per hour Motorcycle 60 to 110 per hour Cyclist 60 to 110 per hour Frail 16% to 24%	There are **minimal safety controls** in place, e.g. only meets minimum level of Australian Standards. Redundancy is not built into the system. Safe System treatments are not employed. Facilities are AusRAP 2-star compliant.	**Serious injury** (admitted to hospital) is the *most probable* result of the crash type for the road user group.
5	**Congested** for the road user class. Light vehicles >2,000 per hour Buses >150 per hour Trucks >300 per hour Pedestrians >110 per hour Motorcycle >110 per hour Cyclist >110 per hour Frail >24%	There are **few, if any, safety controls** in place. Redundancy is not built into the system. Safe System treatments are not employed. Facilities are AusRAP 1-star compliant.	**Fatal injury** (dies within 30 days) is the *most probable* result of the crash type for the road user group.
Notes	• Exposure 'volumes' are two-way, per hour, in peak periods. • Likelihood descriptions supply guidance from other road safety predictive methods. These are a guide only. • Severity considers the 'probable' level of injury severity rather than the worst case, as someone could die in practically any road crash. See Figure 11 for the Severity Guidance Chart. • Serious injury has a very broad definition, i.e. the person is admitted to hospital. This may only be for observation and sent home the next day or it may be for quadriplegia or other life changing injury. Also, mental health aspects for emergency responders and witnesses are not considered.		

E.2. Severity Guidance Chart

The severity guidance chart provided in Figure 11 suggests the probable degree of severity for each crash type, should a crash occur at the given speed. **The severity guidance chart is a guide only.** The number of confounding factors in crashes are so great, that, considering the proposed use of this table, it is beyond the scope of a road safety audit to provide a definitive severity outcome for each potential crash.

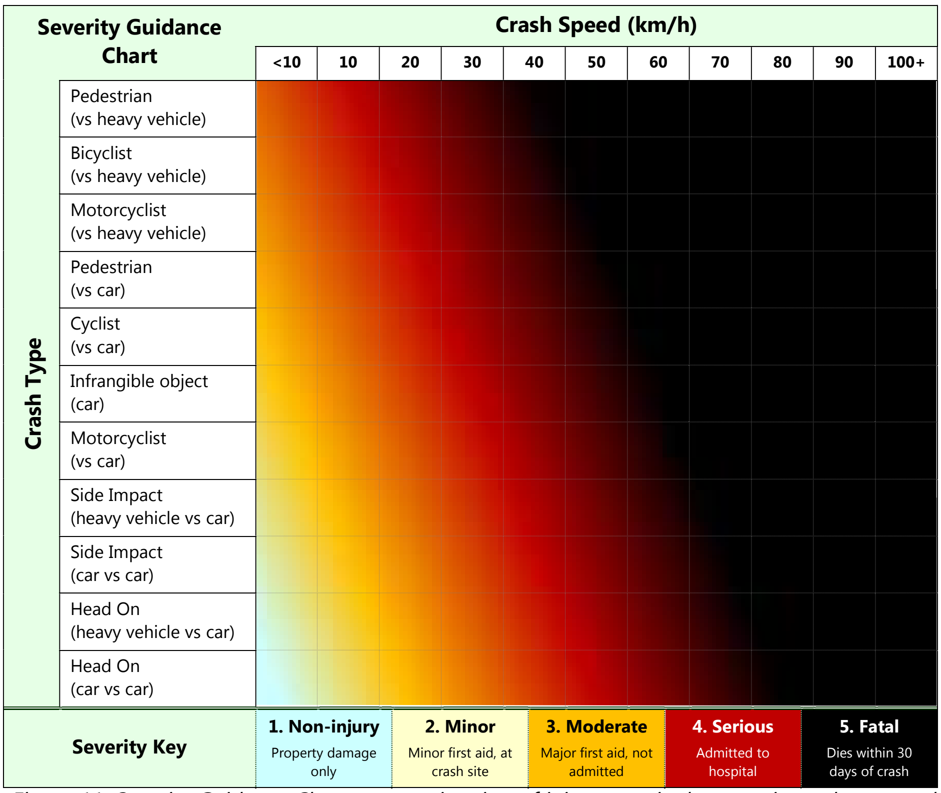


Figure 11. Severity Guidance Chart – approximation of injury severity by generic crash type and speed of crash.

E.3. Risk Rating Tool

Table 11 and Figure 11, are used to inform input into the Risk Rating Tool provided in Appendix F: Road Safety Audit Findings, to 'score' the Exposure, Likelihood and Severity for each road user class, the scores are restricted to whole numbers between 1 and 5 inclusive. Selected check boxes show the Safe System Significant crash types, as described in Appendix D: Contemporary Road Safety.

Note that '**Frail road users**' are included in the road user classes for separate consideration. This acknowledges that some road users are at higher risk of injury from a given event than the general population, and for some a minor injury can lead to their death from complications. Frail road users may be a subset of any of the other road user classes, and include the elderly, very young, and those who are already injured or ill.

Finding:

Risk Rating by Road User Class	Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (out of 10)
	Frail road users				
	Pedestrians				
	Cyclists				
	Motorcyclists				
	Car occupants				
	Bus occupants				
	Truck occupants				

Safe System Significant Crash Types:
- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☐ Vulnerable road user > 30km/h

Finding Risk Rating Gauge

Potential timing of mitigation measures:

© WaySafe® 2023 - Risk Rating Tool RRT2311v3.1

RISK RATING score (x/10)	MINIMAL	LOW	MEDIUM	HIGH	EXTREME
	<3	3 to <4	4 to <5.9	5.9 to 8.1	>8.1

Figure 12. Risk Rating Tool – double-click to use, click outside the box to close.

For an identified Risk, the Risk Rating by Road User Class provides for the level of Risk for each road user class in the incident. For example, should the incident be between a pedestrian and a car, the pedestrian would be scored using their Exposure, Likelihood and their 'probable' injury Severity, and the car occupants be scored for their Exposure and Likelihood, and their 'probable' injury Severity. The Risk Rating for each road user class is calculated by Formula 1, on page 20. The Finding Risk Rating is calculated using each of the road user class risk scores in Formula 2.

APPENDIX F: ROAD SAFETY AUDIT FINDINGS

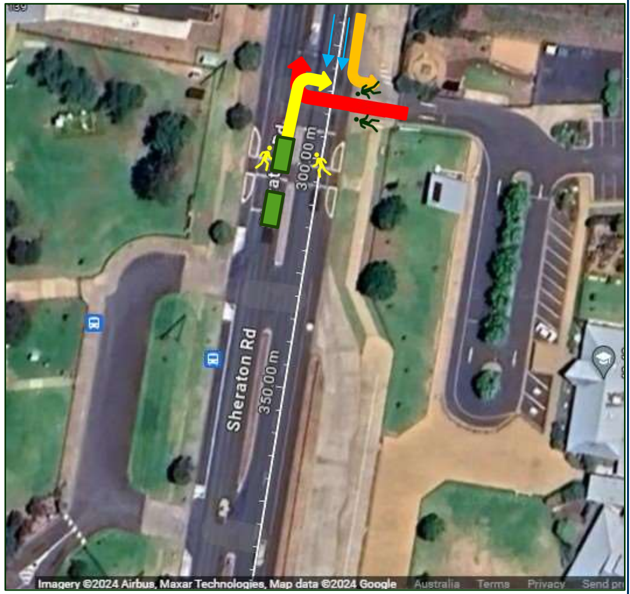
Appendix F provides details of the road safety hazards and risks identified in this road safety audit. It is based on the Austroads 2022 reporting model and risk rating, enhanced through a risk rating system adapted from the Safe System Assessment scoring methodology. It provides a more objective assessment of the level of risk through numeric values for exposure, likelihood, and injury severity. This ensures the audit considers all road user classes and provides a baseline score of the potential level of risk for each road user class and for the Finding.

Similar to Safe System Assessment scoring, each road user class is scored for Exposure, Likelihood and Severity. The risk score for each road user class is calculated as described on page 20, providing a comparison basis for road user classes and potentially the road users at most risk. These road user class risk scores are used to calculate a total risk score for the hazard (Finding) as described on page 20. This provides a baseline score for individual road user classes and total for the hazard, allowing greater targeting of treatments of the hazard, program targeting for funding, and a baseline risk score to assess the potential effectiveness of treatments.

The Safe System Significant Crash Types area in the Tool provides whether the identified crash types and severities are likely to exceed the Safe System injury threshold, that is of the five identified high-risk crash types and a potential for serious injury or fatal severity outcomes. Should the Severity be determined to be severe injury or fatality, Austroads 2022 suggests that the **likelihood level is considered irrelevant**, the level of risk of the hazard should be reduced or eliminated no matter the likelihood.

Finding 1: Vehicular access gap in median

Location:	St Johns Primary School access, 285m south of Mitchell Hwy, eastern side of Sheraton Rd.
Rationale for Road Safety Risk and Potential Road Safety Event:	A concrete median separates northbound and southbound traffic flows along Sheraton Rd, extending around 670m south from Mitchell Hwy. Gaps are provided along this length to allow right turn movements for ingress and egress of private developments, and Wellington Rd. These gaps are controlled by 'No U-turn' restrictions during School Zone times. The exception being the southern gap, which is provided for southbound vehicles to U-turn to travel north towards Mitchell Hwy. + The northbound right turn ingress movement (see F1.1, yellow arrow) requires the driver to give way to two southbound lanes (blue arrows) and vehicles turning left (orange arrow) also entering the site. In addition, they must cross a footpath and give way to pedestrians (green walking shapes). During the congested periods, the driver may have to wait, with a steady stream of oncoming traffic and few gaps, leading to a queue of vehicles (green rectangles) through the Children's Crossing (see Finding 4). The turning driver may feel pressure to take inadequate gaps, misjudge the clearance time, and be struck by a through vehicle; or in accelerating to clear the oncoming traffic, collide with a pedestrian. As these crashes should be at low speed, they would probably result in minor injuries for motor vehicle occupants, and serious injuries to a pedestrian. Should the through vehicle be a truck or bus, more severe injuries are probable for the car occupants. Should the through vehicle be a motorcycle, serious injuries may be sustained by the rider. A low speed rear-end crash may occur while the turning driver is waiting in the right lane, resulting in minor injuries to vehicle occupants. + A driver turning right to exit the site (F1.1 red arrow) to travel north on Sheraton Rd faces similar give way requirements and gap selection issues, and additionally has to give way to vehicles turning right into the site or making a U-turn through the median gap. This may lead to longer delays for car occupants leaving the site, and once the internal area is full, lead to queueing on Sheraton Rd while awaiting access, see Finding 3. Vehicles queueing in Sheraton Rd reduces sight distance for the egressing



F1.1: Right turn ingress and egress at St Johns Primary School, through the median gap.

F1.2: Right turn into St Johns Primary and opposing U-turn.

Finding 1: Vehicular access gap in median

right turn driver and through vehicle driver. Should a crash occur, it would likely be a low-speed right-angle crash, probably resulting in moderate to serious injuries of the turning vehicle occupants. Should the through vehicle be a bus or truck, serious injuries are more probable. Similarly, should the through vehicle be a motorcyclist, the rider may sustain serious injuries.

\+ Several southbound drivers were observed making a U-turn through this gap in the median. With vehicles queued in the left lane waiting access to St Johns Primary School, this effectively blocked the southbound direction, leading to longer queues, more delays, and potential for driver impatience and pressure to move. The results of this may manifest at this site, or further along the road, with drivers distracted and making poor decisions.

F1.3: Oversize load manoeuvring around a U-turning vehicle

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	2	**4**	7.4
Pedestrians	5	2	**4**	7.4
Cyclists	3	2	3	4.8
Motorcyclists	2	2	3	4.1
Car occupants	4	3	2	5.7
Bus occupants	4	2	1	4.7
Truck occupants	3	2	1	3.6
Road users at highest risk:	Frail road users, Pedestrians,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.6 — **MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

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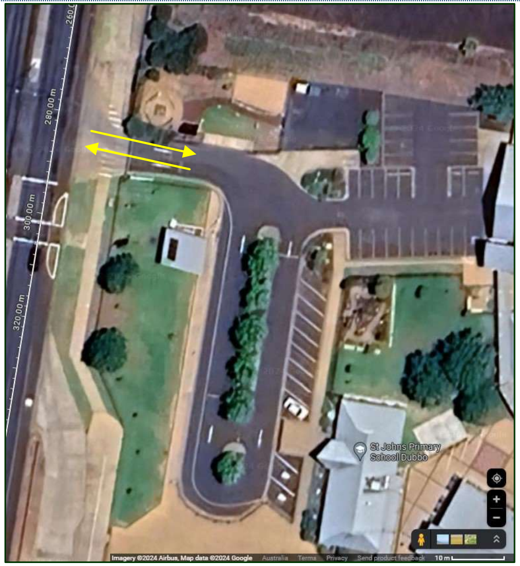
Finding 2: Availability of vehicle parking / waiting spaces during peak demand.

Location:	St Johns Primary School parking area, accessed from driveway 285m south of Mitchell Hwy, eastern side of Sheraton Rd.	 F2.1: Aerial photograph of St John's Primary School access and parking facilities. *(Source: Google Maps)*  F2.2: 360-degree photograph showing pedestrian activity and vehicle queueing in Sheraton Rd, red arrow vehicle 1, yellow arrow vehicle 12 (blue arrow, Elgas delivery truck, northbound).
Rationale for Road Safety Risk and Potential Road Safety Event:	Vehicular access to St John's Primary School is via a two-way driveway, see F2.1, yellow arrows. During peak periods of parking demand, the site does not accommodate the volume of light vehicles attempting to access the site to pick up passengers. At the time of the afternoon site inspection, this led to around 12 drivers choosing to queue out of the parking area and along the left lane of Sheraton Rd, being stopped in the left lane for five or more minutes. *Notes:* It was observed that a) drivers did not queue across the footpath area when entering the site; b) other drivers chose to park in the public parking areas accessed from Wellington Rd, less than 200m to the north. This queueing has the potential to result in: + Drivers who were legally parked at the kerb being unable to leave, which may lead to driver frustration and potential for (although highly unlikely) road rage or erratic, distracted driving once released from the parking space. + Reduced traffic capacity and delay to through drivers, with potential for driver frustration. + Delay to school buses leading to school bus driver stress attempting to meet timetabling expectations, potentially resulting in speeding and poor gap acceptance. A resultant crashing may occur in the audit vicinity or further on the journey, potentially with moderate injuries to occupants. + Reduction of sighting between southbound drivers and the Children's Crossing, which may lead to a driver being unable to observe a person on the Children's Crossing until too late to stop; and for the Children's Crossing supervisor to adequately observe an approaching vehicle, and enter the crossing area, without time for either the driver or the pedestrian to stop or clear the impact area. In either event, resulting in a pedestrian being struck by a motor vehicle, with probable serious injuries sustained by the pedestrian. This may be a less-likely occurrence for heavy vehicles as the driver eye height (nominally 2.4m) is generally	

Finding 2: Availability of vehicle parking / waiting spaces during peak demand.

above the light vehicle roof line (nominally less than 2m), providing less-obstructed sighting to the crossing for the driver, and of the vehicle for the crossing supervisor.

+ Reduction of sighting for drivers exiting the parking area, with significant reduction for right-turn drivers. The queued vehicles tend to taper from the left lane towards the kerb closer to the driveway, see F2.2.

+ This has the potential to allow better sighting for left turn drivers (compared to right turn drivers) and some protection from southbound through vehicles, although it is recognised that the school's school bus stop access driveway is around 40m south of the parking area driveway, buses moving left as the driver prepares for the turn. Crashes occurring are likely to be low speed and low impact angle or rear end, with the probable consequence being minor injuries to the turning vehicle occupants.

+ A driver turning right from the site has reduced sighting of through vehicles, and through vehicle drivers of the turning vehicle. This may place the turning vehicle in the line of through vehicles, with right-angle, right-side impacts into the driver and/or rear passenger doors, resulting in moderate injuries. Should the through vehicle be a truck or bus, serious injuries may be the consequence for the turning vehicle occupants. Should the through vehicle be a motorcycle, serious injury of the rider is probable.

With the above risks, the main moderating factor for both the likelihood and severity of crashes is the low-speed environment, which is partly due to the School Zone speed limit, and partly due to the traffic congestion. The outcome being a reduced probability of serious injuries should a crash occur. As the congestion eased, it was noted that through vehicle speeds increased, however the queueing issue had dissipated opening sight triangles for drivers to normal distances.

F2.3: Looking north at the queued vehicles.

Finding 2: Availability of vehicle parking / waiting spaces during peak demand.

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	2	3	6.7
Pedestrians	5	2	3	6.7
Cyclists	3	2	3	4.8
Motorcyclists	2	2	**4**	5.1
Car occupants	4	3	2	5.7
Bus occupants	4	2	2	5.1
Truck occupants	3	2	1	3.6
Road users at highest risk:	Frail road users, Pedestrians,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on >70km/h
- [ ] Side impact, car vs car >50km/h
- [ ] Run-off-road (side impact infrangible object) >40km/h
- [x] Vulnerable road user >30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.5 — **MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

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Finding 3: Two-way vehicular access driveway

Location: St John's Primary School access, 285m south of Mitchell Hwy, eastern side of Sheraton Rd

Rationale for Road Safety Risk and Potential Road Safety Event:

Vehicular access to St John's Primary School is via a two-way driveway. During peak periods of parking demand, the site does not accommodate the volume of light vehicles attempting to access the site to pick up passengers, see Finding 2. This results in drivers queueing in Sheraton Rd. As discussed in demand the queued vehicles may limit sighting for drivers exiting the site, who are slow to clear the driveway, potentially adding to delay within the site and further queueing in Sheraton Rd.
In addition, drivers in both directions are stopping on the driveway with the potential to block sighting of, and for, pedestrians using the footpath. This, and the necessarily wide driveway pedestrians to cross, my reduce the potential for a driver to observe a pedestrian on the footpath, or otherwise walking between stopped vehicles, leading to the pedestrian being struck by the vehicle and a young (frail) child being seriously injured.

F3.1: Vehicles queueing with a driver who had turned right into the site (yellow arrow) pushing ahead of the left turn queue.

F3.2: Vehicles entering and exiting through pedestrians.

Risk Ratings for road user classes and overall Finding Risk Rating:

Risk Rating by Road User Class

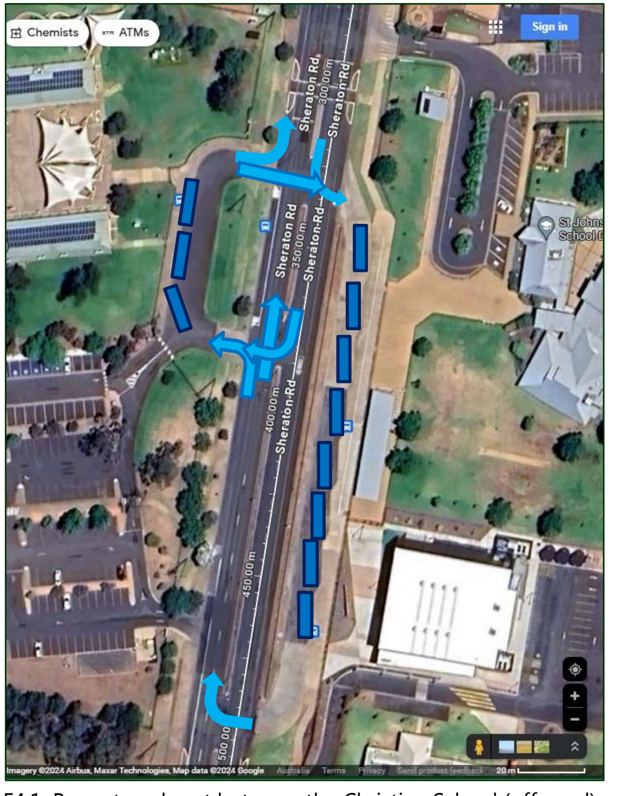
Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	3	**4**	7.9
Pedestrians	5	3	3	7.2
Cyclists	3	2	3	4.8
Motorcyclists	2	2	2	3.2
Car occupants	4	2	1	4.7
Bus occupants	4	1	1	4.3
Truck occupants	3	1	1	3.1
Road users at highest risk:	Frail road users			

Safe System Significant Crash Types:

- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☐ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.3 — **MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

Finding 4: Vehicles queueing at or through the Children's Crossing		
Location:	Children's Crossing, 300m south of Mitchell Hwy	 F4.1: Buses travel east between the Christian School (off-road) school bus stop, west side (left in aerial photograph above) of Sheraton Rd to the St John's (off-road) school bus stop. Further south, at the exit from St John's bus stop, school buses turn right onto Sheraton Rd to access the Christian School bus stop or continue north. Blue arrows show the bus movements.
Rationale for Road Safety Risk and Potential Road Safety Event:	With the high level of activity on Sheraton Rd, vehicles turning and U-turns, and entering and leaving the road, there is potential for queueing through the Children's Crossing. This was observed during the site inspections and was noted by a crossing supervisor as being a safety issue. This queueing may arise due to: + Northbound drivers turning right into St John's Primary school or making a U-turn at this gap in the median, also see Finding 1. These drivers will typically be required to wait for a gap in oncoming traffic, which can be a considerable time, leading to a queue of vehicles behind extending through the Children's Crossing. + Southbound buses servicing both St John's Primary and St John's College, the entry access to the bus stop area being around 20m south of the Children's Crossing. With the volume of buses accessing this area, queueing of buses was observed to occur through the crossing, see F4.4. This is a significant risk to pedestrians and the Children's Crossing Supervisors as other drivers may continue through the crossing, around the stopped bus. This action is permissible under NSW Road Rule 80. + School buses travel east across Sheraton Rd between the Christian School bus stop and the St John's school bus stop. With the traffic density and the distance to cross Sheraton Rd, bus drivers may select minimal gaps in traffic, see F4.2, leading to brief periods of vehicles queueing across the Children's Crossing. In any of these events, vehicles queued through the crossing may obscure a pedestrian who is using the crossing and emerges into the path of a through vehicle. This could occur while the crossing is active, i.e. the 'Children Crossing' flags are displayed, or outside the times of operation of the Children's Crossing, as was observed during the site inspection. In this incident, which occurred after the crossing supervisors had packed up and left, a driver in the left lane stopped when two children were crossing Sheraton Rd. A driver in the right lane proceeded past the stopped car and	

Finding 4: Vehicles queueing at or through the Children's Crossing

apparently sighting the children, stopped at the area marked for pedestrians, see F4.3.

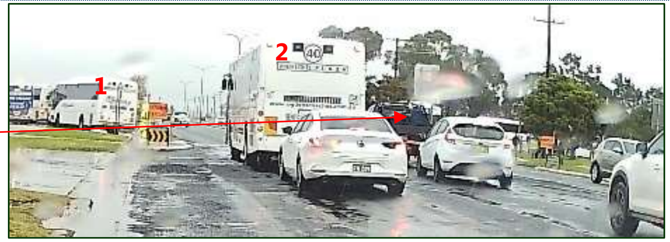
It is recognised that multi-lane pedestrian crossings are inherently unsafe, and this example of a driver 'being nice' to these children, or perhaps unaware of their responsibilities at an inactive Children's Crossing, encouraged the children to cross, which could have led to them into being struck by a vehicle in the adjacent lane. It should also be recognised that the children may not be aware that when the 'Children Crossing' flags are not displayed, vehicles have priority, and used the site in the same manner as an active Children's Crossing.

F4.3: Near miss at the inactive Children's Crossing. Fortunately, on this occasion, the children were walking away from the approaching vehicle.

F4.2: Bus driver selecting a small gap, requiring through vehicles to slow to avoid a collision, with potential for queueing of through vehicles across the Children's Crossing.

1. Bus stopped on driveway into St John's bus stop; **2.** Bus stopped at Children's Crossing at 15:23:35; **3.** Cars passing the stopped bus. **4.** Children's Crossing supervisor.

Finding 4: Vehicles queueing at or through the Children's Crossing



1. Bus stopped on driveway into St John's bus stop; **2.** Bus stopped at Children's Crossing; **3.** Cars passing the stopped bus.

NSW Road Rule 80: A driver approaching a children's crossing, or pedestrian crossing, must not overtake or pass a vehicle that is travelling in the same direction as the driver and is stopping, or has stopped, to give way to a pedestrian at the crossing.

F4.4: Series of photographs. A bus stopped at the active Children's Crossing at 15:23:35 for one minute while waiting for a spot in the school bus parking area. During this time, eight light vehicles passed the bus stopped at the crossing and proceeded through the crossing. CLICK HERE FOR VIDEO

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class	Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
	Frail road users	5	4	4	8.5
	Pedestrians	5	5	4	9.3
	Cyclists	3	4	3	6.3
	Motorcyclists	2	4	3	5.7
	Car occupants	4	4	1	6.2
	Bus occupants	4	4	1	6.2
	Truck occupants	3	4	1	5.4
	Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on >70km/h
- ☐ Side impact, car vs car >50km/h
- ☐ Run-off-road (side impact infrangible object) >40km/h
- ☑ Vulnerable road user >30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 7 — HIGH

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

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Note: The high likelihood scored in the Risk Rating is related to the vehicles continuing past the stopped bus, and through the Children's Crossing. Drivers proceeding past the bus did so with varying degrees of caution (see video). It is of significant concern that the road environment encourages this action, and that the NSW Road Rules condone the action, provided there are pedestrians on the crossing. As such, the only safety control is the crossing supervisor stopping pedestrians entering the crossing until the queued vehicle (bus) has cleared the crossing.

Finding 5: Road pavement condition

Location: Northern section of Sheraton Rd, full length of the divided road

Rationale for Road Safety Risk and Potential Road Safety Event:

The pavement condition of this northern section of Sheraton Rd is poor, with sections of:

+ Rough patched surface or failing road materials, see F5.1. Rough surfaces require additional work by the vehicle tyres and suspensions to keep the vehicle in contact with the road surface. This may lead to additional wear on the components and increase the potential for failure of the suspension or tyres, or the ability of these parts to maintain adequate contact with the road surface. This may result in a driver losing control, the errant vehicle:
    - Side-swiping another vehicle or crossing the median head-on into opposing traffic.
    - Leaving the road and continuing into pedestrians on the footpath or into an infrangible object.
    - Increasing stopping distance leading to a rear-end crash.

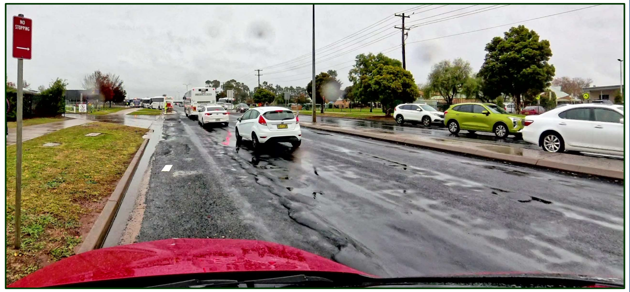
  The bouncing of the vehicle will likely generate additional noise, with the potential to distract road users and mask directions given by the crossing supervisors to pedestrians.

+ Shoving and rutting, see F5.2, may lead to rough surfaces with parallel longitudinal edges that may trap rain run-off into the wheel paths of vehicles. This may lead to vehicle tyres losing traction and the vehicle aquaplaning out of control, with potential for:
    - Rear-end and side-swipe type crashes
    - Skidding into the Children's Crossing.

  These situations may prove a greater hazard to two-wheeled vehicles, the rutting trapping the wheels contrary to the riders steering, leading to the rider losing control and falling onto the road.

+ Water ponding in gutters and extending onto the road, see F5.3, may also lead to aquaplaning, or the uneven pressure of water against the wheels on one side of the vehicle, slowing that side of the vehicle, drawing the vehicle further into the water. This may lead to:

F5.1: Rough surface near Wellington Rd T-junction



F5.2: Shoved and rutted surface, trapping water in longitudinal ruts. Buses, which can be seen queued at St John's Primary School bus stop, ejected some of the water in these ruts as they travelled along the road.

F5.3: Water ponding in gutters extending onto the road surface.

Finding 5: Road pavement condition

- The driver losing control and travelling further into the water and off the road, potentially into an infrangible object or pedestrian.
- The driver over-correcting the steering and, once out of the water, driving across the road, side-swiping another vehicle or crossing head-on into opposing traffic.

+ Loose material on the road surface, and in places it is in heaped windrows, see F5.3. Most of the loose material observed was small stones ejected from potholes, from patching, and from reseals. These small stones may reduce traction for a vehicle changing speed or turning, leading to loss of control crashes similar in nature to those associated with the rough surface or water ponding.

F5.4: Loose material, pothole, and water ponding.

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	3	3	7.2
Pedestrians	5	3	**4**	7.9
Cyclists	3	4	3	6.3
Motorcyclists	2	4	3	5.7
Car occupants	4	3	3	6.3
Bus occupants	4	2	2	5.1
Truck occupants	3	2	1	3.6
Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 6.2 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

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Finding 6: Proximity of Wellington Rd to Mitchell Hwy		
Location:	Wellington Rd T-junction with Sheraton Rd	 F6.1: Sheraton Rd looking south towards the Wellington Rd T-junction. Note cars turning right from Wellington Rd across two traffic lanes and the path of through vehicles.
Rationale for Road Safety Risk and Potential Road Safety Event:	Wellington Rd terminates at Sheraton Rd, on the eastern side, 100m south of the Mitchell Hwy roundabout. This roundabout operates two lanes, and it is possible that a driver turning right from Mitchell Hwy (west) or doing a U-turn from Sheraton Rd (south), could run parallel with a vehicle from the north or east travelling into Sheraton Rd (south). On leaving the roundabout, the driver may need to move to the left lane to access Wellington Rd and the adjoining car parking and businesses. The driver may not expect or observe a vehicle in their blind spot and change lanes, side-swiping the vehicle in the left lane. This may result in minor injuries of vehicle occupants. A driver exiting the roundabout in the right lane may also choose to change lanes to the left, and do so where the road straightens, further from the roundabout. Divers exiting Wellington Rd and turning right may observe this vehicle's turn indicator and assume it is turning left into Wellington Rd. They proceed, entering Sheraton Rd and are struck at right-angles into the driver door. This could result in serious injuries to the vehicle occupants. There is a pedestrian refuge across Sheraton Rd in this area. A driver who is attempting to look for vehicles in their blind spot may not observe a pedestrian crossing the road. See Finding 10 and the link to a video provided in Finding 7.	

Finding 6: Proximity of Wellington Rd to Mitchell Hwy

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	3	2	3	4.8
Pedestrians	3	2	**4**	5.7
Cyclists	3	2	**4**	5.7
Motorcyclists	2	4	**4**	6.5
Car occupants	4	3	3	6.3
Bus occupants	4	1	2	4.7
Truck occupants	3	1	1	3.1
Road users at highest risk:	Motorcyclists			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☑ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge	
Finding Risk Rating Score: 5.4	**MEDIUM**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

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Finding 7: Queueing at Mitchell Hwy roundabout

Location: Sheraton Rd southern leg of the Mitchell Hwy roundabout

Rationale for Road Safety Risk and Potential Road Safety Event:

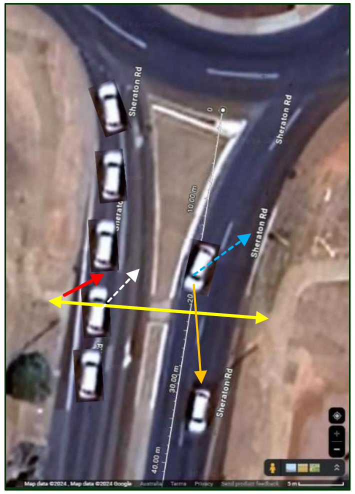
During the site inspections, queueing was observed on all legs of the Mitchell Hwy – Sheraton Rd roundabout during peak periods. Roundabouts rely upon drivers assessing the prevailing traffic conditions and selecting a safe gap in the circulating traffic. Where there is queueing on all legs of a roundabout the delay can become significant leading to driver frustration, selecting inappropriate gaps, and potentially driving erratically further along their journey.

An example video from one of the site inspections is available here: Sheraton SB 07-06-2024 PM.mp4. Although the queue and delay on the Mitchell Hwy western approach was short, queueing was evident on all four legs, as was driver frustration. For example, a driver towing a horse float entered the roundabout from Mitchell Hwy eastern leg, resulting in the affected circulating vehicle driver braking. This may result in a rear-end collision as a following driver may not be prepared for the lead vehicle to stop in the roundabout.

It is also possible that a pedestrian may decide to cross the road between the queued vehicles, and drivers looking to their right for an appropriate gap in the roundabout traffic, be unaware of the pedestrian. Moving up in the queue, the vehicle may collide with the pedestrian, leading to moderate injuries to the pedestrian.

The potential for a pedestrian to be unseen by a queued driver, or a driver changing lanes is represented in F7.2. The yellow arrow represents pedestrian refuge and path alignment, the red arrow represents a pedestrian crossing from the west through the queued vehicles while the white arrow represents the driver watching the roundabout traffic, the blue arrow represents a southbound driver checking their blind spot before changing lanes (orange arrow).

F7.1: Queueing to make a left turn onto Mitchell Hwy (west).



F7.2: Potential for a pedestrian to be unseen by a queued driver, or a driver changing lanes. Yellow arrow represents pedestrian desire line, red arrow pedestrian crossing from the west, blue arrow southbound driver checking their blind spot before changing lanes.

Finding 7: Queueing at Mitchell Hwy roundabout

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	3	2	3	4.8
Pedestrians	3	2	3	4.8
Cyclists	3	2	3	4.8
Motorcyclists	2	3	3	4.8
Car occupants	4	3	2	5.7
Bus occupants	4	2	2	5.1
Truck occupants	3	2	1	3.6
Road users at highest risk:	Car occupants			

Safe System Significant Crash Types:

- ☐ Head-on >70km/h
- ☐ Side impact, car vs car >50km/h
- ☐ Run-off-road (side impact infrangible object) >40km/h
- ☐ Vulnerable road user >30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 4.9

MEDIUM

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

Finding 8: Readability of road and traffic lanes		
Location:	Length of Sheraton Rd	
Rationale for Road Safety Risk and Potential Road Safety Event:	Drivers may have difficulty discerning the road alignment, lane alignment, and lane widths along lengths of Sheraton Rd. This condition may be exacerbated under adverse conditions, such as when the road is wet, when it is raining, and at night. In the northern section, the line marking provides minimal assistance to drivers, the pavement defects discussed in Finding 5 have partially obscured the line marking with loose material, has had patching over-laid, and shoves, ruts and ponded water obscure the line marking in areas. Where markings are visible during the day, they are generally less conspicuous at night. There is therefore potential for sideswipe and run-off-road crash types, resulting in minor to moderate injury severity of vehicle occupants, and serious injuries to a motorcyclist or cyclist. Should a vehicle leave the road, it may enter the pedestrian area, resulting in a low-speed pedestrian crash and moderate injuries to a pedestrian. In the southern and eastern sections, line marking is provided on the lead into the Boundary Rd roundabout, and the roundabout has road lighting, as does Boundary Rd to the west. For the remainder of the southern and eastern sections, delineation or other driver aids are scarce. For the southern section, a crest may preclude adequate overtaking sight distance (overtaking sight distance was not assessed during the initial site inspections). At night this may not be obvious, and lights in the distance may disorient drivers, assuming that these lights are from vehicles in the distance. This may lead to a driver overtaking where there is insufficient length to safely complete the manoeuvre resulting in a head-on, sideswipe or run-off-road crash. The eastern section has two sharp turns, the northern having an unsealed road surface that contains large, deep potholes, windrows of loose material on the outside of the turn, and delineation devices damaged and covered with mud. The southern turn is sealed, with deep windrows of loose material, and alignment sparsely marked with guideposts. Both curve alignments are difficult to discern at night, and the road surface	 F8.1: Northbound, northern section, approaching the Children's Crossing, showing the difference in conspicuity of the line marking associated with the crossing compared to the longitudinal line marking.  F8.2: Northbound, southern section, approaching the crest. Night vs day comparison.

Finding 8: Readability of road and traffic lanes

conditions have the potential to destabilise a vehicle, with the potential for a driver to enter the turns too fast, lose control and run off the road.

Head-on crashes are possible in both the southern and eastern sections, and during times of low visibility have a higher probability. These sections have a signposted speed limit of 60km/h; however, speed data was not available and observations during the site inspections suggested that travel speeds were higher than the posted limit. In consideration of probable crash speeds, a head-on crash may result in serious injuries for light vehicle occupants, with a higher probability of serious injuries should a heavy vehicle or motorcyclist be involved. Should a vehicle strike a cyclist or pedestrian, fatal injuries are the probable outcome.

It was noted during the site inspections that several warning and regulatory signs appeared to be missing, including ‘no U turn’ signs in the northern section, and a ‘turn warning’ sign in the south. Also, a 60km/h speed sign interferes with sighting of the southwestern 40km/h school zone sign.

F8.3: Eastern section, northern turn, deep potholes and deep windrows of loose material on the outside of the curve.

F8.4: Eastern section, southern turn, southern approach demonstrating readability of the sharp turn at night.

Finding 8: Readability of road and traffic lanes

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class	Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
	Frail road users	2	3	**4**	5.7
	Pedestrians	1	3	**4**	5.4
	Cyclists	2	3	**4**	5.7
	Motorcyclists	2	2	3	4.1
	Car occupants	3	3	3	5.5
	Bus occupants	2	3	2	4.1
	Truck occupants	3	3	1	4.4
	Road users at highest risk:	Frail road users, Cyclists,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge	Finding Risk Rating Score: 5.1 **MEDIUM**
Potential timing of mitigation measures:	Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

Finding 9: Pedestrian refuge

Location:	Sheraton Rd north, 10m south of Mitchell Hwy	 F9.1: Northbound, showing crossing distance for pedestrians and proximity to the roundabout.  F9.2: Southbound, exiting the roundabout, showing the refuge, queued vehicles on the northbound side, and potential for a driver changing lanes through the refuge area.
Rationale for Road Safety Risk and Potential Road Safety Event:	A pedestrian refuge is provided in the Sheraton Rd concrete median. Pedestrians need to cross two lanes of traffic to reach the refuge and two lanes to reach the kerb. On the southbound (eastern) side, vehicles are exiting the roundabout. As described in Finding 6, a southbound driver in the right lane who intends to turn left into Wellington Rd, will need to change lanes and should check their blind spot before moving left. This may occur in the vicinity of the refuge. Should a pedestrian be in the path of the vehicle, the driver may be otherwise engaged with the blind spot check and collide with the pedestrian. The probable outcome would be serious injuries or fatality of the pedestrian. On the northbound (western) side, drivers are approaching the roundabout, and may be queued while waiting to access the roundabout. A pedestrian may choose to cross the road between the queued vehicles and emerging, be struck by a vehicle in the adjacent lane. The probable outcome would be serious injuries or fatality of the pedestrian. While walking between the queued vehicles, a driver may be unaware of the proximity of the pedestrian, and moving with the queue, strike the pedestrian. Minor injuries are the probable result of this occurrence.	

Finding 9: Pedestrian refuge

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	3	2	3	4.8
Pedestrians	3	3	**4**	6.3
Cyclists	3	2	3	4.8
Motorcyclists	2	3	3	4.8
Car occupants	4	3	2	5.7
Bus occupants	4	2	2	5.1
Truck occupants	3	2	1	3.6
Road users at highest risk:	Pedestrians			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 5.1

MEDIUM

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

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Finding 10: Transition of the road configuration between two lanes and four lanes

Location: Southern extent of divided road

Rationale for Road Safety Risk and Potential Road Safety Event:

At the southern extent of the divided road, the road configuration transitions between four lanes to the north, and two lanes to the south.

For southbound drivers, this achieved by the right through lane being marked with right turn arrows, and the end of the lane forming a U-turn facility. A driver in the right lane approaching this may be unaware of the change, and in making a rushed lane change, sideswipe a vehicle on the left.

For northbound drivers, the change is more radical. The northbound approach lane alignment is directly towards the southbound U-turn lane; a rapid left shift is required to adjust the alignment of northbound drivers to the left of the introduced median. This change is short, and as may be seen in the photographs in the F10.2 photo storyboard, difficult to observe and understand during poor daylight conditions, and practically impossible at night. A driver who is unaware of the left shift requirement, may continue into the opposing traffic, leading to a head-on crash, or in attempting the left shift, over steer and lose control, running off the road or rolling over. Although this is in a 60km/h speed zone (and 40km/h school zone), the site is at the termination of an open rural area, with the potential for drivers to be travelling above the posted speed limit, particularly at night under low traffic activity. Such crashes may result in serious injury to light vehicle occupants and motorcyclists.

F10.1: Southbound, right lane becomes a right turn lane.

F10.2: Northbound, approaching the transition area during the day (top), similar location at night (2nd in stack), at the transition (3rd in stack) at night, and during the day (left).

Finding 10: Transition of the road configuration between two lanes and four lanes

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class	Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
	Frail road users	3	4	**4**	7.0
	Pedestrians	3	1	1	3.1
	Cyclists	2	2	3	4.1
	Motorcyclists	2	4	**4**	6.5
	Car occupants	4	4	**4**	7.7
	Bus occupants	3	3	3	5.5
	Truck occupants	3	3	2	4.8
	Road users at highest risk:	Car occupants			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☑ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge	Finding Risk Rating Score: 5.8
	MEDIUM
Potential timing of mitigation measures:	Should be corrected in the very near future, even if costs are moderate. A delay until the routine maintenance must be justified. Temporary mitigation measures should be implemented until final corrective action taken.

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Finding 11: Concrete block across road		
Location:	Southern leg of Boundary Rd roundabout	 F11.1: Southern leg of the Boundary Rd roundabout is closed by a concrete block, day and night examples
Rationale for Road Safety Risk and Potential Road Safety Event:	The southern leg of the Sheraton Rd – Boundary Rd roundabout is yet to be constructed. The road is closed, and vehicles precluded access by the placement of an infrangible concrete block in the middle of the road. Under daylight, the block can be seen. At night the block is illuminated by the road lighting. Despite this, a concrete block in the middle of the road is not to be expected and combined with the colour of the concrete and the 50km/h speed limit installed beside the barrier, drivers would not be expecting the road to be closed in this manner. A driver may have difficulty observing the concrete block when continuing towards the southern leg, and taking evasive action run off the road into a lighting pole or strike the block. Should a crash occur, it could be expected to be at a lower speed, resulting in moderate injuries to light vehicle occupants. Should the vehicle be a motorcycle, the rider may sustain serious injuries.	

Finding 11: Concrete block across road

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	2	2	3	4.1
Pedestrians	1	1	1	1.0
Cyclists	2	2	3	4.1
Motorcyclists	2	2	**4**	5.1
Car occupants	3	2	2	4.1
Bus occupants	2	2	2	3.2
Truck occupants	3	2	1	3.6
Road users at highest risk:	Motorcyclists			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 3.8 — **LOW**

Potential timing of mitigation measures: Should be corrected at a suitable time, if cost is low.

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Finding 12: School bus timetabling and traffic volumes		
Location:	School bus egress from both off-road school bus bays	 F12.1: Top- Bus approaching Sheraton Rd from St John's bus bay, note car in northbound left lane brake lights. Centre- Bus enters road and all cars stop, the car in the northbound right lane braking harder as the bus enters road. Bottom- Bus clears the access and cars start to move. Also see Findings 4 and 13.
Rationale for Road Safety Risk and Potential Road Safety Event:	Both school bus bays are located off-road in dedicated bus only areas. One is on the eastern side of Sheraton Rd and services St John's Primary School and St John's College (St John's bus bay). The other is located on the western side of Sheraton Rd and services Dubbo Christian School. Also see Finding 4. From the St John's bus bay, the majority of buses turn right to travel north on Sheraton Rd. A proportion of these buses then turn left into the Christian School bus bay. From the Christian School bus bay, some buses turn left to continue north on Sheraton Rd, others cross Sheraton Rd to enter the St John's bus bay, the Christian School egress being opposite the St John's ingress. Operating under the NSW Road Rules (normal operation), the traffic volumes would lead to long delays for these manouevres. A practice has developed that, when the road is busy, through light vehicle drivers will stop to allow buses to exit the school bus bays. For drivers who are aware of this practice, they see a bus waiting to enter, or a vehicle ahead stopping, and expect that the vehicle in front will stop on the through travel lane, and/or that a bus will turn without delay onto Sheraton Rd. For a driver who is not aware of this practice, a vehicle in front stopping on the roadway, or a bus emerging, may not be expected and lead to the vehicle colliding with the bus or, in attempting evasive action, collide with another vehicle. During these peak school bus and traffic periods, the 40km/h School Zone is in force, with any collisions expected to occur below 40km/h. Note: some drivers in this area appeared to be travelling above 40km/h, however sample speed measurements were not taken. Should a crash occur between a car and a bus, the probable outcome is moderate injury. Should a heavy vehicle be the through vehicle, there is potential for a moderate to severe degree of injury severity to bus occupants. A motorcyclist may sustain moderate to serious injuries should they collide with a bus. Pedestrians may also be indirectly involved, see Finding 13.	

Finding 12: School bus timetabling and traffic volumes

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	2	3	6.7
Pedestrians	5	2	**4**	7.4
Cyclists	3	2	**4**	5.7
Motorcyclists	2	2	3	4.1
Car occupants	4	4	3	7.0
Bus occupants	4	5	2	7.4
Truck occupants	3	2	2	4.1
Road users at highest risk:	Pedestrians, Bus occupants,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

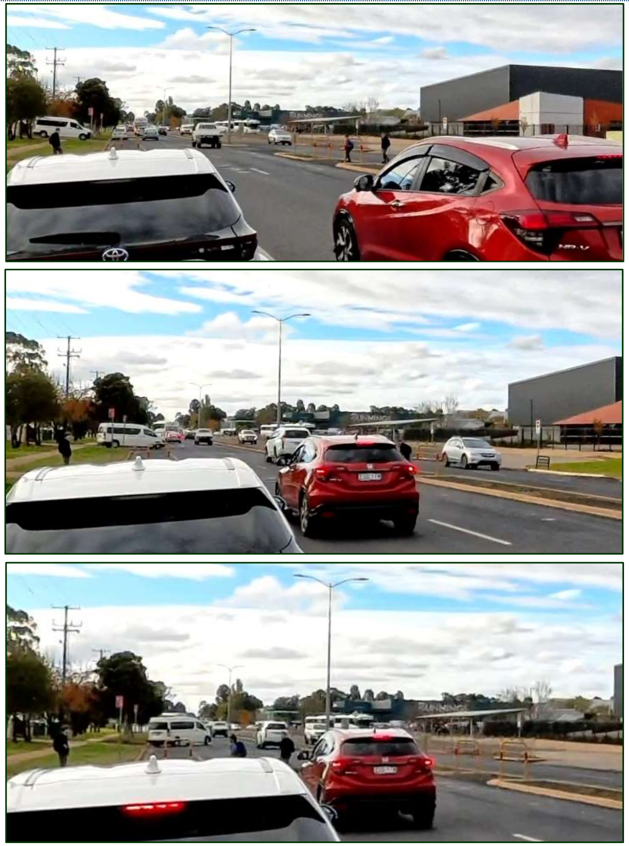
- [ ] Head-on > 70km/h
- [ ] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 6.3 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

 RRT2309 v3.0

Finding 13: Drivers stopping to allow child pedestrians to cross the road	
Location:	At and in the vicinity of the pedestrian refuge, and at the Children's Crossing when it is not operational.
Rationale for Road Safety Risk and Potential Road Safety Event:	Similar to Finding 12, drivers may consider stopping to allow pedestrians to cross the road when there is no legal requirement to stop. Although drivers may feel they are improving safety by stopping to allow a child to cross the road, due to the multi-lane nature of the road stopping may be increasing risk to the pedestrians. This was observed during the site inspections, a driver stopped for a pedestrian is overtaken by another driver, with the potential for the pedestrian to emerge from in front of the stopped vehicle and walk into the path of the moving vehicle. The driver of the moving vehicle may be unaware of the reason for stopping, assuming that the stopped driver is waiting for a parking space or to access a driveway. The probable outcome of a collision between a car and a child pedestrian, is likely serious, with potential for fatality if struck by a heavy vehicle. A photograph 'storyboard' is provided in F13.1. In this case the stopped vehicle is in the further lane from the pedestrians, so they are not emerging into the adjacent travel lane. Should the pedestrians be walking in the opposite direction, such as in the morning, or the red vehicle have been in the right lane, the pedestrians would be emerging from in front of the stopped vehicle, the driver of a moving vehicle being unable to sight the pedestrians until they were in the vehicle's path.



F13.1: Top- Red vehicle is slowing as pedestrians reach the median. Centre- Red vehicle stopping, white vehicle proceeds through at speed. Bottom- Pedestrians complete crossing the road, red car remains stationary.

Finding 13: Drivers stopping to allow child pedestrians to cross the road

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	4	**5**	9.3
Pedestrians	5	4	**5**	9.3
Cyclists	3	2	3	4.8
Motorcyclists	2	3	3	4.8
Car occupants	4	4	2	6.5
Bus occupants	4	3	1	5.4
Truck occupants	3	3	1	4.4
Road users at highest risk:	Frail road users, Pedestrians,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- ☐ Head-on > 70km/h
- ☐ Side impact, car vs car > 50km/h
- ☐ Run-off-road (side impact infrangible object) > 40km/h
- ☑ Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 6.7 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

Finding 14: Speed of vehicles		
Location:	Sheraton Rd, western side, southern end of the divided road.	  F14.1: Potential speeding in the School Zone by the northbound vehicle. This vehicle can also be seen in the F13.1 storyboard.
Rationale for Road Safety Risk and Potential Road Safety Event:	Although speed data was not collected, it appeared that some drivers were travelling over the 40km/h School Zone speed limit. The speed of southbound drivers appeared to slowly increase as they drove south past the St John's school bus zone. The speed of some northbound drivers did not appear to decrease until traffic congestion forced their drop in speed. This has the potential to increase the degree of injury severity sustained by road users, particularly the most vulnerable in this area, being child pedestrians. In Finding 13, the photographic storyboard in F13.1 occurred immediately after this vehicle had passed through, the following vehicle travelling at a similar speed, passing as the children reached the pedestrian refuge in the median. When considering the probable outcome to a child pedestrian struck by a vehicle similar to the utility in the top photograph, the potential for a fatal outcome can be envisaged, the height and unforgiving nature of the 'bull bar' having potential for severe head and thoracic injuries of a child, even when travelling below the 40km/h School Zone speed limit. In the photographs provided in F14.1, and based on the linemarking, it appears that the northbound vehicle has travelled around 24m in the same time that the southbound vehicle has travelled around 14m, with an estimated speed of around 60km/h.	

Finding 14: Speed of vehicles

Risk Ratings for road user classes and overall Finding Risk Rating

Risk Rating by Road User Class

Road User Class	Exposure (score 1-5)	Likelihood (score 1-5)	Severity (score 1-5)	Risk Rating (x/10)
Frail road users	5	4	**5**	9.3
Pedestrians	5	4	**5**	9.3
Cyclists	3	2	**5**	6.7
Motorcyclists	2	3	**5**	6.7
Car occupants	4	4	**4**	7.7
Bus occupants	4	3	3	6.3
Truck occupants	3	3	2	4.8
Road users at highest risk:	Frail road users, Pedestrians,			

SAFE SYSTEM CRASH TYPE(S) IDENTIFIED:

- [ ] Head-on > 70km/h
- [x] Side impact, car vs car > 50km/h
- [ ] Run-off-road (side impact infrangible object) > 40km/h
- [x] Vulnerable road user > 30km/h

Finding Risk Rating Gauge: Finding Risk Rating Score: 7.4 — **HIGH**

Potential timing of mitigation measures: Should be corrected in the very near future, even if costs are high. Temporary mitigation measures should be implemented until final corrective action taken.

APPENDIX G: AUDIT TEAM MEMBER STATEMENT OF INDEPENDENCE

It is fundamental to the auditing process that no member of the Road Safety Audit Team has had any design or construction involvement with the measures being audited and will maintain this independence throughout the audit process.

Team Leaders / Members shall excuse themselves from participation in the audit if:

- They have had any involvement in planning, design, construction, or maintenance activities of the road infrastructure for the project.
- They perceive any possibility of duress or coercion by their employer or employer's staff in relation to the audit.

It may not always be possible to be unaware of the background, planning or development of the road project being audited. It may not always be possible to be unaffected by the outcomes of the road project being audited. In these cases, the affected Team Leader / Member shall make the other Team Members aware of the level of involvement or effect of the project; the Team Leader will determine strategies to manage potential bias.

TEAM MEMBER CONFIRMATION OF INDEPENDENCE

I, Wayde Hazelton of WaySafe, Lead Auditor, NSW Auditor number RSA-02-0079, confirm that I was involved with the Stage 6: Existing Road, Road Safety Audit, have had no other involvement in this road project, and hold no bias or vested interest in its outcome.

Signed:

Date: 28/06/2024

I, Robert Glen Morgan of WaySafe, Auditor, NSW Auditor number RSA-02-0963, confirm that I was involved with the Stage 6: Existing Road, Road Safety Audit, have had no other involvement in this road project, and hold no bias or vested interest in its outcome.

Signed:

Date: 28/06/2024

APPENDIX H: RISK MANAGER ACTIONS FROM FINDINGS

Project Name:	Sheraton Rd, Dubbo – Temporary Haulage Route		
Audit No.:	A-242124	**Audit Stage**:	Stage 6: Existing Road

The manager of the road safety risks identified by this Road Safety Audit must assess the risks in consideration of other risks and priorities to be managed and respond to the Findings outlining the proposed (so far as is reasonably practicable) actions, priority and timing of the actions, and the level of residual risk once these actions are complete. It is important that the Risk Manager details the reasoning behind proposed actions or inaction.

Finding	Risk Rating	Risk Manager Actions	Priority / Timing	Risk level reduced SFAIRP?
Finding 1: Vehicular access gap in median	**MEDIUM**			☐ Yes ☐ No
Finding 2: Availability of vehicle parking / waiting spaces during peak demand	**MEDIUM**			☐ Yes ☐ No
Finding 3: Two-way vehicular access driveway	**MEDIUM**			☐ Yes ☐ No
Finding 4: Vehicles queueing at or through the Children's Crossing	**HIGH**			☐ Yes ☐ No

Finding	Risk Rating	Risk Manager Actions	Priority / Timing	Risk level reduced SFAIRP?
Finding 5: Road pavement condition	**HIGH**			☐ Yes ☐ No
Finding 6: Proximity of Wellington Rd to Mitchell Hwy	**MEDIUM**			☐ Yes ☐ No
Finding 7: Queueing at Mitchell Hwy roundabout	**MEDIUM**			☐ Yes ☐ No
Finding 8: Readability of road and traffic lanes	**MEDIUM**			☐ Yes ☐ No
Finding 9: Pedestrian refuge	**MEDIUM**			☐ Yes ☐ No
Finding 10: Transition of the road configuration between two lanes and four lanes	**MEDIUM**			☐ Yes ☐ No
Finding 11: Concrete block across road	**LOW**			☐ Yes ☐ No
Finding 12: School bus timetabling and traffic volumes	**HIGH**			☐ Yes ☐ No

Finding	Risk Rating	Risk Manager Actions	Priority / Timing	Risk level reduced SFAIRP?
Finding 13: Drivers stopping to allow child pedestrians to cross the road	**HIGH**			☐ Yes ☐ No
Finding 14: Speed of vehicles	**HIGH**			☐ Yes ☐ No

	Risk Manager:			
	Signature:		**Date:**	

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The crash performance of seagull intersections and intersections with left turn slip lanes

Shane Turner[a], Fergus Tate[b], Graham Wood[c]

[a]National Road Safety Specialists, Stantec NZ, [b] Lead Safety Advisor (roads and roadsides) NZ Transport Agency, [c]Consultant Statistician

Abstract

A number of alternative intersection layouts may reduce traffic delays and/or improve road safety. Two alternatives are reviewed in this research; 'priority controlled Seagull intersections' and intersections with a Left Turn Slip Lane. Seagull intersections are used on roads to reduce traffic delays. However, some do experience high crash rates. While left turn slip lanes allow turning traffic to move clear of the through traffic before decelerating. Although there is debate about the safety problems that occur at Seagull intersections and Left Turn Slip lanes there has been very little research to quantify the safety impact of different layouts. In this study, crash prediction models have been developed to quantify the effect of various Seagull Intersection and Left Turn Slip lane designs on the key crash types at priority intersections.

Introduction

The majority of urban and rural intersections have priority control (Stop or Give-Way) or no formal control. National crash data (2011 to 2015) indicates that 64% of rural and 43% of urban intersection all-injury crashes occur at three leg priority intersections. The serious injury and fatal crash proportion is the same at 64% for rural intersections though higher (52 %) for urban intersections. Despite the high proportion of crashes a relatively small proportion of research studies have focused on crashes at priority intersections, compared with the number of studies that have been undertaken of traffic signals, roundabouts and road links, especially in urban areas. In New Zealand there is a gap in the crash prediction models that are available to the road safety industry, especially for urban areas. With a focus on the safe system philosophy, it is important we have better tools (crash prediction models) to look at the safety of this intersection type (priority control), where over 50% of serious injuries and fatalities occur.

The challenge with priority controlled intersections is that there are so many intersections to consider for safety improvement. Generally the focus needs to be on the higher volume intersections, where high right turning volumes and high through volumes at peak times results in fewer gaps and increased risk taking. A common treatment at high volume priority rural intersections (where speed limit is 80 km / h or greater) is Left Turn Slips lanes (to reduce rear-end crashes and remove slower moving turning traffic from the through traffic). There are however concerns that some designs may increase the risk of crashes involving through and right turn out vehicles (JA crashes), due to left turners masking following through vehicles.

Another treatment type, which is less common, is ‘Seagull’ layouts, where drivers can break their right turn movement into two stages (see figure below, which also has one type of Left Turn Slip lane, LTSL). In the first stage they cross over to a painted or solid median area. In the second stage they merge with through traffic on the main road via a merge lane and taper. While in theory these layouts should be safer, the experience is that some have high numbers of JA crashes and LB (right turn against or right turn versus opposing through vehicle) crashes, possibly due to poor design and intersection complexity. Seagull intersections are typically priority controlled, but can also operate as traffic signals. A signal controlled Seagull intersection operates with three signal phases, and allows the through movement in one direction to flow continuously. This project focuses on priority controlled Seagull intersections. So in this paper there are crash prediction models for standard intersection layouts (with and without Left Turn Slip lanes) and Seagull layouts.

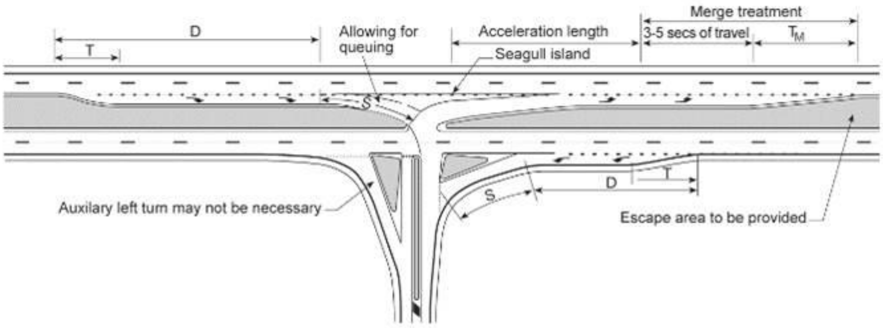

Figure 1: Typical Seagull Intersection Layout with Raised Islands

The first section of the paper looks at the limited research available on the safety performance of seagulls and the safety issues associated with LTSL. The paper then presents the data collected and the models produced ….

Literature Review

The literature review focused on research of priority controlled seagull intersections and priority intersections that have LTSLs (particularly from the main road into a side-road). Across New Zealand there are a variety of existing types of seagull intersections and general priority tee-junctions. Seagull intersections (see Figure 1) have three key characteristics, 1) a seagull shaped ‘splitter’ island between through and right turning traffic on main road, 2) a merge lane with acceleration taper for right turn traffic turning out of side road and 3) at least one bypass lane for traffic traveling straight through from left to right. Many of the higher volume standard priority intersections have some characteristics that are similar to seagulls, like left turn slip lanes and also areas in the median where drivers can wait and merge with through traffic. However unless they have all three characteristics specified they are not seagull intersections.

Figure 1 also shows two left turn slip lanes (LTSL) into and out of the side-road. There are a variety of different LTSL layouts, from small painted islands up to large solid islands, with different deceleration lane lengths. The focus in this study was the LTSL from the main road into the side-road.

There is limited research available on seagull layouts (called chanelised layouts in other parts of the world). Tang and Levett (2009) identified that two major crash types (right-near and right-through) were predominant in all crashes at seagull intersections in New South Wales (refer to Figure 1 for equivalent crash types in NZ). The multivariate study of potential crash causing factors provided very little evidence on why these crashes were occurring. The study did show that young female drivers and older (≥ 67 years old) male drivers were over-represented in the two main crash types. A potential explanation for the older age group demographic was the diminishing cognitive ability of older drivers, which may be causing them to misjudge appropriate gaps in the traffic.

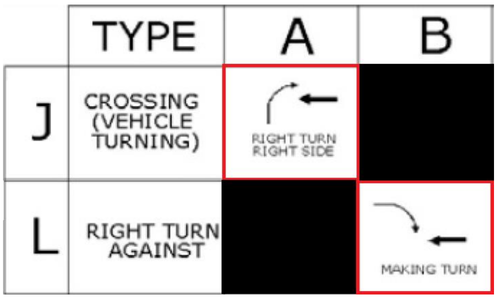

Figure 1: Common crash types at seagull intersections (NZ crash coding)

Radalj, et al., (2006) analysed the crash data and the design, of 76 seagull intersections in Perth, Western Australia. The study identified that seagull intersections installed as per the recommended guidelines, do not result in any significant (positive or negative) change in the type or number of crashes. However, where the intersection angle did not conform to the recommended guidance, the crash numbers and severity increased, especially the latter. The authors recommended that seagull islands should not be considered as an intersection safety treatment (as they had been in the past), as at best they tend to have a similar safety record as a standard T-intersection, and at worse can have a much worse safety record.

Both Summersgill et al. (1996) and Elvik et al. (2009) concluded that the safety effect of channelised passing lanes at T-intersections (Seagull intersection equivalent) is to increase the crash risk. In the case of Elvik, a 26% overall increase in all crashes. In the Summergill study they found a 50% increase in ‘JA’ crashes. This research supports the concerns of most road safety specialists that Seagull intersections are less safe, especially if poorly designed, than traditional T-intersections.

Harper, et al., (2011) researched the safety performance of three design variations of a seagull intersection design for the A1 Highway / Island Point Road intersection in New South Wales, Australia. After the seagull intersection was constructed a number of ‘right near’ (JA) type crashes began to occur. The intersection was subsequently modified to include a short left turn splay that included a small raised concrete splitter island and priority control. However, this did not effectively address the ‘right-near’ crashes, and consequently right-through (LB) type crashes began to occur more frequently. A final modification increased separation between the left-turn deceleration lane and the straight through lane of the major road. After which the crashes reduced appreciably. The separation of the left turn lane from the through movement by a painted splitter island improved visibility for vehicles turning out of the side-road. This design of LTSLs has safety benefits at seagull and standard priority t-junctions, especially in higher speed areas.

There is more extensive safety research on Left Turn Slip lanes. While the functions and use of left turn lanes are reasonably well documented (to reduce rear-end crashes), the overall safety benefits and dis-benefits have recently been questioned, particularly in rural/high speed areas. Elvik et al (2009) identified from several studies that the provision of left turn lanes at T-intersections acts to increase the number of injury crashes by 12%. The study reasoned that left turn lanes may create blind spots where a vehicle turning left can obscure through traffic coming from the right side of the Side Road. He also added that large scale intersection channelisation can complicate the road layout, and may increase driver error.

Masters research by Urlich (2014) considered the safety performance of LTSL facilities at rural at grade T-intersections in New Zealand. The study focused on how LTSLs impact on the available sight distances for side road traffic to through vehicles and how this related to the crash rates. The analysis showed that the installation or modification of LTSL (into side-roads) can increase injury crash rates. The key reason being that left turn vehicles do mask following through vehicles on a regular basis. This research indicates that careful consideration needs to be made on the design of LTSL so they do not compromise the safety of the intersection.

The previous research indicates that for both seagull intersections and LTSLs there is evidence that crash rates can go up if intersections are not well designed. The experience in Perth (by Radalj) showed that seagulls should not be considered a road safety treatment. Seagulls do reduce traffic delays and may be constructed to reduce delays. However it is important that they are well designed, especially in high speed areas where crash severity is often higher, to at least produce a neutral road safety outcome. In terms of the design of LTSL, there is some evidence that they can mask through vehicles and lead to increased crashes between right turn out and through vehicles. Especially in higher speed areas and where traffic volumes (left turn in and right turn out) are at higher levels, then the design should look to address visibility problems. Each of these matters was considered in this research study.

Data Collection and Sample Size

The study utilised data that had previously been collected for standard three-arm urban and rural priority T-intersections (Turner 2001; Turner and Roozenberg 2007). In both the urban and rural studies data was collected for more than 90 priority T-intersections. The majority of the older sites did not have LTSLs and none had a seagull layout. The ones with LTSLs were separated and combined with the new sites added to the dataset. The intention was to compare the safety performance of sites with LTSL and seagulls with 'standard (unmodified)' priority intersections.

A further 68 new intersections were selected across both islands of New Zealand, in multiple cities and rural areas that had seagull treatments and LTSLs. Given it is a relatively rare intersection type, most of the seagull intersections for which turning volume data was already available, or could easily be collected nationally, were included in the dataset. Rural intersections with LTSLs were selected mainly in the Canterbury and Wellington regions. Table 1 shows the number of sites selected by type and local (urban or rural).

Table 1 - Number of Seagull intersections and LTSL sites selected

Intersection type	Urban	Rural	Total
Seagull T-intersection	17	14	31
T-intersections with LTSL	4	34	38

Approximately half the sites are in the South Island (mainly in Canterbury and Christchurch City) and the other half are spread around a number of North Island cities (urban) and regions (rural). This was combined with the 'old' sites from previous studies (Turner (2001) and Turner and Roozenberg (2007)). Table 2 shows the combined dataset. Note that it was not possible to get all the data required for some of the intersections selected (in Table 1). Also, some of the older sites did have LTSL, so are listed as LTSL sites.

Table 2 Total Number of Priority Sites by type and location (urban or rural)

Intersection type	Urban	Rural	Total
T-intersection (standard)	92	93	185

T-intersection with LTSL	10	37	47
Seagull T-intersection	17	12	29
Total	119	142	261

We note that the 261 intersections described are necessarily a convenience sample, a mix of previously sampled and more recently obtained sites. The data has been collected from all around New Zealand with many of the data sites being from the Canterbury region as the researchers involved were based in Canterbury. The effect of the Canterbury earthquakes and the change to the give way rules (on 25 March 2012) have been ignored, with all sites combined for analysis on a national basis. The results of the analysis should be seen as descriptive of these intersections and not the entire set of intersections of the given types (T, T with LTSLs and seagull intersections) in New Zealand. No full sampling frame (listing all intersections of a given type) exists, necessitating the approach that has been taken. This is normal the case with this type of study.

A database was set-up to store data for all 261 intersections. Where relevant, data from previous studies was extracted and imported into the database. Layout data was collected from Google maps and street-view, with checking on-site at most locations. Data included 1) turning traffic volumes (six movements), 2) crash data, 3) operating speed and/or speed limit (on through road) and 4) layout data. For standard T-intersections there were 25 layout variables. For LTSL and seagulls this increased to 51 variables and 67 variables respectively.

Crash data was extracted from New Zealand Crash Analysis System (CAS). A 50m square 'radius' was applied to each intersection for extracting the crash data. This system includes all crashes reported by the Police. Only injury (minor and serious) and fatal crashes were included in the modelling. Non-injury or property damage only crashes were excluded due to highly variable reporting rates of this crash type across New Zealand. For approximately 20 sites from each of the rural and urban standard T-intersection datasets (from previous research), the crash data was collected for the same time period as the new intersections (along with recent traffic volumes). A five-year crash period of 2010–2014 was used for each intersection.

The speed limit was extracted from the crash listings for each intersection. For intersections with zero crashes (only in old datasets) the speed limit was extracted from these datasets. If neither of these approaches produced speed limits then a Google Earth search was done to check the speed limit signs leading up to the intersection. Urban speed limits ranged from 50 km/h to 70 km/h, with the majority being 50 km/h. Rural speed limits ranged from 80 km/h to 100 km/h, with the majority of sites having a speed limit of 100km/h. There were some sites with 'rural' (high) speed limits within urban areas.

Previous research on rural intersections by Turner and Roozenburg (2007) shows that the actual approach speed on the main road was a better variable than the speed limit for the prediction model. Unlike on urban roads, the operating speed can be different from the speed limit because of the surrounding terrain and road alignment. In the models both operating speed and speed limit were tested for rural roads, and operating speed was found to be a better predictor variable.

The layout data included the general geometry of the intersections (eg whether on curve or grade), the layout of lanes (width and length), the island/median types (solid, painted and hit posts) and sizes, the number of traffic lanes, and the distance and type of the nearest upstream and downstream features (eg another side road, parking, bus bay). A summary of the layout variables collected is listed in Table 3.

Table 3 Intersection layout variables

Category	Layout variables
General	Road category, intersection types and region
Right turn off main road	Right-turn bay, right-turn bay width, right-turn bay length and right-turn bay stacking
Main road median(s)	Length and width
Near side characteristics	Number of lanes and shoulder width
Features within wider intersection and proximity	Near side upstream and downstream, far side upstream and downstream eg. parking and side-roads
Far side characteristics	Number of lanes and shoulder width
Side road details	Number of lanes, median island and median island width
Curvature of main road	No curvature, moderate or sharp
Gradient	Side road, main road left approach and main road right approach
Street furniture	Lighting, chevron sign, side road signs, main road speed limit sign and side road speed limit sign
Left-turn slip lane on main road	Type, profile, control and pedestrian crossing
Left-turn slip lane off main road	Type, profile, control, pedestrian crossing, offset distances from side road and main road
Splitter and median islands	Upstream splitter, upstream median, downstream splitter, downstream median
Acceleration lane	Type, length and width

Crash Casual Factors

Expert Opinion of Crash Causal Factors

A workshop involving experienced safety auditors and designers was held to discuss the key causal factors that they believe, based on their experience, impact on the safety of intersections with seagull layouts and LTSLs. This work was undertaken to help identify some of the variables that needed to be considered in the modelling. Please note that a number of these factors are picked up and addressed in the design process or safety audits and hence some can-not be tested in crash modelling due to few sites having these faults. Indeed the fact that many are picked up before construction is a good thing. The concerns raised (in no particular order) include:

1. **Visibility to the end of the merge.** If the merge lane is too long for traffic turning right from the side road then it can appear as a separate traffic lane further upstream of the intersection. If it is too short or on a curve then vehicles may be cautious about entering the through lane.
2. **Length of the upstream splitter island.** By making the upstream splitter island longer, drivers waiting in the side road to turn right will be able to determine whether vehicles approaching from the left are in the bypass lane or are moving into the right-turn bay (and hence have priority). The main concern here is that the drivers are having to focus too much on the left and not enough on vehicles approaching from the right.
3. **The seagull intersection island.** Drivers in the side road need to be able to identify that there is a seagull intersection island in front of them and hence a seagull layout intersection. If the seagull intersection island is painted, too low or over a crest in the road, motorists may not be able to judge that they can turn right without giving way to bypass traffic, causing driver frustration in vehicles behind them.
4. **Main road curvature.** When intersections are located at a curve in the main road, there can be issues with reliably assessing which lane drivers are in. They may for example appear to

be in the bypass lane but instead are coming into the right-turn bay. The same can occur in terms of judging if a vehicle is turning into a LTSL or going straight through.

5. **Speed environment (speed limit and operating speed).** The speed of approaching vehicles can be difficult to judge when the speed limit is high. Higher speeds are also more likely to cause serious injury and fatal crashes than lower-speed intersections. High speed in combination with a poorly designed intersection or one on a curve is undesirable.
6. **Length of the acceleration lane**. Seagull intersections with a deficient taper can catch drivers out when they are merging with traffic. In addition merging from the right is a fairly uncommon movement as most merges are from the left.
7. **Presence of central medians and splitter islands**. In rural areas median and splitter islands can come as a surprise to drivers when they occur over only a short section of roadway. Some drivers can also become confused about how to negotiate the intersection islands when turning in and out of side roads. This distraction can be enough to take the focus off giving way to traffic (eg. research by Harper, 2011).
8. **Double or single lane**. Having two rather than one lane for through traffic can impact on speeds and also increase the distance to the safety of the median or side road.
9. **Available sight distance**. Sight distance is important if drivers are to avoid collision with vehicles they must give way to. The lack of readability of an intersection layout can lead to indecision and driver error. At seagull intersections and priority intersections with LTSLs, insufficient sight distance can be due to 1) the alignment and topography or 2) location and length of the LTSL. In particular dynamic queuing in a LTSL can temporarily restrict visibility of through traffic when turning right out of the side road.

<u>Crash Analysis</u>

An analysis of crashes at the rural intersections (Figure 3) shows that 'JA' and 'LB' (see Figure 2 for crash codes) increase at sites with a LTSL and at seagulls (note that most seagulls have LTSLs). This is partly explained by higher traffic volumes at these enhanced intersections. Understanding whether this increase can be attributed to the increase in traffic volume or the layout (LTSL or seagull) is a key question that we sort to address in this research study.

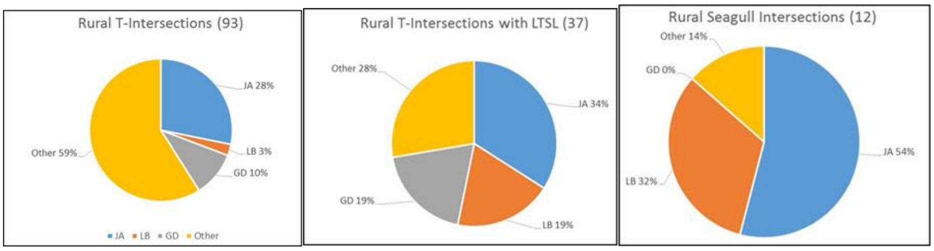

Figure 3 – Key crash types at T-intersections

At urban intersections a comparison between standard and seagull layouts indicates that the proportion of JA crashes increases from 24% to 34% and the proportion of LB crashes increases from 16% to 20%. Again this may be due to higher average traffic volumes at seagulls.

Crash Prediction Modelling.

In this study generalised linear models were developed for the key crash types at standard priority T-intersections, T-intersections with LTSL and for seagull intersections. The same statistical methods were used to develop the original urban and rural priority t-intersection models (Turner 2001; Turner and Roozenberg 2007). The main changes being the addition of speed for the urban models and a design index for both the urban and rural models. The dataset of course also includes seagull intersection layouts and intersections with LTSLs.

Generalised Linear Models

Generalised linear models were first introduced to road crash studies by Maycock and Hall (1984), and extensively developed in Hauer et al. (1989). These models were further developed and fitted using crash data and traffic counts for motor-vehicle crashes in New Zealand by Turner (1995).

The aim of the modelling exercise is to develop relationships between the mean number of crashes (as the dependent variable flows), and traffic flows, speeds and road layout variables. The latter being represented by a design index. For this study the generalised linear models are of the following form:

Equation 1 $Y = b_0\, Q_1^{b1}\, Q_2^{\,b2}\, \text{Speed}^{\,b3}\, \text{Design Index}^{\,b4}$

where,

Y is the annual mean number of crashes,

Q_1 and Q_2 are the average daily flow of vehicles in conflict for each crash type,

'Speed' is either the mean road speed limit (MRSL) or operating speed,

'Design Index' is a combination of road design features that impacts on safety

b_i are the model coefficients.

The selected model error structure is either Poisson or negative binomial. The "Poisson" model is used where the variance in crash numbers is roughly equal to the mean over the majority of the explanatory variable range. Generally, however, the variability is higher than the mean and hence the "negative binomial" model is more commonly used. The negative binomial model is a mixture of Poisson distributions by a gamma distribution. The model is described using two parameters k and μ, where k along with the coefficients $b_0,...,b_n$ must be estimated from the data. A more detailed explanation of the models is given in Turner (1995) and Hauer et al. (1989).

The Akaiki information criterion (AIC) has been used to select the most appropriate model. It is defined as AIC = 2k-2ln(L), where k is the number of parameters to be estimated and L is the likelihood of the model fitted. It balances the number of parameters used against the likelihood of the model, using information theory. The AIC measures the relative quality of models; the model with the lowest AIC might still not be of much value so therefore this can be used as a guide only for intersection improvement.

The models were tested for goodness of fit using a grouping technique developed by Wood (2002). We have low mean values so intersections must be grouped and a G^2 statistic formed. When the model fits, G^2 follows a chi-square distribution with degrees of freedom approximately the number of groups minus the number of parameters in the model. If the model does not fit, the test indicates intersections with exceptional performance, either highly unsafe or highly safe.

Intersection 'Design Index'

The major new addition in all models (compared to previous models) is an intersection design index. In the past design variables have been added individually and often have very low predictive power on their own. When combined together into a design index the combined variable was generally more important than design variables on their own. The research experimented with an 'expert' driven design index but found a data-driven one able to explain more.

The data-driven design index captures the way aspects of the geometry of the intersection influence safety, using the specific data gathered about each intersection. This was developed for each intersection type/region/crash type case (eg seagull, urban, JA crashes). A partial model incorporating the conflicting flows and speed limit was fitted and the crash residuals examined – these are the variations in the crash rate not explained by the partial model. These residuals were plotted against up to 63 intersection factors (in case of seagulls) and those factors explaining some variation in the residual crash rate were noted. These were given equal weight and combined into a single design index.. more....

Crash Prediction Modelling Results

Crash prediction models have been built for all combinations of location (rural and urban), intersection type (T-intersection, T-intersection with LTSLs and seagull intersections) and major crash type (JA and LB) for which adequate data is available. These cases are summarised in Table 4.

Table 4 - Crash summary models developed

Standard T-intersection			**T-intersection – LTSL**			**Seagull**		
	JA	LB		JA	LB		JA	LB
Rural (93)	TRJA	X	Rural (37)	TLRJA	TLRLB	Rural (12)	SRJA	SRLB
Urban (92)	TUJA	TULB	Urban (10)	X	X	Urban (17)	SUJA	X

There were insufficient intersections or crashes for four of the combinations (those marked 'X'); in these cases models could not be fitted. The number of intersections in each row of each sub-table is shown (for example, there are 93 rural T-intersections). For each of the remaining eight datasets a design index was developed, built using the geometric variables found to influence the safety of the combination (see section 5.3). The key variables change from case to case. The design index runs from low values when the intersection is safe to high values when it is unsafe.

<<<Models Table>>>>

In some cases the addition of the design index was the key reason for achieving a good fitting model. This is the case with the TLRJA model, which has a constant term, flows Q1 and Q5, MRSL and the TLRJADI design index provides an excellent fit (see section 6.3.4 for the model and section 6.5 for the goodness-of-fit testing). The model with only constant term, or constant term with Q1, or constant term with both Q1 and Q5 fails to fit (the fitting algorithm does not converge). When MRSL is included as a fourth variable the model does fit, with AIC value of 22.14. When, in addition, the TLRJA design index TLRJADI is included, the model is improved, with a lower AIC value of 19.11 (the lower the AIC value, the better the fit). The design index in all cases considerably improves the model, reducing the AIC, the goodness of fit criterion, where a lower figure indicates a better fit.

Summary of Findings and Future Research

The previous research in this area, and an analysis of national crash data and crashes at the study intersections, identified there were three main crash types at high-volume priority T-intersections: JA (right-turn crossing), LB (right turn against) and GD (right turn rear-end). Right-turn bays have been shown to significantly reduce the 'GD type' crashes and are applied fairly consistently to higher-volume T-intersections across New Zealand to address this issue. The lower cost treatments that are available for JA and LB crashes are less effective and hence these crash types, especially JA crashes, are still relatively common at T-intersections.

Of particular interest in this study has been the impact of LTSLs and seagull layouts, at priority T-intersections, on JA and LB crashes. As detailed in the literature review, road safety professionals are concerned that in some situations LTSLs may be increasing the risk of JA crashes. There are also concerns that seagull layouts, especially poorly designed ones, also increase the crash risk. The impact of various design and layout variables on crash occurrence is also significant. Other important variables include the conflicting traffic volumes and speed.

The following sections outline the key findings of the research as they apply to urban and rural seagulls and LTSL in rural areas. These findings were identified in the literature review and through crash prediction modelling.

Urban seagull intersections

The key road safety findings at urbans seagulls are as follows:

1. Wider right-turn bays (on main road) increase JA crashes (higher-speed entry may draw attention of right-turn-out drivers more to the left rather than to the right).

2. Seagull intersection layouts with wider medians have more JA crashes (Radalj et al 2006 found that poorly designed right-turn bays in wide medians – high angle – increased crashes and especially crash severity).

3. A greater nearside shoulder width increased JA crashes (this could be due to a greater crossing distance to the safety of the median).

4. Far-side upstream features impact on JA crashes (these are likely to draw the attention of drivers turning right into the main road to the left, rather than the right where they should be primarily focused).

5. A greater number of side road traffic lanes reduces LB crashes (unclear why this is the case).

6. Larger seagull islands (and typically larger intersections) increase JA crashes (most likely due to higher negotiation speeds).

7. The longer the acceleration lane is for drivers turning into the main road the more JA crashes are expected (it is unclear why this is the case).

Rural T-intersections with LTSLs

The key road safety findings at rural intersections with LTSLs are as follows:

1. A shorter right-turn bay for turning into the side road increases JA crashes (this means that drivers drop into the right-turn bay later – this may draw the attention of the right-turn-out drivers to the left rather than to the right).

2. A greater number of side road traffic lanes reduces LB crashes (unclear why this is the case).

3. The presence and greater width of the side road median island increases LB crashes (may be associated with a slower right-turn movement around the median island, leaving the right turning vehicle exposed to a crash for longer).

4. The absence of a top-of-the-T chevron board increases LB crashes (would expect this treatment to reduce JA crashes – unclear why this is the case).

5. The type of downstream median island impacts on the number of JA crashes. Wider painted and solid medians are safer (unclear why this is the case).

6. A give way control on a LTSL appears to reduce JA crashes (this could be due to lower speeds of left-turning vehicles or due to the safer design of the LTSL – generally give ways are placed on a high entry angle LTSL).

Rural seagull intersections

The key road safety findings at rural seagulls are as follows:

1. Longer right-turn bay increases LB crashes (may be surrogate for high right-turn movement and create pressures on drivers to make the right turn into side road).

2. Seagull intersections with wider main road medians have more LB and JA crashes (see comment son urban seagulls).

3. The presence of two near-side lanes increases LB and JA crashes (this may be due to wider distance to cross to get to a safe area).

4. The presence of two far-side through lanes increases LB and JA crashes (This is likely to be highly correlated to the number of near-side lanes, where the extra width is likely to increase crashes).

5. Intersections with stop controls have a higher risk of JA crashes than give way control (this is likely to be due to the reduced approach sight distance at stop controlled intersections).

6. The type of LTSL treatment impacts on LB crashes (this has been found in other studies – might be that right-turn-out of side road drivers are expecting vehicles to turn left rather than travel straight through).

7. The more positive the offset between the side road limit line and the left-turn bay lane line, the higher the number of JA crashes. This is likely to be due to left-turning vehicles obscuring sight distance to through vehicles for drivers on the side road if the side road limit line is well set back from the main road.

Other

These relationships were explored further in the detailed analysis, which included the development of eight crash prediction models for the more common intersection types. Generally the rural crash models had good fit to the crash data. Based on the good fit there is a level of confidence that these models are useful for estimating crashes in rural areas. In comparison the two models for standard urban T-intersections had a poor fit, despite a lot of variables being identified. Further work is required to develop better fitting models for urban priority intersections.

An Excel toolkit was developed to assess the safest form of control for a given combination of variables~~.~~ ~~This is available as~~(see Turner et al. 2018 ~~and~~ at www.nzta.govt.nz/resources/research/reports/644). There is considerable scope for a designer to improve safety by improving an intersection's design. Where this is not possible the designer can look at changing to a different layout, by adding a LTSL or a seagull layout. It is likely that the benefit of this will depend on the speed limit and the conflicting traffic volumes. Further work is required to test the toolkit and determine whether it is useful for designers to find ways of improving intersection design to provide crash reduction benefits. Hence we suggest caution in using the spreadsheet alone to change road designs.

Future Research

The focus of future research should be to:

1. Examine further the impact various LTSL types and combination of left-turn and through traffic volumes and speeds have on crash rates. The number of sites may need to be doubled from the existing sample size of 37 rural intersections to produce robust results.

2. Explore alternative forms of the design indices that have been used for each of the eight models. This may improve the goodness of fit of the models.

3. Study the effect of upstream and downstream features like car parking, bus shelters and side roads. The research could look at the type of features and the distance to features. It would also be useful for urban roads, in particular, to look at how road features impact on approach speeds.

4. Develop better crash prediction models for JA and LB crashes at standard T-intersections, especially urban intersections. These models currently underestimate the number of crashes at medium and high-volume intersections, as most of the intersections had low traffic volumes.

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Seagull Intersection Layout. Island Point Road - A Case Study

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Abstract
The Seagull junction treatment is at the high end of at grade intersection treatments. It provides separate lanes for both right and left turns off the through road. It also provides a separate lane for vehicles turning right from the side road to enter and accelerate to through traffic speed before merging with through traffic.

There are many Seagull junction layouts across the road network. They exist with many variations in design layout, road geometry and site conditions. They also have varying safety records and have been the object of much discussion about their operational safety.

This case study considers three variations of a Seagull layout that have been in place at the junction of the Princes Highway and Island Point Road approximately 20km south of Nowra on the south coast of NSW. It examines the impact that each of these layouts had on the operational safety of the junction.

Key words

Seagull treatment, sight distance, crash types

Introduction

Island Point Road services the local coastal communities of Tomerong, St Georges Basin and Jervis Bay to the east of the Princes Highway. These communities are serviced by the nearby large regional centre of Nowra, approximately 20 km to the north. The proximity of Nowra reflects the major traffic movements at this junction of left into and right out of Island Point Road. The Annual Average Daily Traffic (AADT) on the Princes Highway at this location is 12,000 vehicles per day, approximately 50% of which turn left into Island Point Road.

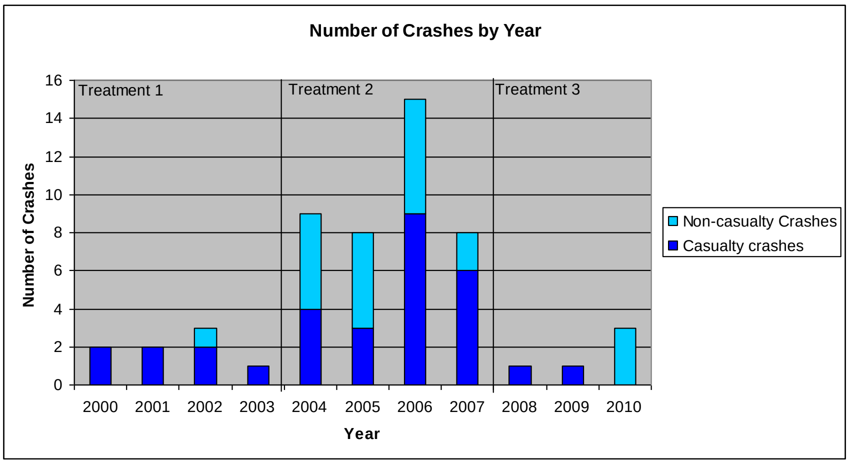
The junction of Island Point Road and the Princes Highway is located in a rural area abutted by forest. The highway is constructed to 100 km/h design speed with a 100 km/h posted speed limit. The junction is located on the back of a 1000m radius curve on an almost level grade. The north and southbound carriageways on the Princes Highway are separated by a raised concrete median at this location. Sight distances well in excess of safe intersection sight distance are available for all movements.

A seagull layout was first constructed at this location in 1996 as part of a realignment of the Princes Highway in the vicinity of Island Point Road. The seagull treatment did not operate as well as anticipated with the development of 'right near' (RUM code 13) type crashes. The site was then modified to address this crash type. Unfortunately this modification did not address the initial crash type and also coincided with the emergence of a 'right thru' (RUM code 21) crash type further reducing the road safety performance of the junction. A third modification to the layout was undertaken which has dramatically reduced the number of crashes at this location.

This study considers the three seagull design variations, the associated crash outcomes from each and identifies the deficiencies of the initial two treatments.

Crash data for each of the treatments at Island Point Road.

The following graph shows the crash data results associated with the three seagull layouts. Although Treatment 1 was constructed in 1996, crash data is only shown from 2000 to provide more equal periods in graphical representation. It should be noted that the crash types shown in the following 3 seagull layouts were not influenced by other contributing factors such as time of day or wet weather etc.



Graph 1: Crashes Vs Treatment Type

As can be seen from this graph there was a significant rise in the crash rate following the construction of Treatment 2, which continued until the construction of Treatment 3 in mid 2007. Construction of Treatment 3 which is currently in place has resulted in a significant improvement in the crash rate. The graph also shows the number of casualty crashes for each year with 9 casualty crashes in 2006. Of the total of 53 crashes, 31 were casualty crashes resulting in 57 injuries and 2 fatalities. The majority of the casualty crashes (22) and injuries (37) and 1 fatality occurred while treatment 2 was in operation.

Seagull treatment layouts and associated crash types

- **Seagull treatment 1 (constructed 1996)**

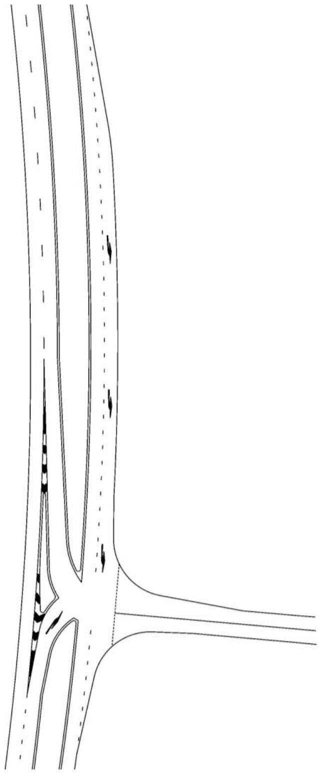


Figure 1: Treatment 1 Design Layout

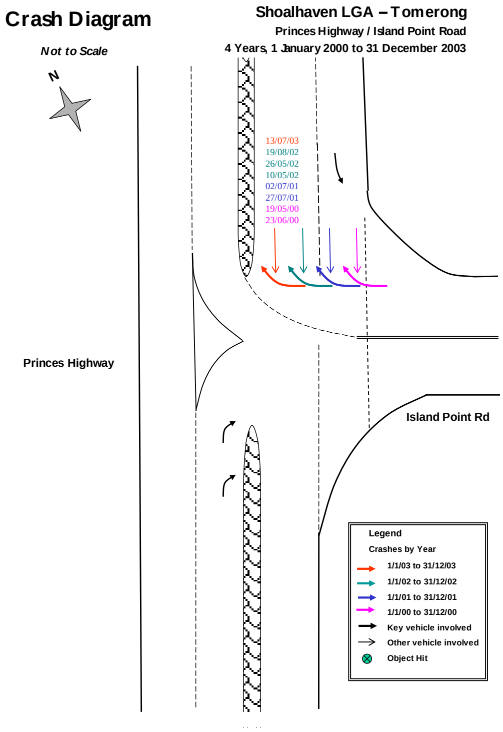
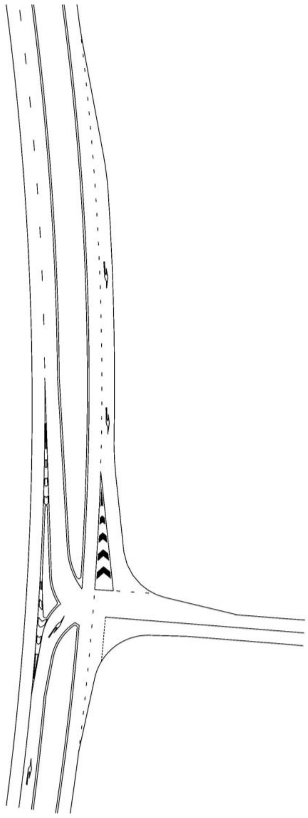


Figure 1.1: Treatment 1 Crash Diagram 2000 to 2003

The layout depicted in Figure 1 was constructed as part of a larger upgrade of the Princes Highway in this area to improve highway alignment and separate opposing traffic. The layout was designed in accordance with the standard rural seagull design layout. Following the installation of Treatment 1 a 'right near' crash type started to develop as shown in Figure 1.1. The colours in Figure 1.1 represent the different years and the date of each crash is shown. Treatment 2 was then designed and constructed in an attempt to address the 'right near' crashes.

- **Seagull treatment 2 (constructed 2004)**



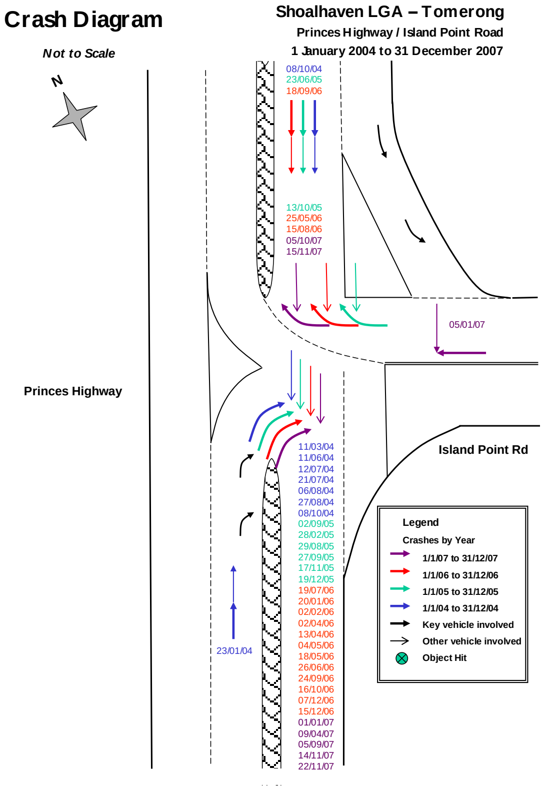


Figure 2: Treatment 2 - Design Layout

Figure 2.1: Treatment 2 Crash Diagram 2004 to 2007

Treatment 2 involved the modification of the original seagull layout with the inclusion of a short left turn splay, which included a small raised concrete island, at the southern end of the painted chevron area. The layout also included the installation of a hold line and give way sign at the left turn deceleration lane's junction with Island Point Road. However the crash data in Figure 2.1 shows the development of a very significant number of 'right through' crashes yet previously there were no crashes of this type. In addition there has been no impact on the 'right out with through southbound' crash type that this layout was intended to address.

- **Seagull treatment 3 (constructed 2007)**

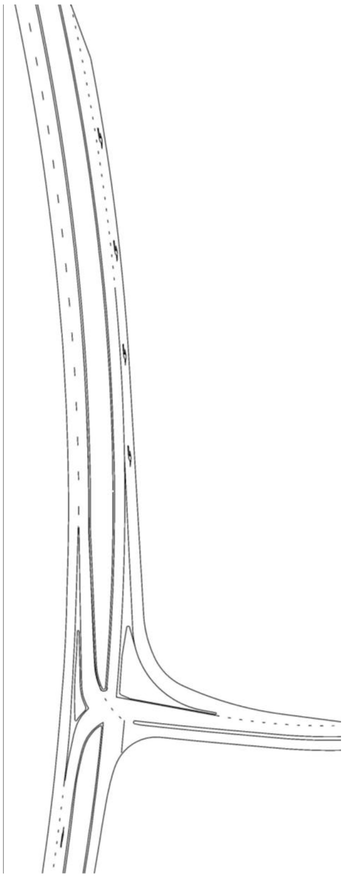


Figure 3: Treatment 3 - Design Layout

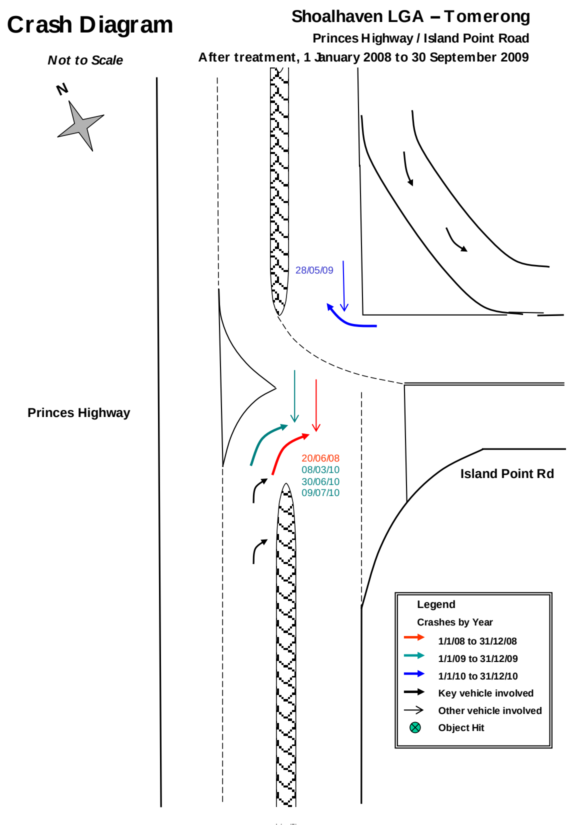


Figure 3.1: Treatment 3 Crash Diagram 2008 to 2010

A third modification of the seagull treatment included two key features. The first was to move the junction of the left turn lane with Island Point Road further east from the Princes Highway and provide a merge of the left turn deceleration lane with Island Point Road. The second was a major widening at the throat of the junction to further separate the left turn deceleration lane from the southbound through lane which significantly opens up available sight distance to the north for vehicles exiting Island Point Road. As can be seen from Figure 3.1 this third modification also coincided with a significant reduction in the number of crashes, especially the ‘right thru’ crash type.

Discussion

The first seagull layout (Fig. 1), was constructed in accordance with the standard seagull design layout in 1996 but developed a poor crash history with vehicles turning right out of Island Point Road colliding with through southbound vehicles approaching on their right.

In an attempt to address the crash types that had developed, a relatively minor adjustment was made to the layout (see Fig. 2). This involved the construction of a short left turn splay at the southern end of the left turn deceleration lane near its junction with Island Point Road. It also included the installation of a small concrete island, a hold line and give way sign at the left turn lane's junction with Island Point Road as depicted in Figure 2.

The construction of Treatment 2 did not address the 'right through' type crashes but it was also accompanied by a new and significant crash problem involving vehicles turning right into Island Point Road colliding with through southbound vehicles. There were no crashes of this type prior to the reconfiguration of the left turn arrangement which was in accordance with *Part 4A Austroads Fig 7.14.* It was not immediately obvious why this crash type developed. Drivers turning right into Island Point Road were now appearing to make poor decisions when turning right in front of opposing southbound through traffic. It is of interest that the only adjustment to the layout that coincided with the occurrence of these crash types was a minor modification of the left turn lane and the inclusion of a give way sign for southbound left turning traffic.

With the increasing number of 'right in with through southbound' and the 'right out with through southbound' crash types still occurring and an obvious solution not evident a more detailed investigation was undertaken to determine the cause of these crashes. The investigations involved onsite monitoring, the installation of 'Crashcam' to record crashes and near misses together with a more extensive investigation of statements made to Police by those involved in these types of crashes. It was only after these more extensive examinations of the Police and witness statements that a likely cause was identified.

It was found that traffic turning left off the highway into Island Point Road were stopping at the hold line to give way to those vehicles stored waiting to turn right into Island Point Road off the highway. This was confusing to some drivers waiting to turn right off the highway as it is counterintuitive to the standard give way rules that normally apply at a 'T Junction'. It appears that right turning drivers would be more focused on vehicles in the left lane to anticipate if they would yield right of way, rather than focusing on the opposing through vehicles. On site observations also revealed that in other cases drivers waiting in the left turn lane would actually call right turning drivers through the junction. The drivers of these vehicles were only 8 metres apart.

The fact that distance between the drivers turning right and those turning left was only 8 metres apart, made it easy for both drivers to have good eye contact with each other.

The design of Treatment 2 with the left turn splay arrangement and the inclusion of a 'Give Way' sign at its junction with Island Point Road appear to have put doubt in the minds of drivers, as it was counterintuitive to the Give Way rule applying at 'T Junctions. Based on the on-site observations of driver behaviour and the more in depth investigations of Police crash reports, it was evident that the confusion between drivers making these turns has contributed significantly to the 'right through' crash type. There were also many accounts of near misses associated with this scenario.

Following identification of the contributing factors associated with the 'right through' crashes, Treatment 3 (see Fig.3) was developed. In developing this treatment careful consideration was given to address not only this crash type but also the 'right out with through southbound' crashes. Any proposed countermeasures needed to be combined into the one treatment.

The first part of the countermeasure was to move the junction of the left turn lane with Island Point Road further away from the Princes Highway. This increased the separation of left turning vehicles from the vehicles waiting to turn right into Island Point Road thus reducing any confusion that may have previously occurred where drivers had eye contact. As part of this work the left turn lane was returned onto Island Point Road where a merge was provided. The need for either driver to yield to the other at the junction was now removed in favour of a merge away from the junction. It also made the decision process for drivers turning right simpler as they now only had to focus on through southbound traffic. This countermeasure focused on addressing the 'right through' crash type.

The second countermeasure was to move the left turning traffic clear of the sight line of vehicles waiting to turn right from Island Point Road. This was done by providing greater separation between the left turn deceleration lane and through southbound vehicles on the Princes Highway. This not only further increased sight distance to the north for vehicles exiting Island Point Road but also reduced the potential for left turning vehicles to 'mask' through southbound vehicles. This countermeasure focused on crashes involving vehicles turning right out colliding with through southbound vehicles on the Princes Highway. This crash type had developed under Treatment 1 and continued under Treatment 2. As can be seen in Figure 3.2 the construction of Treatment 3 has been effective in significantly addressing both crash types.

It is important to remember that the variations between the three constructed treatments were restricted to changes to the left turn lane. No other adjustments were made to the layout. All treatments had the same arrangement for right in, right out and left out movements.

Conclusion

The findings from these investigations and subsequent countermeasures indicate that careful consideration should be given to road environment, traffic volumes, turning patterns, sight distances and possible counterintuitive elements when considering the most appropriate design for a seagull treatment at 'T Junctions'. The findings also suggest that in-depth analysis of the contributing crash factors may need to be undertaken to ensure that the appropriate countermeasure is implemented.

There were two issues identified in this case study in relation to the standard rural seagull layout. The first was that the design of the connection for the left lane into Island Point Road was critical in ensuring that drivers did not become confused as to who had right of way. It also reduced the decision making process for drivers turning right into Island Point Road. They now only have to focus on southbound through traffic. In widening the 'T Junction', the 3rd treatment also further separated the conflict points, thereby simplifying the decision making process for all drivers. While the final treatment adopted at Island Point Road was to return the left turn lane into the side road to provide a merge well clear of the Princes Highway, other countermeasures were also considered.

The second issue identified in this study is that there was a significant road safety benefit in the construction of the left turn lane well clear of the sight line for a vehicle waiting to turn right from the side road. This is obviously a more costly option in both land required and construction costs. While this treatment was justified and successful in this instance, further research would be required to determine at what traffic volumes this crash type becomes an issue and when this treatment may be justified at other locations.

Further, it would seem reasonable to expect that the issues identified at Island Point Road, associated with the design of the left turn deceleration lane, would exist at most junctions regardless of the right turn arrangements. This suggests that it would be of benefit, when considering the design of any rural auxiliary left turn lane, to install the lane well clear of the sight line for vehicles entering from the side road, regardless of the 'T Junction' design, i.e. a seagull treatment, channelized right turn or any other right turn arrangement.

It is also worth noting that there are many variations to the standard seagull design layout. These variations can be influenced by the road environment, traffic volumes, turning movements and existing crash patterns and types. For these reasons there are probably no two exactly the same seagull design layouts. There are many elements within each design that can impact on the safety performance of the junction treatment in its set of circumstances. Examining only crash statistics will not always lead to the identification of contributing factors nor to the development of an effective countermeasure. In this particular instance the crash type that developed under Treatment 2 in no way indicated the true contributing factors. Care also needs to be taken when investigating crash data and developing countermeasures to ensure that any proposed engineering works are not misinterpreted by road users.

The casualty crash rate types should also be carefully considered as they tend to highlight the more critical crash types, which under a safe system approach should be given higher priority

While there has been considerable discussion about the design and subsequent safety of seagull layouts, especially in high speed rural areas, this case study clearly shows that when applied correctly 'seagull treatments' can be an effective road safety engineering treatment at rural 'T Junctions'.

DUBBO REGIONAL COUNCIL

REPORT: Draft Planning Agreement VPA23-004 - Orana Battery Energy Storage System - Results of Public Exhibition

DIVISION: Development and Environment
REPORT DATE: 21 June 2024
TRIM REFERENCE: ID24/1157

EXECUTIVE SUMMARY

Purpose	• Seek endorsement • Fulfil legislated requirement	
Issue	• Council at its meeting on 24 May 2024 adopted a draft Planning Agreement for the Orana Battery Energy Storage System for the purposes of public exhibition. • The draft Planning Agreement relates to a State Significant Development Application (SSD-45242780) that was approved on 22 December 2023 for the construction and operation of a 400 MW battery energy storage system at 6945 Goolma Road, Montefiores. • The terms of the draft Planning Agreement require Wellington Battery ProjectCo Pty Ltd to pay Council a total of $3.2 million, with $1.3 million paid at commencement of operations, and $160,000 paid annually from year 8 onwards from the anniversary of commencement of operations. The first monetary contribution would be utilised for the Wellington Road Shared Pathway, and the secondary and annual monetary contributions would be utilised to benefit the community through delivering projects described in Council's Renewable Energy Benefit Framework. • The draft Planning Agreement was placed on public exhibition from 15 May 2024 to 17 June 2024. Council received three public submissions.	
Reasoning	• Part 7.1 of the Environmental Planning and Assessment Act 1979 and associated Regulation.	
Financial Implications	Budget Area	Growth Planning Branch
	Funding Source	Growth Planning Branch budget
	Proposed Cost	Council will receive $1.3 million at commencement of operations, and $160,000 annually from year 8 onwards from the anniversary of commencement of operations.
	Ongoing Costs	There are no ongoing costs associated with this report.
Policy Implications	Policy Title	There are no policy implications arising from this report.

STRATEGIC DIRECTION

The Towards 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes six principle themes and a number of objectives and strategies. This report is aligned to:

Theme:	4 Leadership
CSP Objective:	4.1 Council provides transparent, fair and accountable leadership and governance
Delivery Program Strategy:	4.1.1 Council encourages and facilitates two-way communication with and between stakeholders and the community

RECOMMENDATION

1. **That Council enter into a Planning Agreement (attached in Appendix 1) with Wellington Battery ProjectCo Pty Ltd or an associated entity of the same.**
2. **That Council note the submissions received during the public exhibition period (attached in Appendix 2).**
3. **That all documentation in relation to this matter be signed under the Common Seal of Council.**

Stephen Wallace
Director Development and Environment

TH
Manager Growth Planning

BACKGROUND

1. Previous Resolutions of Council

11 April 2024 IPEC24/17	*1. That a draft Planning Agreement be prepared in accordance with the terms identified in this report.* *3. That a draft Planning Agreement and Explanatory Note prepared in accordance with the terms identified in this report be placed on public exhibition in accordance with the provisions of the Environmental Planning and Assessment Act 1979.* *4. That following the conclusion of the public exhibition period, a further report be presented to Council for consideration, including any submissions received.*
24 April 2024 CCL24/81	*1. That the report of the Infrastructure, Planning and Environment Committee meeting held on 11 April 2024, be adopted.*

2. Orana Battery Energy Storage System

On 22 December 2023, the NSW Department of Planning and Environment approved a State Significant Development Application (SSD-45242780) for the construction and operation of the Orana Battery Energy Storage System (BESS) at 6945 Goolma Road, Montefiores. The BESS will have an overall capacity of 400 megawatts (MW), up to 1,600 megawatt hours (MWh), and a Capital Investment Value (CIV) of $879M.

The general layout and location of the development in shown in **Figure 1** below:

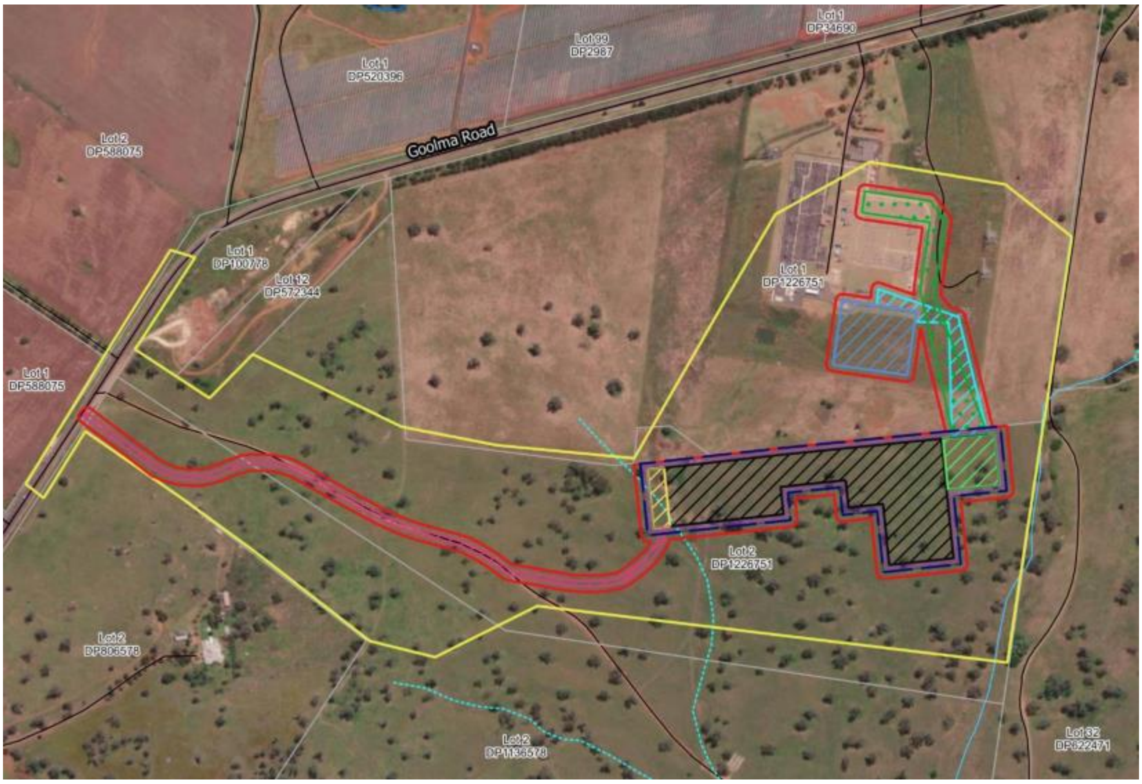


Figure 1: Location of the development

REPORT

1. Details of the Planning Agreement

The terms of the draft Planning Agreement (attached in **Appendix 1**) require Wellington Battery ProjectCo Pty Ltd to pay Council a total of $3.2 million, with $1.3 million paid at commencement of operations, and $160,000 paid annually from year 8 onwards from the anniversary of commencement of operations. The first monetary contribution would be utilised for the Wellington Road Shared Pathway, and the secondary and annual monetary contributions would be utilised to benefit the community through delivering projects described in Council's Renewable Energy Benefit Framework. Operations is defined as:

> *operation of the development, but does not include commissioning, trials of equipment of the use of temporary facilities.*

Funding for the secondary and annual monetary contributions would be indexed annually from commencement of operations to the Australian Consumer Price Index – Sydney All Groups.

2. Public Exhibition and Submissions

The draft Planning Agreement and Explanatory Note were placed on public exhibition from 15 May 2024 until 9am, 17 June 2024. They were publicly notified in the following ways:

Channel	Date
Council Website	15 May 2024 – 17 June 2024
Council Customer Experience Centres	15 May 2024 – 17 June 2024
Macquarie Regional Library Branches	15 May 2024 – 17 June 2024
Daily Liberal Council Column	15, 22 and 29 May 2024, and 5 and 12 June 2024
Letter to adjoining landowners	14 May 2024

Council received three submissions during the public exhibition period (attached in **Appendix 2**). A summary of the submissions and Council's response is provided below.

Comment	Council Response
Council and staff should be commended on this agreement in absence of precedents in this industry.	These comments are noted. Council received the offer to enter into a Planning Agreement before the Renewable Energy Benefit Framework was amended on 15 February 2024 that requires funding targets for battery energy storage systems to be equivalent to: • 0.50% of Capital Investment Value of the project, with payment of all funds prior to the commencement of the development; or • 0.75% of Capital Investment Value of the project, with the payment of funds as annual payments.

Comment	Council Response
• I fully support the proposal to install battery storage in our area. • We need reliable 24/7 electricity, but wind and solar do not provide this (event with batteries). Coal and gas are more reliable.	The NSW Government Department of Planning and Environment were the consent authority for the State Significant Development Application. Council provided comments to the Government as part of their assessment process.

3. Next Steps

Subject to Council resolution, the Planning Agreement will be executed by affixing the Common Seal, and then sent to the developer for signing. It will then be uploaded to Council's website and the NSW Planning Portal. This process is required in accordance with the Environmental Planning and Assessment Regulation 2021.

APPENDICES:

1⇩ Draft Planning Agreement

2⇩ Submissions

PLANNING AGREEMENT for ORANA BESS

Land to which the Agreement applies: Lot 2 in DP 1226751 which is subject to subdivision into Lot 1 in DP 1301494
ADDRESS: 6945 Goolma Road, Montefiores, New South Wales, 2820

Dubbo Regional Council (ABN 53 539 070 928) (Council)
Wellington Battery ProjectCo Pty Ltd (ACN 655 856 652) (Developer)

DUBBO REGIONAL COUNCIL

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Parties to this Agreement

Developer	Name	**Wellington Battery ProjectCo Pty Ltd**
	Address	'KPMG Tower 3 International Towers' Level 38, 300 Barangaroo Avenue, Sydney NSW 2000
	ACN	655 856 652
	Contact Name	Tim Hoban
	Contact email	tim.hoban@akayshaenergy.com
	Phone	0437 136 149
Council	Name	**Dubbo Regional Council**
	Address	PO Box 81, Dubbo NSW 2830
	ABN	53 539 070 928
	Contact email	infrastructurecontributions@dubbo.nsw.gov.au

Background

The construction and operation of a 400MW/1600MWh Battery Energy Storage System (Orana BESS), generally comprising battery storage modules, inverters and transformers, on-site switching station, underground and above ground cables, connection to the existing Transgrid Wellington 330kV substation, access road and associated operational facilities including control room and site offices. Orana BESS will be located on a 10 hectare subdivision on existing Lot 2 DP1226751, which will be subdivided to new Lot 1 DP1301494, directly to the south of the Transgrid substation on Goolma Road.

DUBBO REGIONAL COUNCIL

Operative provisions

Part 1 - Preliminary

1 Definitions and Interpretation

1.1 In this Agreement the following definitions apply:

1.1.1 **Act** means the Environmental Planning and Assessment Act 1979 (NSW).

1.1.2 **Agreement** means this Agreement and includes any schedules, annexures and appendices to this Agreement.

1.1.3 **Contribution Year** means every 12 month period from 1 July of each year.

1.1.4 **Costs** means a cost, charge, expense, outgoing, payment, fee and other expenditure of any nature.

1.1.5 **Department** means the Department of Planning and Environment or replacement government authority responsible for administering the Act and Development Consent.

1.1.6 **Development** means the development of the Orana BESS.

1.1.7 **Development Consent** means the development consent dated 22 December 2023, granted by the Minister for Planning under the Act, as modified from time to time, pursuant to application SSD 45242780.

1.1.8 **Dispute** means a dispute or difference between the Parties under or in relation to this Agreement.

1.1.9 **Event of Default** means a breach of this Agreement.

1.1.10 **Land** means Lot 2 in DP 1226751 which is subject to subdivision into Lot 1 in DP 1301494.

1.1.11 **Monetary Contribution** means the monetary contribution required to be made under this Agreement.

1.1.12 **Operation** means the operation of the development, but does not include commissioning, trials of equipment or the use of temporary facilities.

1.1.13 **Operations Date** means the date the Developer has issued notice of commencement of operation to the Department in accordance with the Development Consent.

1.1.14 **Party** means a party to this Agreement, including their successors and assigns.

1.1.15 **Regulation** means the Environmental Planning and Assessment Regulation 2021.

1.1.16 **Renewable Energy Benefit Framework** means the framework adopted by Council on 8 December 2022, as modified from time to time used to guide developers of Electricity Generating Works on Council's requirements to deliver benefits to the community.

1.1.17 **Value** means the $ amount agreed between the Parties as the value of a Monetary Contribution made under this Agreement, or as otherwise agreed between the Parties.

1.2 Interpretation

In the interpretation of this Agreement, the following provisions apply unless the context otherwise requires:

1.2.1 **Headings** are inserted for convenience only and do not affect the interpretation of this Agreement.

1.2.2 A reference in this Agreement to **a business day** means a day other than a Saturday or Sunday on which banks are open for business generally in Sydney.

1.2.3 If the day on which any act, matter or thing is to be done under this Agreement is not a business day, the act, matter or thing must be done on the next business day.

1.2.4 A reference in this Agreement to dollars or $ means Australian dollars and all amounts payable under this Agreement are payable in Australian dollars.

1.2.5 A reference in this Agreement to a $ value relating to a Monetary Contribution is a reference to the value exclusive of GST.

1.2.6 A reference in this Agreement to any law, legislation or legislative provision includes any statutory modification, amendment or re-enactment, and any subordinate legislation or regulations issued under that legislation or legislative provision.

1.2.7 A reference to a clause, part, schedule or attachment is a reference to a clause, part, schedule or attachment of or to this Agreement.

1.2.8 An expression importing a natural person includes any company, trust, partnership, joint venture, association, body corporate or governmental agency.

1.2.9 Where a word or phrase is given a defined meaning, another part of speech or other grammatical form in respect of that word or phrase has a corresponding meaning.

1.2.10 A word which denotes the singular denotes the plural, a word which denotes the plural denotes the singular, and a reference to any gender denotes the other genders.

1.2.11 References to the word 'include' or 'including' are to be construed without limitation.

1.2.12 A reference to this Agreement includes the agreement recorded in this Agreement.

1.2.13 A reference to a Party to this Agreement includes a reference to the employees, agents and contractors of the Party, the Party's successors and assigns.

1.2.14 A reference to 'dedicate' or 'dedication' in relation to land is a reference to dedicate or dedication free of cost.

1.2.15 Any schedules, appendices and attachments form part of this Agreement.

1.2.16 Notes appearing in this Agreement are operative provisions of this Agreement.

2 Planning agreement under the Act

2.1 This Agreement is a planning agreement governed by Subdivision 2 of Part 7 of the Act.

3 Application of this Agreement

3.1 This Agreement applies to the Land and the Development.

4 Date upon which this Agreement takes effect

4.1 This Agreement takes effect when signed by both Parties. The date on which it takes effect is specified at the end of this Agreement.

5 Warranties

5.1 The Parties warrant to each other that they:

5.1.1 Have full capacity to enter into this Agreement, and

5.1.2 Are able to fully comply with their obligations under this Agreement.

6 Further agreements

6.1 The Parties may, at any time and from time to time, enter into agreements relating to the subject-matter of this Agreement that are not inconsistent with this Agreement for the purpose of implementing this Agreement.

7 Surrender of right of appeal

7.1 The Developer is not to commence or maintain, or to cause or procure the commencement or maintenance, of any proceedings in any court or tribunal or similar body appealing against, or questioning the validity of this Agreement.

Part 2 - Payment of the Monetary Contributions

8 The Monetary Contribution under this Agreement

8.1 The Developer must notify the Council that Operation has occurred within 14 days of the Operations Date for the Development.

8.2 Upon receipt of the notice referred to in clause 8.1, the Council must issue an invoice, in the form of a No GST invoice, to the Developer for the amount of $1.3 million as specified in Schedule 1 of this Agreement (**First Monetary Contribution**).

8.3 Upon the eighth anniversary of the Operations Date (**Second Monetary Contribution Date**) and thereafter until the twenty year anniversary of the Operations Date, the Council must invoice, in the form of a No GST invoice, to the Developer the amount of $160,000 as adjusted in accordance with clause 12 as specified in Schedule 1 of this Agreement (**Second Monetary Contribution**).

8.4 The Developer will pay to the Council, within 30 days of receipt of each invoice, the amount of the monetary contribution specified and calculated in accordance with this Agreement.

9 Application of the Monetary Contribution

9.1 The Council will apply each of the amounts of the monetary contribution towards the use specified in Schedule 1 and Schedule 2 of this Agreement, and as otherwise agreed to by the Developer.

9.2 Council will under no circumstances refund any monetary contribution made under this Agreement.

10 Public Recognition

10.1 The Council must publicly and positively acknowledge the payment of the Monetary Contribution by the Developer and the Developer’s role in funding each target activity or local project under the funding agreement in this Agreement.

10.2 The form of public acknowledgement required is to be agreed by Council and the Developer (acting reasonably) but must include:

10.2.1 the prominent inclusion of the Developer's logo in any advertisement for funding applications or an announcement made in relation to the target activity or local project; and

10.2.2 where appropriate, a permanent sign recognising that the Development is funded by the Developer via this Agreement,

as approved by the Developer.

11 Application of Section 7.11, 7.12 and 7.24 of the Act to the Development

11.1 This Agreement excludes the application of Section 7.11 to the Development.

11.2 This Agreement excludes the application of Section 7.12 to the Development.

11.3 This Agreement excludes the application of Section 7.24 to the Development.

12 Indexation of Monetary Contribution

12.1 The Second Monetary Contribution payable under this Agreement and each subsequent monetary contribution shall be adjusted with the formula set out below calculated from the Operations Date but the parties acknowledge will not be payable until the Second Monetary Contribution Date and in accordance with clause 8.3

$$MC = \frac{A \times B}{C}$$

Where:

MC is the monetary contribution payable

A on the Operations Date is $160,000; and

For each subsequent year: is the Monetary Contribution payable during the Contribution Year just ended.

B is the most recent Index number (last published) before the end of the Contribution Year just ended; and

C is the most recent Index number (last published) before the commencement of the Contribution Year just ended.

12.2 In this clause **Index** means: the Consumer Price Index (CPI) (Sydney All Groups). The table in the Schedule 1 provides the Developer's obligation under this Agreement.

DUBBO REGIONAL COUNCIL

13 How money is paid

13.1 A monetary contribution is made for the purposes of this Agreement when the Council receives the full amount of the monetary contribution payable under this Agreement in cash or by endorsed bank cheque or by the deposit by means of electronic funds transfer of cleared funds into a bank account nominated by the Council. Council will not accept any other forms of payment.

13.2 Despite clause 13.1, if Council agrees, in its absolute discretion, to accept payment of a monetary contribution by EFTPOS using a credit card, the Developer will be required to pay a surcharge in accordance with Council's adopted schedule of fees and charges.

Part 3 - Review and Monitoring

14 Review of Agreement

14.1 If either Party is of the opinion that any change of circumstance has occurred, or is imminent, that materially affects the operation of this Agreement the Party may request a review of the whole or any part of this Agreement.

14.2 For the purposes of clause 14.1, the relevant changes include (but are not limited to) any change to a law that restricts or prohibits or enables the Council or any other Authority to restrict or prohibit any aspect of the Development.

14.3 If a review is requested in accordance with clause 14.1, the Parties are to use all reasonable endeavours, in good faith, to agree on and implement appropriate amendments to this Agreement.

14.4 If this Agreement becomes illegal, unenforceable or invalid as a result of any change to a law, the Parties agree to do all things necessary to ensure that an enforceable agreement of the same or similar effect to this Agreement is entered into.

14.5 A failure by a Party to agree to take action requested by the other Party as a consequence of a review referred to in clause 14.1 (but not 14.5) is not a Dispute for the purposes of this Agreement and is not a breach of this Agreement.

14.6 If the Parties agree to amend this Agreement under this clause 14, any such amendment must be in writing and signed by the Parties and exhibited in accordance with the Act and Regulation.

DUBBO REGIONAL COUNCIL

15 Monitoring and Reporting

15.1 The Developer acknowledges that the Council will continuously monitor compliance with the Developer's obligations under this Agreement.

16 Notation on Planning Certificate

16.1 Not applicable under this Agreement.

Part 4 - Dispute Resolution

17 Notice of Dispute

17.1 If a party claims that a dispute has arisen under this agreement (Claimant), it must give written notice to the other party (Respondent) stating the matters in dispute and designating as its representative a person to negotiate the dispute (Claim Notice). If a notice is given, the Parties are to meet within 10 business days of the notice in an attempt to resolve the Dispute.

18 Mediation

18.1 If the Dispute is not resolved within a further 20 business days, the Parties are to mediate the Dispute in accordance with the Mediation Rules of the Law Society of New South Wales published from time to time and are to request the President of the Law Society to select a mediator.

18.2 If the Dispute is not resolved by mediation within a further 20 business days, or such longer period as may be necessary to allow any mediation process which has been commenced to be completed, then the Parties may exercise their legal rights in relation to the Dispute, including by the commencement of legal proceedings in a court of competent jurisdiction in New South Wales.

18.3 Each Party is to bear its own costs arising from or in connection with the appointment of a mediator and the mediation and the Parties are to share equally the costs of the President, the mediator, and the mediation.

Part 5 - Indemnities

19 Risk

19.1 The Developer performs this Agreement at its own risk and its own cost.

20 Release

20.1 The Developer releases the Council from any Claim it may have against the Council arising in connection with the performance of the Developer's obligations under this Agreement except if, and to the extent that, the Claim arises because of the Council's negligence or default.

21 Indemnity

21.1 The Developer indemnifies the Council from and against all Claims that may be sustained, suffered, recovered or made against the Council arising in connection with a breach by the Developer of its obligations under this Agreement except if, and to the extent that, the Claim arises because of the Council's negligence or default.

Part 6 - Other Provisions

22 Confidentiality

22.1 This agreement is a public document, and its terms are not confidential.

22.2 The parties acknowledge that:

22.2.1 Confidential Information may have been supplied to some or all of the Parties in negotiations leading up to the making of this agreement; and

22.2.2 the Parties may disclose to each other further Confidential Information in connection with the subject matter of this agreement.

22.3 Subject to clauses 22.4 and 22.5, each Party agrees:

22.3.1 not to disclose any Confidential Information received before or after the making of this agreement to any person without the prior written consent of the Party who supplied the Confidential Information; or

22.3.2 to take all reasonable steps to ensure all Confidential Information received before or after the making of this agreement is kept confidential and protected against unauthorised use and access.

22.4 A Party may disclose Confidential Information in the following circumstances:

22.4.1 in order to comply with the law, or the requirements of any Authority; or

22.4.2 to any of their employees, consultants, advisers, financiers or contractors to whom it is considered necessary to disclose the information, if the employees, consultants, advisers, financiers or contractors undertake to keep the Confidential Information confidential.

22.5 The obligations of confidentiality under this clause do not extend to information which is public knowledge other than as a result of a breach of this clause.

23 Notices

23.1 Any notice, consent, information, application or request that is to or may be given or made to a Party under this Agreement is only given or made if it is in writing and sent in one of the following ways:

23.1.1 delivered or posted to that Party at its address, or

23.1.2 emailed to that Party at its email address.

23.2 For the purposes of this clause a Party's address and email address are as noted under 'Parties to this Agreement'.

23.3 If a Party gives the other Party 5 business days' notice of a change of its address or email, any notice, consent, information, application or request is only given or made by that other Party if it is delivered, posted or emailed to the latest address.

23.4 Any notice, consent, information, application or request is to be treated as given or made if it is:

23.4.1 delivered, when it is left at the relevant address,

23.4.2 sent by post, 2 business days after it is posted, or

23.4.3 sent by email and the sender does not receive a delivery failure message from the sender's internet service provider within a period of 24 hours of the email being sent.

23.5 If any notice, consent, information, application or request is delivered, or an error free transmission report in relation to it is received, on a day that is not a business day, or if on a business day, after 5pm on that day in the place of the Party to whom it is sent, it is to be treated as having been given or made at the beginning of the next business day.

24 Approvals and Consent

24.1 Council agrees that following receipt of the requisite documentation from the Developer, it will use best endeavours to promptly certify the land subdivision and provide the construction and occupation certificates.

25 Costs

25.1 The Developer is to pay to the Council the Council's costs of preparing, negotiating, executing and stamping and registering this Agreement, and any document related to this Agreement within 5 business days of a written demand by the Council for such payment.

25.2 The Developer is also to pay to the Council the Council's reasonable costs of enforcing this Agreement within 5 business days of a written demand by the Council for such payment.

26 Entire Agreement

26.1 This Agreement contains everything to which the Parties have agreed in relation to the matters it deals with.

26.2 No Party can rely on an earlier document, or anything said or done by another Party, or by a director, officer, agent or employee of that Party, before this Agreement was executed, except as permitted by law.

27 Further Acts

27.1 Each Party must promptly execute all documents and do all things that another Party from time to time reasonably requests to effect, perfect or complete this Agreement and all transactions incidental to it.

28 Governing Law and Jurisdiction

28.1 This Agreement is governed by the law of New South Wales.

28.2 The Parties submit to the non-exclusive jurisdiction of its courts and courts of appeal from them.

28.3 The Parties are not to object to the exercise of jurisdiction by those courts on any basis.

29 Joint and Individual Liability and Benefits

29.1 Except as otherwise set out in this Agreement:

29.1.1 any agreement, covenant, representation or warranty under this Agreement by 2 or more persons binds them jointly and each of them individually, and

29.1.2 any benefit in favour of 2 or more persons is for the benefit of them jointly and each of them individually.

DUBBO REGIONAL COUNCIL

30 No Fetter

30.1 The Parties acknowledge that Council is a consent authority with statutory rights and obligations pursuant to the Act.

30.2 This Agreement is not intended to operate, and shall not be construed as operating to fetter, in any unlawful manner:

30.2.1 the power of Council to make any law; or

30.2.2 the exercise by Council of any statutory power, discretion or duty.

30.3 Nothing in this Agreement shall be construed as requiring Council to do anything that would cause it to be in breach of any of its obligations at law.

31 Illegality

31.1 If this Agreement or any part of it becomes illegal, unenforceable or invalid as a result of any change to a law, the Parties are to co-operate and do all things necessary to ensure that an enforceable agreement of the same or similar effect to this Agreement is entered into.

32 Severability

32.1 If a clause or part of a clause of this Agreement can be read in a way that makes it illegal, unenforceable or invalid, but can also be read in a way that makes it legal, enforceable and valid, it must be read in the latter way.

32.2 If any clause or part of a clause is illegal, unenforceable or invalid, that clause or part is to be treated as removed from this Agreement, but the rest of this Agreement is not affected.

33 Amendment

33.1 No amendment of this Agreement will be of any force or effect unless it is in writing and signed by the Parties to this Agreement in accordance with section 203 of the Regulation.

34 Waiver

34.1 The fact that a Party fails to do, or delays in doing, something the Party is entitled to do under this Agreement, does not amount to a waiver of any obligation of, or breach of obligation by, another Party.

34.2 A waiver by a Party is only effective if it:

34.2.1 is in writing,

34.2.2 is addressed to the Party whose obligation or breach of obligation is the subject of the waiver, 34.2.3 specifies the obligation or breach of obligation the subject of the waiver and the conditions, if any, of the waiver,

34.2.4 is signed and dated by the Party giving the waiver.

34.3 Without limitation, a waiver may be expressed to be conditional on the happening of an event, including the doing of a thing by the Party to whom the waiver is given.

34.4 A waiver by a Party is only effective in relation to the particular obligation or breach in respect of which it is given and is not to be taken as an implied waiver of any other obligation or breach or as an implied waiver of that obligation or breach in relation to any other occasion.

34.5 For the purposes of this Agreement, an obligation or breach of obligation the subject of a waiver is taken not to have been imposed on, or required to be complied with by, the Party to whom the waiver is given.

35 GST

35.1 In this clause:

35.1.1 Adjustment Note, Consideration, GST, GST Group, Margin Scheme, Money, Supply and Tax Invoice have the meaning given by the GST Law.

35.1.2 GST Amount means in relation to a Taxable Supply the amount of GST payable in respect of the Taxable Supply.

35.1.3 GST Law has the meaning given by the A New Tax System (Goods and Services Tax) Act 1999 (Cth).

35.1.4 Input Tax Credit has the meaning given by the GST Law and a reference to an Input Tax Credit entitlement of a party includes an Input Tax Credit for an acquisition made by that party but to which another member of the same GST Group is entitled under the GST Law.

35.1.5 Taxable Supply has the meaning given by the GST Law excluding (except where expressly agreed otherwise) a supply in respect of which the supplier chooses to apply the Margin Scheme in working out the amount of GST on that supply.

35.2 Subject to clause 35.3, if GST is payable on a Taxable Supply made under, by reference to or in connection with this Agreement, the Party providing the Consideration for that Taxable Supply must also pay the GST Amount as additional Consideration.

35.3 No additional amount shall be payable by the Council under clause 35.2 unless, and only to the extent that, the Council (acting reasonably and in accordance with the GST Law) determines that it is entitled to an Input Tax

Credit for its acquisition of the Taxable Supply giving rise to the liability to pay GST.

35.4 If there are Supplies for Consideration which is not Consideration expressed as an amount of Money under this Agreement by one Party to the other Party that are not subject to Division 82 of the A New Tax System (Goods and Services Tax) Act 1999, the Parties agree:

35.4.1 to negotiate in good faith to agree the GST inclusive market value of those Supplies prior to issuing Tax Invoices in respect of those Supplies;

35.4.2 that any amounts payable by the Parties in accordance with clause 35.2 (as limited by clause 35.3) to each other in respect of those Supplies will be set off against each other to the extent that they are equivalent in amount.

35.5 No payment of any amount pursuant to this clause 35, and no payment of the GST Amount where the Consideration for the Taxable Supply is expressly agreed to be GST inclusive, is required until the supplier has provided a Tax Invoice or Adjustment Note as the case may be to the recipient.

35.6 Any reference in the calculation of Consideration or of any indemnity, reimbursement or similar amount to a cost, expense or other liability incurred by a party, must exclude the amount of any Input Tax Credit entitlement of that party in relation to the relevant cost, expense or other liability.

35.7 This clause continues to apply after expiration or termination of this Agreement.

36 Explanatory Note

36.1 The Appendix contains the Explanatory Note relating to this Agreement required by s205 of the Regulation.

36.2 Pursuant to s205(5) of the Regulation, the Parties agree that the Explanatory Note is not to be used to assist in construing this Agreement.

Schedule 1: Monetary Contribution

Year	Amount	Use	Timing of payment
Year 1	$1.3 million	For funding towards the Wellington Showground shared pathway	Upon receipt of the notice referred to in clause 8.1
Year 8 – 20	$160,000 as adjusted pursuant to clause 12	In accordance with Schedule 2	Upon the eighth anniversary of the Operations Date and thereafter until the twenty year anniversary of the Operations Date

Schedule 2: Use of Monetary Contribution

Council will utilise the Monetary Contribution received from the Developer towards the benefit of the community of the Dubbo Regional Council Local Government Area as described in the Renewable Energy Benefit Framework adopted by Council in 2022, as amended from time to time.

The benefit/s to the community includes (but may not be limited to) the following:

- Road infrastructure provision and maintenance.
- Housing opportunities and initiatives.
- Strategic planning.
- Economic development and investment attraction opportunities and initiatives.
- Skills development.
- Community facilities and recreation opportunities.
- Youth welfare and support.
- Town centre development and maintenance in Wellington.
- Other infrastructure provision that provides for the continued health, wellbeing and development of the community.

Council will engage with the Developer to identify opportunities within the Wellington community, and the Developer, acting reasonably, shall agree to the appropriate allocation of the Monetary Contribution.

DUBBO REGIONAL COUNCIL

Execution

Executed as an Agreement

Dated:

Executed by **Dubbo Regional Council**

The Common Seal of Dubbo Regional Council was hereunto affixed this day of
pursuant to a resolution of Council dated

Signature of Chief Executive Officer | **Signature of Mayor**

Executed by/on behalf of **Wellington Battery ProjectCo Pty Ltd** by its authorised representative.

Signature of | **Signature of**

Name | **Name**

Appendix: Explanatory Note

Response No: 1

Contribution ID: 1844
Member ID: 644
Date Submitted: May 24, 2024, 09:02 PM

Q1	**First Name**
Short Text	Bill
Q2	**Last Name**
Short Text	Williamson
Q3	**Organisation or Community Group**
Short Text	
Q4	**Contact Number**
Telephone	
Q5	**Email**
Email	
Q6	**Written Submission**
Long Text	Council (and staff) should be commended on negotiating a 0.4% agreement on this in absence of precedents in this industry.
Q7	**File Upload**
File Upload	
Q8	**I acknowledge the Privacy Statement for Dubbo Regional Council.**
Single Checkbox	Yes

Response No: 2

Contribution ID: 1794
Member ID: 423
Date Submitted: May 22, 2024, 08:48 AM

Q1	**First Name**
Short Text	David
Q2	**Last Name**
Short Text	Bennett
Q3	**Organisation or Community Group**
Short Text	[redacted]
Q4	**Contact Number**
Telephone	[redacted]
Q5	**Email**
Email	[redacted]
Q6	**Written Submission**
Long Text	We need reliable 24/7 electricity. Wind/Solar do not provide this even with batteries. The batteries depend on the wind which is NOT reliable! Terrible decision to leave what has worked for years; coal and gas!
Q7	**File Upload**
File Upload	
Q8	**I acknowledge the Privacy Statement for Dubbo Regional Council.**
Single Checkbox	Yes

Response No: 3

Contribution ID: 1750
Member ID: 73
Date Submitted: May 15, 2024, 04:10 PM

Q1	**First Name**
Short Text	Kimberly
Q2	**Last Name**
Short Text	Matthews
Q3	**Organisation or Community Group**
Short Text	
Q4	**Contact Number**
Telephone	
Q5	**Email**
Email	[redacted]
Q6	**Written Submission**
Long Text	I fully support the proposal to install battery storage in our area. With the amount of solar panels being installed, it just makes sense to have batteries to allow for this power to be used optimally
Q7	**File Upload**
File Upload	
Q8	**I acknowledge the Privacy Statement for Dubbo Regional Council.**
Single Checkbox	Yes