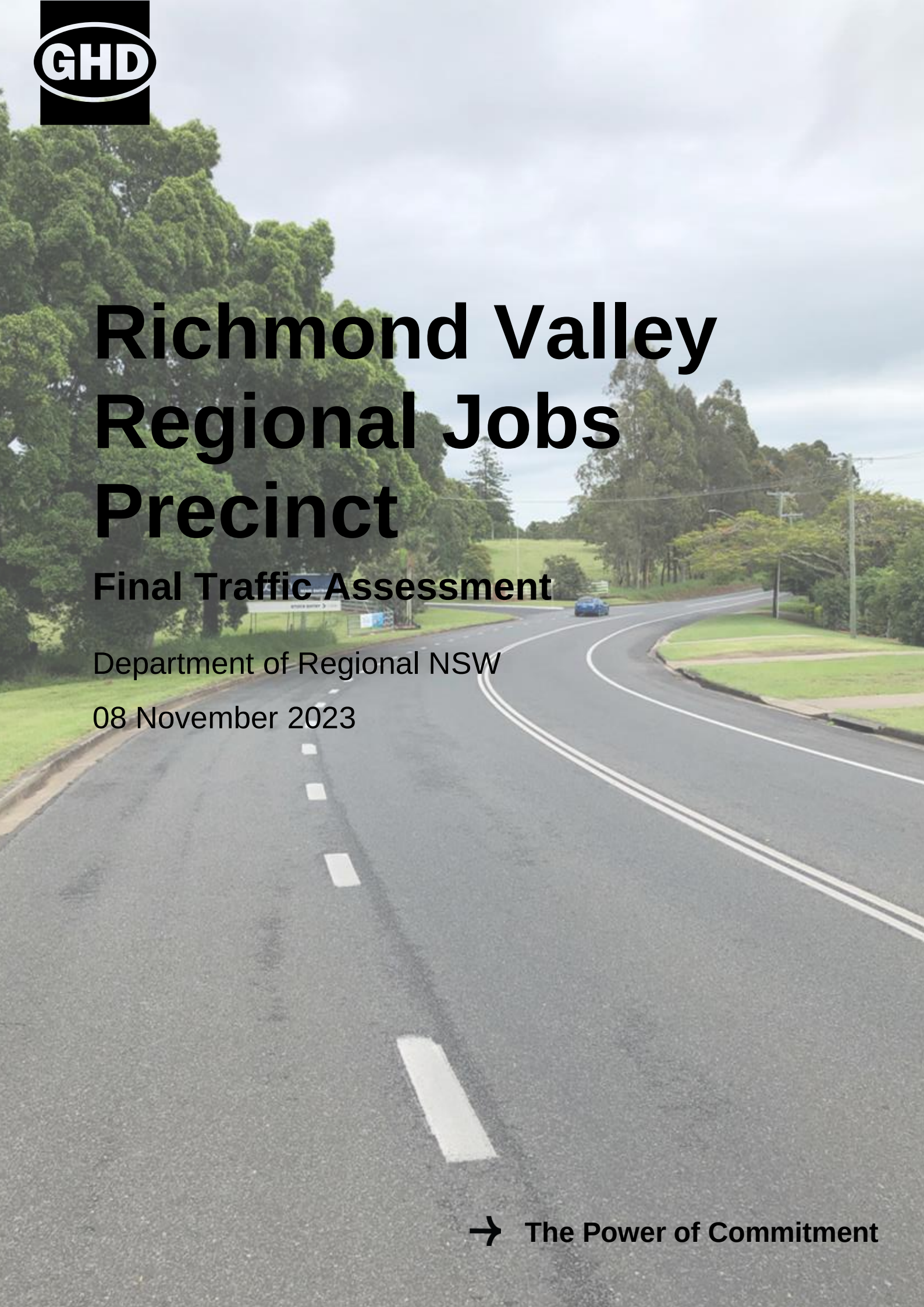

Richmond Valley Regional Jobs Precinct

Final Traffic Assessment

Department of Regional NSW

08 November 2023

The Power of Commitment

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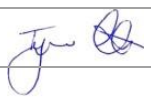
S4	1	M Lucas	T Cook		N Malcolm		08/11/23

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was engaged by the Department of Regional NSW (DRNSW) to prepare a Traffic Assessment (TA) for the three proposed development areas that form the Richmond Valley Regional Job Precinct (RJP's) located in Casino, NSW, as shown in Figure 1.1, namely:

– Area 1 – Nammoona Industrial precinct
– Area 2 – Casino Food Co-op and surrounds precinct
– Area 3 – Johnston Street Industrial area and surrounds precinct

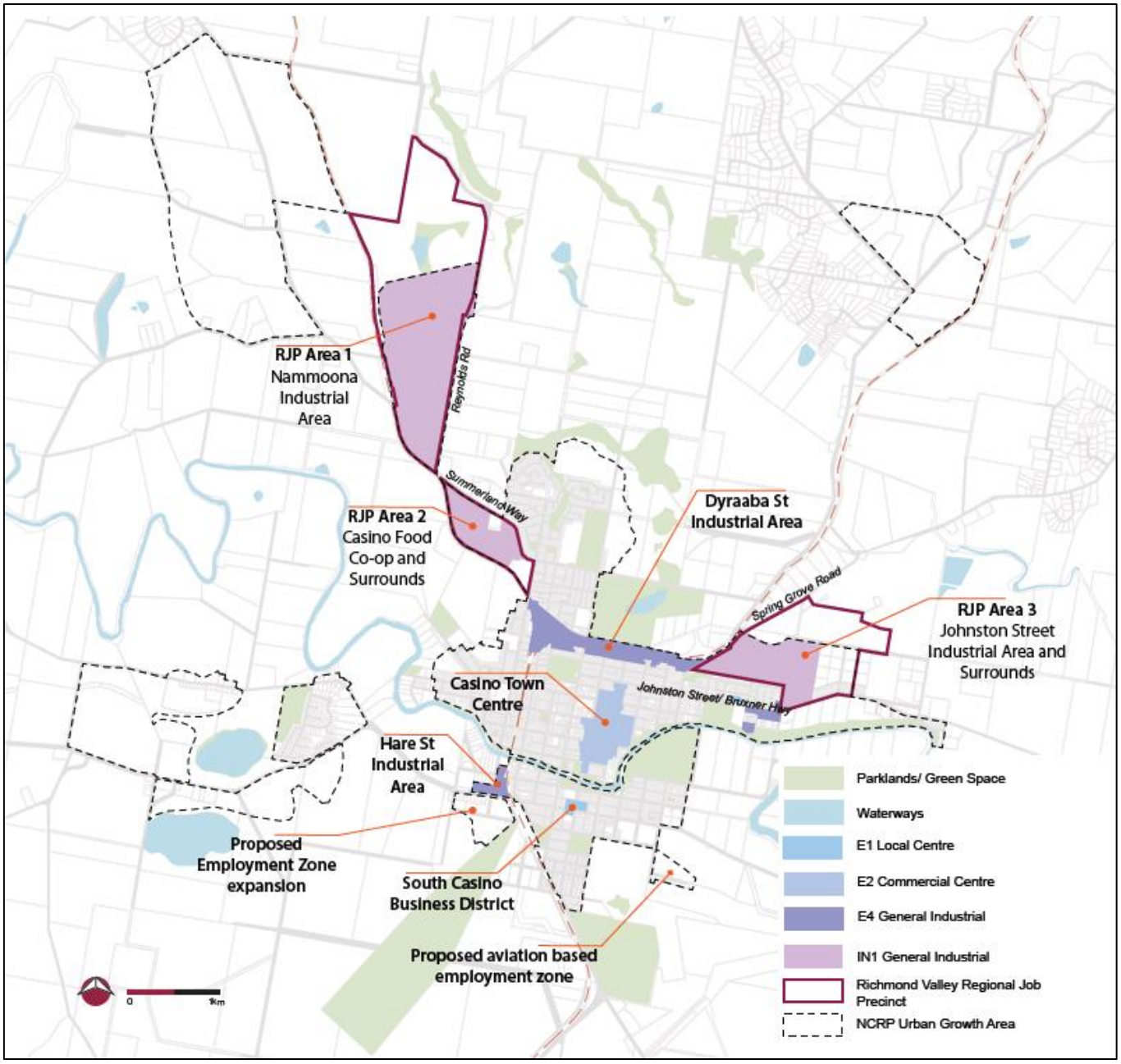


Figure 1.1 Richmond Valley Regional Job Precincts

Source: *Richmond Valley Regional Jobs Precinct Draft Structure Plan*

1.2 Purpose of this report

This TA has been undertaken with the following key objectives to support the proposed development of the RJP:

- Inform future planning controls to ensure a coordinated and efficient approach to land use planning, environmental management and transport infrastructure.
- Provide an integrated approach to determining the optimal mix of land uses and density concentrations as a means of minimising (where possible) trip generation and transport-related demand.
- Ascertain the cumulative and regional traffic and transport impacts associated with future land-based demands associated with the RJP.
- Maximise efficiency and safety of the existing/proposed transport systems in proximity to the subject site.

1.3 Scope and limitations

The study has been limited by the following:

- The following traffic count surveys were undertaken to support the analysis included in this TA:
  - Peak hour traffic survey counts (6:00 am – 9:00 am and 4:00 pm – 7:00 pm) at the following locations:
    - Reynolds Road/Summerland Way
    - Bruxner Highway/East Street
    - Bruxner Highway/Cassino Drive
    - Summerland Way/Hillcrest Lane
    - Summerland Way/private Co-op access road
  - Seven-day classified "tube" traffic counts at the following locations:
    - Bruxner Highway east of Cassino Drive
    - Summerland Way south of Reynolds Road
- Information on the RJP development land use and staging, provided by DRNSW.
- SIDRA intersection modelling has been undertaken for the 2031 and 2041 horizon years in accordance with the RJP land use data provided by the DRNSW.
- No strategic or micro-simulation traffic modelling has been undertaken for this study.
- Cost estimates for the proposed infrastructure are strategic only and have been developed based on benchmarking against similar projects.
- Analysis has accounted for the 1,700 dwellings associated with the Urban Growth Investigation Areas.

The following assumptions were made as part of this study:

- Trip generation for the proposed industrial land uses was undertaken on a first principles basis in accordance with the proposed land uses and traffic survey outputs.
- The trip generation for the residential dwellings associated with the Urban Growth Investigation Areas was determined in accordance with the Transport for New South Wales (TfNSW) Technical Direction (2013).
- It has been assumed that a priority controlled T-junction will be constructed at the intersection of Bruxner Highway and Arthur Street by 2031.
- It has been assumed that a roundabout will be constructed at the intersection of Bruxner Highway and Arthur Street by 2041.
- It has been assumed that a roundabout will be constructed at the intersection of Bruxner Highway and East Street by 2041.

1.4 Data review

1.4.1 Local Strategic Planning Statement Beyond: 20-20 Vision (2020)

The Planning Statement was prepared by Richmond Valley Council to address planning and development issues and support a sustainable future for the region. Planning priorities identified in the statement include:

– Provide a safe integrated traffic, cycle and pedestrian network.
– Partner with the State government to grow agricultural and freight links along the Pacific Highway, Summerland Way, Bruxner Highway, and North Coast Railway, including an intermodal freight facility at Casino.

1.4.2 North Coast Regional Plan 2036

The North Coast Regional Plan 2036 (NCRP 2036) details the NSW Government Strategy to guide land use planning in the North Coast of NSW, including Casino. Key land use priorities for Richmond Valley include:

– Grow agricultural and freight links along Summerland Way
– Foster stronger transport connections with Kyogle, Lismore and South-east Queensland
– Support the development of an intermodal freight facility in Casino
– Deliver new employment opportunities at Casino

With respect to traffic and transport, some of the key directions and actions in the NCRP include:

– Facilitate more recreational walking and cycling paths and expand inter-regional walking and cycling links
– Strengthen regionally significant transport corridors

1.4.3 Draft North Coast Regional Plan 2041

The Draft North Coast Regional Plan 2041 (NCRP 2041) sets a 20 year strategic land use planning framework for the region. A key activity identified in the NCRP 2041, is:

Support the development of the Richmond Valley Regional Jobs Precinct to create a hub focused on high-value agriculture, food processing, manufacturing, distribution and renewable energy.

1.4.4 Summerland Way Draft Corridor Strategy (2016)

The Summerland Way Draft Corridor Strategy was prepared by the NSW Government to set out management strategies for Summerland Way for a 20-year period. The vision for Summerland Way includes:

– Become a safer route for all road users
– Cater for the travel needs of all road users between Grafton and the Queensland border as well as within Casino
– Support the active transport need of cyclists, pedestrians and public transport users

The following planning priorities were identified:

– Short term:
  - Maintain and improve travel efficiency for local and regional road users, by catering for a mix of heavy vehicles, light vehicles, tourist traffic and vulnerable road users.
  - Progressively improve formation widths to provide 3.5 m lanes, sealed shoulders and edge lines.
  - Improve safety to high-risk areas with high crash rates, particularly at intersections in Grafton, Casino and Kyogle.
– Medium term:
  - Continue to provide safety improvements

- Continue to improve formation widths
- Continue to maintain travel efficiency

– Long term:
  - Continue to provide safety improvements
  - Continue to maintain travel efficiency

The Corridor Strategy indicates that in 2035, Summerland Way is expected to operate with a good level of service and minimal delays accounting for the projected traffic volumes.

1.4.5 2740 Bruxner Highway, Casino Traffic Impact Assessment (2018)

In 2018, Bitzios Consulting prepared a Traffic Impact Assessment (TIA) to support the proposed industrial and residential rezoning for land located at 2740 Bruxner Highway, as displayed in Figure 1.2.

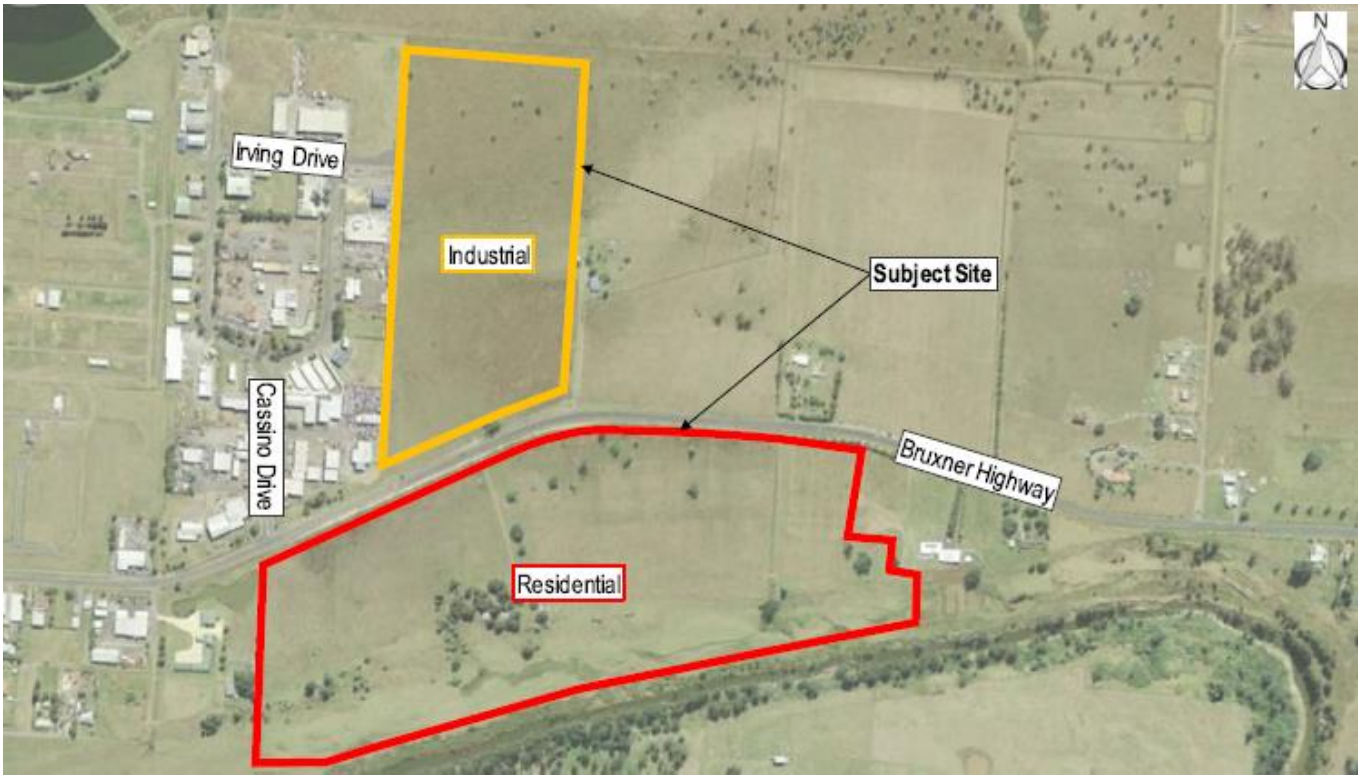


Figure 1.2 2740 Bruxner Highway subject site

Source: 2740 Bruxner Highway Traffic Impact Assessment.

The 2740 Bruxner Highway subject site is located within (and forms a significant proportion) the Johnston Street Industrial area and surrounds precinct subject site, as detailed in Section 3.3.

The proposed development consists of 217 residential lots and 57,600 m^2 of industrial land use. These land uses are expected to generate 338 trips in the AM peak hour and 394 trips in the PM peak hour.

Two proposed priority T-intersections on Bruxner Highway are proposed to provide access to the development, as displayed in Figure 1.3.

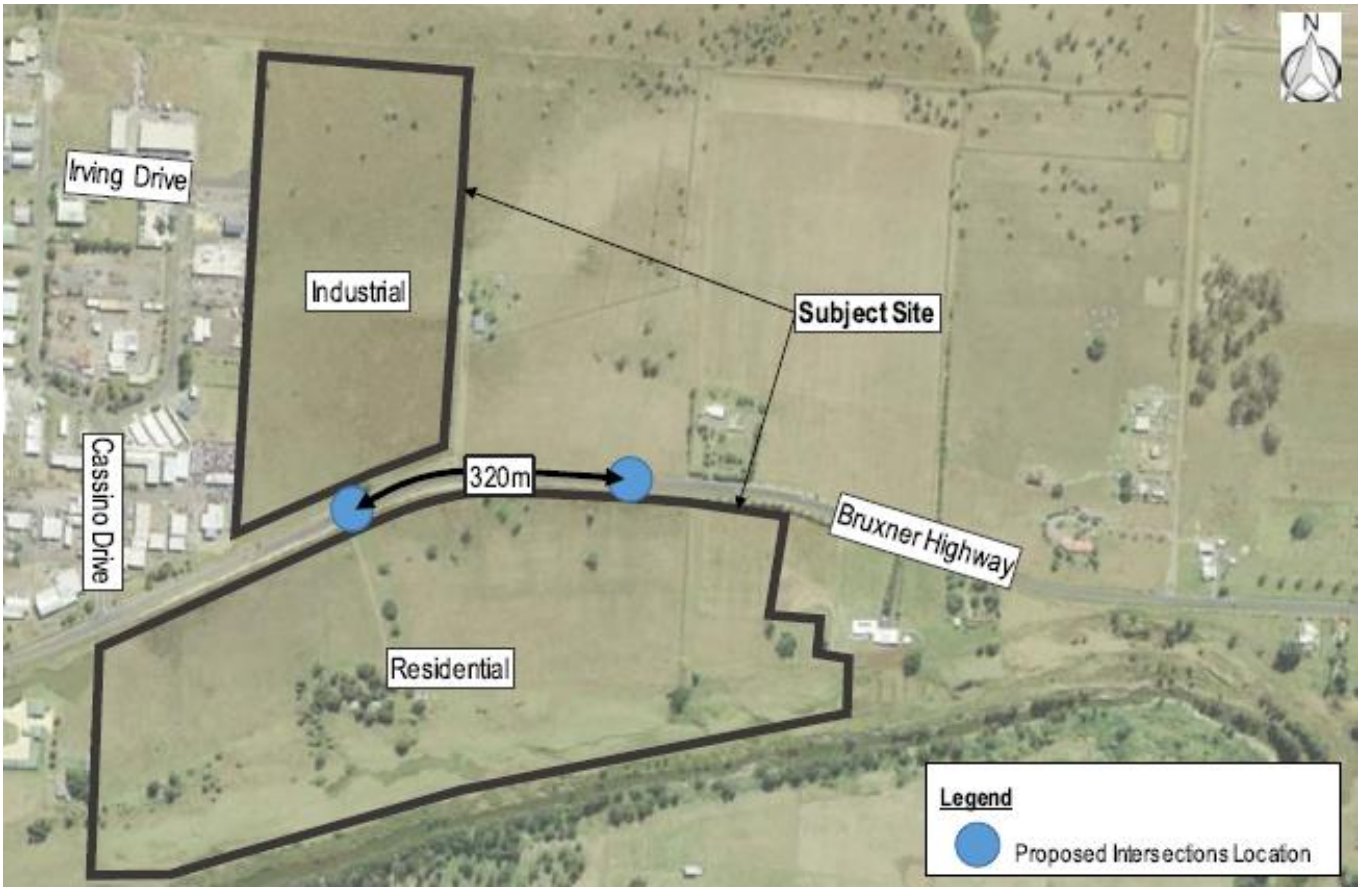


Figure 1.3 Proposed access intersection locations

Source: 2740 Bruxner Highway Traffic Impact Assessment

The analysis in the report indicated that, in accordance with Austroads, the proposed intersections require channelised and auxiliary turning lanes on the Bruxner Highway (refer to Figure 1.4).

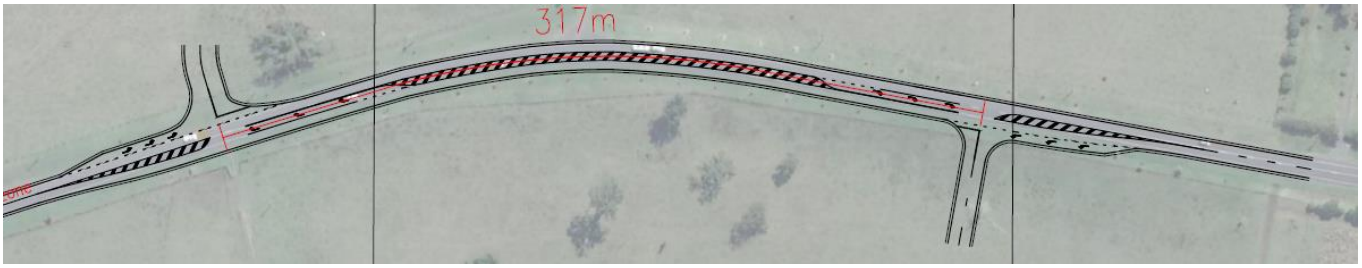


Figure 1.4 Proposed access intersection configurations

Source: 2740 Bruxner Highway Traffic Impact Assessment

It was recommended that the 50 kilometre (km) per hour (h) posted speed limit be extended past the development on the Bruxner Highway.

SIDRA intersection modelling was undertaken for the two proposed access intersections and the existing intersection of Bruxner Highway/Cassino Drive for the current year (2019) and a ten-year horizon (2029).

The SIDRA intersection analysis indicated that the intersections of interest are expected to operate with a good level of service and minimal delays in the 2029 horizon year of analysis.

It is noted that the rezoning proposed in the Bitzios report has not been implemented at the time of writing this report.

1.4.6 Pedestrian Access and Mobility Plan (2020)

The Richmond Valley Council (RVC) Pedestrian Access and Mobility Plan (PAMP) has been prepared to create a schedule for future active transport infrastructure in Richmond Valley.

The key issues identified for Casino include:

– Pedestrian crossings within the central shopping area are dominated by vehicle movement.
– Limited pedestrian and shared connections to locations outside of the town centre.
– A large proportion of the residential streets lack footpaths, resulting in pedestrian movement along roads.
– Residential streets close to the town centre have a higher volume of vehicles due to key attractors.
– Large rural residential lots reduce walkability and create longer distances to locations such as bus stops.
– Gaps in the existing network reduce the safety of users.

The PAMP categorises proposed upgrades as:

– Priority A – to be implemented as urgent projects
– Priority B – to be implemented when funding is available
– Priority C – to be implemented when funding is available

The existing and suggested active transport network is displayed in Figure 1.5.

Figure 1.5 Casino active transport network

Source: Richmond Valley Council – Pedestrian Access Mobility Plan

With respect to the three sites the PAMP proposes:

– A shared path on Summerland Way between Hotham Street and Reynolds Road (Geo Code C36, Priority C).

– A shared path on Spring Grove Road between Johnston Street and Naughtons Gap Road (Geo Code C28, Priority A).

1.4.7 Northern Rivers Rail Trail – Casino to Bentley Masterplan

RVC is in the preliminary planning stages for the provision of a recreational active transport path along a disused rail corridor between Casino and the town of Bentley (which is located in the City of Lismore LGA). The total length of this corridor is approximately 13.5 kilometres.

The Australian Government has committed $7.5 million towards the planning and construction of the Casino to Bentley Rail Trail Corridor under the National Tourism Icons Program.

The proposed route of the rail trail between Casino and Bentley is displayed in Figure 1.6.

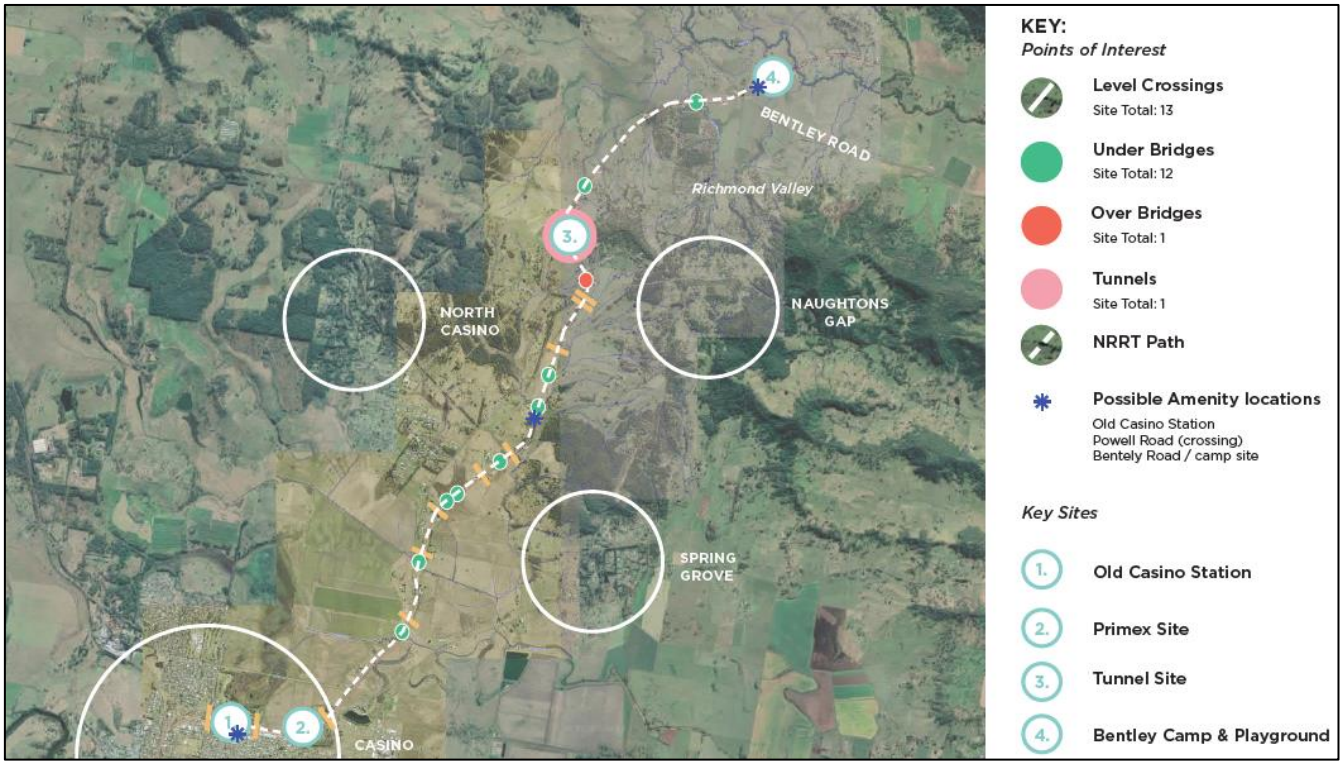


Figure 1.6 Northern Rivers Rail Trail

Source: Casino to Bentley Masterplan

A proposed "stop" on the rail trail is located at the Development Area 3a (Primex site), located within the Johnston Street Industrial area and surrounds precinct (refer to Section 3.3).

It is proposed to provide an at grade car park and picnic facilities north west of the Development Area 3a (Primex) site adjacent to Spring Grove Road for persons using the rail trail for recreational purposes.

2. Existing situation

2.1 Roads

2.1.1 Road hierarchy

Functional road classification involves the relative balance of mobility and access functions. TfNSW has four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by TfNSW, typically no limit in flow and designed to carry vehicles long distances between regional centres.
- **Sub-Arterial Roads** – can be managed by either TfNSW or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub-region or provide connectivity from arterial road routes (regional links).
- **Collector Roads** – provide connectivity between local roads and the-arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

The key roads that will support access/egress to and from the RJP sites are displayed in Figure 2.1.

Figure 2.1 Key road network

Source: Google Maps modified by GHD

2.1.2 Summerland Way

Summerland Way is a state road (refer to Figure 2.2) that runs north from Grafton, passing through Casino and terminating at the border of NSW and Queensland. It is a north-south inland route that runs approximately parallel to the Pacific Highway. Summerland Way is an important route for the agricultural and industrial industries in regional NSW.

A railway level crossing (refer to Figure 2.3) with supporting signage and boom gates is located at Summerland Way south of the Nammoona Industrial Precinct. The speed limit on Summerland Way is typically 80 km/h but reduces to 50 km/h within the Casino Township.

In proximity to the RJP, Summerland Way provides double lane markings and a single travel lane in either direction. The travel lanes provide widths of 3.5 m. While Summerland Way provides sealed shoulders, these are fairly narrow, in the order of one metre.

On-street parking and active transport infrastructure are not provided on Summerland Way.

A desktop review indicates that Summerland Way north of Casino has been designed and constructed in accordance with Austroads specifications, with 3.5 metre wide travel lanes and an overall road reserve of around eight metres.

Figure 2.2 Summerland Way at the frontage to the Casino Food Co-op and surrounds precinct

Source: Google Maps

Figure 2.3 Rail level crossing at Summerland Way

Source: Google Maps

2.1.3 Bruxner Highway

Bruxner Highway (named Johnston Street within Casino, refer to Figure 2.4) is a 420-kilometre east-west state road, which traverses Northern Tablelands. The Bruxner Highway connects Casino to Lismore and Ballina, linking into the Pacific Highway. Bruxner Highway is also an important route for the agricultural and industrial industries in regional NSW.

Within Casino, Bruxner Highway has a speed limit of 50 km/h to 60 km/h. To the east of Cassino Drive, the speed limit increases to 100 km/h outside the Casino Township.

Figure 2.4 Bruxner Highway in proximity to the Johnston Street industrial area

Source: Google Maps

Typically, the Bruxner Highway provides lane markings and a single travel lane in either direction. The travel lanes on Bruxner Highway provide widths of 3.5 m.

Within the Casino Town Centre, on-street parking is available on Bruxner Highway. However, to the east of Clark Street, the road reserve narrows and on-street parking is not available.

A desktop review indicates that the Bruxner Highway west of Casino has been designed and constructed in accordance with Austroads specifications, with travel lanes of 3.5 metres and an overall road reserve of approximately eight metres.

2.1.4 Spring Grove Road

Access to North Casino is provided via Spring Grove Road and Naughtons Gap Road. Spring Grove Road (refer to Figure 2.5) is a local road with a 60 km/h speed limit.

Spring Grove Road is a sealed road with a width of approximately six to seven metres. No lane markings or sealed shoulders are provided.

Figure 2.5 Spring Grove Road looking to the north-east

Source: Google Maps

To the south of Dryaaba Street, Spring Grove Road's name changes to East Street. East Street intersects Bruxner Highway at a four-way priority controlled intersection (refer to Figure 2.6).

Figure 2.6 East Street looking south to Bruxner Highway

Source: Google Maps

2.1.5 Cassino Drive

Cassino Drive is a local road that provides access to a number of commercial/industrial land uses. It typically provides a single travel and parking lane in either direction. Cassino Drive has a posted 50 km/h speed limit.

Figure 2.7 Cassino Drive looking south to the Bruxner Highway

Source: Google Maps

The intersection of the Bruxner Highway and Cassino Drive is displayed in Figure 2.8.

Figure 2.8 Bruxner Highway/Cassino Drive intersection

Source: Google Maps modified by GHD

At its intersection with Cassino Drive, the Bruxner Highway provides an (approximate) 80 m left turn deceleration lane and a 90 m acceleration lane for left turning vehicles from Cassino Drive. Additionally, an auxiliary right turn is provided to enable westbound vehicles to manoeuvre around vehicles seeking to turn right into Cassino Drive.

2.1.6 Reynolds Road

Reynolds Road is a local road that provides existing industrial land uses within the Nammoona Industrial precinct subject site, which provides a single travel lane in either direction.

Between Summerland Way and Dargaville Drive, Reynolds Road provides a carriageway width of approximately seven metres with marked centre lines (refer to Figure 2.9).

North of Dargaville Drive, the road reserve narrows to approximately six metres, without centre lines (refer to Figure 2.10).

Figure 2.9 Reynolds Road looking north from Summerland Way

Source: Google Maps

Figure 2.10 Reynolds Road looking north from Dargaville Road

Source: Google Maps

2.2 Public transport

Casino is served by a rail service operating between Central Station in Sydney and Roma Street Station in Brisbane (refer to Figure 2.11). The morning rail service travels between Sydney and Brisbane, and the evening service travels between Casino and Sydney.

Additionally, there are daily regional coach services that connect Casino to areas such as Brunswick Heads, Lismore, Byron Bay and Ballina.

Figure 2.11 Public transport – Casino

Source: TfNSW

The location of Casino Station in the context of the RJP sites is displayed in Figure 2.12. The station is located approximately two - three kilometres from the RJP sites, and it is unlikely future workers will utilise the train to access their places of employment.

Figure 2.12 Casino Station

The following local bus services operate within Casino:

– 671 Casino to Gays Hill loop service (refer to Figure 2.13) – two morning and two afternoon services.
– 672 Casino to Northwest Casino via Hospital loop service (refer to Figure 2.14) – three morning and two afternoon services.

The bus services do not currently provide access to the Richmond Valley RJP subject sites.

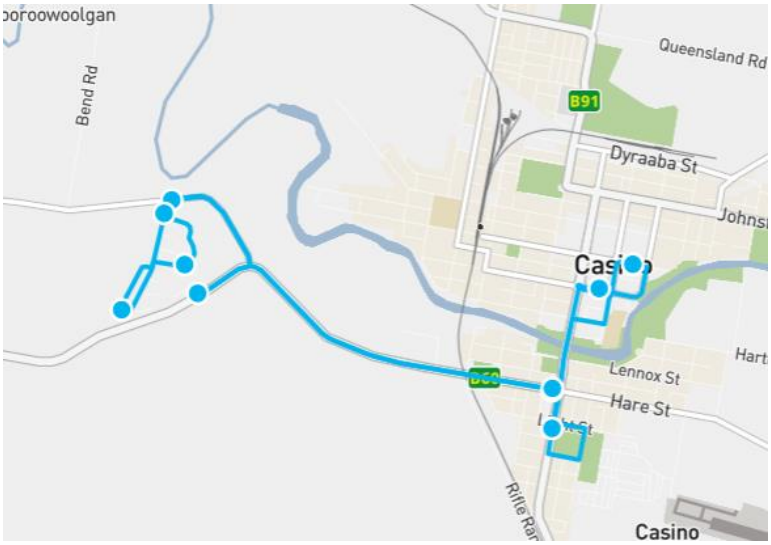


Figure 2.13 671 bus service
Source: TfNSW

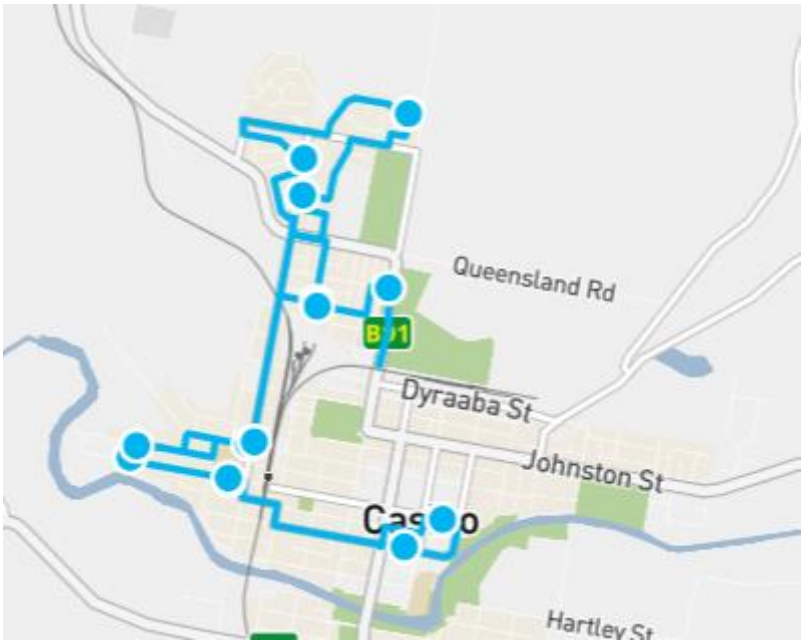


Figure 2.14 672 bus service

Source: TfNSW

2.3 Active transport

A desktop review of the active transport facilities in Casino indicates the following:

– There are no bicycle facilities provided on Summerland Way. The road provides sealed shoulder with widths of approximately one metre.
– An east/west concrete footpath is provided on the southern side of Summerland Way (referred to as Queensland Road within Casino) between Colches Street and West Street. The concrete footpath also aligned in a north/south direction on the western side of West Street.
– A pedestrian crossing is provided on Summerland Way at the frontage to Casino High School.
– A concrete footpath is provided on the Bruxner Highway between West Street and Cassino Drive. Within Casino, the Bruxner Highway provides sealed shoulders of up to seven metres. However, in proximity to Cassino Drive, the shoulder widths narrow to the order of one metre or less.

Austroads Guide to Road Design Part 6A Paths for Walking and Cycling indicates the desirable minimum width for a regional two-way bicycle path should be three metres. Accordingly, the shoulders on Summerland Way and Bruxner Highway (east of Clark Street) of approximately one metre are not wide enough to accommodate cyclists safely.

In accordance with their relatively remote locations, the active transport infrastructure in proximity to the Nammoona Industrial precinct and Casino Food Co-op and surrounds precinct is poor.

The active transport facilities in proximity to the Johnston Street Industrial area and surrounds precinct are better, with the provision of footpaths and wide shoulders on the Bruxner Highway.

2.4 Freight access

The TfNSW Restricted Access Vehicle (RAV) map identifies Summerland Way, Bruxner Highway, Reynolds Road and Cassino Drive as being part of the 19/23/25 m B – double routes (refer to Figure 2.15).

Figure 2.15 TfNSW Freight Routes

Source: TfNSW

2.5 Current traffic volumes

This section outlines the traffic count surveys undertaken for the purposes of this assessment. The timing and locations of the traffic surveys were discussed and agreed upon with RVC.

2.5.1 Intersection counts

GHD engaged Trans Traffic Survey to undertake traffic turning counts on Tuesday 25 October 2022, at the following intersections:

– Reynolds Road/Summerland Way
– Bruxner Highway/East Street
– Bruxner Highway/Cassino Drive
– Summerland Way/Hillcrest Lane
– Summerland Way/private Co-op access road

The surveys were undertaken during the following time periods:

– Weekday AM peak (three hours): 6:00 am to 9:00 am
– Weekday PM peak (three hours): 4:00 pm to 7:00 pm

Analysis of the survey data identified the following peak hour periods:

– Weekday AM peak hour: 8:00 am to 9:00 am
– Weekday PM peak hour: 4:00 pm to 5:00 pm

The outputs of the traffic survey volumes for Summerland Way are displayed in Figure 2.16 (AM peak hour) and Figure 2.17 (PM peak hour).

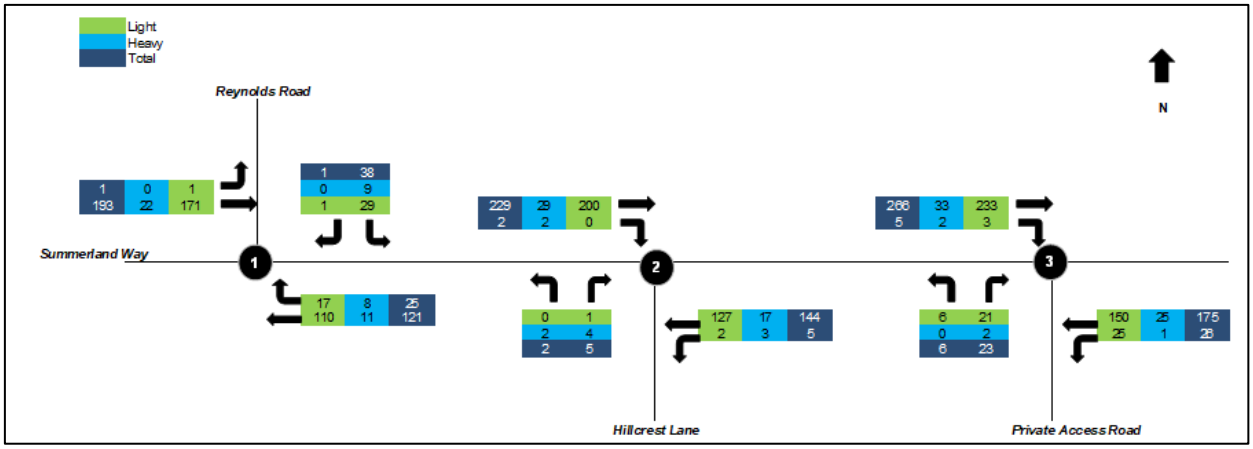


Figure 2.16 Summerland Way intersections – AM peak hour

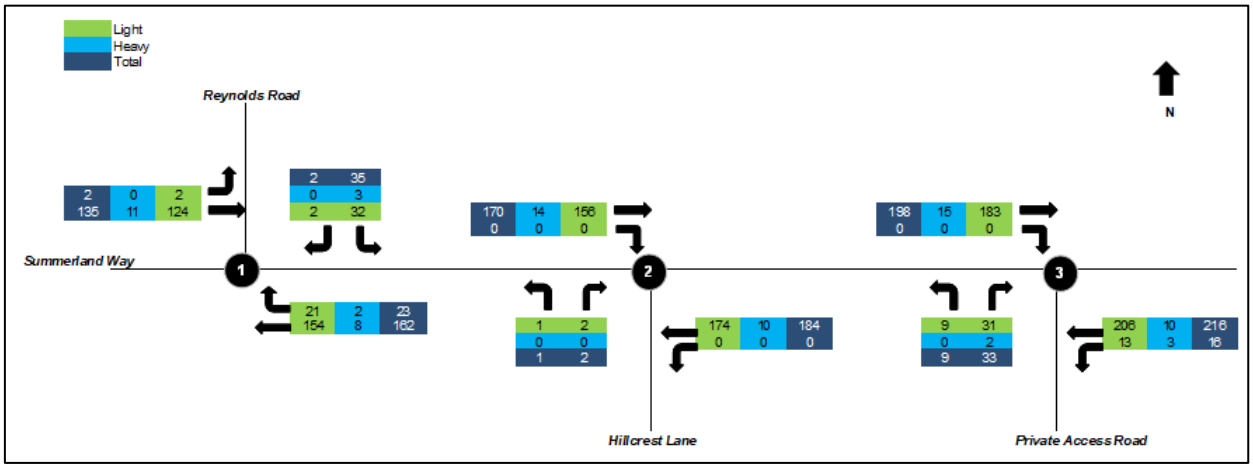


Figure 2.17 Summerland Way intersections – PM peak hour

The data in Figure 2.16 and Figure 2.17 indicates that:

– The volumes of vehicles using Hillcrest Lane are minor, and the private access is the primary entry/exit point to the industrial land uses within the Casino Food Co-op and surrounds precinct.
– The majority of vehicles access/egress Reynolds Road and the private access road to/from the east (in the direction of Casino).

The outputs of the traffic survey volumes for the Bruxner Highway are displayed in Figure 2.18 (AM peak hour) and Figure 2.19 (PM peak hour).

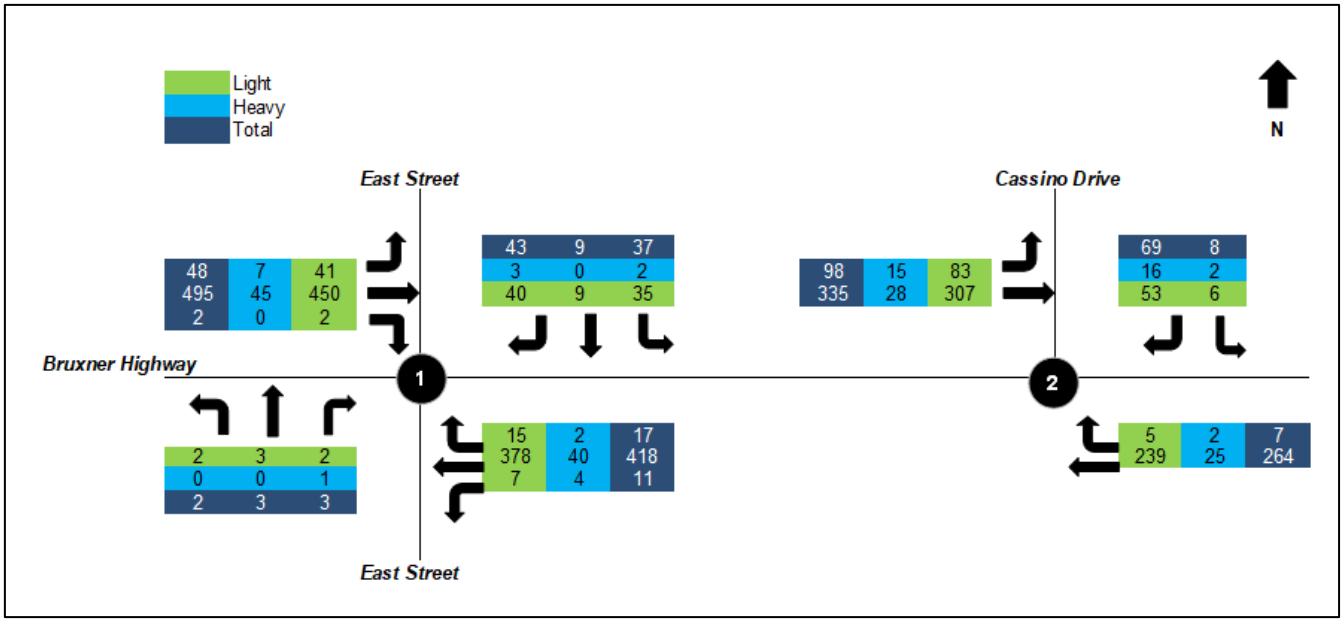


Figure 2.18 Bruxner Highway intersections – AM peak hour

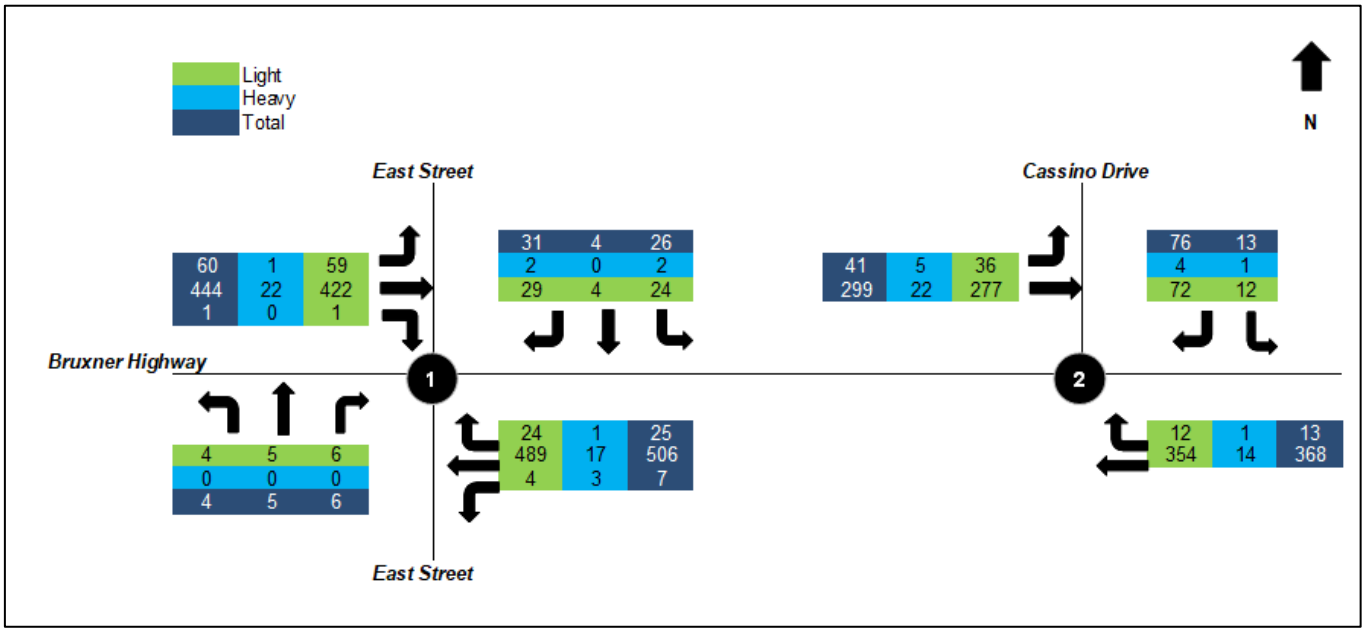


Figure 2.19 Bruxner Highway intersections – PM peak hour

2.5.2 Mid-block traffic counts

Seven day classified “tube” traffic counts at the following locations between Saturday 22 October 2022 and Saturday 29 October 2022, at the following locations:

– Bruxner Highway east of Cassino Drive
– Summerland Way south of Reynolds Road

The outputs of the tube counts for Summerland Way are displayed in Figure 2.20.

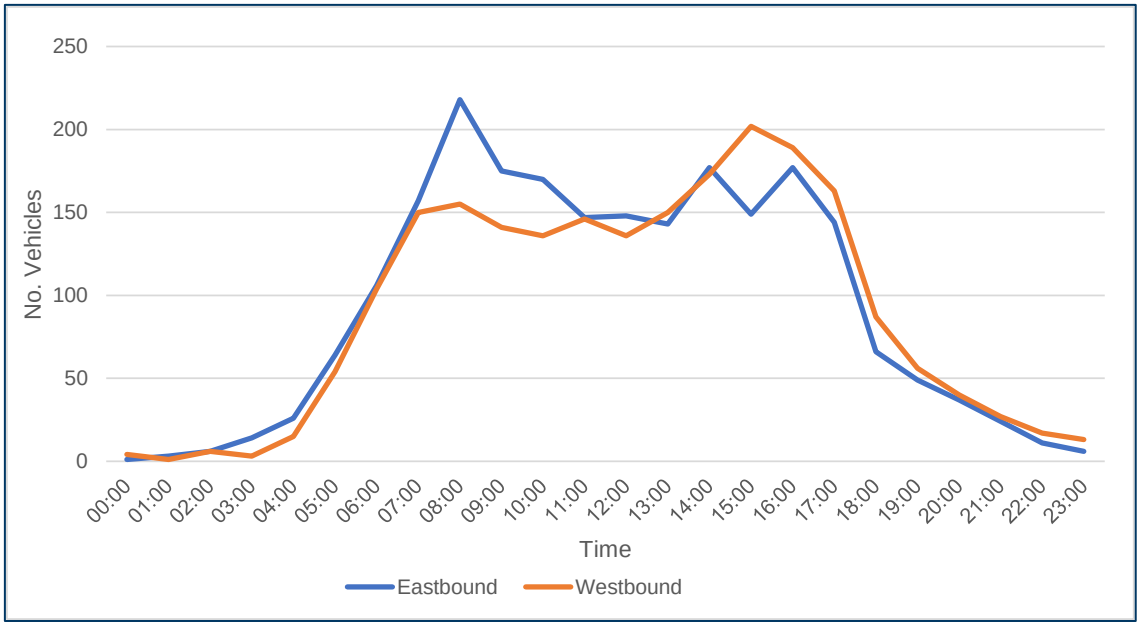


Figure 2.20 Average weekday traffic volumes on Summerland Way (2022)

The traffic survey data displayed in Figure 2.20 indicates that:

– Peak hour activity occurs between 8:00 am-9:00 am (373 vehicles) and 4:00 pm-5:00 pm (366 vehicles).
– In the morning peak hour, approximately 60 percent of vehicles travel eastbound toward Casino and 40 percent travel westbound away from Casino.
– In the afternoon peak hour approximately 50 percent of vehicles travel eastbound toward Casino and 50 percent travel westbound away from Casino.

The data indicates that approximately 13 percent of vehicles on Summerland Way are trucks.

The outputs of the tube counts for Bruxner Highway are displayed in Figure 2.21.

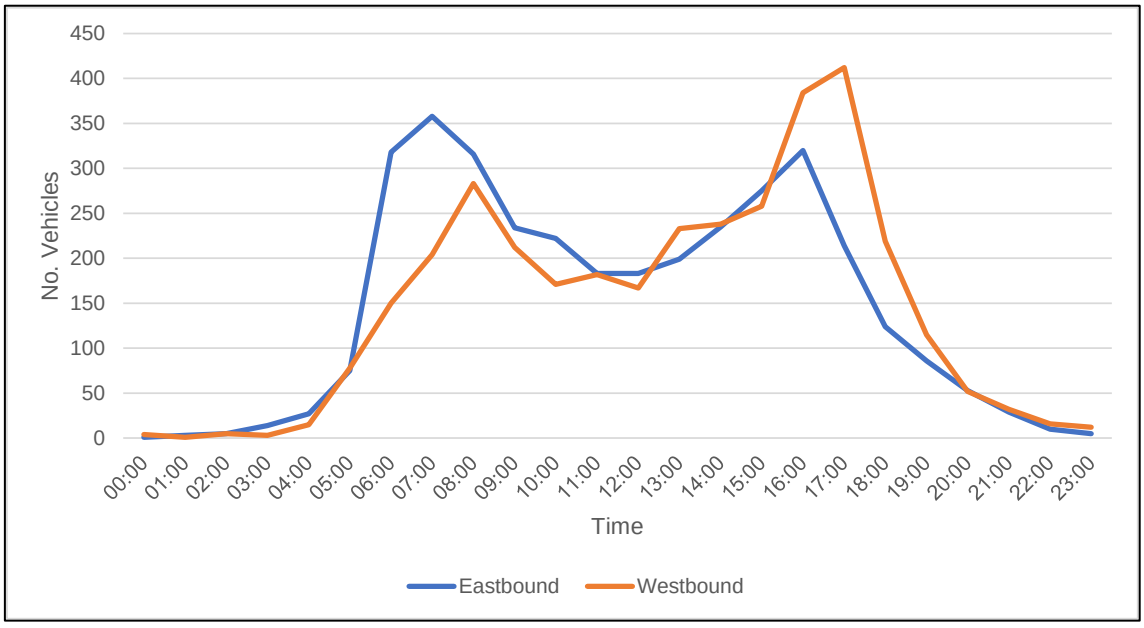


Figure 2.21 Average weekday traffic volumes on Bruxner Highway (2022)

The traffic survey data displayed in Figure 2.21 indicates that:

– Peak hour activity occurs between 8:00 am – 9:00 am (599 vehicles) and 4:00 pm – 5:00 pm (704 vehicles).

– In the morning peak hour, approximately 55 percent of vehicles travel eastbound away from Casino and 45 percent travel westbound towards Casino.
– In the morning peak hour, approximately 45 percent of vehicles travel eastbound away from Casino and 55 percent travel westbound towards Casino.
– The data indicates that approximately 12 percent of vehicles on Bruxner Highway are heavy vehicles.

It is noted that the timing and locations of the traffic surveys detailed above were discussed and agreed upon with RVC.

The traffic survey data is displayed in Appendix A.

2.6 Intersection operation

2.6.1 Current intersection performance

The performance of an existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. SIDRA 9.0 intersection modelling software was used to assess the proposed peak-hour operating performance of intersections on the surrounding road network.

The criteria for evaluating the operational performance of intersections are provided by the Guide to Traffic Generating Developments (TfNSW, 2002) and reproduced in Table 2.1. The criteria for evaluating the operational performance of intersections are based on a qualitative measure (i.e., Level of Service – LoS A), which is applied to each band of average vehicle delay.

Table 2.1 Level of Service Criteria for Intersections

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

Source: Guide to Traffic Generating Developments (TfNSW 2002)

The existing intersection layouts, which have been modelled using SIDRA 9 as part of this assessment, include:

– Summerland Way/Reynolds Road and Summerland Way/Hillcrest Lane (modelled as a network – refer to Figure 2.22)
– Summerland Way and Co-op access road (refer to Figure 2.23)
– Bruxner Highway and East Street (refer to Figure 2.24)
– Bruxner Highway and Cassino Drive (refer to Figure 2.25)

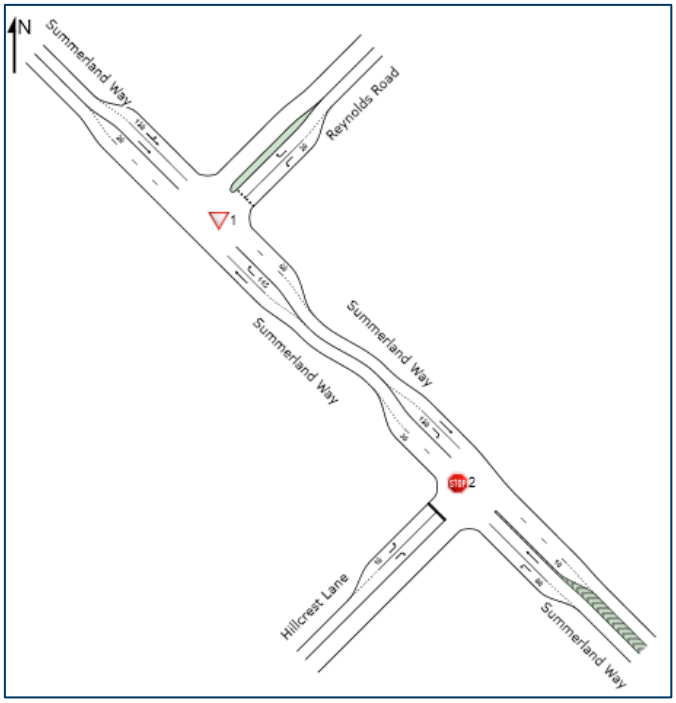


Figure 2.22 Summerland Way intersection with Reynolds Road and Hillcrest Lane (SIDRA)

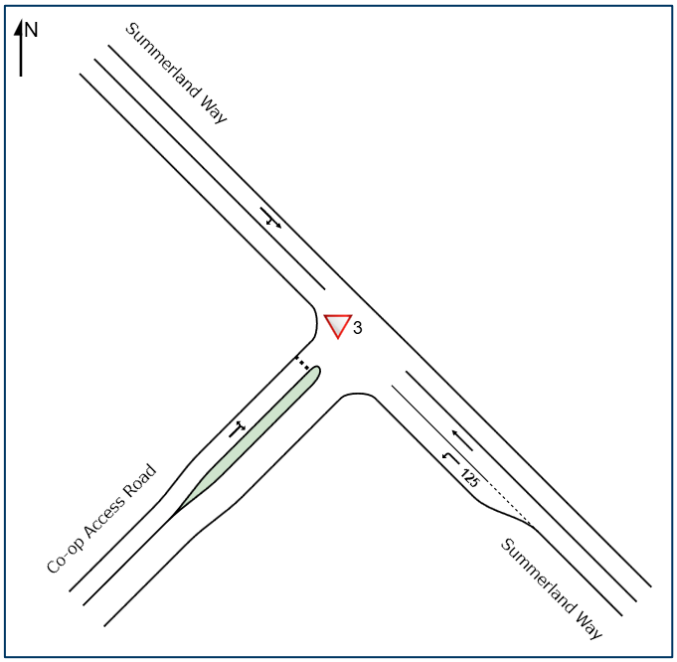


Figure 2.23 Summerland Way and Co-op access road (SIDRA)

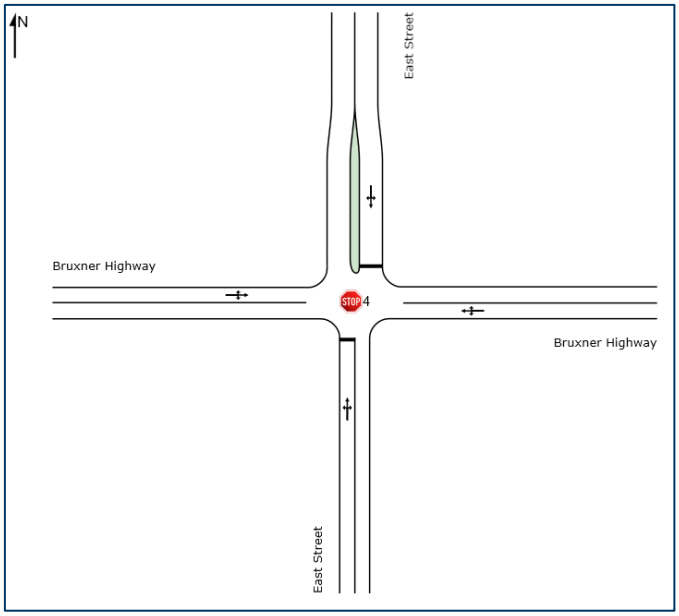


Figure 2.24 Bruxner Highway and East Street (SIDRA)

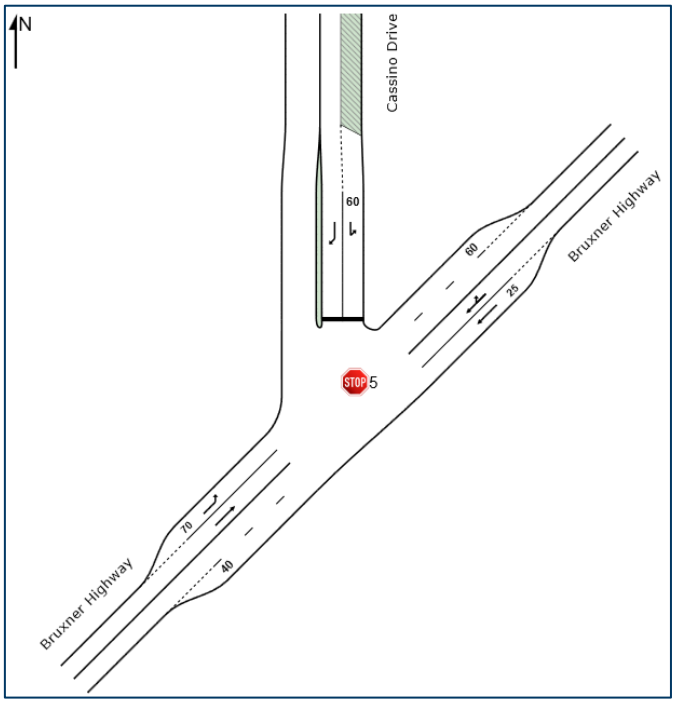


Figure 2.25 Bruxner Highway and Cassino Drive (SIDRA)

The results of the SIDRA intersection modelling analysis, based on the existing traffic volumes and road geometry, are summarised in Table 2.2.

Table 2.2 Current intersection performance – SIDRA results

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Summerland Way and Reynolds Road						
Summerland Way - east	1.5	A	0.9	1.0	A	0.6
Reynolds Road	5.3	A	1.1	5.0	A	0.8
Summerland Way - west	0.1	A	0	0.2	A	0
Total	**1.2**	**A**	**1.1**	**1.1**	**A**	**0.8**
Summerland Way and Hillcrest Lane						
Summerland Way - east	0.3	A	0	0	A	0
Summerland Way - west	0.1	A	0.1	0.1	A	0
Hillcrest Lane	14.6	B	0.4	9.1	A	0.1
Total	**0.4**	**A**	**0.4**	**0.1**	**A**	**0.1**
Summerland Way and Co-op access road						
Summerland Way - east	0.9	A	0	0.4	A	0
Summerland Way - west	0.2	A	0.5	0	A	0.1
Co-op access road	6.2	A	0.8	8.4	A	1.0
Total	**0.8**	**A**	**0.8**	**0.9**	**A**	**1.0**
Bruxner Highway and East Street						
East Street – south	15.6	B	0.6	14.2	A	0.8
Bruxner Highway – east	0.8	A	2.8	0.8	A	3.3
East Street – north	19.6	B	8.2	18.5	B	5.2
Bruxner Highway - west	0.5	A	0.3	0.6	A	0.2
Total	**2.3**	**A**	**8.2**	**1.8**	**A**	**5.2**
Bruxner Highway and Cassino Drive						
Bruxner Highway – east	0.6	A	1.0	0.6	A	1.2
Cassino Drive	22.1	B	9.2	18.7	B	7.6
Bruxner Highway – west	1.1	A	0	0.6	A	0
Total	**3**	**A**	**9.2**	**2.6**	**A**	**7.6**

The data in Table 2.2 indicates that the intersections of interest on Summerland Way and the Bruxner Highway currently operate with minor delays and a good LoS.

The SIDRA outputs for the existing situation are included in Appendix B.

2.6.2 Mid-block analysis

The TfNSW Guide to Traffic Generating Developments indicates that urban roads (consistent with roads within a town), have midblock capacities of 900 vehicles/hour/lane (corresponding to a Level of Service D).

The traffic volume data detailed in Section 2.5 indicates that Summerland Way, Reynolds Road, Cassino Drive and East Street/Spring Grove Road are all operating well within their mid-block capacities.

2.7 Crash data

Crash data for Summerland Way and Bruxner Highway has been sourced for a five-year period (2016 – 2020) from the TfNSW Centre for Road Safety.

Crash data for Summerland Way between Hotham Street and the railway crossing is displayed in Figure 2.26.

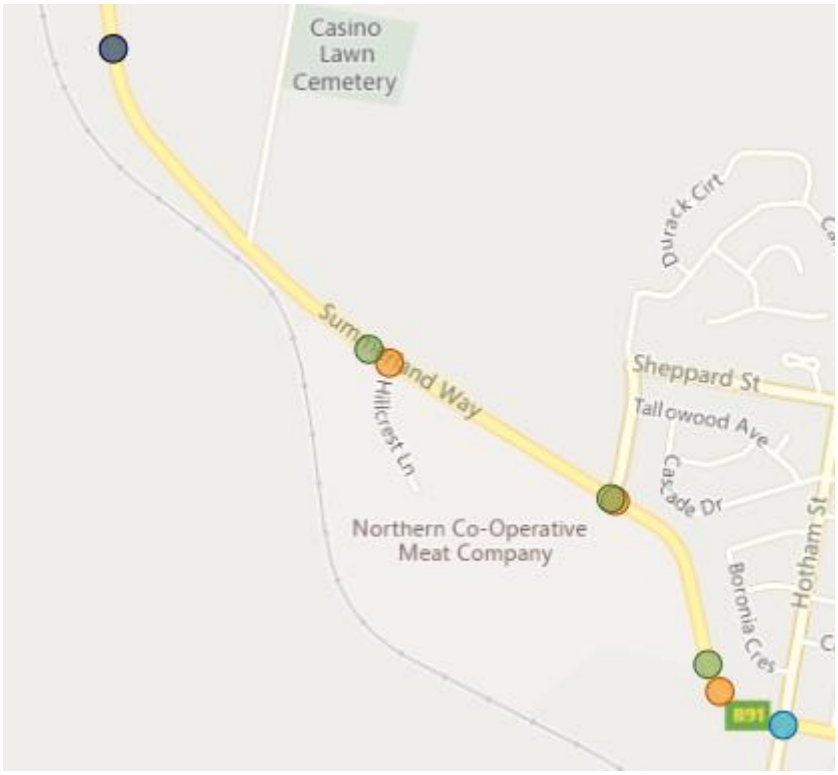


Figure 2.26 Crash Data – Summerland Way

Source: TfNSW

In summary:

- A total of eight crashes were recorded.
- One crash at the intersection with Hotham Street resulted in a minor injury.
- Two crashes were recorded at the intersection with Rosewood Avenue, one of which resulted in a serious injury and one of which was a non-casualty crash.
- Two crashes were recorded in proximity to Hillcrest Lane, one of which resulted in a serious injury and one of which was a non-casualty crash.
- Two crashes occurred between Hotham Street and Rosewood Avenue, one of which resulted in a serious injury and one of which was a non-casualty crash.
- One crash occurred south of the rail crossing and resulted in a moderate injury.

Crash data for Bruxner Highway between East Street and Richmond Road is displayed in Figure 2.27.

In summary, six crashes were recorded as follows:

– Four crashes resulted in moderate injuries
– Two crashes resulted in serious injuries

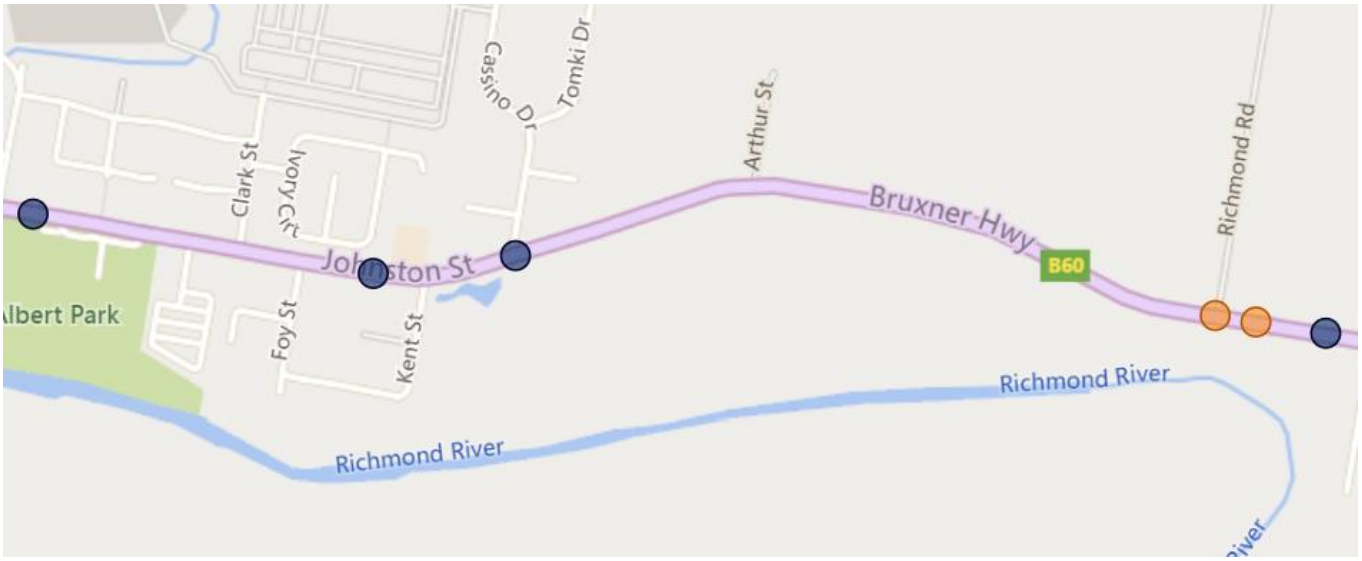


Figure 2.27 Crash Data – Bruxner Highway

Source: TfNSW

3. Proposed developments

A summary of each of the RJP sites is provided below. The preliminary analysis of proposed land use data for each of the sites has been provided by the DRNSW. Detailed land uses will be identified subject to specific development applications subsequent to the approval of the RJP.

3.1 Area 1 – Nammoona Industrial precinct

3.1.1 Site summary

The Nammoona Industrial precinct currently contains the following land uses:

– Northern Rivers Livestock Exchange
– A council landfill facility
– Riverina stockfeed
– A Boral timber facility

Information provided by the DRNSW indicates that these land uses have a combined Gross Floor Area (GFA) of 47,550 m^2.

This area also has direct heavy rail frontage to the North Coast Railway Line but only provides limited access to this infrastructure (e.g. loading/unloading rail ballast). Within the southern portion, 13 hectares of land is already under construction to provide nine industrial lots.

Nammoona Industrial precinct is zoned IN1, RU1 Primary Production with additional use of a rail freight transport facility is permitted under Schedule 1 of the Richmond Valley Local Environmental Plan (RVLEP) for land at Reynolds Road, Casino, being Lot 2, DP 547143. Surrounding land includes zoning E2 Environmental Conservation.

The Draft Richmond Valley RJP Structure Plan recommendations for the Nammoona Industrial precinct are shown in Figure 3.1. The primary access to the site will be provided via the intersection of Summerland Way and Reynolds Road. A small section of the Nammoona Industrial precinct is located to the southwest of Summerland Way.

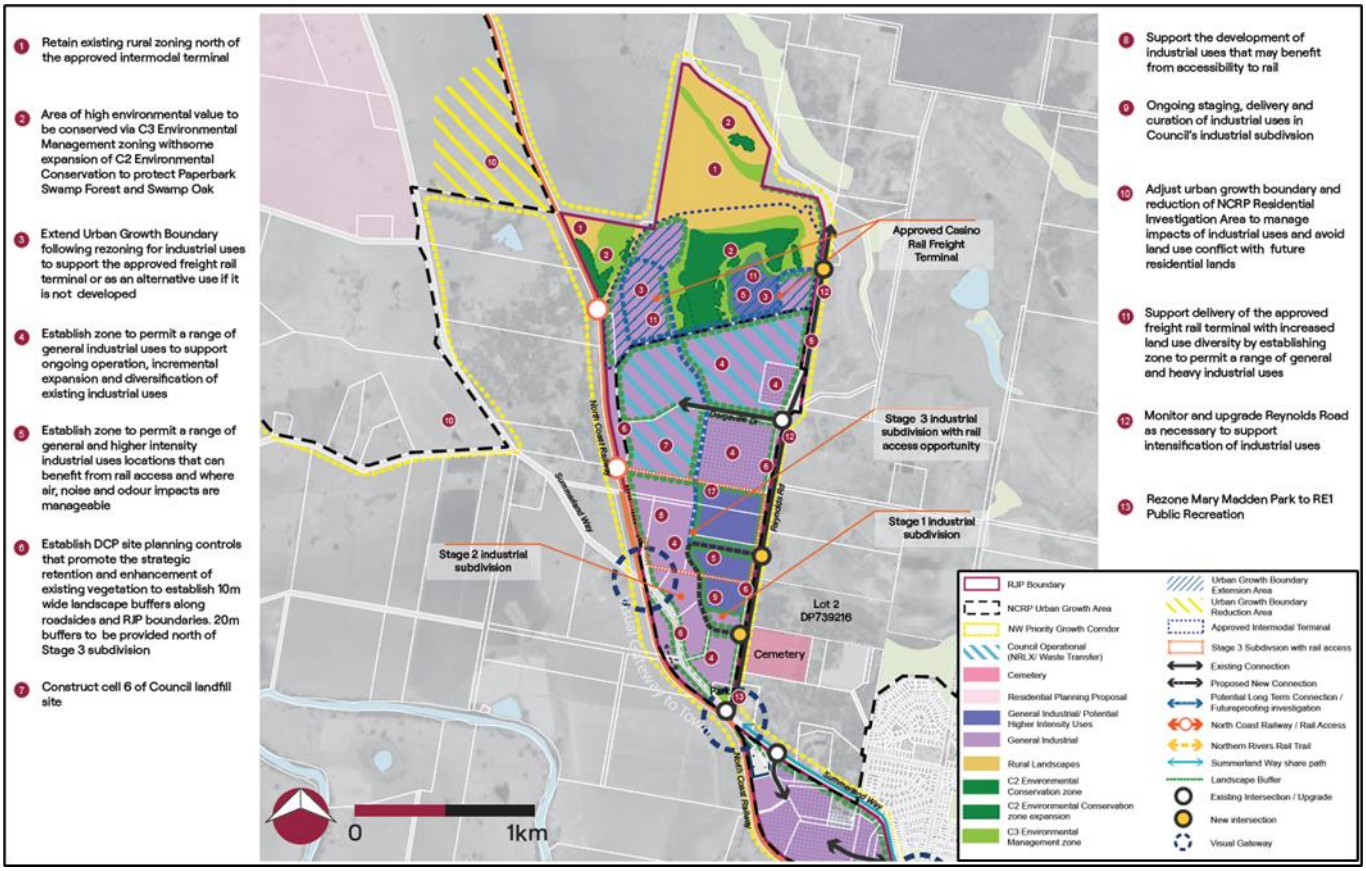


Figure 3.1 Regional Jobs Precinct 1 – Nammoona Industrial precinct

Source: *Richmond Valley Regional Jobs Precinct Draft Structure Plan*

3.1.2 Proposed land use

The proposed land uses for the Nammoona Industrial precinct include:

- An intermodal rail facility with supporting warehousing facilities
- Heavy industry food processing facilities
- A renewable circular energy provider, i.e. energy from waste
- General industrial, potentially including:
  - Bio-degradable and/or compostable packaging manufacturers
  - Technical/engineering service providers support to the regional food processing industry
  - Logistics suppliers who provide intermodal/cold chain solutions
  - Medical grade processors

3.1.3 Intermodal facility

The Nammoona Industrial precinct proposes an intermodal facility to the north of the subject site utilising access from the Australian Rail Track Corporation (ARTC) mainline via a passing loop at Nammoona Industrial precinct to minimise cost and additional signalling arrangements. At this stage, planning for multiple uses for bulk and intermodal products also adds flexibility of operation in the terminal layout.

The Northern Terminal has development approval as the Casino Rail Freight Terminal for rural related produce and is progressing through further planning and funding for construction, with plans that include both container traffic from the site and a grain facility which is focused toward stockfeed for domestic and export markets. Potential for woodchips, logs, grains and meat /hides are also considered in the business plan with potential volumes of 300,000 tonnes to 500,000 tonnes from year one to year three growing beyond that time to one million tonnes per annum (research dated 2011). An assessment of the terminal operations by the proponent as part of planning approval applications for the terminal operations has indicated annual truck movements growing from 22,000 to 60,000 over the first five years of operation. However, this will be dependent on actual demand outcomes.

The intermodal facility has the potential to generate significant heavy vehicle traffic on Reynolds Road and at the intersection with Summerland Way.

3.2 Area 2 – Casino Food Co-op and surrounds precinct

3.2.1 Site summary

The Casino Food Co-op and surrounds precinct is currently a single-user area but does support a variety of activities. Several different activities are undertaken within the complex, with cattle yards supporting an abattoir and tannery. The *Draft Richmond Valley RJP Structure Plan* recommendations for the Casino Food Co-op and surrounds precinct are shown in Figure 3.2. It is noted that:

- Several different activities are undertaken within the complex, with cattle yards supporting an abattoir and tannery.
- The three properties adjoining the complex are all owned by infrastructure providers, including Essential Energy, Richmond Valley Council, and NSW Education.
- Information provided by the DRNSW indicates that these land uses have a combined Gross Floor Area (GFA) of 66,680 m^2.
- The land acquired by Essential Energy was previously intended to accommodate a substation. This is currently zoned IN1 Light Industry, so it would be immediately capable of supporting a variety of uses, with the appropriate consent.
- RVC-owned land is part of the town's water supply network. This land is zoned RU1 Primary Production, so it may rely on rezoning to facilitate further development (depending on the use).
- Land owned by the Minister for Education is currently zoned R1 General Residential and hosts a variety of activities connected to the High School as well as other community uses.
- The primary access is proposed via the intersections of Summerland Way/Hillcrest Lane and Summerland Way/Co-op access road.

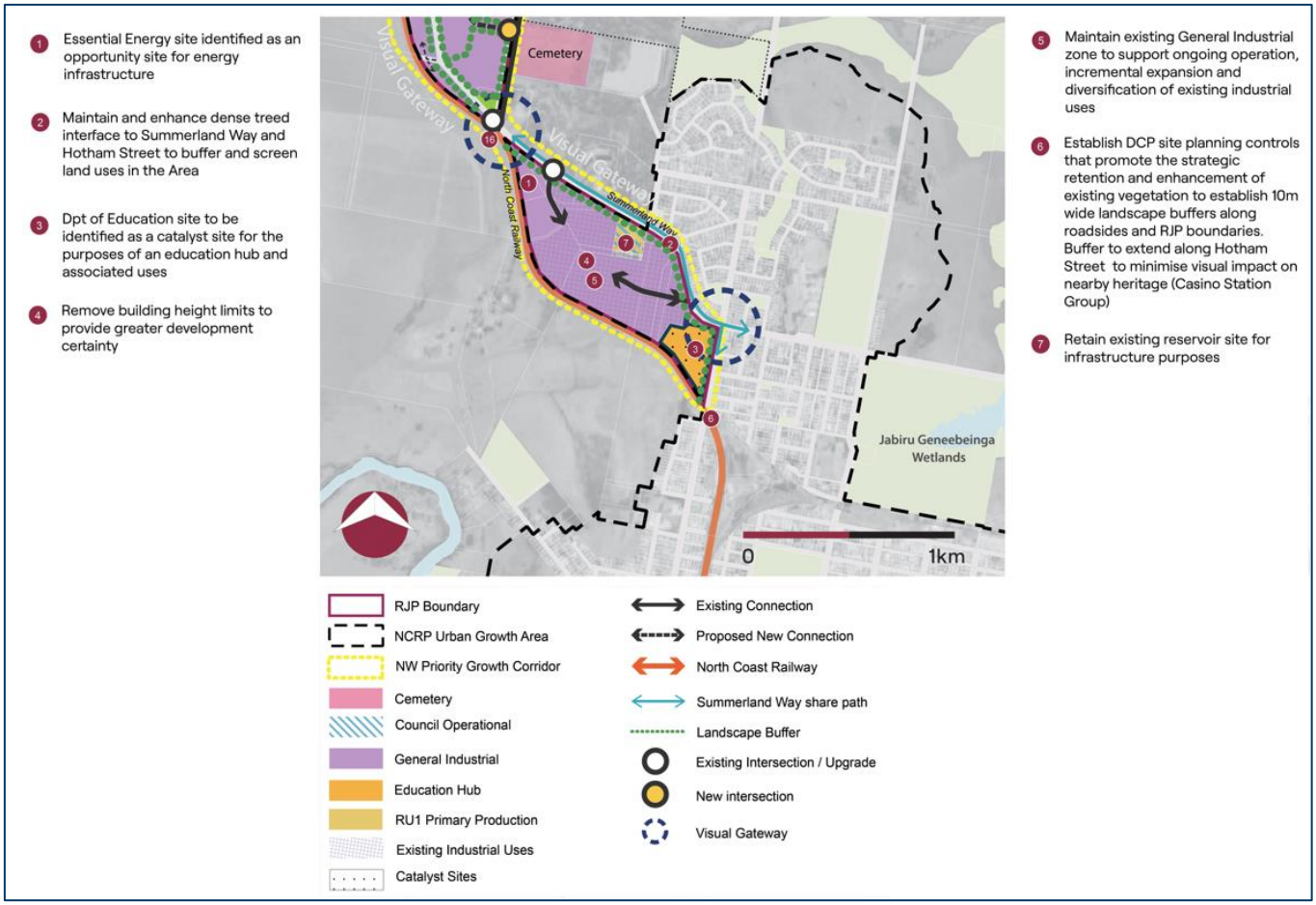


Figure 3.2 Regional Job Precinct 2 – Casino Food Co-op Area

Source: *Richmond Valley Regional Jobs Precinct Draft Structure Plan*

3.2.2 Proposed land use

Information provided by the DRNSW indicates that while additional light/general industrial uses may be provided at the Casino Food Co-op and surrounds precinct, no land uses are currently put forth as part of the RJP. This is due to the Nammoona, Johnston Street Industrial area and surrounds precinct being identified as being sufficient to accommodate the required commercial/industrial land uses in Casino.

3.3 Area 3 – Johnston Street Industrial area and surrounds precinct

3.3.1 Site summary

The Johnston Street Industrial area and surrounds precinct currently contain a mix of industrial, and agribusiness uses as well as the Casino STP. The *Draft Richmond Valley RJP Master Plan* recommendations for the Johnston Street Industrial area and surrounds precinct are shown in Figure 3.3.

Area 3 – Johnston Street Industrial area and surrounds precinct consists of the following areas:

– Development Area 3a (Primex)
– Development Area 3b (Arthur Street)
– Development Area 3c (STP residue)

The existing zoning for Area 3 consists of:

– IN1 General Industrial
– RU1 Primary Production
– E2 Environmental Conservation

A number of industrial land uses are currently located within the Johnston Street Industrial area and surrounds precinct that are accessed/egressed to and from Cassino Drive, including a council works depot, manufacturing facilities, a smash repair facility and warehousing/storage facilities.

It is proposed to relocate Council's current STP from the north east corner of the site (highlighted in yellow hatching below), to an adjacent site to the east (highlighted as item 1 below).

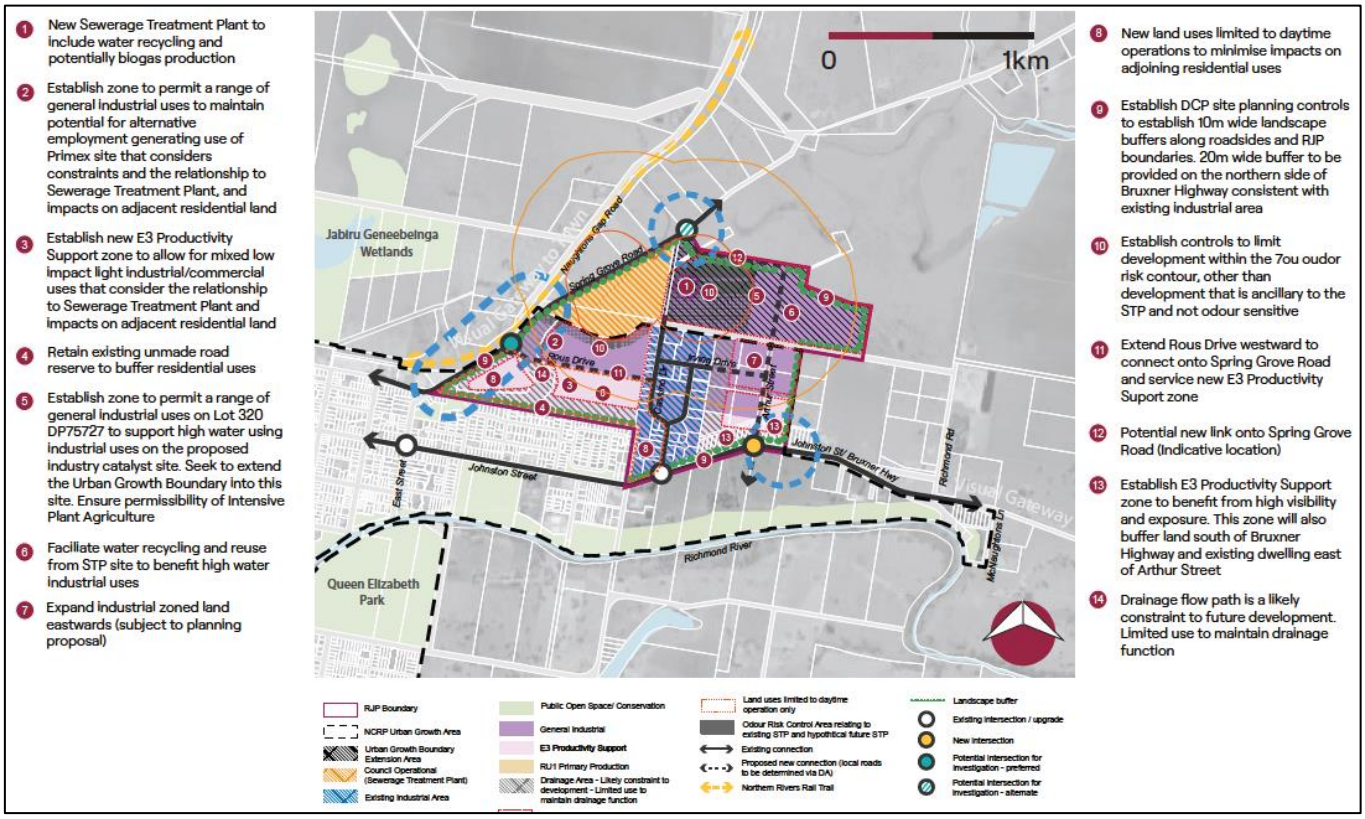


Figure 3.3 Regional Job Precinct 3 –Johnston Street Industrial area and surrounds precinct

Source: *Richmond Valley Regional Jobs Precinct Draft Structure Plan*

The primary access to the Johnston Street Industrial area and surrounds precinct is proposed via:

– The existing intersection of Bruxner Highway/Cassino Drive
– A potential new roundabout at the intersection of Bruxner Highway/Arthur Street

A secondary access is proposed on Spring Grove Road, as displayed in Figure 3.3.

– The preferred access/egress point is located approximately 600 metres (travel distance) north of Bruxner Highway (between Dryaaba Street and Naughtons Gap Road).
– An alternate access/egress point is located approximately two kilometres (travel distance) north of the Bruxner Highway.

Key benefits of the preferred access point on Spring Grove Road include:

– It is closer to Bruxner Highway and provides better integration with the Casino township.
– It provides a more direct route to the Bruxner Highway for emergency evacuations.

For the purposes of the assessment, it is assumed that the intersections would consist of T-junctions, with a single travel lane in either direction on all legs and short left turn and right turn lanes provided on Spring Grove Road.

The proposed structure plan displayed in Figure 3.3 provides:

– A series of new local roads including:
  - Arthur Street, which is proposed to run in a north/south direction and intersect Bruxner Highway
  - Rous Drive, which is proposed to run in an east west direction and intersect Spring Grove Drive
  - The extension of Irving Drive to support connectivity between Cassino Drive and Arthur Street
– Multiple access/egress points provide flexibility for emergency vehicles to enter and exit the Johnston Street Industrial area and surrounds precinct (as required).
– A potential new travel route between Bruxner Highway and Spring Grove Road via Arthur Street.

In summary, the existing/proposed road network will provide multiple external access points and will support internal connectivity to the existing/proposed industrial land uses.

A concept level drawing of the preferred access intersection on Spring Grove Road is displayed in Figure 3.4. Key features of the potential Spring Grove Road access intersection include a channelised right lane (CHR) and auxiliary left lane (AUL) suitable for accommodating 19 metre semi-trailers. The preferred access intersection is approximately 170 m south west of the proposed central entry to the Primex site and approximately 150 m south west of the proposed southern Rail Trail car park off Spring Grove Road. Property impacts and potential infrastructure conflicts to be considered during the detailed design of the intersection include:

– Property boundary (northern side of Spring Grove Road)
– Property access (southern side of Spring Grove Road)
– Overhead powerlines (northern side of Spring Grove Road)
– DN 600mm sewer rising main (northern side road reserve of Spring Grove Road)
– DN 100mm water main (southern side road reserve of Spring Grove Road)

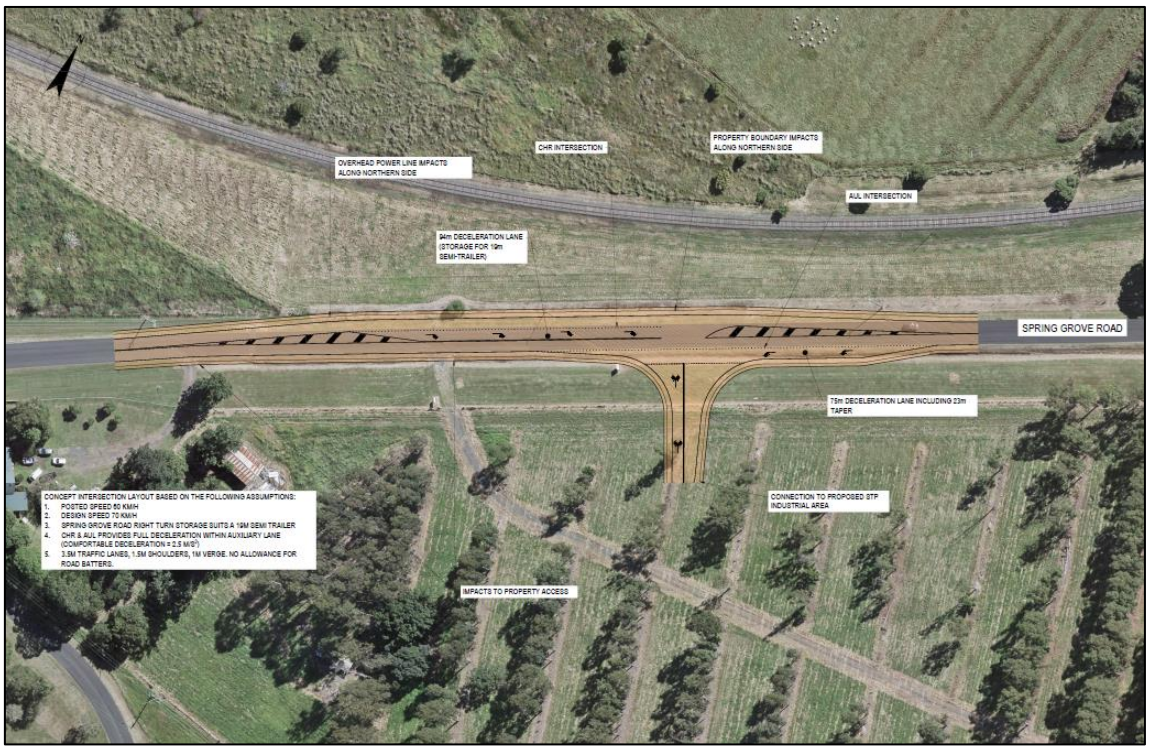


Figure 3.4 Proposed preferred access intersection on Spring Grove Road

Information provided by RVC indicates that the outputs of flood models show that an easement approximately 50 metres wide is required on the southeastern side of Spring Grove Road, to retain capacity for drainage flows. Accordingly for the preferred access point, a concrete bridge structure would be required to cross the drainage easement and link into Spring Grove Road.

Information provided by RVC indicates that the bridge structure would consist of a Reinforced Concrete Box Culvert with link slabs (12 metre by 14 metre) and guard rails.

The *Regional Jobs Precinct Flood Impact Assessment (2023)* under flood conditions with limited warning time, the evacuation of the Johnston Street Industrial area and surrounds precinct would need to occur via Bruxner Highway and Spring Grove Road. The provision of the bridge structure would be required to support evacuation activity via Spring Grove Road.

3.3.2 Proposed land use

The proposed land uses for the Johnston Street Industrial area and surrounds precinct include:

– An intensive agriculture facility
– General industrial, potentially including:
  - Bio-degradable and/or compostable packaging manufacturers
  - Technical/engineering service providers support to the regional food processing industry
  - Logistics suppliers who provide intermodal/cold chain solutions
  - Medical grade processors.

3.4 RJP land use summary

A summary of the land uses for the Johnston Street Industrial area and surrounds precinct and Nammoona Industrial area precinct are provided in Table 3.1.

Table 3.1 RJP proposed development yield

Description	FSR	2026 (m^2)	2031 (m^2)	2036 (m^2)	2041 (m^2)	Total (m^2)
Nammoona Industrial precinct						
Intermodal - Logistics (Intermodal facility operations)	0.3	1,700	3,047	2,924	2,072	9,743
Intermodal - Logistics (Warehousing)	0.3	4,110	7,365	7,069	5,008	23,552
Intermodal - General industrial (low to moderate impact) potentially including Logistics suppliers who provide intermodal/cold chain solutions	0.3	5,002	8,963	8,603	6,095	28,662
Heavy Industry - Food Processing – soybeans (heavy/ high impact) - Non Constrained Area	0.3	3,420	6,128	5,882	4,167	19,597
Heavy Industry - Food Processing – soybeans (heavy / high impact) - Biodiversity Offset Dependent	0.3	806	1,444	1,386	982	4,618
Renewable/circular economy energy providers – Energy from Waste (heavy / high impact)	0.3	1,766	3,164	3,037	2,152	10,118
General industrial Stage 1 (low to moderate impact)	0.3	2,516	4,509	4,328	3,066	14,420
General industrial Stage 2 (heavy/ high impact)	0.3	4,154	7,444	7,145	5,062	23,804
General industrial Stage 2 (low to moderate impact)	0.3	2,309	4,136	3,971	2,813	13,229
General industrial Stage 3 (low to moderate impact)	0.3	6,155	11,028	10,586	7,499	35,268
Total		**31,938**	**57,226**	**54,930**	**38,916**	**183,010**
Johnston Street industrial area and surrounds precinct						
General industrial Stage 1 (low to moderate impact)	0.2	4,044	7,246	6,955	4,927	23,171
Lot 320 – Intensive agriculture/high water usage	0.3	9,965	17,854	17,138	12,142	57,099
Primex - Light industrial/commercial	0.3	4,772	8,550	8,207	5,814	27,342
Primex site – General Industrial (low to moderate impact)	0.3	5,702	10,217	9,807	6,948	32,673
Total		**24,483**	**43,867**	**42,107**	**29,831**	**140,288**

3.5 Residential development

RVC has identified the need for additional housing in Casino to support the potential growth in population and businesses. It is estimated that between 700 to 1,700 additional houses will be required in the next 20 years to support the additional influx of people and families.

RVC has identified, through the Urban Land Release Strategy 2005, several future growth areas for Casino. The key Casino Urban Growth Investigation Areas (UGIA) identified to support the residential growth in Casino are displayed in Figure 3.5 and include:

– South Fairy Hill Residential Investigation Area
– North Casino Residential Investigation Area
– Barlings Lane Residential Investigation Area
– West Casino Residential Investigation Area
– Urban infill sites (within the Casino Township)

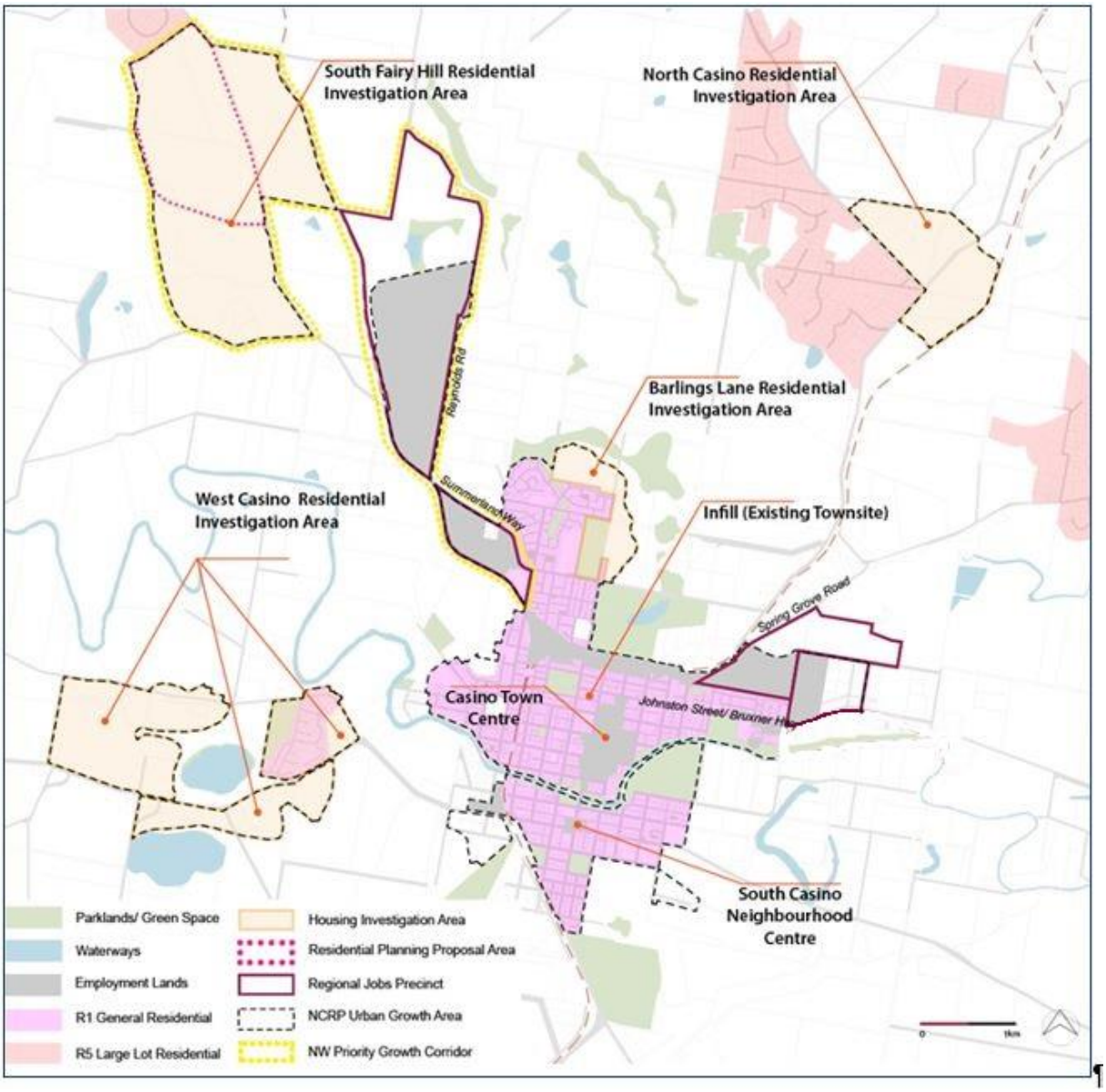


Figure 3.5 Proposed residential development areas

Source: DRNSW

The projected timing of the development of the residential dwellings in Casino is summarised in Table 3.2. It is noted that there is no residential development proposed for the West Casino site.

Table 3.2 Residential development projections – 2026 to 2041

Area	2026	2031	2036	2041	Total
Barlings Lane	64	64	-	-	128
Urban infill	30	53	51	36	170
South Fairy Hill	237	425	408	290	1,360
North Casino	7	13	13	9	42
Total	338	555	472	335	1,700

The majority of the dwellings associated with the UGIA are proposed to be constructed within the South Fairy Hill subdivision.

The preliminary Fairy Hill Master Plan is displayed in Figure 3.6. It currently proposes a single access/egress point (via a large roundabout) on Summerland Way.

Figure 3.6 Fairy Hill Master Plan

Source: DRNSW

The majority of vehicles associated with the Fairy Hill UGIA would be expected to utilise Summerland Way to access and egress the Casino Township.

4. Traffic impact assessment

4.1 Trip generation rates

4.1.1 TfNSW data

The TfNSW (2013) technical direction trip generation rates for industrial parks and business estates in regional areas are summarised in Table 4.1.

Table 4.1 TfNSW (2013) average trip rates for business parks and industrial estates

Weekday Rates	Regional Average	Regional Range
AM peak (one hour) vehicle trips per 100 m^2 of GFA.	0.70	0.32-1.20
PM peak (one hour) vehicle trips per 100 m^2 of GFA.	0.78	0.39-1.30

The technical direction specifies the following regional average trip rates for industrial development in regional areas:

– AM peak hour 0.70 trips per 100 m^2 GFA
– PM peak hour 0.78 trips per 100 m^2 GFA.

4.1.2 Case Study

In January 2022, GHD undertook a traffic study to support the application of a mixed-use commercial / industrial development in Mount Penang on the Central Coast. As part of this study, GHD prepared the working paper Mount Penang Parklands – Trip Generation Review. The purpose of the technical document was to detail the trip generation rate review for the industrial / business park land uses planned for the proposed development within the Mount Penang Parklands.

The key outputs of the study are as follows:

– To support the analysis, traffic surveys were undertaken at the existing Manns Road Industrial Area in the Central Coast, NSW.
– The analysis was based on three days of traffic survey data to support a robust analysis.
– The analysis identified the following peak hour trip generation rates:
  - AM site peak hour (one hour between 7:00 am – 9:00 am) – 0.48 trips per 100 m^2 GFA.
  - PM site peak hour (one hour between 4:00 pm – 6:00 pm) – 0.40 trips per 100 m^2 GFA.
– The identified rates fall within the “regional range” provided by TfNSW.
– TfNSW reviewed and approved the road network peak hour trip rates.

4.1.3 Traffic count data

A first principles trip generation analysis has been undertaken for the proposed development based on the outputs of the traffic surveys detailed in Section 2.5. This analysis is outlined in the following sub-sections.

4.1.3.1 Johnston Street Industrial area and surrounds precinct

Cassino Drive is the only access/egress point for the majority of the existing industrial land uses currently located within the Johnston Street Industrial area and surrounds precinct. Information provided by the DRNSW indicates that these existing industrial land uses have a combined Gross Floor Area (GFA) of 36,750 m^2.

Based on the traffic surveys data (detailed in Section 2.5) during peak periods of road network activity, the following vehicle activity was recorded at Cassino Drive:

– 182 vehicle movements (105 inbound and 77 outbound).

– 143 vehicle movements (54 inbound and 89 outbound).

Based on the observed traffic data for the Johnston Street Industrial area and surrounds precinct, the trip rates (per 100 m^2 GFA) for the existing land uses are summarised in Table 4.2.

Table 4.2 Johnston Street Industrial area and surrounds precinct trip rates

GFA (m^2)	Per 100 m^2	AM peak hour		PM peak hour	
		Number of trips	Trip rate	Number of trips	Trip rate
36,750	367.5	182	**0.50**	143	**0.39**

The data in Table 4.2 indicates that the existing industrial land uses within the Johnston Street Industrial area and surrounds precinct:

– 0.50 trips per 100 m^2 GFA in the AM peak hour
– 0.39 trips per 100 m^2 GFA in the PM peak hour

4.1.3.2 Nammoona Industrial precinct

Reynolds Road is the only access/egress point for the existing industrial land uses currently located within the Nammoona Industrial precinct. Information provided by the DRNSW indicates that these land uses have a combined Gross Floor Area (GFA) of 47,550 m^2.

Based on the traffic survey data (detailed in Section 2.5) during peak periods of road network activity, the following vehicle activity was recorded at Reynolds Road:

– 65 vehicle movements (26 inbound and 39 outbound)
– 62 vehicle movements (25 inbound and 37 outbound)

Based on the observed traffic counts, the resulting trip generation rates (per 100 m^2 GFA) for the Nammoona Industrial precinct are summarised in Table 4.3.

Table 4.3 Nammoona Industrial precinct trip rates

GFA	Per 100 m^2	AM peak hour		PM peak hour	
		Number of trips	Trip rate	Number of trips	Trip rate
47,550	475.5	65	**0.14**	62	**0.13**

The data in Table 4.3 indicates that the industrial land uses within the Nammoona Industrial precinct generate:

– 0.14 trips per 100 m^2 GFA in the AM peak hour
– 0.13 trips per 100 m^2 GFA in the PM peak hour

The existing land uses accessed from Cassino Drive include commercial developments such as a car wash and a vehicle smash repair, which are expected to generate more traffic than the land uses accessed via Reynolds Road, which contributes to the difference in the trip generation outputs.

4.1.4 Summary

The trip generation rates associated with the existing industrial and uses accessed from Cassino Drive have been used in order to determine the trip traffic generation for the RJP land uses for the following reasons:

– They are specific to Casino Township and, therefore provide a robust approach for deriving the traffic generation of similar industrial development for this area.
– They are consistent with the range of trip rates for industrial uses identified by TfNSW in their technical direction (2013).
– They are consistent with the trip generation values determined by a GHD case study for an existing industrial area.
– They are higher than the rates associated with the current land uses within the Nammoona Industrial precinct and will, therefore provide a robust approach to the traffic and transport assessment for the RJP sites.

For the purposes of this traffic generation, the following arrival and departure split has been adopted for the analysis, as this is consistent with the current vehicle activity at Cassino Drive:

– 60 percent inbound and 40 percent outbound in the AM peak hour
– 40 percent inbound and 60 percent outbound in the PM peak hour

Additionally, in accordance with the traffic survey data from the intersection of Bruxner Highway and Cassino Drive, it has been assumed that 25 percent of overall vehicles will consist of heavy vehicles.

4.1.5 Intermodal facility

As detailed in Table 3.1, the Nammoona Industrial precinct includes the following intermodal facilities:

– Intermodal facilities operation
– Warehousing
– General industrial land uses, including intermodal/cold chain solutions

In 2010, a Traffic Impact Assessment[1] was prepared for an intermodal rail terminal within the Nammoona Industrial precinct. The assessment identified that:

– The intermodal facility would have up to 20 employees.
– With respect to heavy vehicles, the maximum movements are expected to be 344 heavy vehicles per day, (172 inbound and 172 outbound).

GHD has reviewed the intermodal facility assessment and noted the following:

– The growth perspective of the terminal operations to enable triple the number of truck trips in the first five years appears very high, and assumptions in 2010 are not necessarily applicable today (new woodchips and log processing facilities). At this stage, without a further updated assessment, the tempering or staging of this volume uptake needs to be considered with likely lower overall number of trips if not all opportunities are realised.
– In addition, the increase in the use of road train configurations which can carry up to four standard containers (TEU) or additional bulk loadings, would likely reduce the overall number of trips accessing the terminal.
– The impact will be greater for bulk materials, including aggregate, grain and woodchips, where the impact Is likely to be a reduction of trips by up to 20- 25 percent. However, there is also a potential for a reduction of trips for logs and container traffic in the region of 15 percent of total trips.
– Considering that bulk materials represent 55 percent of trips and logs and containers represent 45 percent of trips this indicates an overall impact of reducing the number of trips by approximately 25 percent.
– Accordingly, compared to the data in the 2010 assessment, a reduction in heavy vehicles of 25 percent is appropriate. Therefore, it has been assumed that the intermodal facility will generate up to 260 heavy vehicle movements per day (130 inbound and 130 outbound).

Additionally, for the purposes of analysis, it has been assumed that:

– The trip data identified above apply to the facilities operation and warehousing. For the general industrial land uses associated with the intermodal facility, the trip rates identified in Section 4.1.4 are appropriate.
– 20 percent of the overall daily heavy vehicle activity will occur in each of the morning and afternoon peak hours.
– In accordance with the data in Table 3.1, it is assumed that the intermodal facility will be 50 percent operational in 2031 and fully operational in 2041.

4.1.6 Residential development

The TfNSW (2013) technical direction identifies the following trip rates for low-density rural residential dwellings:

– 0.71 trips per dwelling in the AM peak hour
– 0.78 trips per dwelling in the PM peak hour

[1] Traffic Impact Assessment for Summerdowns Rail Terminal at Nammoona (Plateway, 2010)

It is noted that these rates do not include trips made internal to a subdivision, which may constitute 25 percent of the overall trips.

For the purposes of analysis, the following arrival and departure split has been assumed for the proposed residential development:

– 20 percent inbound and 80 percent outbound in the AM peak hour
– 80 percent inbound and 20 percent outbound in the PM peak hour

4.2 Trip generation (number of vehicles)

The following sections summarise the expected traffic generation for each of the proposed future land uses for the future horizons years of 2031 and 2041. This traffic generation analysis has been undertaken to inform the SIDRA intersection modelling analysis, detailed in Section 4.4.

4.2.1 Industrial development

The expected trips associated with the Nammoona Industrial precinct, in accordance with the land use data detailed in Table 3.1, are detailed in Table 4.4.

Table 4.4 Nammoona Industrial precinct trip generation

Year	GFA	AM peak hour		PM peak hour	
		Inbound	Outbound	Inbound	Outbound
Intermodal facility (including warehouses)					
2031	**16,222**	**22**	**14**	**14**	**22**
	Light vehicle	6	4	4	6
	Heavy vehicles	16	10	10	16
2041	**33,295**	**43**	**29**	**29**	**43**
	Light vehicle	12	8	8	12
	Heavy vehicles	31	21	21	31
Other industrial land uses					
2031	**72,942**	**219**	**146**	**128**	**192**
	Light vehicle	164	109	96	144
	Heavy vehicles	55	36	32	48
2041	**149,715**	**449**	**299**	**234**	**350**
	Light vehicle	337	225	175	363
	Heavy vehicles	112	75	58	88
Total Nammoona Industrial precinct					
2031	**89,164**	**241**	**160**	**142**	**214**
	Light vehicle	170	114	100	150
	Heavy vehicles	71	46	42	64
2041	**183,010**	**492**	**328**	**263**	**393**
	Light vehicle	349	233	183	375
	Heavy vehicles	143	96	79	119

The data in Table 4.4 indicates that the Nammoona Industrial precinct is expected to result in the following trip generation:

– In 2031: 401 trips in the AM peak hour, with 356 trips in the PM peak hour
– In 2041: 820 trips in the AM peak hour and 656 trips in the PM peak hour

The expected trips associated with the Johnston Street Industrial area and surrounds precinct, in accordance with the land use data detailed in Table 3.1, are detailed in Table 4.5.

Table 4.5 Johnston Street Industrial area and surrounds precinct trip generation

Year	GFA	AM peak hour		PM peak hour	
		Inbound	Outbound	Inbound	Outbound
Total Johnston Street Industrial area and surrounds precinct					
2031	**68,350**	**205**	**138**	**107**	**159**
	Light vehicle	154	103	81	119
	Heavy vehicles	52	35	26	40
2041	**140,287**	**422**	**280**	**219**	**330**
	Light vehicle	316	210	164	247
	Heavy vehicles	106	71	55	83

The data in Table 4.5 indicates that the Johnston Street Industrial area and surrounds precinct will generate:

– In 2031: 343 trips in the AM peak hour and 267 trips in the PM peak hour
– In 2041: 702 trips in the AM peak hour and 549 trips in the PM peak hour

4.2.2 Residential development

The trips associated with the proposed residential developments detailed in Section 3.5 and the trip rates detailed in Section 4.1.6 are summarised in Table 4.6. A 25 percent reduction has been applied to account for internal trips within the South Fairy Hill Subdivision.

Additionally, it is expected that there will be a nexus between the commercial/industrial trips detailed in Table 4.4 and Table 4.5 and the residential trips. Namely, some residents from the UGIAs will work at the RJP. To account for this expected interaction, the residential trips have been reduced by 10 percent, i.e. 10 percent of the residential trips are associated with individuals accessing/egressing their place of employment within the Nammoona, Johnston Street Industrial area and surrounds precinct. As the RJP is intended to support the co-location of jobs within regional communities, a ten percent reduction supports a conservative assessment.

Table 4.6 Residential trip volumes (UGIAs)

Year	Site	No Dwellings	AM peak hour		PM peak hour	
			Inbound	Outbound	Inbound	Outbound
2031	Barlings Lane	128	16	65	72	18
	Infill	83	11	42	47	12
	South Fairy Hill	662	63	254	279	70
	North Casino	20	3	10	11	3
	Total	**893**	**93**	**372**	**409**	**102**
2041	Barlings Lane	128	16	65	72	18
	Infill	170	22	87	95	24
	South Fairy Hill	1,360	130	521	573	143
	North Casino	42	5	21	24	6
	Total	**1,700**	**174**	**695**	**764**	**191**

The data in Table 4.6 indicates that the proposed residential developments are expected to generate:

– In 2031: 465 trips in the AM peak hour and 511 trips in the PM peak hour
– In 2041: 869 trips in the AM peak hour and 955 trips in the PM peak hour.

4.3 Trip distribution

The expected trips generated by the RJP and residential developments have been distributed onto the road network based on observed traffic patterns identified in the traffic surveys detailed in Section 2.5.

The following sections outline the assumed trip distribution for the other proposed land uses.

4.3.1 Nammoona Industrial precinct

The outputs from the traffic surveys at Reynolds Road indicate that in AM and PM peak periods, approximately 95 percent of vehicles access and egress the existing industrial land uses to and from the south. This pattern is consistent with residents of Casino using Summerland Way to access/egress their place of employment.

As the RJP sites are developed, it is expected that there will be an increase in vehicles accessing/egressing the Nammoona Industrial precinct to and from the north, i.e., the South Fairy Hill subdivision. For the purposes of analysis, it has been assumed that in the 2031 and 2041 horizon years (refer to Figure 4.1):

– 25 percent of trips will access/egress the Nammoona Industrial precinct to and from the north
– 75 percent of trips will access/egress the Nammoona Industrial precinct to and from the south.

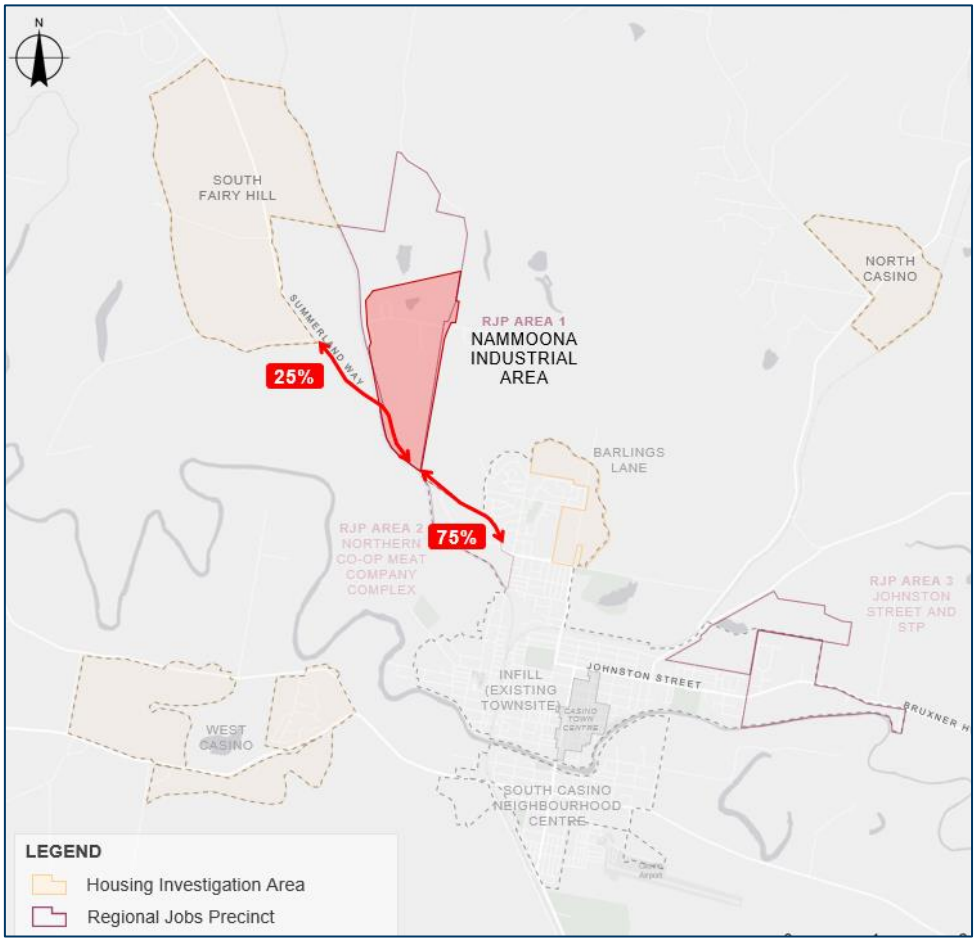


Figure 4.1 Nammoona Industrial precinct - estimated trip distribution

4.3.2 Johnston Street Industrial area and surrounds precinct

As detailed in Section 3.3, the Johnston Street Industrial area and surrounds precinct master plan propose an upgrade of the Bruxner Highway/Arthur Street. Preliminary analysis has been based on assuming a T-junction at the Arthur Street intersection. A concept level drawing of the proposed intersection upgrade is displayed in Figure 4.2.

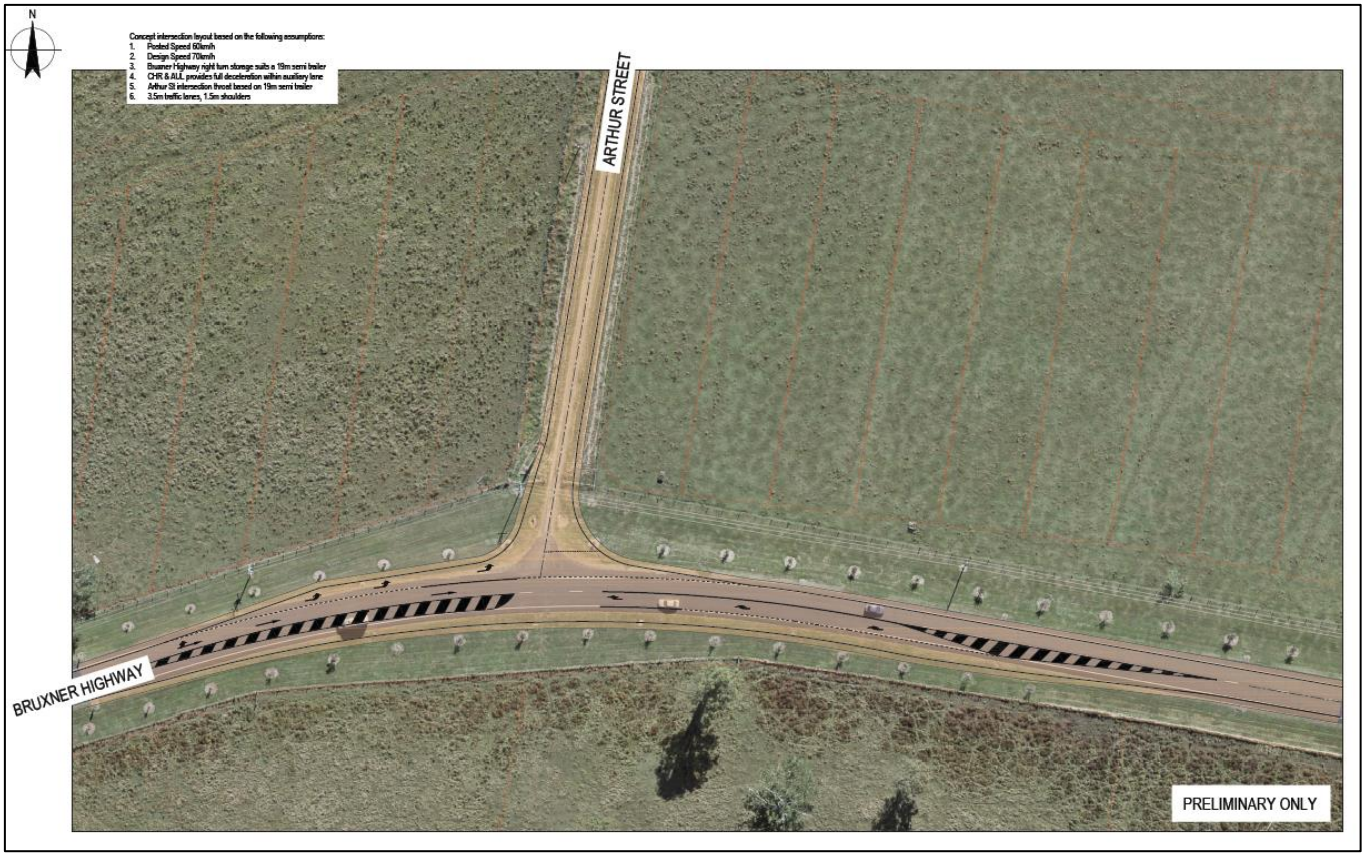


Figure 4.2 Potential Bruxner Highway and Arthur Street upgrade

Key features of the potential Arthur Street intersection upgrade include a channelised right lane (CHR) and auxiliary left lane (AUL) suitable for accommodating 19 metre semi-trailer.

With respect to the Johnston Street Industrial area and surrounds precinct, the following has been assumed:

– A minor/secondary access will be provided on Spring Grove Road. For the purposes of analysis, it has been assumed that 20 percent of vehicles will access/egress the RJP via the intersection of East Street/ Spring Grove Road. In accordance with the current patterns of vehicle activity at the intersection of East Street/Bruxner Highway:
  - For vehicles egressing the RJP from Spring Grove Road/East Street, 55 percent will turn right onto Bruxner Highway and (towards Casino) 45 percent will turn left onto the Bruxner Highway.
  - For vehicles entering the RJP from Spring Grove Road/East Street, 70 percent will turn left from the Bruxner Highway (from Casino) 30 percent will turn right from the Bruxner Highway.
– The main access point to the industrial areas will be provided on the Bruxner Highway and Cassino Drive and Arthur Street. For the purposes of analysis it has been assumed that:
  - 55 percent of trips will access/egress the RJP site to and from the west (from the direction of Casino).
  - 25 percent will access and egress the RJP site to and from the east.

As displayed in Figure 3.3, internal roads will connect Cassino Drive with Arthur Street and the wider RJP subject site.

The trip distribution assumptions that have been applied to the Johnston Street Industrial area and surrounds precinct are displayed in Figure 4.3.

Figure 4.3 Johnston Street Industrial area and surrounds precinct Johnston Streettrip distribution

4.3.3 Residential areas

A description of the trip distribution assumptions that have been applied to the residential areas detailed in Section 3.5 is as follows:

– For North Casino, it is assumed that all vehicles will access/egress the site via Naughtons Gap Road, Spring Grove Road and East Street.
– For Barlings Lane and the infill sites it is assumed that:
  - 20 percent of inbound and outbound trips will traverse Bruxner Highway
  - 20 percent of inbound and outbound trips will traverse Summerland Way
– For South Fairy Hill it has been assumed that:
  - 25 percent of trips will access/egress the site to/from the north, and 75 percent of trips will access/egress the site to/from the south
  - 20 percent of the trips to and from the south will traverse the Bruxner Highway

The trip distribution assumptions that have been applied to the residential UGIAs are displayed in Figure 4.4.

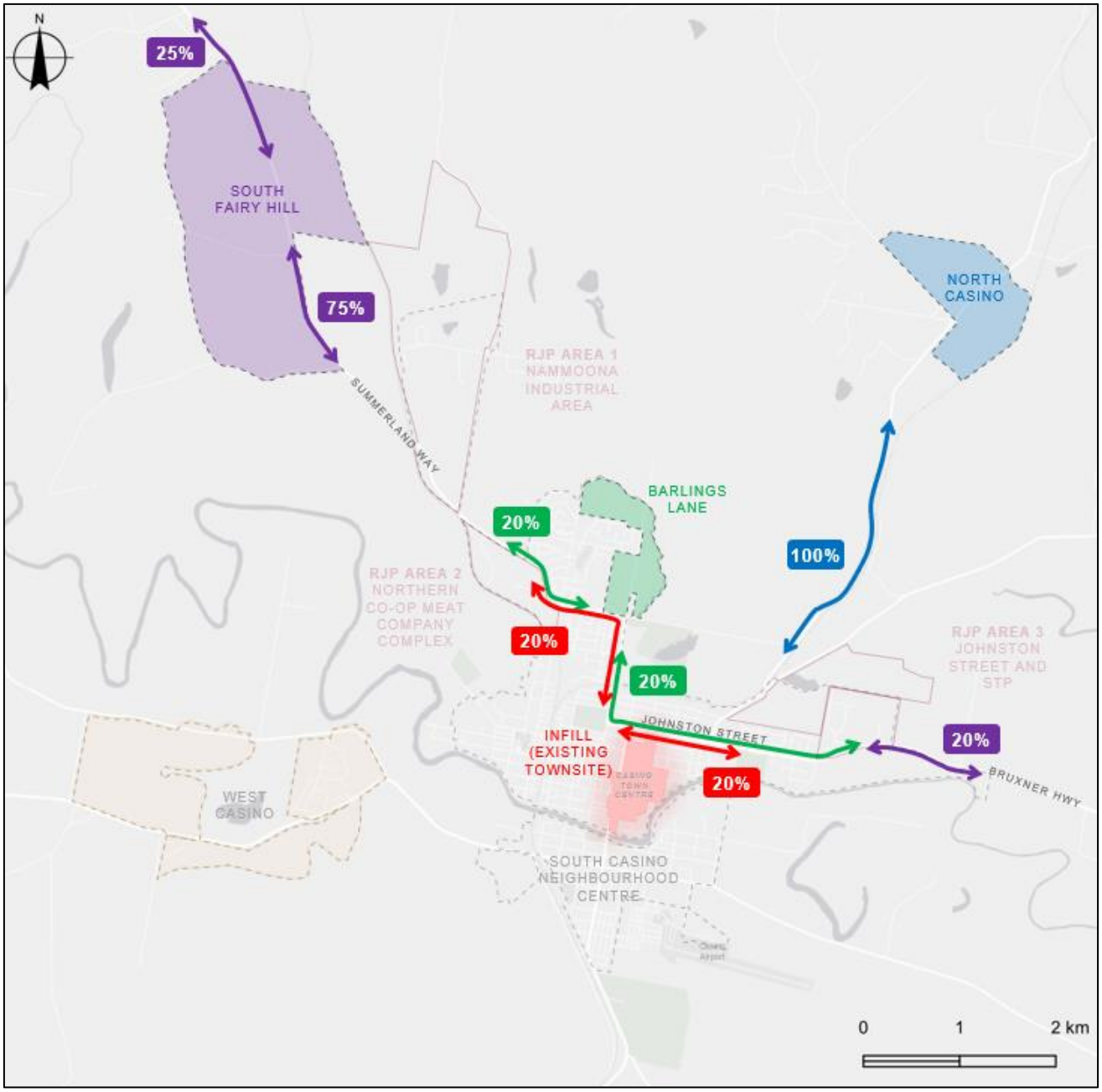


Figure 4.4 UGIA trip distribution

4.4 Impact assessment

4.4.1 2031 horizon year

Based on the key assumptions identified in Section 4.1 – Section 4.3:

– The 2031 AM and PM peak hour traffic volumes for Summerland Way are displayed in Figure 4.5 and Figure 4.6, respectively.
– The 2031 AM and PM peak hour traffic volumes for Bruxner Highway are displayed in Figure 4.7 and Figure 4.8, respectively.

To account for wider regional growth, an additional five percent growth rate has been applied to the through traffic on Summerland Way and Bruxner Highway.

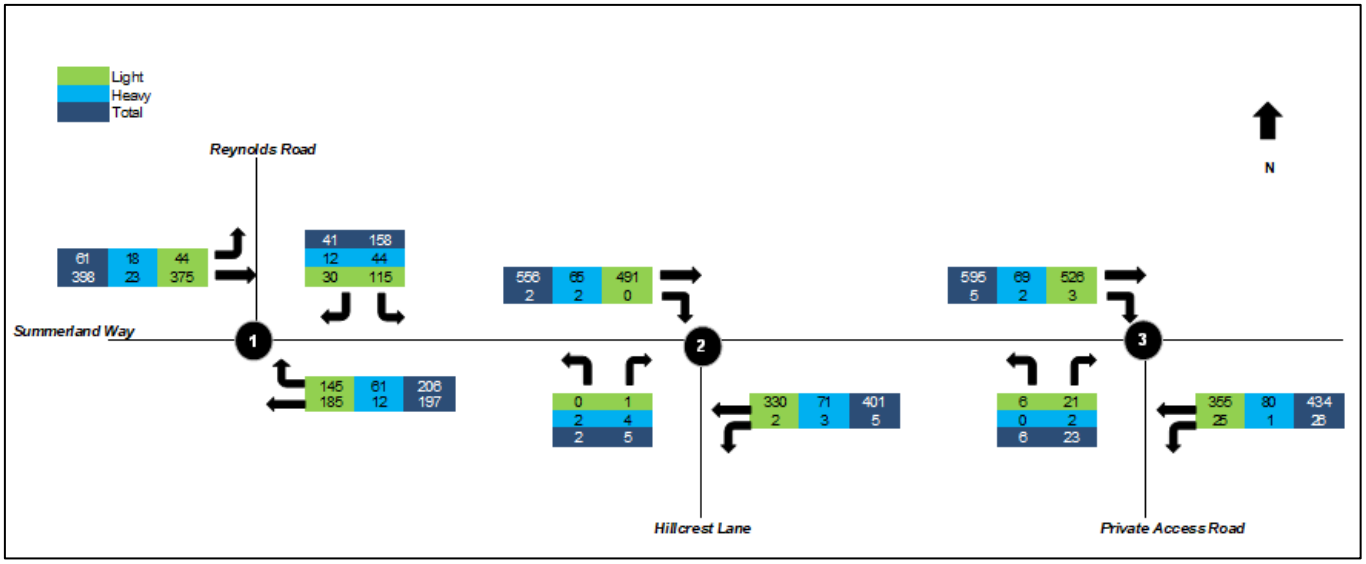


Figure 4.5 Summerland Way AM peak hour traffic volumes – 2031

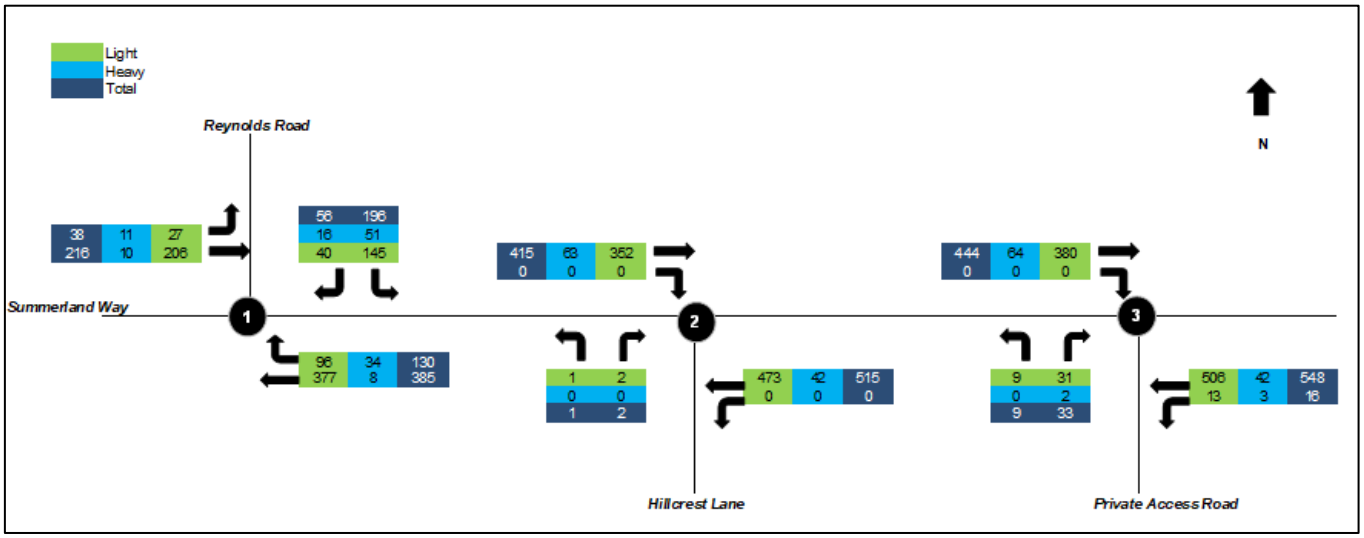


Figure 4.6 Summerland Way PM peak hour traffic volumes – 2031

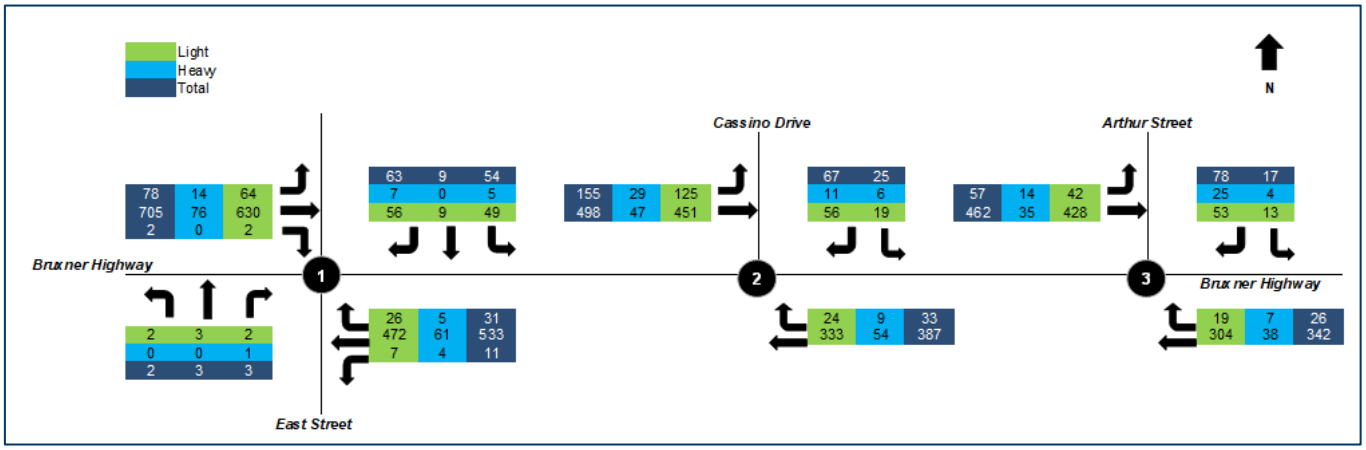


Figure 4.7 Bruxner Highway AM peak hour traffic volumes – 2031

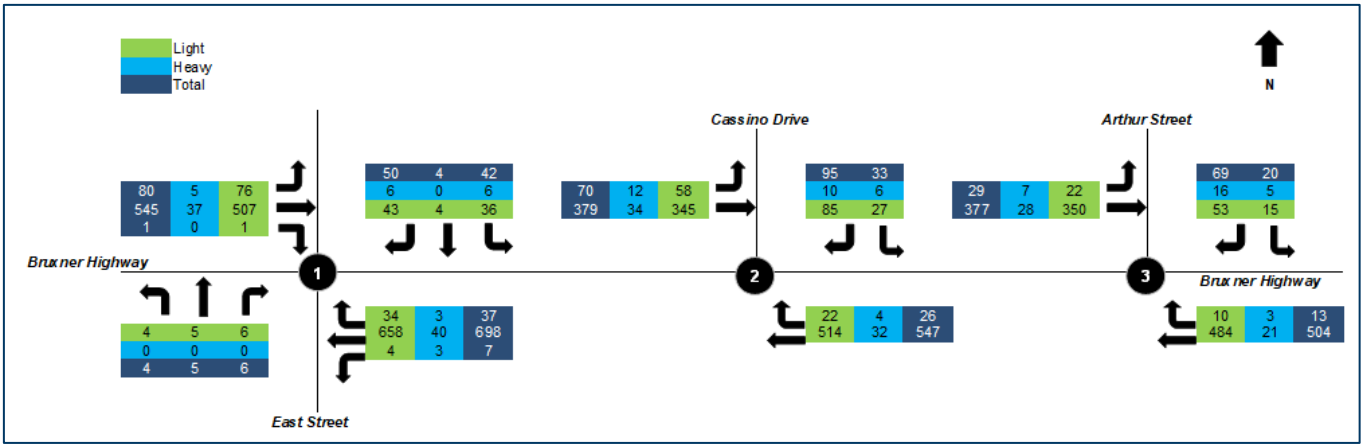


Figure 4.8 Bruxner Highway PM peak hour traffic volumes – 2031

The layout of the Bruxner Highway/Arthur Street intersection, as modelled in SIDRA is displayed in Figure 4.9.

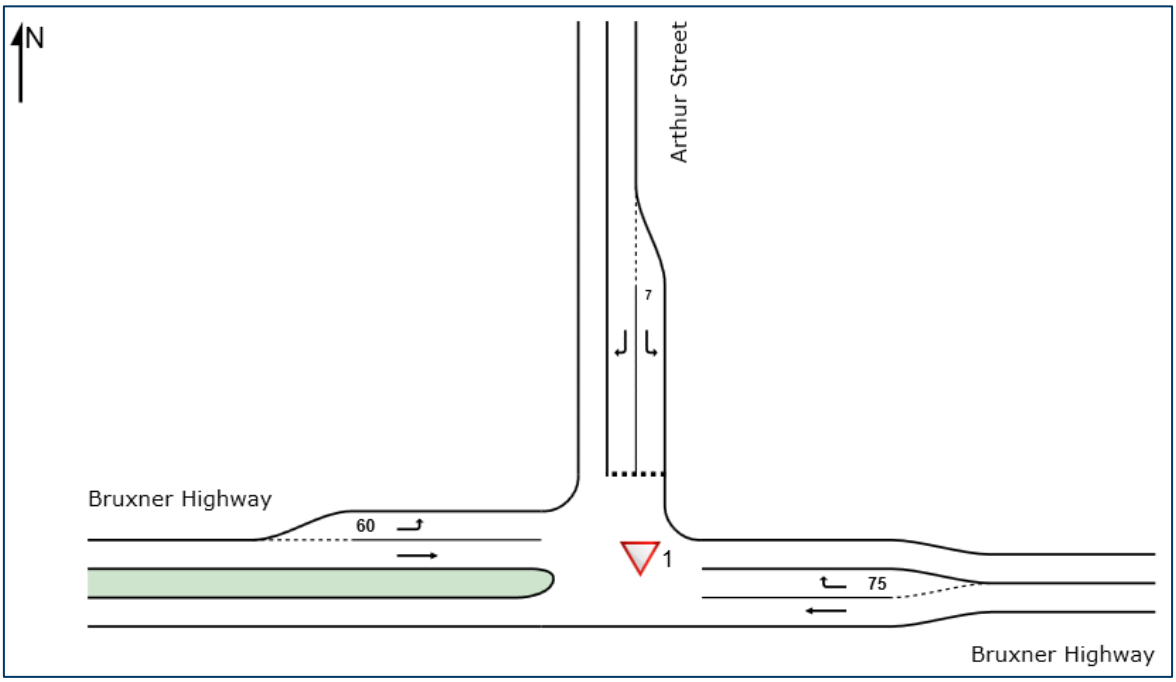


Figure 4.9 Bruxner Highway/Arthur Street intersection layout (SIDRA)

The outputs of the 2031 horizon year SIDRA analysis are displayed in Table 4.7.

Table 4.7 2031 SIDRA analysis

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Summerland Way and Reynolds Road						
Summerland Way - east	6.2	A	14	2.3	A	5
Reynolds Road	7.3	A	5	6.8	A	6
Summerland Way - west	1.1	A	0	1.2	A	0
Total	**4.2**	**A**	**-**	**3.1**	**A**	**-**
Summerland Way and Hillcrest Lane						
Summerland Way - east	0.1	A	0	0.1	A	0

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Summerland Way - west	0.1	A	0	0.1	A	0
Hillcrest Lane	32.7	C	2	14.8	B	0
Total	**0.4**	**A**	**-**	**0.1**	**A**	**-**
Summerland Way and Co-op access road						
Summerland Way - east	0.5	A	0	0.2	A	0
Summerland Way - west	0.3	A	1	11.6	A	0
Co-op access road	10.6	A	2	12.3	A	2
Total	**0.6**	**A**	**-**	**0.6**	**A**	**-**
Bruxner Highway and East Street						
East Street – south	29.0	C	1	22.4	B	2
Bruxner Highway – east	2.3	A	9	1.3	A	8
East Street – north	121.7	F	57	61.9	E	20
Bruxner Highway - west	0.5	A	1	0.5	A	0
Total	**11.6**	**A**	**-**	**5.1**	**A**	**-**
Bruxner Highway and Cassino Drive						
Bruxner Highway – east	2.7	A	7	1.1	A	3
Cassino Drive	53.9	D	20	48.5	D	26
Bruxner Highway – west	1.2	A	0	0.8	A	0
Total	**5.9**	**A**	**-**	**6.3**	**A**	**-**
Bruxner Highway and Arthur Street						
Bruxner Highway – east	0.8	A	1	0.3	A	1
Cassino Drive	34.8	C	18	30.7	C	14
Bruxner Highway – west	0.8	A	0	0.5	A	0
Total	**4.4**	**A**	**-**	**3.1**	**A**	**-**

The data in Table 4.7 indicates that in the 2031 horizon year, the intersections of interest typically operate with an acceptable LoS. The exception is the intersection of Bruxner Highway and East Street. Due to the heavy east/west traffic volumes on Bruxner Highway, the vehicles on East Street (north) are expected to experience long delays.

To mitigate against this, the intersection of Bruxner Highway and East Street was remodelled as a single lane roundabout, as displayed in Figure 4.10.

Figure 4.10 Proposed roundabout at Bruxner Highway and East Street

Key aspects of the proposed roundabout include:

– A single approach, departure and circulation lane

– An 8.5 m wide circulation lane to support the movement of large trucks

The layout of the proposed roundabout, as modelled in SIDRA, is displayed in Figure 4.11.

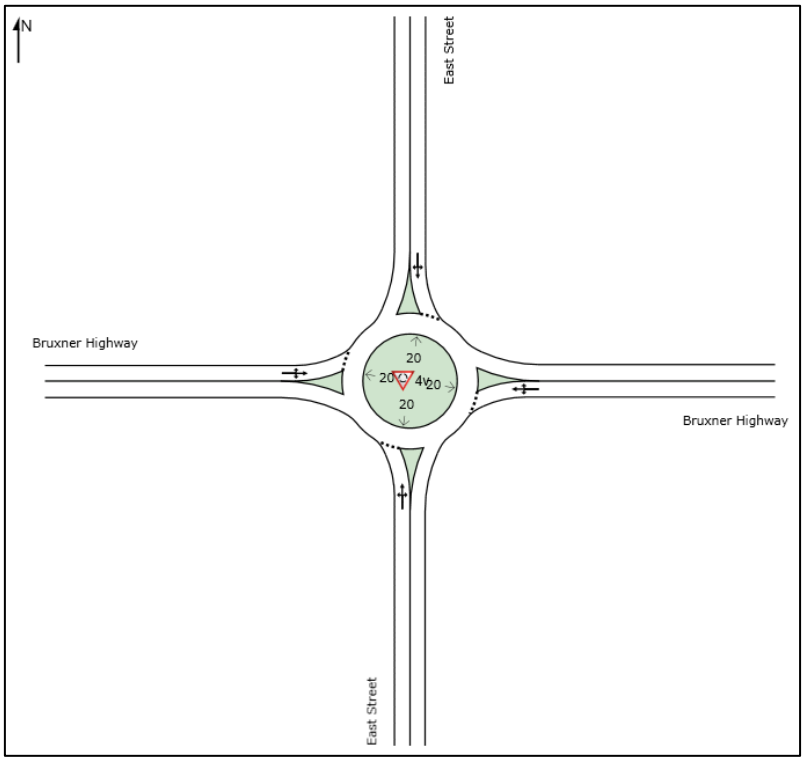


Figure 4.11 Bruxner Highway/East Street mitigated layout (SIDRA)

The 2031 SIDRA outputs for the intersection of Bruxner Highway and East Street accounting for the proposed mitigated layout are displayed in Table 4.8.

Table 4.8 Bruxner Highway and East Street 2031 SIDRA outputs - roundabout

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Bruxner Highway and East Street (roundabout)						
East Street – south	9.4	A	1	10.6	A	1
Bruxner Highway – east	3.8	A	34	3.6	A	44
East Street – north	11.7	A	11	9.6	A	6
Bruxner Highway – west	3.3	A	49	3.2	A	30
Total	**4.2**	**A**	**-**	**3.9**	**A**	**-**

The data in Table 4.8 indicates that in the 2031 horizon year, the intersection of Bruxner and East Street operates with an acceptable Level of Service as a single lane roundabout.

The SIDRA outputs for the 2031 horizon year are displayed in Appendix C.

4.4.2 2041 horizon year

For the purposes of analysis, it has been assumed that the roundabout at the intersection of Bruxner Highway and East Street (refer to Figure 4.10) will be constructed prior to 2041.

Additionally, on 27July 2022, GHD met with TfNSW and RVC to discuss access options for the Johnston Street Industrial area and surrounds precinct. During the meeting, TfNSW indicated that they would, in principle, support a roundabout on Bruxner Highway at Cassino Drive or Arthur Street. RVC have indicated a preference for the roundabout at Arthur Street as it would slow vehicles on Bruxner Street approaching the Casino Township from the east.

The concept layout drawing of the proposed roundabout at the intersection of Bruxner Highway and Arthur Street is displayed in Figure 4.12.

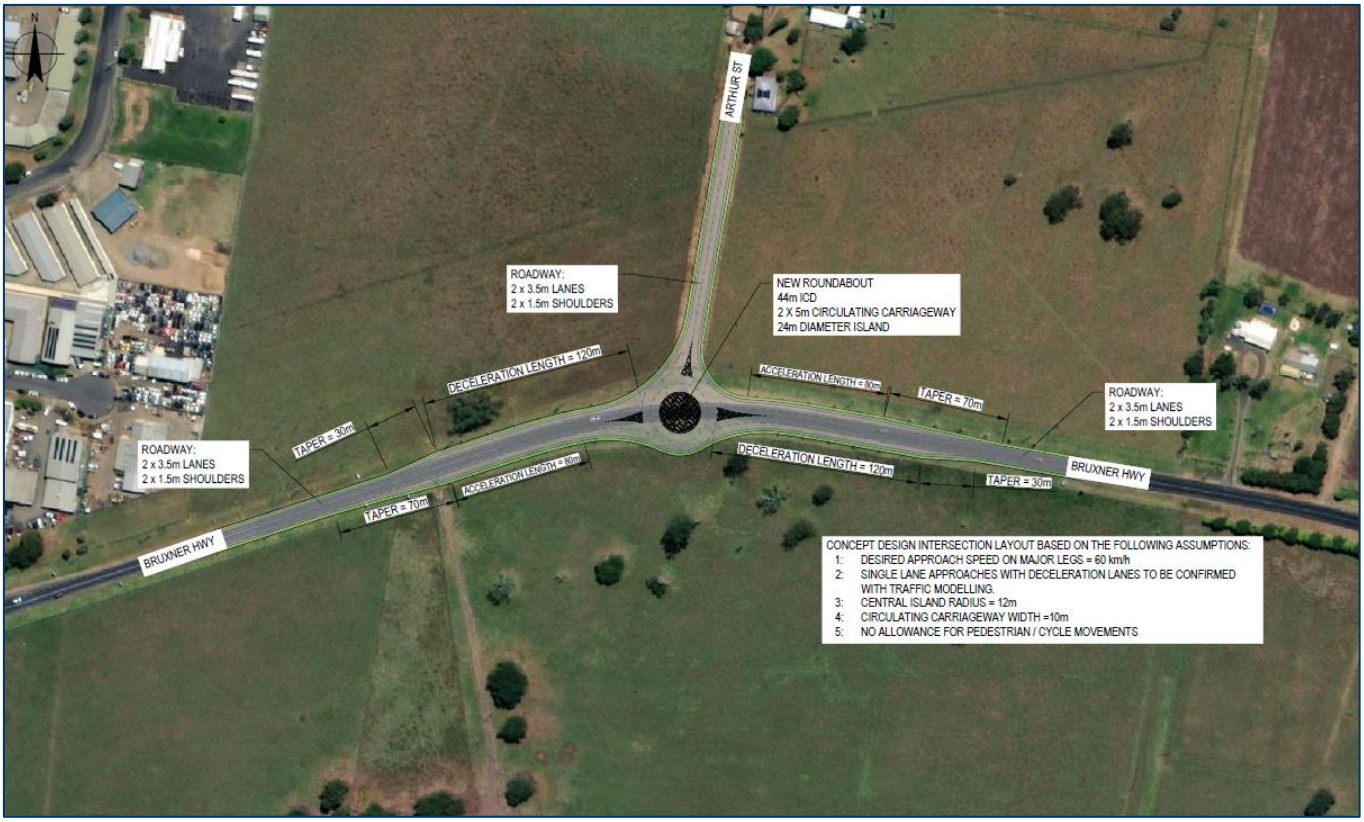


Figure 4.12 Proposed roundabout at Bruxner Highway and Arthur Street

Key aspects of the proposed roundabout include:

– A single approach and departure with additional short acceleration and deceleration lanes on Bruxner Highway.
– Two circulation lanes.
– A circulation carriageway width of 10 metres and a 24 metre diameter island to support the movement of large trucks.

The layout of the proposed roundabout at the intersection of Bruxner Highway and Arthur Street, as modelled in SIDRA, is displayed in Figure 4.13.

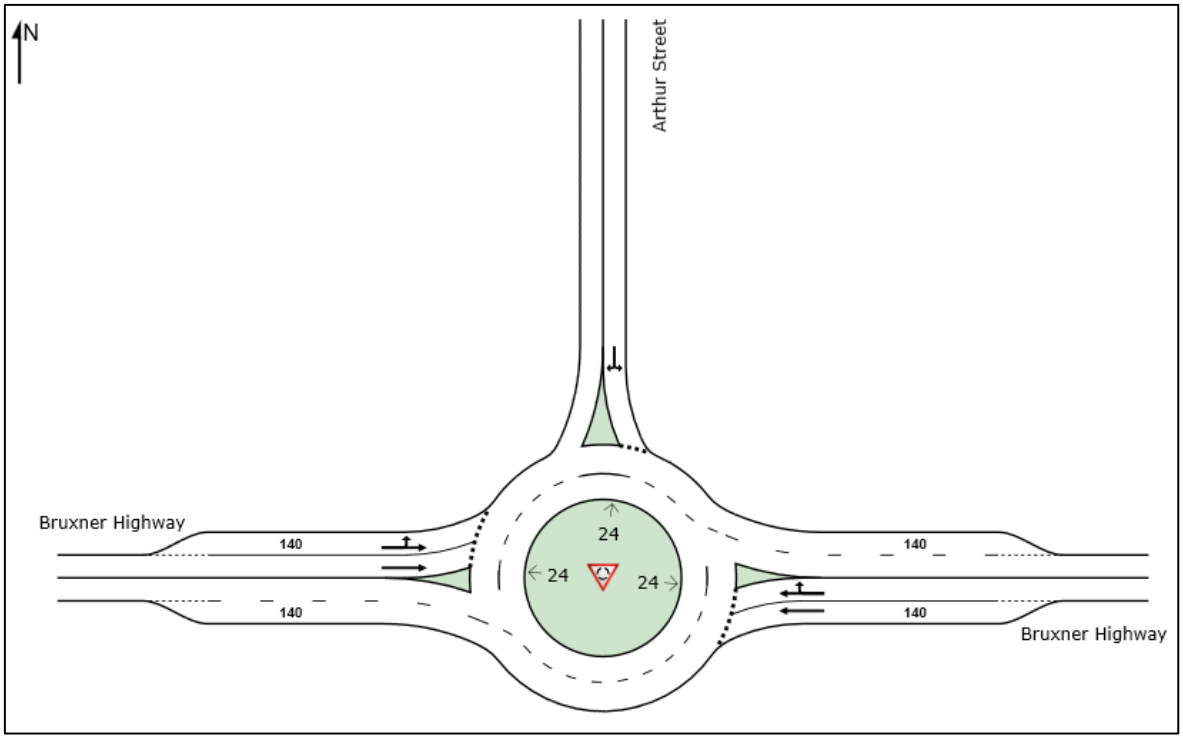


Figure 4.13 Bruxner Highway and Arthur Street intersection mitigated layout (SIDRA)

Based on the key assumptions identified in Section 4.1 – Section 4.3:

– The 2041 AM and PM peak hour traffic volumes for Summerland Way are displayed in Figure 4.14 and Figure 4.15, respectively.
– The 2041 AM and PM peak hour traffic volumes for Bruxner Highway are displayed in Figure 4.16 and Figure 4.17, respectively.

To account for wider regional growth, an additional ten percent growth rate has been applied to the through traffic on Summerland Way and Bruxner Highway.

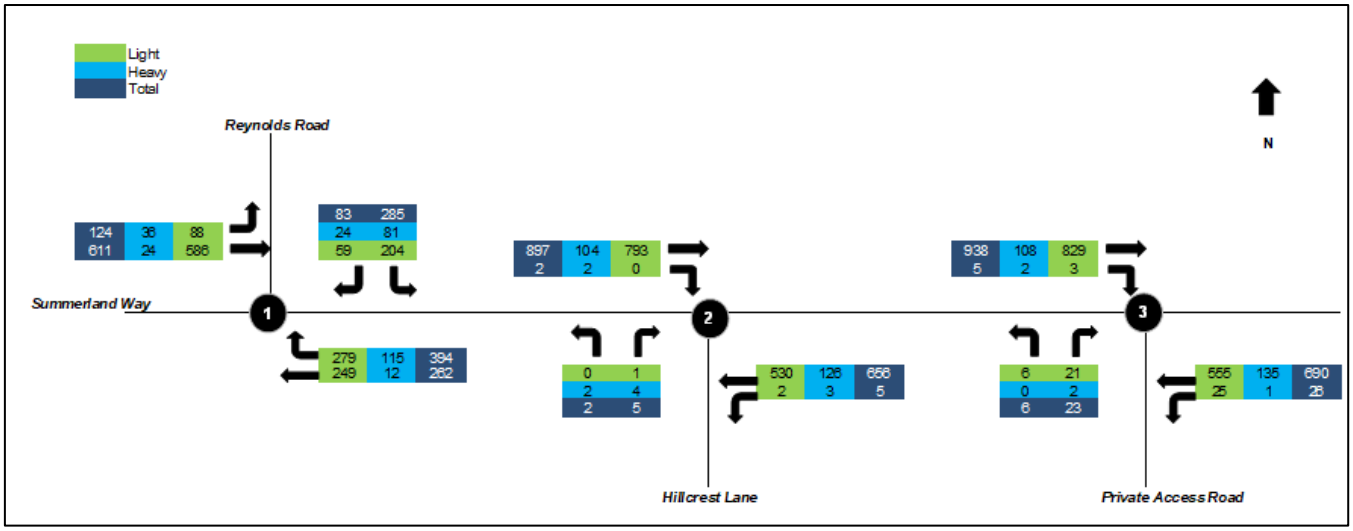


Figure 4.14 Summerland Way AM peak hour traffic volumes – 2041

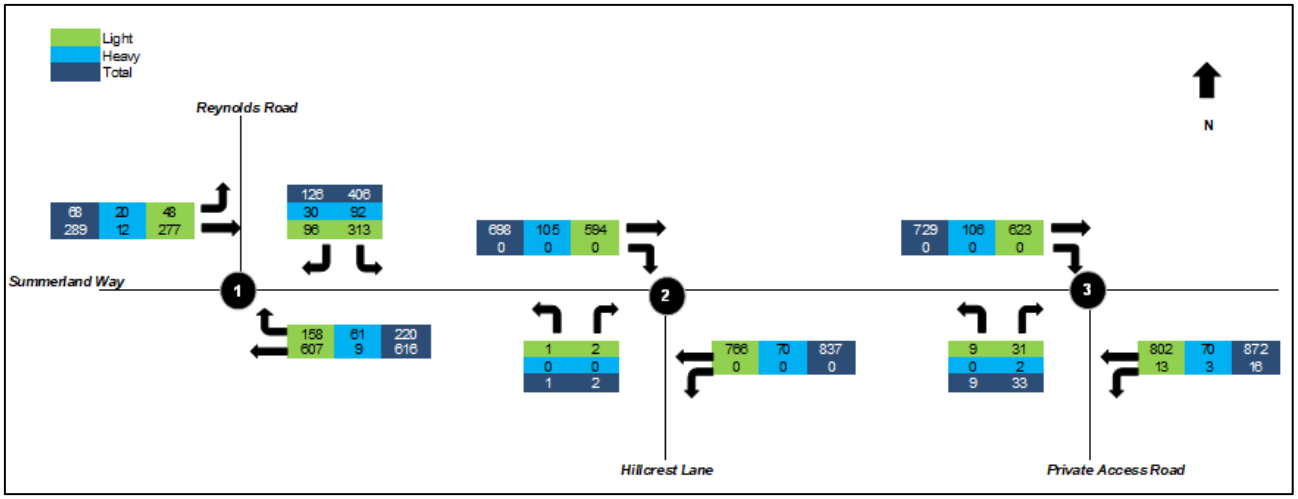


Figure 4.15 Summerland Way PM peak hour traffic volumes – 2041

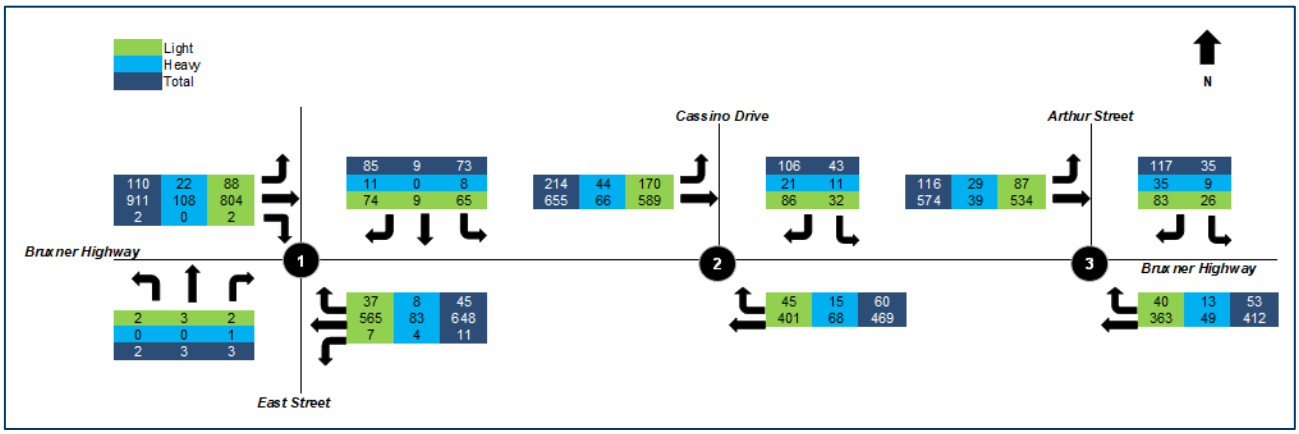


Figure 4.16 Bruxner Highway AM peak hour traffic volumes – 2041

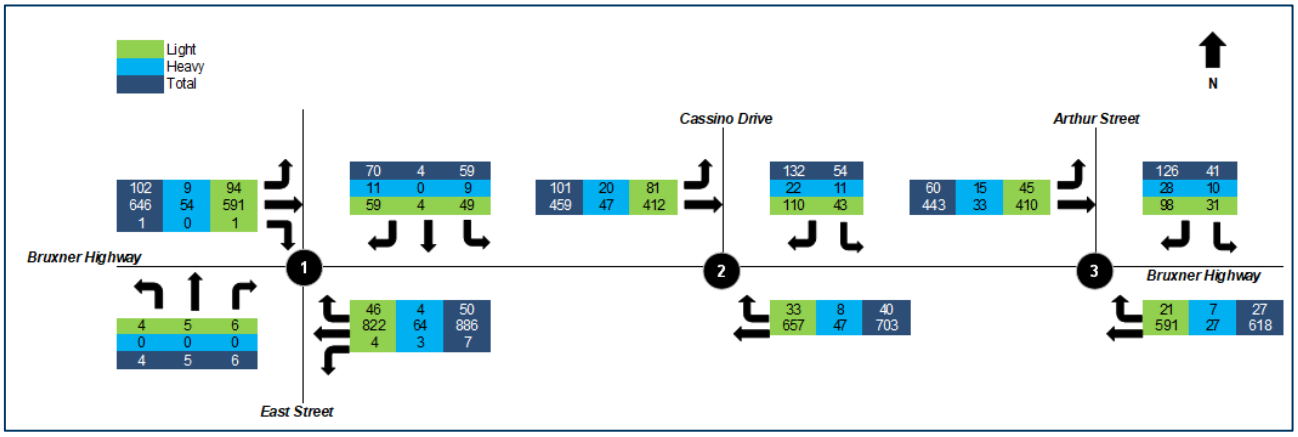


Figure 4.17 Bruxner Highway PM peak hour traffic volumes – 2041

The 2041 SIDRA outputs are displayed in Table 4.9.

Table 4.9 2041 Sidra outputs

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Summerland Way and Reynolds Road						
Summerland Way - east	39.9	C	174	2.8	A	12
Reynolds Road	13.7	A	17	10.9	A	19
Summerland Way - west	1.4	A	0	1.5	A	0
Total	**18.3**	**B**	**-**	**5.0**	**A**	**-**
Summerland Way and Hillcrest Lane						
Summerland Way - east	0.1	A	0	0.1	A	0
Summerland Way - west	0.2	A	0	0.1	A	0
Hillcrest Lane	102.0	F	6	26.2	B	0
Total	**0.6**	**A**	**-**	**0.2**	**A**	**-**
Summerland Way and Co-op access road						
Summerland Way - east	0.4	A	0	0.3	A	0
Summerland Way - west	0.7	A	5	0.1	A	1
Co-op access road	26.8	B	4	25.5	B	5
Total	**1.0**	**A**	**-**	**0.9**	**A**	**-**
Bruxner Highway and East Street (roundabout)						
East Street – south	13.3	A	1	17.2	B	2
Bruxner Highway – east	5.3	A	64	5.3	A	99
East Street – north	28.2	A	68	10.0	A	1
Bruxner Highway - west	4.9	A	130	4.4	A	7
Total	**7.1**	**A**	**-**	**5.4**	**A**	**-**
Bruxner Highway and Cassino Drive						
Bruxner Highway – east	8.1	A	27	1.8	A	7
Cassino Drive	>200	F	421	>200	F	463
Bruxner Highway – west	1.3	A	0	0.9	A	0
Total	**163.0**	**F**	**-**	**152.7**	**F**	**-**
Bruxner Highway and Arthur Street (roundabout)						
Bruxner Highway – east	7.0	A	10	6.7	A	13
Cassino Drive	13.5	A	9	12.3	A	9
Bruxner Highway – west	5.8	A	12	5.6	A	8
Total	**7.1**	**A**	**-**	**7.0**	**A**	**-**

The data in Table 4.9 indicates that:

– In the 2041 horizon year the intersections of interest typically operate with an acceptable LoS.

– At the intersection with Reynolds Road, the queues on the eastern leg of Summerland Way associated with vehicles accessing the Nammoona RJP will be in the order of 175 metres. The current right-turning lane has a length of approximately 150 metres. Accordingly, it may need to be lengthened slightly so that right turning vehicles do not inhibit northbound vehicles on Summerland Way.

– Vehicles on Hillcrest Lane seeking to exit onto Summerland Way in the AM peak hour and vehicles on Cassino Drive seeking to exit onto Bruxner Highway are expected to experience significant delays.

A review of the SIDRA model for Summerland Way/Hillcrest Lane indicates that the delays are associated with the right turning vehicles. Due to the chevron on Summerland Way (refer to Figure 4.18), right turning vehicles are required to traverse an additional three metres to head south. Accordingly, SIDRA allocates an increased gap acceptance parameter resulting in poor LoS.

Figure 4.18 Summerland Way and Hillcrest Lane

The intersection of Summerland Way and Hillcrest Lane was remodelled in SIDRA in the 2041 horizon years without the chevron, as displayed in Figure 4.19.

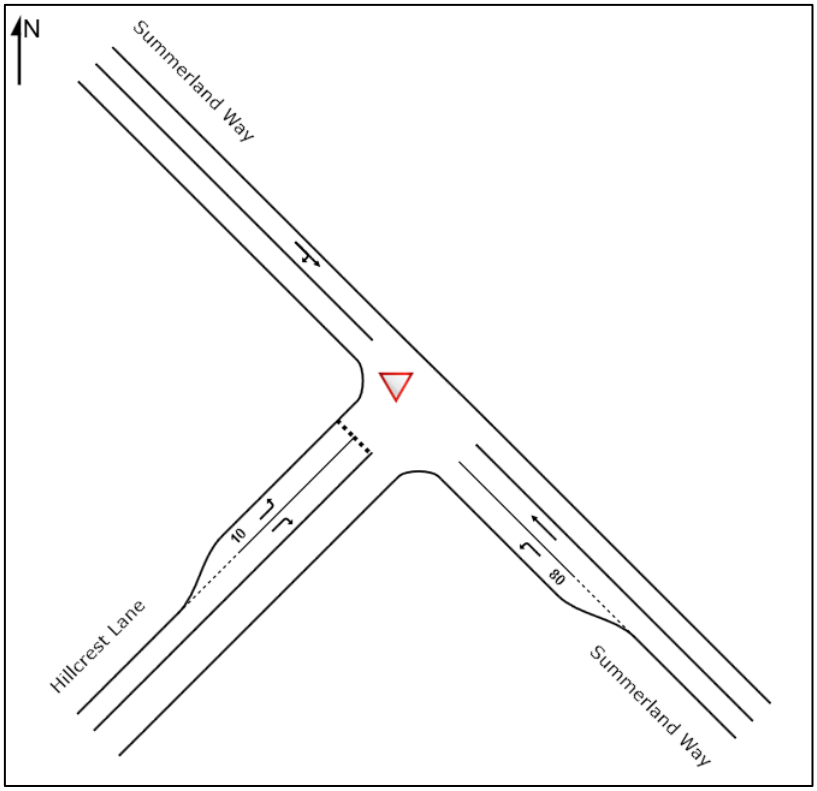


Figure 4.19 Summerland Way and Hillcrest Lane mitigated layout

The outputs of the 2041 SIDRA analysis for the intersection of Summerland Way and Hillcrest Lane, in accordance with the geometry displayed in Figure 4.19, are detailed in Table 4.10.

Table 4.10 Summerland Way and Hillcrest Lane - 2041 SIDRA outputs

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Summerland Way and Hillcrest Lane						
Summerland Way - east	0.1	A	0	0.1	A	0
Summerland Way - west	0.5	A	3	0.1	A	1
Hillcrest Lane	34.1	C	2	12.6	A	0
Total	**0.5**	**A**	**-**	**0.1**	**A**	**-**

The data in Table 4.10 indicates that based on the geometry displayed in Figure 4.19, the intersection of Summerland Way and Hillcrest Lane will operate with an acceptable LoS in the 2041 horizon year.

Analysis indicates that due to the heavy vehicle activity on Bruxner Highway, in the 2041 horizon year, there are insufficient gaps for vehicles to turn from Cassino Drive, resulting in long delays for outbound vehicles.

A potential mitigation measure is to construct a “seagull” layout at the intersection of Bruxner Highway and Cassino Drive. A seagull intersection would enable right turning vehicles from Cassino Drive to merge into the westbound traffic lane on Bruxner Highway.

A concept drawing of a seagull intersection (in accordance with Austroads Guidelines) at the intersection of Bruxner Highway and Cassino Drive is displayed in Figure 4.20.

Figure 4.20 Seagull configuration at the intersection of Cassino Drive/Bruxner Highway

It is noted that under a seagull arrangement, right turning vehicles seeking to access/egress properties to the west of Cassino Drive, would be required to cross the merge lane and chevron lane, which has potential safety issues. Accordingly, a seagull layout is not considered feasible at the intersection of Cassino Drive and Bruxner Highway.

An alternative mitigation measure is to ban right turn movements from Cassino Drive onto Bruxner Highway. Under this arrangement, vehicles could:

– Utilise the internal road network within the Johnston Street Industrial area and surrounds precinct to access Arthur Street and turn right onto Bruxner Highway.
– Turn left from Cassino Drive onto Bruxner Highway and undertake a U-turn at the Bruxner Highway/Arthur Street intersection.

For the purposes of analysis, it has been assumed that in the 2041 horizon year, 50 percent of the right turning vehicles will egress directly from Arthur Street, and 50 percent of vehicles will undertake a U-turn at the proposed roundabout.

The layout of the Bruxner Highway and Cassino Drive (left out only) intersection, as modelled in SIDRA in the 2041 horizon year, is displayed in Figure 4.21.

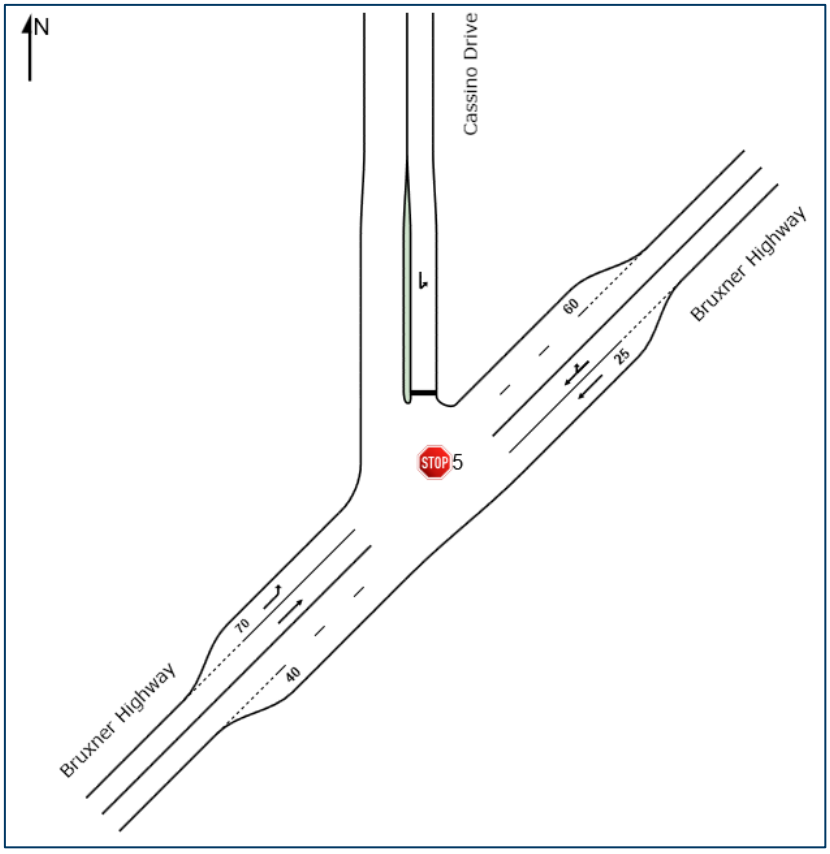


Figure 4.21 Bruxner Highway and Cassino Drive mitigated layout

The 2041 AM and PM peak hour traffic volumes for the intersections of Bruxner Highway/Cassino Drive and Bruxner Highway/Arthur Street, accounting for the removal of right turns from Cassino Drive, are displayed in Figure 4.22 and Figure 4.23, respectively.

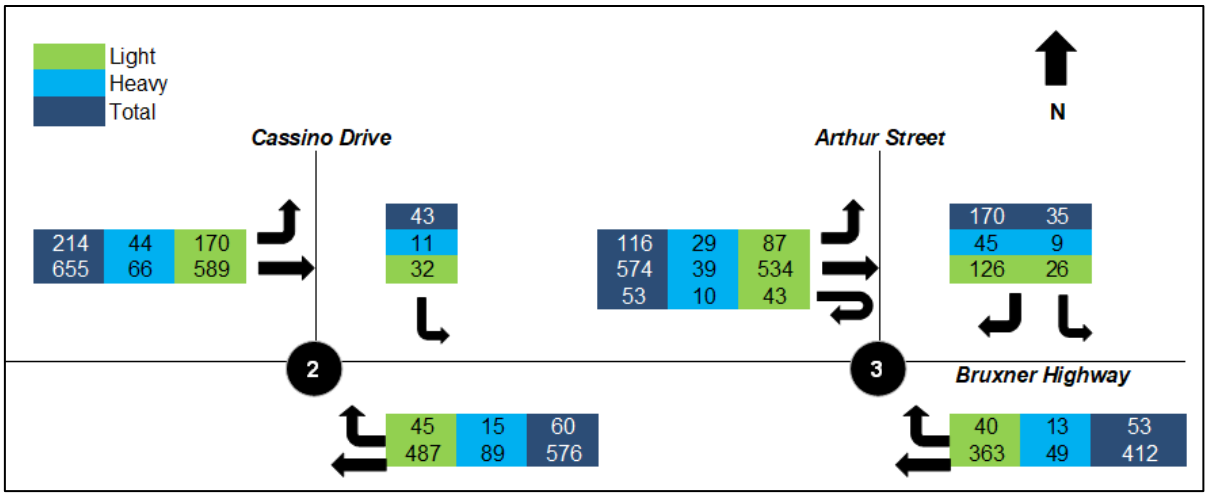


Figure 4.22 Bruxner Highway AM peak hour traffic volumes (no right turns Cassino Drive) – 2041

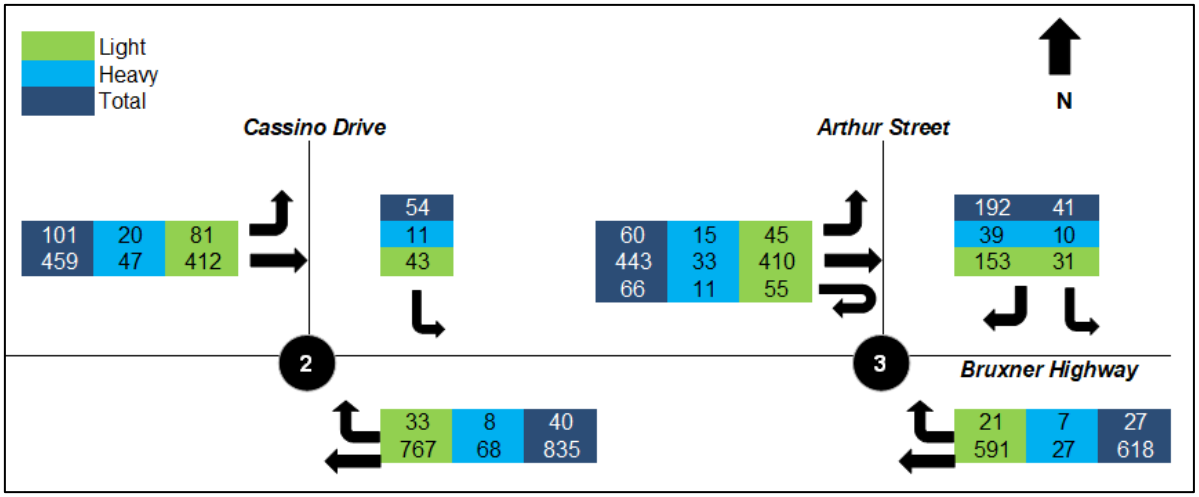


Figure 4.23 Bruxner Highway PM peak hour traffic volumes (no right turns Cassino Drive) – 2041

The 2041 SIDRA outputs for the intersections of Bruxner Highway/Cassino Drive and Bruxner Highway/Arthur Street, accounting for the removal of right turns from Cassino Drive, are displayed in Table 4.11.

Table 4.11 Bruxner Highway/Cassino Drive and Bruxner Highway/Arthur Street - 2041 SIDRA outputs

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Bruxner Highway and Cassino Drive (no right turn)						
Bruxner Highway – east	8.3	A	36	1.9	A	10
Cassino Drive	19.2	B	4	13.6	A	3
Bruxner Highway – west	1.4	A	0	1.0	A	0
Total	**4.7**	**A**	**-**	**2.0**	**A**	**-**
Bruxner Highway and Arthur Street (roundabout)						
Bruxner Highway – east	7.9	A	11	7.9	A	15
Arthur Street	14.2	A	13	13.2	A	13
Bruxner Highway – west	6.2	A	15	6.3	A	10
Total	**7.9**	**A**	**-**	**8.1**	**A**	**-**

The results in Table 4.11 indicate that in the 2041 horizon year if the right turn from Cassino Drive is removed and the associated traffic is redistributed onto the proposed roundabout at Arthur Street, both intersections with the Bruxner are expected to operate with a good LoS.

If in the 2041 horizon year, right turns from Cassino Drive are removed, vehicles seeking to exit the Johnston Street Johnston Street Industrial area and surrounds precinct (refer to Figure 3.3) could alternatively exit onto Spring Grove Road, travel southwards and turn right from East Street onto Bruxner Highway.

As detailed previously, Spring Grove Road is intended to support a secondary access to the Johnston Street Industrial area and surrounds precinct. Analysis has been undertaken for the following scenarios:

– In the AM peak hour, 40 percent of the right turning vehicles from Cassino Drive were distributed on the right turn from East Street on Bruxner Highway.
– In the PM peak hour, 50 percent of the right turning vehicles from Cassino Drive were distributed on the right turn from East Street on Bruxner Highway.

The 2041 AM and PM peak hour traffic volumes for the intersection of Bruxner Highway/East Street accounting for the removal of right turns from Cassino Drive are displayed in Figure 4.24 and Figure 4.25, respectively.

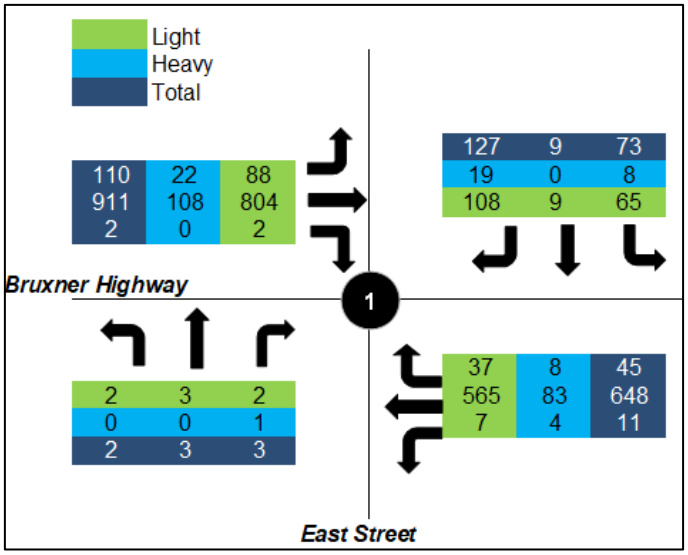


Figure 4.24 Bruxner Highway/East Street AM peak hour traffic volumes (no right turns Cassino Drive) – 2041

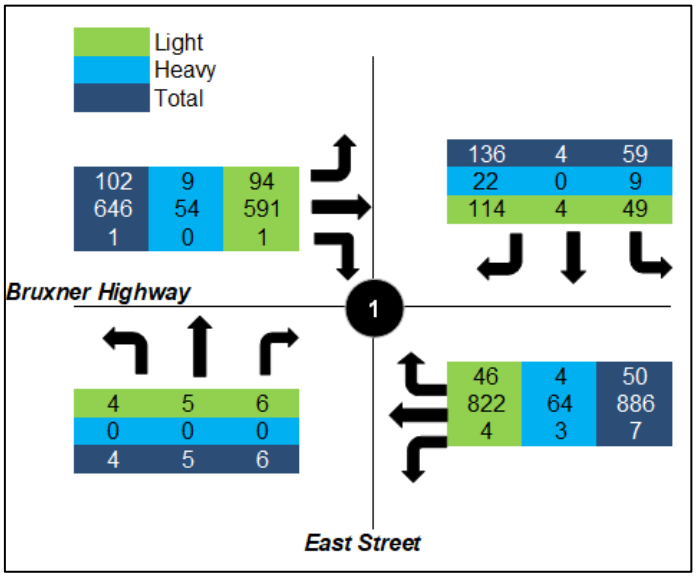


Figure 4.25 Bruxner Highway/East Street PM peak hour traffic volumes (no right turns Cassino Drive) – 2041

The 2041 SIDRA outputs, for the intersection of Bruxner Highway/East Street, accounting for the removal of right turns from Cassino Drive, are displayed in Table 4.12.

Table 4.12 Bruxner Highway/East Street - 2041 SIDRA outputs

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
Bruxner Highway and East Street						
East Street – south	14.2	A	1	19.6	B	3
Bruxner Highway – east	6.2	A	70	12.2	A	173
East Street – north	41.2	D	60	10.8	A	15
Bruxner Highway - west	5.0	A	135	4.4	A	58
Total	**9.4**	**A**	**-**	**9.1**	**A**	**-**

The data in Table 4.12 indicates that in the 2041 horizon year, if the right turns from Cassino Drive are removed and the associated traffic is partially redistributed onto East Street, the intersection of Bruxner Highway/East Street is expected to operate with a good LoS.

The 2041 SIDRA outputs are included in Appendix D.

4.4.3 Road upgrades

As detailed in Section 2.1.6, Reynolds Road:

– Between Summerland Way and Dargaville Drive has a road reserve width of approximately seven metres with marked centre lines.
– North of Dargaville Road, has a road reserve width of approximately six metres without centre lines.

As displayed in Figure 3.1, the Nammoona Industrial precinct proposes a vehicle access on Reynolds Roads, approximately 1.2 kilometres north of Dargaville Road.

It is recommended that the 1.2 kilometre section of Reynolds Road be widened prior to 2031 to support the vehicle activity associated the Nammoona Industrial precinct.

4.4.4 Summary

A summary of the impacts associated with the RJP and UGIAs and the recommended upgrades to the road network is provided below.

In 2031:

– Based on its current configuration, the intersection of Bruxner Highway/East Street is expected to operate with an unacceptable LoS in the AM peak hour.
– It is recommended that the intersection of Bruxner Highway/East Street be upgraded to a single lane roundabout (refer to Figure 4.10).
– It is recommended that the intersection of Bruxner Highway/Arthur Street be upgraded to a priority controlled T-junction to support access/egress to and from the Johnston Street Industrial area and surrounds precinct (refer to Figure 4.2).

In 2041:

– Based on their current configuration, the intersection of Summerland Way/Hillcrest Lane and Bruxner Highway/Cassino Drive are expected to operate with an unacceptable LoS in AM and PM peak hour periods. Due to the heavy volumes on Bruxner Highway, there are not sufficient gaps to support right turning vehicles from Cassino Drive.
– It is recommended that the chevrons on Summerland Way in proximity to Hillcrest Lane be removed to support an improved LoS.
– It is recommended that the intersection of Bruxner Highway/Arthur Street be upgraded to a roundabout to support access/egress to and from the Johnston Street Industrial area and surrounds precinct Nammoona Industrial area and surrounds precinct (refer to Figure 4.12).

– It is recommended that right turn movements be removed from Cassino Drive onto Bruxner Highway (refer to Figure 4.21).
– The provision of a priority controlled seagull at the intersection of Bruxner Highway and Cassino Drive is not considered feasible (refer to Figure 4.20).
– SIDRA analysis indicates that the proposed roundabouts at East Street and Arthur Street could accommodate the redistributed right turn movements from Cassino Drive.

4.4.5 Costings

4.4.5.1 Introduction

The preliminary indicative cost estimates do not include specific allowances for factors such as the relocation of utilities, site materials and land acquisition. Actual costs will be dependent on market conditions at the time of tendering and construction. A 50% contingency has been applied for such factors, pending detailed design. The estimates have been prepared using rates from current and previous projects GHD has been involved with. The estimate for each site includes the following:

– Civil works for intersection construction.
– 50 percent contingency due to stage of design.

The estimates exclude the following:

– All excavation will be undertaken in materials other than rock.
– No allowance has been made for contaminated materials.
– No allowance for utilities relocations.
– No allowance for property acquisitions.
– No allowance for design.
– It is noted that actual costs will be dependent on market conditions at the time of tendering and construction and will depend on other factors including (but not limited to) weather, access and material availability.

4.4.5.2 Intersections

Preliminary indicative cost estimates have been prepared for the construction of the UGIA access intersections detailed in Section 4.4.1 and 4.4.2 as follows:

– A priority controlled T-junction at the intersection of Bruxner Highway/Arthur Street (refer to Figure 4.2) - $2,119,238 (ex GST).
– A three legged roundabout at the intersection of Bruxner Highway/Arthur Street (refer to Figure 4.12) - $4,111,788 (ex GST).
– A four legged roundabout at the intersection of Bruxner Highway/East Street (refer to Figure 4.10) - $2,334,037 (ex GST).

It is noted that the cost of the roundabout at the Bruxner Highway/Arthur Street does not assume that a T-junction has already been constructed.

Additionally, costings have been prepared for the preferred and alternate access/egress intersection for the Johnston Street Industrial area and surrounds precinct, on Spring Grove Road (refer to Section 3.3). A concept drawing has been prepared for the preferred intersection as shown in Figure 3.4). The indicative cost estimates for the Spring Grove Road are as follows:

– Preferred location - $3,716,650 (ex GST)
– Alternate location - $2,374,330 (ex GST)

The higher cost for the preferred location is associated with the bridge structure over the drainage easement, adjacent to Spring Grove Road.

Additionally, the cost associated with extending the turning lane on Summerland Way (at Reynolds Road) and removing the chevrons on Summerland Way (at Hillcrest Lane) will be in the order of $20,000 (each for both items noted).

4.4.5.3 Roads

The indicative costs associated with the upgrade of Reynolds Road for a length of 1.2 kilometres north of Dargaville Drive with and additional width of one metre is $1,547,424 (ex GST), this includes earthworks, asphalt and linemarking.

A breakdown of the costing calculations for roads and intersections is provided in Appendix F.

4.5 Staging analysis

A low growth and high growth staging analysis has been completed for Lot 320 within the Johnston Street Industrial area and surrounds precinct. The analysis has been undertaken to determine the capacity of the existing intersection of Cassino Drive/Bruxner Highway to accommodate additional traffic volumes associated with the industrial area and the wider growth within and in proximity to the Casino Township.

It is noted that this staging analysis excludes other land uses associated with the Johnston Street Industrial area and surrounds precinct, i.e. the Primex sites.

The location of Lot 320 in the context of the Cassino Drive/Bruxner Highway intersection is displayed in Figure 4.26.

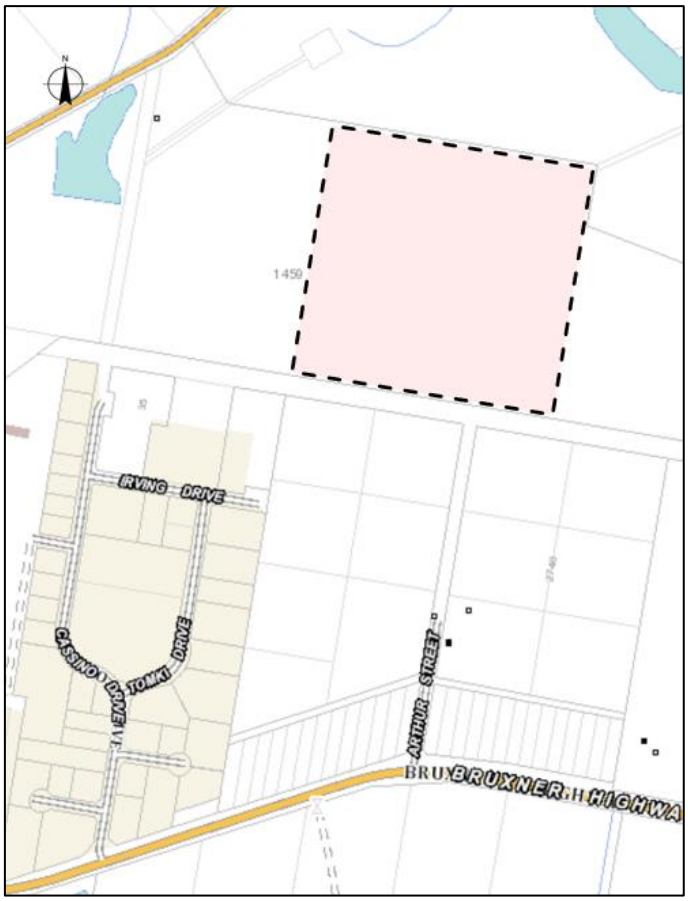


Figure 4.26 Lot 320 location

Source: Six Maps modified by GHD

Outputs from the Draft Structure Plan identify a northern and southern area within the Johnston Street industrial area and surrounds precinct that based on an inundation assessment are most likely to be subject to initial development.

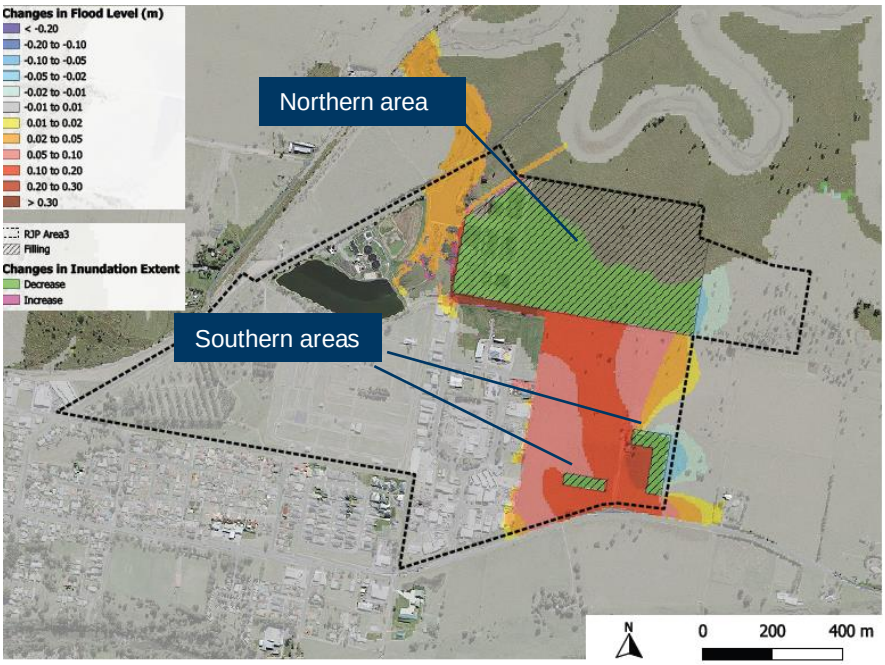


Figure 4.27 Stage 1 Key development areas

Source: Draft Structure Plan Richmond Valley Regional Job Precinct modified by GHD

The northern area is consistent with Lot 320 (refer to Figure 4.26), and as per the analysis below, it is assumed that access will initially be provided via Cassino Drive. Further, it is assumed that the southern areas will be accessed/egressed via an initial upgrade to Arthur Street, and then a further roundabout upgrade to accommodate the future requirements of the entirety of stage 1. These scenarios have also been considered in the infrastructure report staging. (ref; 12621341-REP_Utilities Infrastructure Analysis Report)

SIDRA analysis has been completed for the intersection of Cassino Drive and Bruxner Highway, accounting for the Lot 320 low growth scenario trips in the 2031 and 2041 horizon years and a high growth scenario in the 2026 and 2031 horizon years. It is noted that the Lot 320 analysis:

– Is intended to determine the capacity of Cassino Drive/Bruxner Highway and excludes the other Johnston Street Industrial area and surrounds precinct land uses.
– Assumes that the other proposed access/egress points at Arthur Street and Spring Grove Road have not been developed, i.e., all Lot 320 vehicle activity occurs via Cassino Highway/Bruxner Highway.
– Accounts for:
  - The previously listed assumptions with respect to the proposed residential areas are detailed in Section 4.2.2.
  - The trip distribution characteristics detailed in Section 4.3.2, i.e. 75 percent of trips will access/egress the site to and from the west (from the direction of Casino), and 25 percent of trips will access/egress the site to and from the east.
  - The background growth rates on the Bruxner Highway are detailed in Section 4.4, i.e. a five percent increase in background traffic volumes in 2031 and a ten percent increase in traffic volumes by 2041.

4.5.1 Scenario 1 – low growth

Based on information provided by the Client, the expected yield for the Lot 320 low growth scenario is displayed in Table 4.13.

Table 4.13 Lot 320 yield – low growth scenario

Year	Yield m²
2026	6,866
2031	12,302
2036	11,808
2041	8,366
Total	**39,342**

Utilising the Johnston Street Industrial area and surrounds precinct trip rates detailed in Section 4.1.3.1, the accumulated vehicle trips associated with the Lot 320 low growth land uses are displayed in Table 4.14.

Table 4.14 Lot 320 trip generation characteristics – low growth scenario

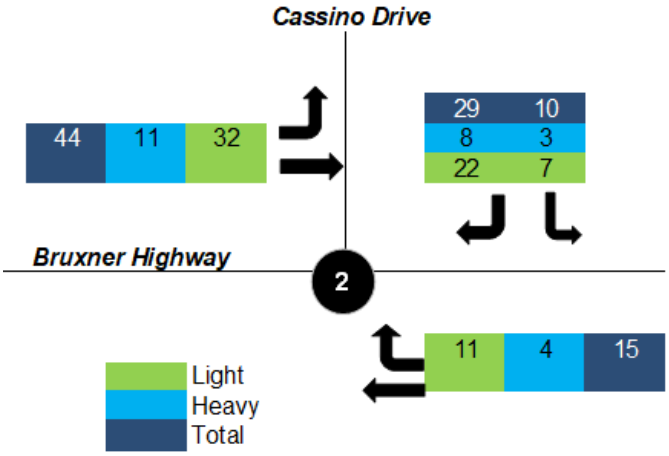
Year	GFA	AM peak hour		PM peak hour	
		Inbound	Outbound	Inbound	Outbound
2026	**6,866**	**21**	**14**	**11**	**16**
	Light vehicle	15	10	8	12
	Heavy vehicles	5	3	3	4
2031	**19,168**	**58**	**38**	**30**	**45**
	Light vehicle	43	29	22	34
	Heavy vehicles	14	10	7	11
2036	**30,976**	**93**	**62**	**48**	**72**
	Light vehicle	70	46	36	54
	Heavy vehicles	23	15	12	18
2041	**39,342**	**118**	**79**	**61**	**92**
	Light vehicle	89	59	46	69
	Heavy vehicles	30	20	15	23

The data in Table 4.14 indicates that the industrial land uses associated with Lot 320 low growth scenario will generate:

– 2026 – 35 vehicle trips in the AM peak hour and 27 trips in the PM peak hour.
– 2031 – 96 vehicle trips in the AM peak hour and 75 trips in the PM peak hour.
– 2036 - 155 vehicle trips in the AM peak hour and 120 trips in the PM peak hour.
– 2041 - 197 vehicle trips in the AM peak hour and 153 trips in the PM peak hour.

The trips associated with Lot 320 low growth scenario in the 2031 horizon year are displayed in Figure 4.28, and the 2041 horizon year trips are displayed in Figure 4.29.

AM Peak Hour



PM Peak Hour

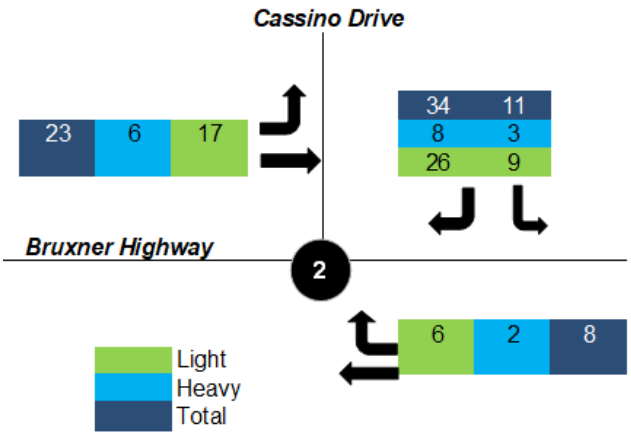
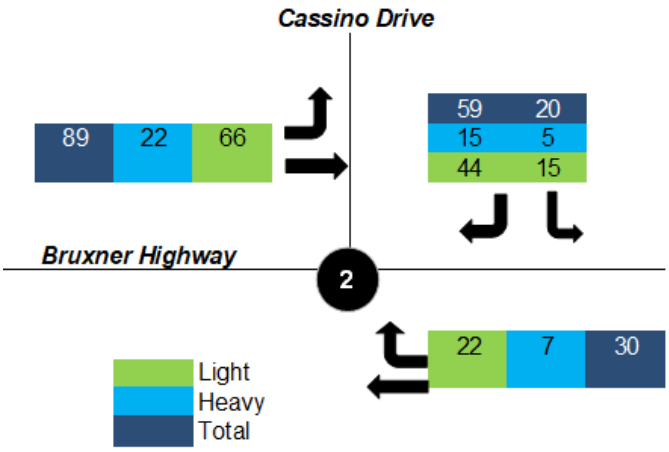


Figure 4.28 Lot 320 trips – 2031 -low growth scenario

AM Peak Hour



PM Peak Hour

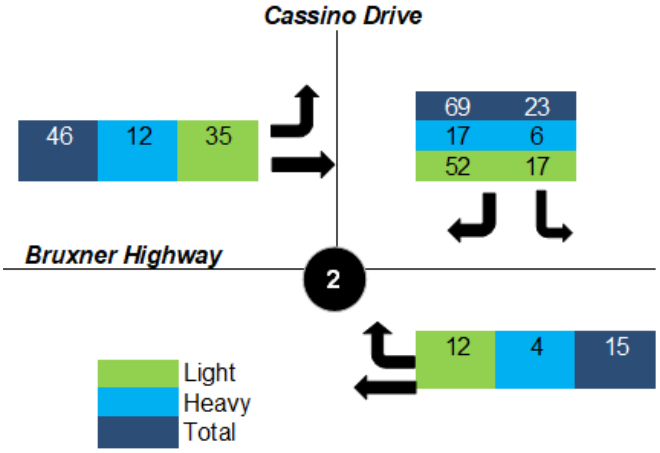
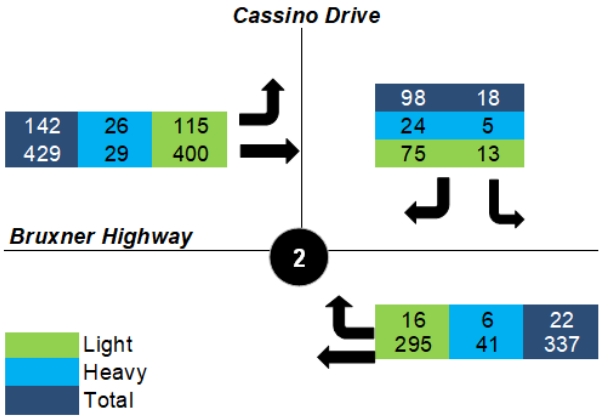


Figure 4.29 Lot 320 trips -2041- low growth scenario

The horizon year traffic volumes accounting for the Lot 320 low growth scenario trips, residential trips and background traffic growth are displayed in Figure 4.30 (2031 horizon year) and Figure 4.31 (2041 horizon year).

AM Peak Hour



PM Peak Hour

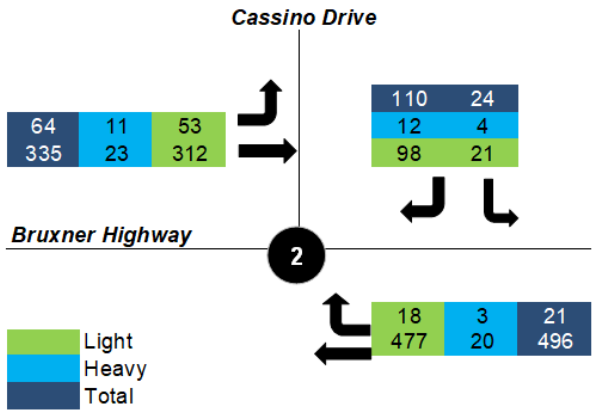
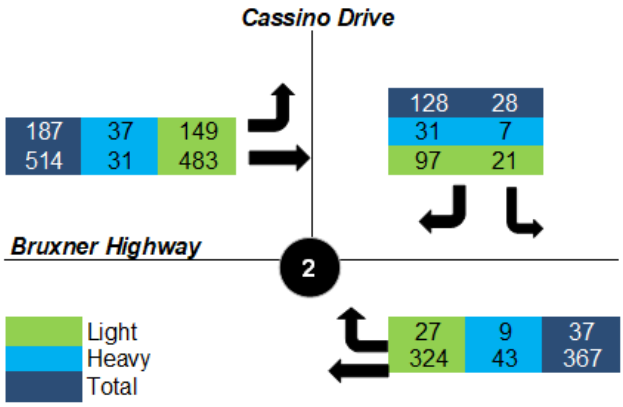


Figure 4.30 2031 traffic volumes (Lot 320) – low growth scenario

AM Peak Hour



PM Peak Hour

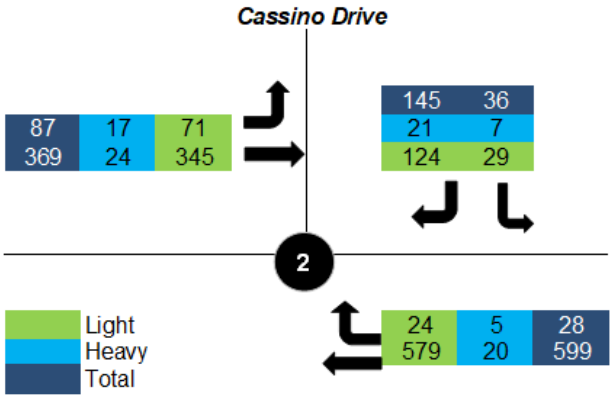


Figure 4.31 2041 traffic volumes (Lot 320) – low growth scenario

The SIDRA outputs for the intersection of Cassino Drive/Bruxner Highway accounting for the existing intersection configuration (as displayed in Figure 2.25) and the traffic volumes in Figure 4.30 (2031) and Figure 4.31 (2041), excluding the Primex site trips and potential additional access points on Arthur Street and Spring Grove Road are presented in Table 4.15.

Table 4.15 Cassino Drive/Bruxner Highway analysis (Lot 320) – low growth scenario

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
2031						
Bruxner Highway – east	1.7	A	4	0.9	A	2
Cassino Drive	53.6	D	30	37.9	C	23
Bruxner Highway – west	1.2	A	0	0.8	A	0
Total	**7.3**	**A**	**-**	**5.6**	**A**	**-**
2041						
Bruxner Highway – east	3.2	A	8	1.2	A	4
Cassino Drive	> 150	F	288	> 150	F	257
Bruxner Highway – west	1.3	A	0	1.0	A	1.0
Total	**62.2**	**E**	**-**	**53.7**	**D**	**-**

The data in Table 4.15 indicates that for the low growth scenario:

– For both the 2031 and 2041 analysis, the main delays are associated with vehicles turning right from Cassino Drive onto Bruxner Highway.
– The 2031 horizon year analysis indicates that Cassino Drive is approaching capacity, but generally operates within acceptable parameters.
– The 2041 horizon year Cassino Drive is operating beyond capacity with significant delays.

In summary, the staging analysis indicates that based upon the expected yields and timing for Lot 320 low growth scenario detailed in Table 4.13, the intersection of Cassino Drive and Bruxner Highway has the capacity to operate within generally actable parameters to 2031.

However:

– As per the analysis detailed in Section 4.4, subsequent to 2031, additional access points will be required, including via a new intersection on Spring Grove Road (refer to Figure 3.4) and/or via Arthur Street (refer to Figure 4.2 and Figure 4.12) in accordance with the Johnston Street Industrial area and surrounds precinct structure plan (refer to Figure 3.3).
– The upgrade of Arthur Street will also support access/egress to and from southern areas, as displayed in Figure 4.27.

4.5.2 Scenario 2 – high growth

Additional analysis has been undertaken for a scenario for Lot 320 high growth scenario. Based on information provided by the Client, the expected yield for the Lot 320 high growth scenario is displayed in Table 4.13.

Table 4.16 Lot 320 yield – high growth scenario

Year	Yield m²
2026	6,866
2031	24,604
2036	7,872
Total	**39,342**

Utilising the Johnston Street Industrial area and surrounds precinct trip rates detailed in Section 4.1.3.1, the accumulated vehicle trips associated with the Lot 320 high growth land uses are displayed in Figure 4.17.

Table 4.17 Lot 320 trip generation characteristics – high growth scenario

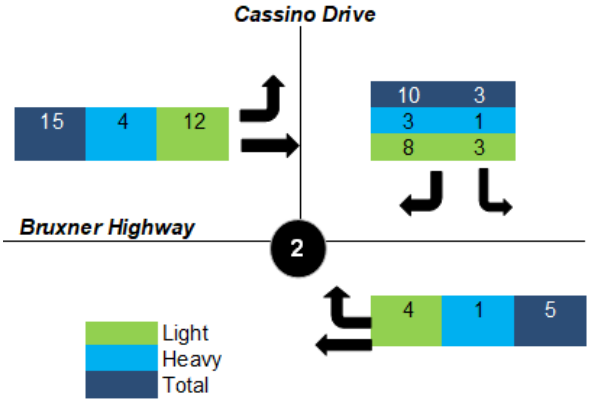
Year	GFA	AM peak hour		PM peak hour	
		Inbound	Outbound	Inbound	Outbound
2026	**6,866**	**21**	**14**	**11**	**16**
	Light vehicle	15	10	8	12
	Heavy vehicles	5	3	3	4
2031	**19,168**	**94**	**63**	**49**	**74**
	Light vehicle	71	47	37	55
	Heavy vehicles	24	16	12	18
2036	**39,342**	**118**	**79**	**61**	**92**
	Light vehicle	89	59	46	69
	Heavy vehicles	30	20	15	23

The data in Table 4.17 indicates that the industrial land uses associated with Lot 320 high growth scenario will generate:

– 2026 – 35 vehicle trips in the AM peak hour and 27 trips in the PM peak hour.
– 2031 – 157 vehicle trips in the AM peak hour and 123 trips in the PM peak hour.
– 2036 - 197 vehicle trips in the AM peak hour and 153 trips in the PM peak hour.

For the high growth scenario, analysis has been completed for the 2026 and 2031 horizon years. The trips associated with Lot 320 high growth scenario in the 2026 horizon year are displayed in Figure 4.32, and the 2031 horizon year trips are displayed in Figure 4.33.

AM Peak Hour



PM Peak Hour

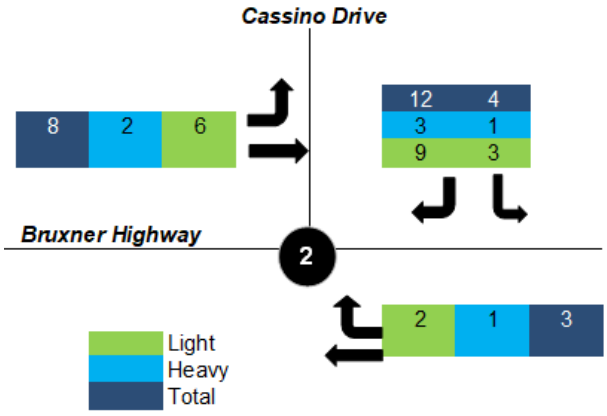
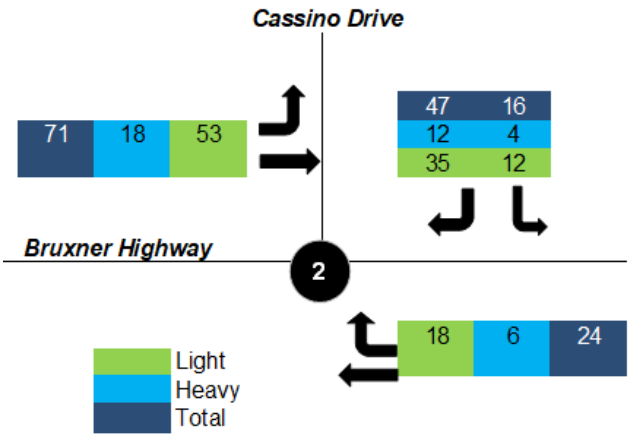


Figure 4.32 Lot 320 trips – 2026 -high growth scenario

AM Peak Hour



PM Peak Hour

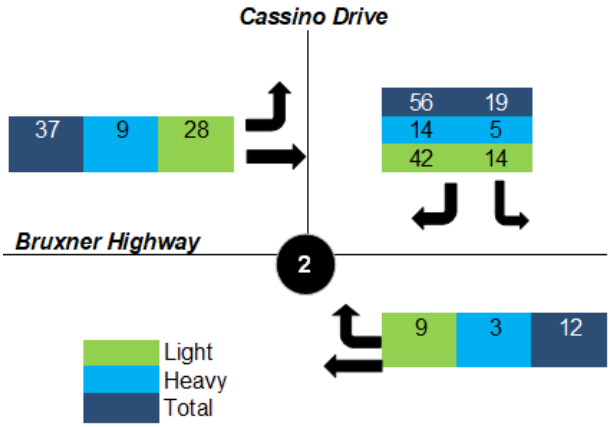


Figure 4.33 Lot 320 trips -2031- high growth scenario

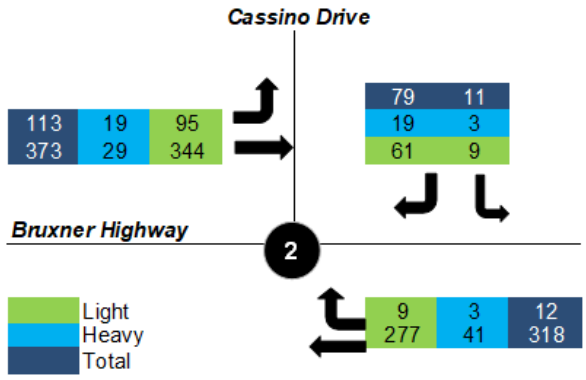
It is noted that for the 2026 horizon year to account for wider regional growth, an additional 2.5 percent growth rate has been applied to the through traffic on Bruxner Highway. Additionally, the following residential trips were applied to the analysis (refer to Table 4.18).

Table 4.18 Residential trip volumes (2026)

Year	Site	No Dwellings	AM peak hour		PM peak hour	
			Inbound	Outbound	Inbound	Outbound
2026	Barlings Lane	64	9	36	40	10
	Infill	30	4	17	19	5
	South Fairy Hill	237	25	101	111	28
	North Casino	7	1	4	4	1
	Total	**338**	**40**	**158**	**174**	**43**

The horizon year traffic volumes accounting for the Lot 320 high growth scenario trips, residential trips and background traffic growth are displayed in Figure 4.34 (2026 horizon year) and Figure 4.35 (2031 horizon year).

AM Peak Hour



PM Peak Hour

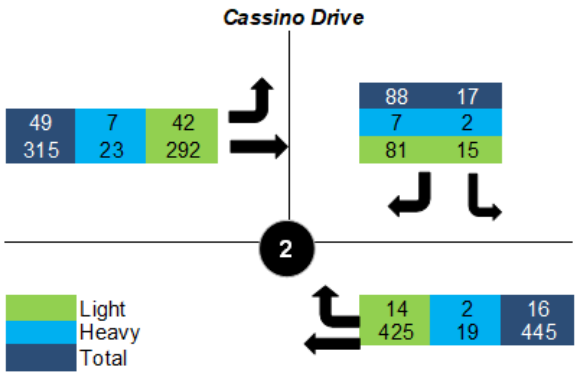
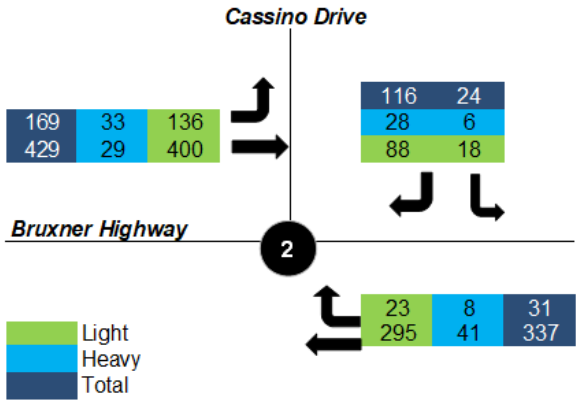


Figure 4.34 2026 traffic volumes (Lot 320) – high growth scenario

AM Peak Hour



PM Peak Hour

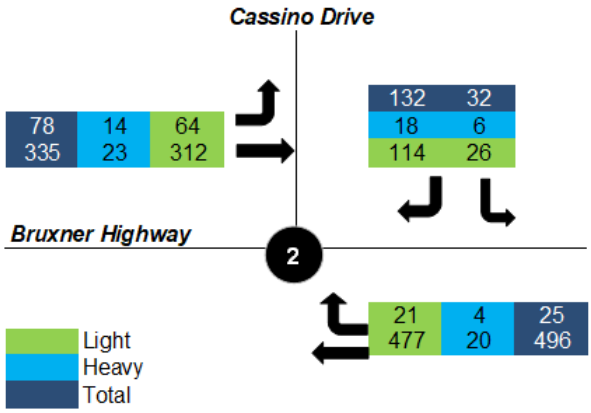


Figure 4.35 2031 traffic volumes (Lot 320) – high growth scenario

The SIDRA outputs for the intersection of Cassino Drive/Bruxner Highway accounting for the existing intersection configuration (as displayed in Figure 2.25) and the traffic volumes in Figure 4.34 (2026) and Figure 4.35 (2031), excluding the Primex site trips and potential additional access points on Arthur Street and Spring Grove Road, are presented in Table 4.19.

Table 4.19 Cassino Drive/Bruxner Highway analysis (Lot 320) – low growth scenario

Intersection	AM Peak			PM Peak		
	Av Delay (sec)	LOS	95th % Queue (m)	Av Delay (sec)	LOS	95th % Queue (m)
2026						
Bruxner Highway – east	0.9	A	2	0.7	A	2
Cassino Drive	32.4	C	15	25.4	B	12
Bruxner Highway – west	1.2	A	0	0.7	A	0
Total	**4.2**	**A**	**-**	**3.5**	**A**	**-**
2031						
Bruxner Highway – east	2.4	A	5	1.1	A	3
Cassino Drive	87.3	F	59	56.8	E	43
Bruxner Highway – west	1.4	A	0	0.9	A	0
Total	**12.6**	**A**	**-**	**9.3**	**A**	**-**

The data in Table 4.19 indicates that for the high growth scenario:

– For both the 2026 and 2031 analysis, the main delays are associated with vehicles turning right from Cassino Drive onto Bruxner Highway.
– The 2026 horizon year analysis indicates that the intersection of Cassino Drive is operating with an acceptable LoS.
– The 2031 horizon year Cassino Drive is operating beyond capacity with significant delays.

The staging analysis indicates that based upon the expected yields and timing for Lot 320 high growth scenario detailed in Table 4.16, the intersection of Cassino Drive and Bruxner Highway has the capacity to operate within generally actable parameters to 2026, but will reach capacity prior to 2031. Accordingly, additional access will be required to be constructed prior to 2031.

In summary, the analysis indicates that based upon the expected yields:

– The intersection of Cassino Drive and Bruxner Highway will operate with an acceptable LoS in the 2026 horizon year.
– In the 2031 horizon year the intersection of Cassino Drive and Bruxner Highway approaches capacity in the low growth scenario (based on a GFA 19,168 m^2) and is beyond capacity for the high growth scenario (based on a GFA.

Based upon the data and assumptions included in this report, the intersection of Arthur Street and Bruxner Highway should be upgraded to a roundabout (as displayed in Figure 4.12) by the time approximately 19,000 m^2 of the proposed industrial land uses within the Johnston Street industrial areas and surrounds precinct have been constructed.

If this High Growth scenario of lot 320 is realised, consideration should be given to the efficiencies of constructing the roundabout upgrade at Arthur Street/Bruxner Highway initially. This could avoid abortive or redundant pavement upgrades to the Arthur street intersection required for a low growth scenario.

All the Lot 320 SIDRA outputs are included in Appendix E.

5. Active and public transport

5.1 Active transport

As detailed in Section 2.3, the active transport facilities in proximity to the RJP subject sites is relatively poor. A summary of recommended upgrades to active transport for each of the RJP sites is provided below.

5.1.1 Nammoona Industrial precinct

As detailed in Section 1.4.4, some of the key visions for Summerland Way (as detailed in key planning documents) are to provide a safe, integrated traffic, cycle and pedestrian network and support the transport need of cyclists, pedestrians and public transport users.

The current layout/road reserve of Summerland Way does not provide any active transport infrastructure or support these visions.

Reynolds Road is about 3.2 km from the Casino Town Centre, which exceeds a comfortable walking distance. However, 3.2 km is a relatively comfortable cycling distance (less than 15 minutes). Additionally, reducing the speed limit on Summerland Way south of Reynolds Road to 60 km/h, would also provide a safer and more comfortable environment for cyclists.

It is recommended that Summerland Way between the Casino Township and Reynolds Road be widened to provide cycle paths, in accordance with the Austroads criteria displayed in Figure 5.1.

The data in Figure 4.5 and Figure 4.6 indicates that by 2031 Summerland Way south of Reynolds Road will accommodate 930 - 960 vehicles per hour.

The data in Figure 4.14 and Figure 4.15 indicates that by 2041 Summerland Way south of Reynolds Road will accommodate 1,530 – 1,550 vehicles per hour.

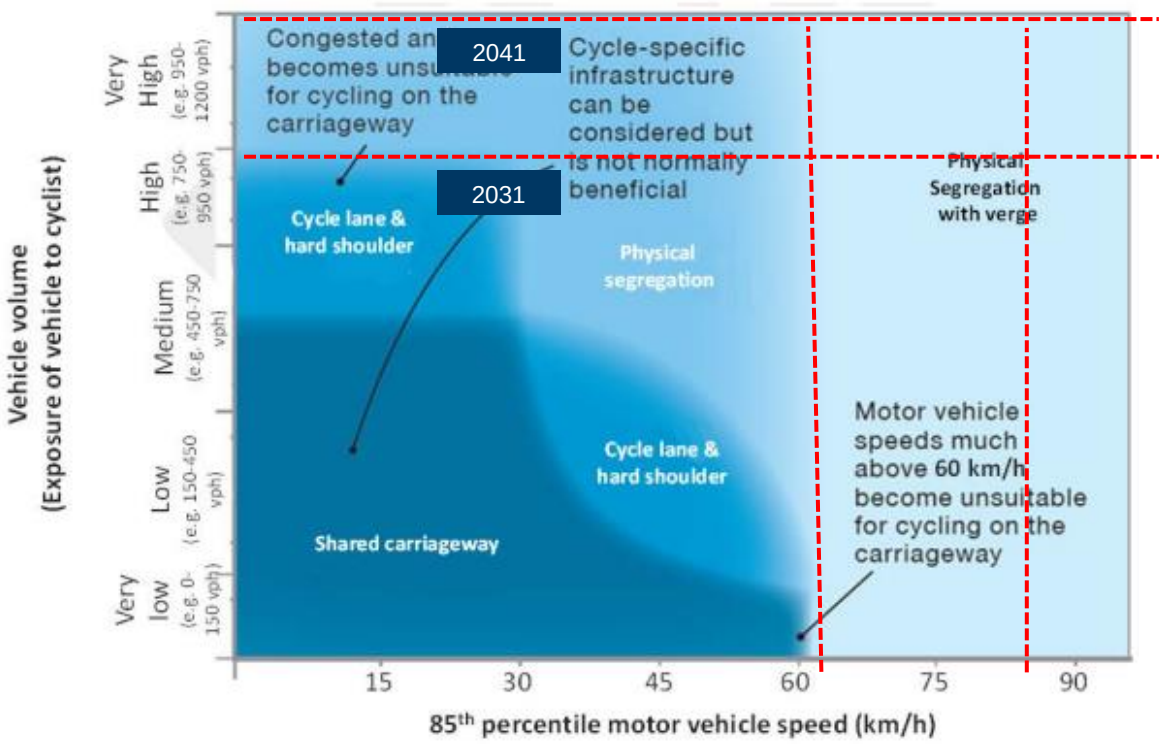


Figure 5.1 Bike path criteria

Source: Cycling Aspects of Austroads Guides

Preliminary analysis suggests that based on the data in Figure 5.1:

– Based on a 60 km/h speed limit on Summerland Way between Casino and Reynolds Road, the provision of physically separated bicycle lane would be appropriate.
– Based on a speed limit of 80 km/h on Summerland Way, a physically separated bike lane with supporting verges would be required.

It is noted that TfNSW have indicated a preference for a separated shared path on the Summerland Way.

As described in Section 1.4.6, the PAMP proposes a shared path on Summerland Way between Hotham Street and Reynolds Road. This path would support active transport connectivity between the Nammoona RJP and the Casino Township.

The Austroads Guide to Road Design Part 6A: Paths for walking and cycling indicates that bicycle paths have a desirable minimum width of between 2.5 m – 3 m.

Additional items to consider when reviewing the provision of active transport to the Nammoona Industrial precinct include:

– Providing an active transport path into the industrial areas from Summerland Way. It is not suggested that heavy vehicles and cyclists share Reynolds Road, unless a dedicated path is provided.
– Providing a bi-directional cycle path on the north-east side of Summerland Way, so northbound cyclists are not required to cross a busy road to access the Nammoona Industrial precinct (which is consistent with the PAMP).

A summary of the active transport recommendations for the Nammoona Industrial precinct, are as follows:

– Design the proposed upgrades for the active transport paths on Summerland Way and Reynolds Road.
– Reduce the speed limit on Summerland Way in proximity to Reynolds Road from 80 km/h to 60 km/h.
– Prepare an advocacy strategy[2] to plan and construct cycling facilities on Summerland Way.
– Seek funding from State and Federal Governments to support regional and local active transport upgrades.
– Implement bike paths/shared paths on Summerland Way and Reynolds Road.

[2] Advocacy strategies should include goal, objectives, target groups, specific activities, stakeholder roles, time frames and expected outcomes

5.1.2 Casino Food Co-op and surrounds precinct

As detailed in Section 3.2, no land uses are currently put forth in the Casino Food Co-op and surrounds precinct as part of the RJP. This is due to the Nammoona, Johnston Street Industrial area and surrounds precinct being identified as being sufficient to accommodate the required commercial/industrial land uses in Casino.

The proposed shared path on Summerland Way detailed in the PAMP would provide utility to the Casino Food Co-op site.

5.1.3 Johnston Street Industrial area and surrounds precinct

The proximity of the Johnston Street Industrial area and surrounds precinct to the Casino township, highlights that walking and cycling should be encouraged as mode shares. The upgrades of the active transport infrastructure in proximity to the industrial areas would provide utility to future employees/residents of the industrial and the wider Casino community.

A significant majority of pedestrians and cyclists would be expected to access/egress the Johnston Street Industrial area and surrounds precinct to/from the west, as there are limited residential developments to the east.

Within Casino, Bruxner Highway has a speed limit of 50 km/h to 60 km/h. To the east of Cassino Drive, the speed limit increases to 100 km/h outside the Casino Township.

The Bruxner Highway currently provides a concrete footpath between West Street and Cassino Drive. It is recommended that the footpath be extended east on Bruxner Highway from Cassino Drive to additional access intersection constructed for the Johnston Street Industrial area and surrounds precinct (as required).

The Bruxner Highway typically provides wide shoulders within Casino, however, in proximity to Cassino Drive the shoulder widths narrow to order of one metre or less. It is recommended that dedicated cycle paths be constructed along the Bruxner Highway between West Street, Cassino Drive and the additional access intersection(s) constructed for the Johnston Street Industrial area and surrounds precinct (as required).

The bike path should be constructed in accordance with the speed limit on the Bruxner Highway and the projected traffic volumes, in accordance with the criteria included in Figure 5.1.

The data in Figure 4.7 and Figure 4.8 indicates that by 2031 Summerland Way south of Reynolds Road will accommodate 930 - 960 vehicles per hour.

The data in Figure 4.16 and Figure 4.17 indicates that by 2041 Summerland Way south of Reynolds Road will accommodate 1,250 – 1,550 vehicles per hour.

Preliminary analysis suggests that based on the data in Figure 5.1:

– Based on a 60 km/h speed limit on Bruxner Highway between Casino and Arthur Street, the provision of physically separated bicycle lane would be appropriate.
– Based on a speed limit of 80 km/h or more on Bruxner Highway, a physically separated bike lane with supporting verges would be required.

A summary of the active recommendations for the Johnston Street Industrial area and surrounds precinct, are as follows:

– Update the PAMP to include the upgrade of the active transport infrastructure on the Bruxner Highway.
– Design the proposed active transport upgrades on the Bruxner Highway.
– Reduce the speed limit on the Bruxner Highway in proximity to Johnston Street Industrial area and surrounds precinct to the west of Arthur Street from 100 km/h to 60 km/h.
– Seek funding from State and Federal Governments to support regional and local active transport upgrades on the Bruxner Highway.
– Implement bike paths/shared paths on Bruxner Highway.

As detailed in Section 1.4.7, it is proposed to construct a 13.5 kilometre active transport rail trail along a disused rail corridor between Casino and the town of Bentley. This trail will primarily support a recreational function, however it will also provide an opportunity for residents of North Casino to cycle to and from key employment areas, particularly the Johnston Street Industrial area and surrounds precinct.

5.1.4 Costings

The following active transport items have been costed:

– The provision of a bi-directional bike path on Reynolds Road with a length of two kilometres.
– The provision of a bi-directional bike path on Bruxner Highway between West Street and Cassino Drive, with a length of 2.4 kilometres.

As the PAMP proposes an active transport path on Summerland Way and Hotham Street it has been excluded from the costing assessment.

Preliminary indicative cost estimates have been prepared for the construction of the bike paths on Reynolds Road and Bruxner Highway, as follows:

– Bruxner Highway – $1,267,488 (ex GST)
– Reynolds Road – $1,497,477 (ex GST)

The costs identified above are associated with the provision of physically separated bike paths in accordance with the criteria displayed in Figure 5.1.

5.2 Public transport

As displayed in Section 2.2, the current public transport services (bus and train) in Casino are infrequent and provide little utility to the RJP area or UGIAs. Further, there are no bus stops in proximity to the RJP subject sites.

If there is a significant increase in patronage demand associated with the employees of commercial/industrial developments associated with the RJP or residential dwellings associated with the UGIAs, it is recommended that bus services be reviewed to determine the feasibility of providing services (including appropriately located bus stops) to the RJP subject sites.

A summary of the public transport recommendations for the RJP, are as follows:

– Prepare a bus improvement strategy and funding submission.
– Assess potential bus services demand associated with the RJP/UGIA.
– If funding is available, trial improved bus services in Casino and its surrounds.
– Advocate to make the improved bus services permanent.
– Continue to monitor the operation of bus services and advocate for route upgrades to account for changes in population densities, demographics and geographic distribution (if required).

Appendices

Appendix A

Traffic survey outputs

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Bruxner Hwy and Cassino Dr, Casino

GPS	-28.861113, 153.068773

Date:	Tue 25/10/22
Weather:	Overcast
Suburban:	Casino
Customer:	GHD

North:	Cassino Dr
East:	Bruxner Hwy
South:	N/A
West:	Bruxner Hwy

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	7:45 AM-8:45 AM
	PM:	4:00 PM-5:00 PM

All Vehicles

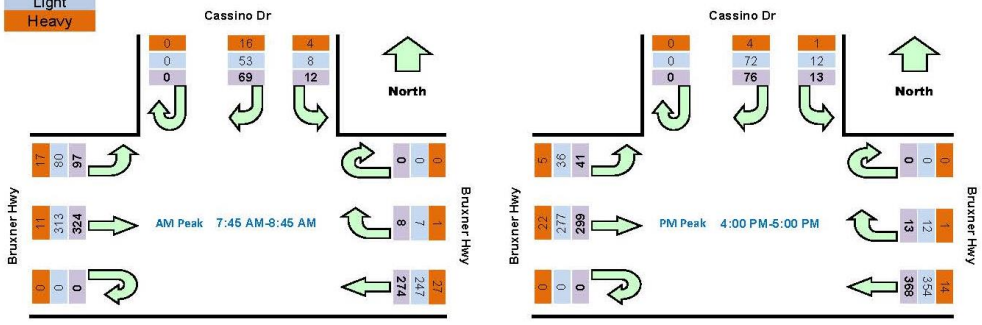
Time		North Approach Cassino Dr			East Approach Bruxner Hwy			West Approach Bruxner Hwy			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
6:00	6:15	0	5	3	0	4	17	0	60	19	562	
6:15	6:30	0	9	0	0	7	20	0	79	34	590	
6:30	6:45	0	13	0	0	2	34	0	63	20	607	
6:45	7:00	0	31	2	0	4	44	0	77	15	644	
7:00	7:15	0	14	3	0	1	19	0	79	20	679	
7:15	7:30	0	10	1	0	1	36	0	100	18	732	
7:30	7:45	0	10	1	0	2	55	0	75	26	774	
7:45	8:00	0	22	4	0	3	64	0	87	28	784	Peak
8:00	8:15	0	19	2	0	2	69	0	79	18	781	
8:15	8:30	0	12	2	0	2	78	0	89	25		
8:30	8:45	0	16	4	0	1	63	0	69	26		
8:45	9:00	0	22	0	0	2	54	0	98	29		
16:00	16:15	0	27	4	0	5	83	0	77	13	810	Peak
16:15	16:30	0	11	4	0	3	85	0	72	8	778	
16:30	16:45	0	25	1	0	3	127	0	90	10	785	
16:45	17:00	0	13	4	0	2	73	0	60	10	727	
17:00	17:15	0	27	3	0	1	71	0	66	9	714	
17:15	17:30	0	15	0	0	1	116	0	51	7	642	
17:30	17:45	0	8	2	0	2	132	0	45	9	558	
17:45	18:00	0	11	2	0	2	93	0	36	5	432	
18:00	18:15	0	8	1	0	1	56	0	34	5	346	
18:15	18:30	0	7	0	0	0	64	0	29	6		
18:30	18:45	1	5	1	0	0	44	0	19	2		
18:45	19:00	0	3	0	0	0	38	0	20	2		

Peak Time		North Approach Cassino Dr			East Approach Bruxner Hwy			West Approach Bruxner Hwy			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
7:45	8:45	0	69	12	0	8	274	0	324	97	784
16:00	17:00	0	76	13	0	13	368	0	299	41	810

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Bruxner Hwy and East St, Casino

GPS -28.859878, 153.055890

Date:	Tue 25/10/22
Weather:	Overcast
Suburban:	Casino
Customer:	GHD

North:	East St
East:	Bruxner Hwy
South:	East St
West:	Bruxner Hwy

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	4:30 PM-5:30 PM

All Vehicles

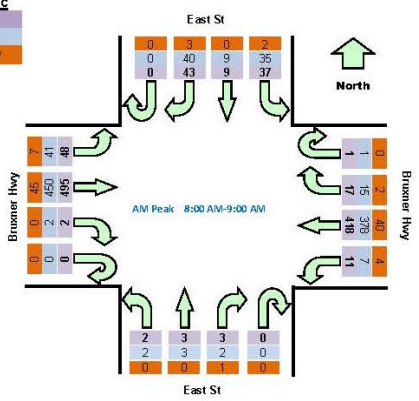
Time		North Approach East St				East Approach Bruxner Hwy				South Approach East St				West Approach Bruxner Hwy				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:00	6:15	0	3	0	12	0	2	42	2	0	0	0	0	0	0	81	5	691	
6:15	6:30	0	4	0	14	0	1	36	0	0	1	1	1	0	0	100	7	745	
6:30	6:45	0	3	0	8	0	6	55	0	0	2	1	0	0	0	80	5	766	
6:45	7:00	0	7	0	15	0	6	84	0	0	1	0	0	0	0	96	10	816	
7:00	7:15	0	6	1	9	0	5	53	2	0	0	0	0	0	0	110	15	844	
7:15	7:30	0	3	0	8	0	4	53	0	0	3	0	1	0	0	104	10	880	
7:30	7:45	0	9	0	10	0	6	77	0	0	1	0	1	0	0	103	3	983	
7:45	8:00	0	13	1	6	0	4	87	2	0	1	0	0	0	0	124	9	1041	
8:00	8:15	0	6	1	10	0	5	91	0	0	1	1	0	0	1	111	10	1089	Peak
8:15	8:30	0	12	2	10	0	3	121	2	0	0	1	1	0	0	122	15		
8:30	8:45	0	14	3	8	1	3	109	4	0	1	0	0	0	0	115	10		
8:45	9:00	0	11	3	9	0	6	97	5	0	1	1	1	0	1	147	13		
16:00	16:15	0	11	2	8	0	6	130	3	0	0	1	1	0	0	119	17	1119	
16:15	16:30	0	10	1	7	0	4	107	2	0	1	1	1	0	0	99	14	1093	
16:30	16:45	0	5	1	6	0	9	159	1	0	3	1	0	0	1	130	18	1121	Peak
16:45	17:00	0	5	0	5	0	6	110	1	0	2	2	2	0	0	96	11	1051	
17:00	17:15	0	2	0	5	0	5	130	3	0	0	2	2	0	0	102	21	1013	
17:15	17:30	0	9	1	7	0	7	148	4	0	4	0	0	0	1	83	11	930	
17:30	17:45	0	11	3	6	0	6	138	5	0	1	0	1	0	0	79	14	807	
17:45	18:00	0	6	1	3	0	8	105	1	0	0	0	0	0	1	63	14	671	
18:00	18:15	0	8	1	3	0	11	92	2	0	0	3	1	0	1	61	6	560	
18:15	18:30	0	7	0	3	0	5	75	3	0	1	0	0	0	0	43	15		
18:30	18:45	0	11	0	4	0	1	63	0	0	0	0	0	0	0	36	13		
18:45	19:00	0	4	1	1	0	0	50	0	0	0	0	0	0	0	32	3		

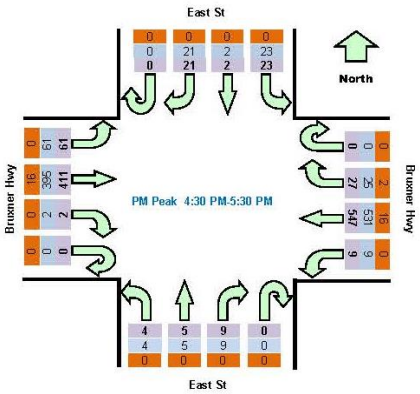
Peak Time		North Approach East St				East Approach Bruxner Hwy				South Approach East St				West Approach Bruxner Hwy				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	43	9	37	1	17	418	11	0	3	3	2	0	2	495	48	1089
16:30	17:30	0	21	2	23	0	27	547	9	0	9	5	4	0	2	411	61	1121

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy





TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Summerland Way and Reynolds Rd, Casin

GPS -28.838025, 153.028537

Date:	Tue 25/10/22
Weather:	Overcast
Suburban:	Casino
Customer:	GHD

North:	Reynolds Rd
East:	Summerland Way
South:	N/A
West:	Summerland Way

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	4:00 PM-5:00 PM

All Vehicles

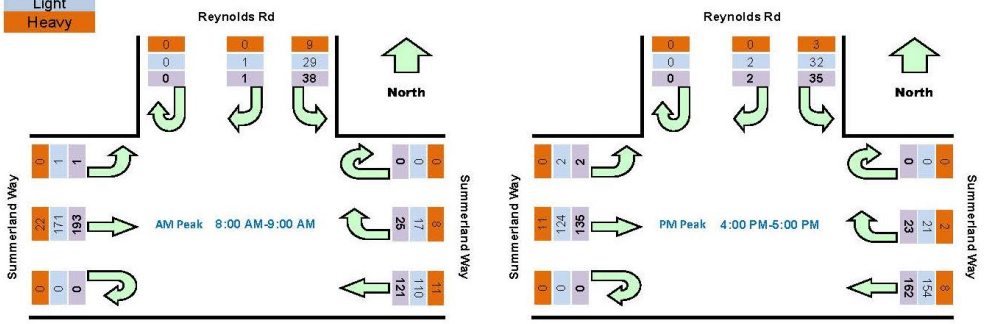
Time		North Approach Reynolds Rd			East Approach Summerland W			West Approach Summerland W			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
6:00	6:15	0	0	2	0	3	17	0	12	0	186	
6:15	6:30	0	1	2	0	4	18	0	21	0	215	
6:30	6:45	0	0	3	0	5	17	0	26	0	230	
6:45	7:00	0	0	4	0	12	14	0	25	0	258	
7:00	7:15	0	1	6	0	6	18	0	31	1	287	
7:15	7:30	0	0	5	0	5	22	0	28	1	328	
7:30	7:45	0	0	4	0	14	22	0	37	2	362	
7:45	8:00	0	0	11	0	8	35	0	30	0	374	
8:00	8:15	0	0	12	0	7	30	0	54	1	379	Peak
8:15	8:30	0	0	6	0	9	38	0	42	0		
8:30	8:45	0	1	11	0	4	24	0	51	0		
8:45	9:00	0	0	9	0	5	29	0	46	0		
16:00	16:15	0	1	9	0	3	41	0	41	0	359	Peak
16:15	16:30	0	0	10	0	6	34	0	39	2	356	
16:30	16:45	0	1	8	0	8	50	0	28	0	348	
16:45	17:00	0	0	8	0	6	37	0	27	0	316	
17:00	17:15	0	0	15	0	7	47	0	22	1	302	
17:15	17:30	0	0	7	0	7	31	0	38	0	257	
17:30	17:45	0	0	3	0	3	30	0	26	1	217	
17:45	18:00	0	0	1	0	1	39	0	23	0	175	
18:00	18:15	0	0	3	0	2	28	0	14	0	138	
18:15	18:30	0	0	1	0	2	25	0	15	0		
18:30	18:45	0	1	2	0	0	8	0	10	0		
18:45	19:00	0	0	0	0	5	11	0	10	1		

Peak Time		North Approach Reynolds Rd			East Approach Summerland W			West Approach Summerland W			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
8:00	9:00	0	1	38	0	25	121	0	193	1	379
16:00	17:00	0	2	35	0	23	162	0	135	2	359

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY trafficsurvey.com.au

Intersection of Access Driveway and Summerland Way, Casino

GPS -28.845690, 153.038142

Date:	Tue 25/10/22
Weather:	Overcast
Suburban:	Casino
Customer:	GHD

North:	Summerland Way
East:	Access Driveway
South:	Summerland Way
West:	Private Co-Operative Access

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	7:45 AM-8:45 AM
	PM:	4:00 PM-5:00 PM

All Vehicles

Time		North Approach Summerland Way				East Approach Access Driveway				South Approach Summerland Way				Approach Private Co-Operative Acces				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:00	6:15	0	2	17	0	0	0	0	0	0	0	22	22	0	6	0	0	275	
6:15	6:30	0	0	27	0	0	0	0	0	0	0	23	11	0	1	0	0	297	
6:30	6:45	0	2	34	0	0	0	0	0	0	0	27	6	0	2	0	0	327	
6:45	7:00	0	4	26	0	0	0	0	0	0	0	32	9	0	2	0	0	351	
7:00	7:15	0	5	42	0	0	0	0	0	0	0	34	8	0	2	0	0	387	
7:15	7:30	0	3	38	0	0	0	0	0	0	0	38	8	0	3	0	2	438	
7:30	7:45	0	5	45	0	0	0	0	0	0	0	37	6	0	2	0	0	469	
7:45	8:00	0	1	53	0	0	0	0	0	0	0	46	3	0	5	0	1	501	Peak
8:00	8:15	0	3	75	0	0	0	0	0	0	0	50	8	0	4	0	2	493	
8:15	8:30	0	1	58	0	0	0	0	0	0	0	45	6	0	12	0	1		
8:30	8:45	0	0	80	0	0	0	0	0	0	0	34	9	0	2	0	2		
8:45	9:00	1	0	53	0	0	0	0	0	0	0	41	3	0	3	0	0		
16:00	16:15	0	0	59	0	0	0	0	0	0	0	48	8	0	11	0	4	472	Peak
16:15	16:30	0	0	47	0	0	0	0	0	0	0	50	5	0	2	0	1	458	
16:30	16:45	0	0	43	0	0	0	0	0	0	0	70	1	0	16	0	2	447	
16:45	17:00	0	0	49	0	0	0	0	0	0	0	48	2	0	4	0	2	396	
17:00	17:15	0	0	41	0	0	0	0	0	0	1	64	1	0	8	0	1	377	
17:15	17:30	0	0	49	0	0	0	0	0	0	0	40	0	0	5	0	0	328	
17:30	17:45	0	0	33	0	0	0	0	1	0	0	44	0	0	2	0	1	292	
17:45	18:00	0	0	34	0	0	0	0	0	0	0	47	2	0	2	0	1	250	
18:00	18:15	0	0	22	0	0	0	0	0	0	0	39	2	0	3	0	1	207	
18:15	18:30	0	0	16	0	0	0	0	0	0	1	34	3	0	4	0	0		
18:30	18:45	0	0	21	0	0	0	0	0	0	0	16	0	0	2	0	0		
18:45	19:00	0	0	13	0	0	0	0	0	0	1	25	2	0	2	0	0		

Peak Time		North Approach Summerland Way				East Approach Access Driveway				South Approach Summerland Way				Approach Private Co-Operative Acces				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
7:45	8:45	0	5	266	0	0	0	0	0	0	0	175	26	0	23	0	6	501
16:00	17:00	0	0	198	0	0	0	0	0	0	0	216	16	0	33	0	9	472

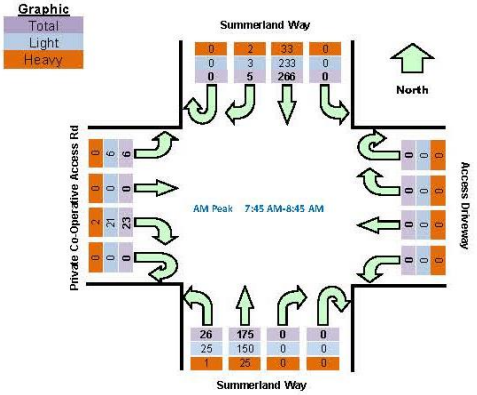
Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

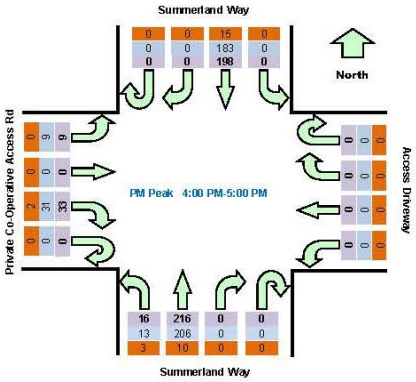
Graphic

Total

Light

Heavy





TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Summerland Way and Hillcrest Ln, Casino

GPS -28.840194, 153.031533

Date:	Tue 25/10/22
Weather:	Overcast
Suburban:	Casino
Customer:	GHD

North:	N/A
East:	Summerland Way
South:	Hillcrest Ln
West:	Summerland Way

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	4:00 PM-5:00 PM

All Vehicles

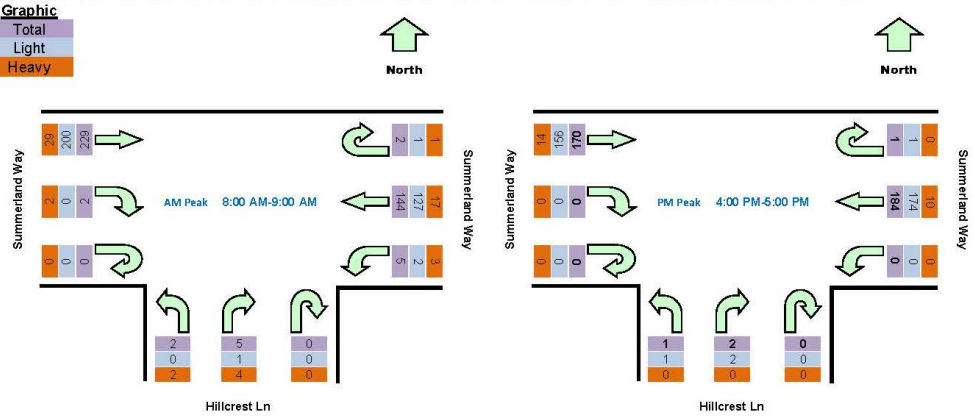
Time		East Approach Summerland W			South Approach Hillcrest Ln			West Approach Summerland W			Hourly Total	
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
6:00	6:15	0	20	2	0	0	0	0	1	13	196	
6:15	6:30	0	21	0	0	1	1	0	1	22	223	
6:30	6:45	0	22	5	0	0	0	0	1	28	244	
6:45	7:00	0	25	2	0	1	1	0	0	29	268	
7:00	7:15	0	23	1	0	1	1	0	0	37	295	
7:15	7:30	0	27	7	0	0	0	0	1	32	337	
7:30	7:45	0	35	0	0	3	1	0	1	40	368	
7:45	8:00	0	42	0	0	1	1	0	1	40	382	
8:00	8:15	0	37	1	0	1	0	0	1	65	389	Peak
8:15	8:30	0	45	0	0	3	2	0	0	48		
8:30	8:45	1	28	3	0	0	0	0	0	62		
8:45	9:00	1	34	1	0	1	0	0	1	54		
16:00	16:15	0	44	0	0	0	0	0	0	50	358	Peak
16:15	16:30	0	40	0	0	0	0	0	0	49	355	
16:30	16:45	0	57	0	0	1	1	0	0	36	349	
16:45	17:00	1	43	0	0	1	0	0	0	35	316	
17:00	17:15	0	54	0	0	0	0	0	0	37	301	
17:15	17:30	0	38	0	0	0	0	0	1	44	257	
17:30	17:45	0	33	0	0	0	0	0	0	29	217	
17:45	18:00	0	39	1	0	0	1	0	0	24	177	
18:00	18:15	0	29	0	0	0	1	0	1	16	138	
18:15	18:30	0	27	0	0	0	0	0	0	16		
18:30	18:45	1	8	0	0	1	0	0	0	12		
18:45	19:00	0	16	0	0	0	0	0	0	10		

Peak Time		East Approach Summerland W			South Approach Hillcrest Ln			West Approach Summerland W			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
8:00	9:00	2	144	5	0	5	2	0	2	229	389
16:00	17:00	1	184	0	0	2	1	0	0	170	358

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Appendix B

SIDRA outputs 2022

MOVEMENT SUMMARY

▽ Site: 1 [2022 | AM | Existing | Summerland Way - Reynolds Road (Site Folder: Existing Scenario)]

Summerland Way & Reynolds Road
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
5	T1	121	11	127	9.1	0.069	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
6	R2	25	8	26	32.0	0.027	8.7	LOS A	0.1	0.9	0.33	0.60	0.33	52.1
Approach		146	19	154	13.0	0.069	1.5	NA	0.1	0.9	0.06	0.10	0.06	73.2
NorthEast: Reynolds Road														
7	L2	38	9	40	23.7	0.036	5.3	LOS A	0.1	1.1	0.14	0.50	0.14	45.3
9	R2	1	0	1	0.0	0.001	6.1	LOS A	0.0	0.0	0.36	0.52	0.36	45.8
Approach		39	9	41	23.1	0.036	5.3	LOS A	0.1	1.1	0.15	0.50	0.15	45.3
NorthWest: Summerland Way														
10	L2	1	0	1	0.0	0.030	6.9	LOS A	0.0	0.0	0.00	0.01	0.00	74.4
11	T1	193	22	203	11.4	0.082	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		194	22	204	11.3	0.082	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
All Vehicles		379	50	399	13.2	0.082	1.2	NA	0.1	1.1	0.04	0.09	0.04	71.7

MOVEMENT SUMMARY

▽ Site: 1 [2022 | PM | Existing | Summerland Way - Reynolds Road (Site Folder: Existing Scenario)]

Summerland Way & Reynolds Road
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
5	T1	162	8	171	4.9	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
6	R2	23	2	24	8.7	0.020	7.8	LOS A	0.1	0.6	0.26	0.58	0.26	59.1
Approach		185	10	195	5.4	0.090	1.0	NA	0.1	0.6	0.03	0.07	0.03	76.6
NorthEast: Reynolds Road														
7	L2	35	3	37	8.6	0.030	5.0	LOS A	0.1	0.8	0.11	0.50	0.11	45.7
9	R2	2	0	2	0.0	0.002	6.0	LOS A	0.0	0.0	0.34	0.52	0.34	45.8
Approach		37	3	39	8.1	0.030	5.0	LOS A	0.1	0.8	0.12	0.50	0.12	45.7
NorthWest: Summerland Way														
10	L2	2	0	2	0.0	0.021	6.9	LOS A	0.0	0.0	0.00	0.04	0.00	74.0
11	T1	135	11	142	8.1	0.057	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	79.8
Approach		137	11	144	8.0	0.057	0.2	NA	0.0	0.0	0.00	0.01	0.00	79.7
All Vehicles		359	24	378	6.7	0.090	1.1	NA	0.1	0.8	0.03	0.09	0.03	72.5

MOVEMENT SUMMARY

STOP Site: 2 [2022 | AM | Existing | Summerland Way - Hillcrest Lane (Site Folder: Existing Scenario)]

Summerland Way & Hillcrest Lane
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
10	L2	5	3	5	60.0	0.004	8.0	LOS A	0.0	0.0	0.00	0.63	0.00	46.8
11	T1	144	17	152	11.8	0.083	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach		149	20	157	13.4	0.083	0.3	NA	0.0	0.0	0.00	0.02	0.00	77.7
NorthWest: Summerland Way														
5	T1	229	29	241	12.7	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
6	R2	2	2	2	100.0	0.003	10.2	LOS A	0.0	0.1	0.33	0.56	0.33	46.3
Approach		231	31	243	13.4	0.134	0.1	NA	0.0	0.1	0.00	0.00	0.00	79.3
SouthWest: Hillcrest Lane														
7	L2	2	2	2	100.0	0.003	12.9	LOS A	0.0	0.2	0.32	0.93	0.32	40.4
9	R2	5	4	5	80.0	0.012	15.3	LOS B	0.0	0.4	0.48	0.95	0.48	41.2
Approach		7	6	7	85.7	0.012	14.6	LOS B	0.0	0.4	0.44	0.94	0.44	41.0
All Vehicles		387	57	407	14.7	0.134	0.4	NA	0.0	0.4	0.01	0.03	0.01	77.2

MOVEMENT SUMMARY

Site: 2 [2022 | PM | Existing | Summerland Way - Hillcrest Lane (Site Folder: Existing Scenario)]

Summerland Way & Hillcrest Lane
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
10	L2	1	0	1	0.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	53.5
11	T1	184	10	194	5.4	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Apprcach		185	10	195	5.4	0.102	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
NorthVest: Summerland Way														
5	T1	170	14	179	8.2	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
6	R2	1	0	1	0.0	0.001	7.7	LOS A	0.0	0.0	0.29	0.55	0.29	51.9
Apprcach		171	14	180	8.2	0.097	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
SouthWest: Hillcrest Lane														
7	L2	1	0	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.29	0.83	0.29	44.1
9	R2	2	0	2	0.0	0.003	9.5	LOS A	0.0	0.1	0.39	0.83	0.39	43.7
Apprcach		3	0	3	0.0	0.003	9.1	LOS A	0.0	0.1	0.36	0.83	0.36	43.8
All Vehicles		359	24	378	6.7	0.102	0.1	NA	0.0	0.1	0.00	0.01	0.00	79.1

MOVEMENT SUMMARY

Site: 3 [2022 | AM | Existing | Summerland Way - Co-op Access Road (Site Folder: Existing Scenario)]

Summerland Way & Co-op access road
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
10	L2	26	1	27	3.8	0.015	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.1
11	T1	175	25	184	14.3	0.103	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		201	26	212	12.9	0.103	0.9	NA	0.0	0.0	0.00	0.08	0.00	77.5
NorthWest: Summerland Way														
5	T1	266	33	280	12.4	0.162	0.1	LOS A	0.1	0.5	0.02	0.01	0.02	79.7
6	R2	5	2	5	40.0	0.162	9.1	LOS A	0.1	0.5	0.02	0.01	0.02	59.4
Approach		271	35	285	12.9	0.162	0.2	NA	0.1	0.5	0.02	0.01	0.02	79.2
SouthWest: Co-op Access Road														
7	L2	6	0	6	0.0	0.032	5.1	LOS A	0.1	0.8	0.36	0.59	0.36	45.7
9	R2	23	2	24	8.7	0.032	6.4	LOS A	0.1	0.8	0.36	0.59	0.36	45.6
Approach		29	2	31	6.9	0.032	6.2	LOS A	0.1	0.8	0.36	0.59	0.36	45.7
All Vehicles		501	63	527	12.6	0.162	0.8	NA	0.1	0.8	0.03	0.07	0.03	75.3

MOVEMENT SUMMARY

Site: 3 [2022 | PM | Existing | Summerland Way - Co-op Access Road (Site Folder: Existing Scenario)]

Summerland Way and Co-op access road
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Summerland Way														
10	L2	16	3	17	18.8	0.010	4.7	LOS A	0.0	0.0	0.00	0.52	0.00	46.4
11	T1	216	10	227	4.6	0.119	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		232	13	244	5.6	0.119	0.4	NA	0.0	0.0	0.00	0.04	0.00	49.7
NorthWest: Summerland Way														
5	T1	198	15	208	7.6	0.113	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	79.9
6	R2	1	0	1	0.0	0.113	7.9	LOS A	0.0	0.1	0.00	0.00	0.00	74.1
Approach		199	15	209	7.5	0.113	0.0	NA	0.0	0.1	0.00	0.00	0.00	79.9
SouthWest: Co-op Access Road														
7	L2	9	0	9	0.0	0.043	7.7	LOS A	0.1	1.0	0.36	0.66	0.36	63.7
9	R2	33	2	35	6.1	0.043	8.6	LOS A	0.1	1.0	0.36	0.66	0.36	61.8
Approach		42	2	44	4.8	0.043	8.4	LOS A	0.1	1.0	0.36	0.66	0.36	62.2
All Vehicles		473	30	498	6.3	0.119	0.9	NA	0.1	1.0	0.03	0.08	0.03	60.4

MOVEMENT SUMMARY

Site: 4 [2022 | AM | Existing | Bruxner Highway - East Street (Site Folder: Existing Scenario)]

Bruxner Highway and East Street
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: East Street														
7	L2	2	0	2	0.0	0.024	9.6	LOS A	0.1	0.6	0.67	0.97	0.67	26.0
2	T1	3	0	3	0.0	0.024	18.5	LOS B	0.1	0.6	0.67	0.97	0.67	44.1
9	R2	3	1	3	33.3	0.024	16.6	LOS B	0.1	0.6	0.67	0.97	0.67	37.1
Approach		8	1	8	12.5	0.024	15.6	LOS B	0.1	0.6	0.67	0.97	0.67	36.9
East: Bruxner Highway														
10	L2	11	4	12	36.4	0.268	7.9	LOS A	0.4	2.8	0.09	0.03	0.09	51.5
11	T1	418	40	440	9.6	0.268	0.3	LOS A	0.4	2.8	0.09	0.03	0.09	51.2
6	R2	17	2	18	11.8	0.268	8.8	LOS A	0.4	2.8	0.09	0.03	0.09	52.7
Approach		446	46	469	10.3	0.268	0.8	NA	0.4	2.8	0.09	0.03	0.09	51.3
North: East Street														
7	L2	37	2	39	5.4	0.301	12.3	LOS A	1.1	8.2	0.75	1.05	0.90	37.2
8	T1	9	0	9	0.0	0.301	20.8	LOS B	1.1	8.2	0.75	1.05	0.90	42.0
9	R2	43	3	45	7.0	0.301	25.7	LOS B	1.1	8.2	0.75	1.05	0.90	31.3
Approach		89	5	94	5.6	0.301	19.6	LOS B	1.1	8.2	0.75	1.05	0.90	35.0
West: Bruxner Highway														
10	L2	48	7	51	14.6	0.315	4.8	LOS A	0.0	0.3	0.01	0.05	0.01	53.9
5	T1	495	45	521	9.1	0.315	0.0	LOS A	0.0	0.3	0.01	0.05	0.01	56.7
6	R2	2	0	2	0.0	0.315	7.3	LOS A	0.0	0.3	0.01	0.05	0.01	54.1
Approach		545	52	574	9.5	0.315	0.5	NA	0.0	0.3	0.01	0.05	0.01	56.2
All Vehicles		1088	104	1145	9.6	0.315	2.3	NA	1.1	8.2	0.11	0.13	0.12	49.3

MOVEMENT SUMMARY

Site: 4 [2022 | PM | Existing | Bruxner Highway - East Street (Site Folder: Existing Scenario)]

Bruxner Highway and East Street
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: East Street														
7	L2	4	0	4	0.0	0.040	10.2	LOS A	0.1	0.8	0.67	0.98	0.67	26.3
2	T1	5	0	5	0.0	0.040	19.1	LOS B	0.1	0.8	0.67	0.98	0.67	44.6
9	R2	6	0	6	0.0	0.040	12.7	LOS A	0.1	0.8	0.67	0.98	0.67	40.0
Approach		15	0	16	0.0	0.040	14.2	LOS A	0.1	0.8	0.67	0.98	0.67	37.7
East: Bruxner Highway														
10	L2	7	3	7	42.9	0.310	7.9	LOS A	0.5	3.3	0.09	0.03	0.10	51.2
11	T1	506	17	533	3.4	0.310	0.3	LOS A	0.5	3.3	0.09	0.03	0.10	51.7
6	R2	25	1	26	4.0	0.310	8.0	LOS A	0.5	3.3	0.09	0.03	0.10	53.2
Approach		538	21	566	3.9	0.310	0.8	NA	0.5	3.3	0.09	0.03	0.10	51.9
North: East Street														
7	L2	26	2	27	7.7	0.211	10.8	LOS A	0.7	5.2	0.72	1.00	0.76	37.6
8	T1	4	0	4	0.0	0.211	19.9	LOS B	0.7	5.2	0.72	1.00	0.76	42.5
9	R2	31	2	33	6.5	0.211	24.8	LOS B	0.7	5.2	0.72	1.00	0.76	31.8
Approach		61	4	64	6.6	0.211	18.5	LOS B	0.7	5.2	0.72	1.00	0.76	35.1
West: Bruxner Highway														
10	L2	60	1	63	1.7	0.283	4.6	LOS A	0.0	0.2	0.01	0.07	0.01	54.6
5	T1	444	22	467	5.0	0.283	0.0	LOS A	0.0	0.2	0.01	0.07	0.01	56.3
6	R2	1	0	1	0.0	0.283	7.8	LOS A	0.0	0.2	0.01	0.07	0.01	53.9
Approach		505	23	532	4.6	0.283	0.6	NA	0.0	0.2	0.01	0.07	0.01	55.9
All Vehicles		1119	48	1178	4.3	0.310	1.8	NA	0.7	5.2	0.10	0.11	0.10	50.3

MOVEMENT SUMMARY

Site: 5 [2022 | AM | Existing | Bruxner Highway- Cassino Drive (Site Folder: Existing Scenario)]

Bruxner - Cassino Drive
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Bruxner Highway														
11	T1	264	25	278	9.5	0.128	0.3	LOS A	0.1	1.0	0.04	0.02	0.04	59.6
26b	R3	7	2	7	28.6	0.128	10.3	LOS A	0.1	1.0	0.06	0.02	0.06	56.7
Approach		271	27	285	10.0	0.128	0.6	NA	0.1	1.0	0.04	0.02	0.04	59.5
North: RoadName														
7b	L3	8	2	8	25.0	0.013	11.6	LOS A	0.0	0.4	0.44	0.86	0.44	43.7
9a	R1	69	16	73	23.2	0.277	23.4	LOS B	1.1	9.2	0.77	1.11	0.89	38.7
Approach		77	18	81	23.4	0.277	22.1	LOS B	1.1	9.2	0.74	1.09	0.84	39.2
SouthWest: Bruxner Highway														
30a	L1	98	15	103	15.3	0.060	4.8	LOS A	0.0	0.0	0.00	0.56	0.00	53.6
5	T1	335	28	353	8.4	0.191	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		433	43	456	9.9	0.191	1.1	NA	0.0	0.0	0.00	0.13	0.00	58.4
All Vehicles		781	88	822	11.3	0.277	3.0	NA	1.1	9.2	0.09	0.18	0.10	56.0

MOVEMENT SUMMARY

Site: 5 [2022 | PM | Existing | Bruxner Highway- Cassino Drive (Site Folder: Existing Scenario)]

Bruxner - Cassino Drive
Site Category: Existing Design
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND 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	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Bruxner Highway														
11	T1	368	14	387	3.8	0.172	0.3	LOS A	0.2	1.2	0.04	0.02	0.04	59.6
26b	R3	13	1	14	7.7	0.172	8.7	LOS A	0.2	1.2	0.06	0.03	0.06	57.8
Approach		381	15	401	3.9	0.172	0.6	NA	0.2	1.2	0.04	0.02	0.04	59.5
North: RoadName														
7b	L3	13	1	14	7.7	0.017	10.4	LOS A	0.1	0.4	0.40	0.86	0.40	44.2
9a	R1	76	4	80	5.3	0.264	20.1	LOS B	1.0	7.6	0.75	1.09	0.85	39.9
Approach		89	5	94	5.6	0.264	18.7	LOS B	1.0	7.6	0.70	1.06	0.79	40.5
SouthWest: Bruxner Highway														
30a	L1	41	5	43	12.2	0.024	4.7	LOS A	0.0	0.0	0.00	0.55	0.00	53.8
5	T1	299	22	315	7.4	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		340	27	358	7.9	0.169	0.6	NA	0.0	0.0	0.00	0.07	0.00	59.1
All Vehicles		810	47	853	5.8	0.264	2.6	NA	1.0	7.6	0.10	0.16	0.11	56.4

Appendix C

SIDRA outputs 2031

Appendix D

SIDRA outputs 2041

Appendix E

Lot 320 SIDRA outputs

Appendix F

Costing breakdown

			2.4 km Bruxner Highway Bike Path			2.0 km Reynolds Road Bike Path		
Pay Item	Description	Unit	Qty	Rate	Total	Qty	Rate	Total
1	General Requirements							
1.1	Site Establishment	Lump sum	1	$26,406	$26,406	1	$30,483	$30,483
1.2	Traffic Control	Lump sum	1	$39,609	$39,609	1	$68,587	$68,587
1.3	Project Management	Lump sum	1	$118,827	$118,827	1	$137,174	$137,174
2	Road works							
2.1	Roundabout							
2.1.1	Earthworks	Cu m	1600	$25	$40,000	2000	$35	$70,000
2.1.2	Preparation, trim and compaction of existing surface	Sq m	4000	$6	$24,000	5000	$6	$30,000
	Sand 50mm	Cu.m	230	$90	$20,700	288	$90	$25,875
2.1.3	Supply, place and compact 150mm thick concrete	Cu.m	1,380	$350	$483,000	1,725	$350	$603,750
2.3	Additional works							
2.3.1	Turf	m	2400	$8.00	$19,200	2400	$8.00	$19,200
2.3.2	Driveways	each	60	$1,000.00	$60,000			
2.3.5	E&S	each	1	$8,000	$8,000	1	$8,000	$8,000
2.3.6	Signs	each	15	$350	$5,250	15	$350	$5,250
	Total (ex. GST)				$844,992			$998,318
	Contingency	%	50		$422,496	50		$499,159
	Grand Total (ex. GST)				$1,267,488			$1,497,477

Project: Richmond Valley SAP **Prepared By: GHD Pty Ltd**
Client: DRNSW

Estimate Type: Strategic Cost Estimate **Date: 11/25/2021**

			Bruxner Hwy/Arthur St T-Junction			Bruxner Hwy/East St Roundabout			Bruxner Hwy/Arthur St Roundabout		
Pay Item	**Description**	**Unit**	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**
1	**General Requirements**										
1.1	Site Establishment	Lump sum	1	$44,151	$44,151	1	$48,626	$48,626	1	$85,662	$85,662
1.2	Traffic Control	Lump sum	1	$66,226	$66,226	1	$72,939	$72,939	1	$128,493	$128,493
1.3	Project Management	Lump sum	1	$198,679	$198,679	1	$218,816	$218,816	1	$385,480	$385,480
2	**Road works**										
2.1	**Roundabout**										
2.1.1	Earthworks	Cu m	2720	$25	$68,000	2677.5	$25	$66,938	5025	$25	$125,625
2.1.2	Preparation, trim and compaction of existing surface	Sq m	5440	$6	$32,640	5355	$6	$32,130	10050	$6	$60,300
	Select subgrade, 300mm thick	Cu.m	1,877	$90	$168,912	1,847	$90	$166,273	3,467	$90	$312,053
2.1.3	Supply, place and compact min 300 mm thick DGS20 (or approved equivalent)	Cu.m	1,877	$115	$215,832	1,847	$115	$212,460	3,467	$115	$398,734
2.1.4	Supply, place and compact min 200 mm thick DGB20 (or approved equivalent)	Cu.m	1,251	$130	$162,656	1,232	$130	$160,115	2,312	$130	$300,495
2.1.5	Prime seal	Sq m	5,440	$6	$32,640	5,355	$6	$32,130	10,050	$6	$60,300
2.1.6	Asphalt	Sq m	5,440	$30	$163,200	5,355	$30	$160,650	10,050	$30	$301,500
2.2	**Drainage**										
2.2.1	Pipes	m	300	$450	$135,000	400	$450	$180,000	600	$450	$270,000
2.2.2	Pits	each	8	$3,000	$24,000	10	$3,000	$30,000	15	$3,000	$45,000
2.3	**Additional works**										
2.3.1	Kerb and gutter	m				990	$85.00	$84,150	2030	$85.00	$172,550
2.3.2	Lines	m	2505	$3.00	$7,515	1400	$3.00	$4,200	3600	$3.00	$10,800
2.3.3	Medians	Sq m	1125	$65.00	$73,125	600	$110.00	$66,000	520	$110.00	$57,200
2.3.4	Chevrons	each		$65	$0		$65	$0		$65	$0
2.3.5	E&S	each	1	$15,000	$15,000	1	$15,000	$15,000	1	$20,000	$20,000
2.3.6	Signs	each	15	$350	$5,250	16	$350	$5,600	20	$350	$7,000
	Total (ex. GST)				**$1,412,826**			**$1,556,025**			**$2,741,192**
	Contingency	%	**50**		**$706,413**	**50**		**$778,012**	**50**		**$1,370,596**
	Grand Total (ex. GST)				**$2,119,238**			**$2,334,037**			**$4,111,788**

	Reynolds Road widening				
Pay Item	**Description**	**Unit**	**Qty**	**Rate**	**Total**
1	**General Requirements**				
1.1	Site Establishment	Lump sum	1	$31,988	$31,988
1.2	Traffic Control	Lump sum	1	$47,982	$47,982
1.3	Project Management	Lump sum	1	$143,946	$143,946
2	**Road works**				
2.1	**Roundabout**				
2.1.1	Earthworks	Cu m	2400	$25	$60,000
2.1.2	Preparation, trim and compaction of existing surface	Sq m	2400	$6	$14,400
	Select subgrade, 300mm thick	Cu.m	828	$90	$74,520
2.1.3	Supply, place and compact min 300 mm thick DGS20 (or approved equivalent)	Cu.m	828	$115	$95,220
2.1.4	Supply, place and compact min 200 mm thick DGB20 (or approved equivalent)	Cu.m	552	$130	$71,760
2.1.5	Lift existing road to suit	cu.m	840	$145	$121,800
2.1.6	Prime seal	Sq m	9,600	$6	$57,600
2.1.7	Asphalt	Sq m	9,600	$30	$288,000
2.2	**Additional works**				
2.2.1	E&S	each	1	$15,000	$15,000
2.2.2	Signs	each	4	$350	$1,400
2.2.3	Linemarking	each	1	$8,000	$8,000
	Total (ex. GST)				**$1,031,616**
	Contingency	**%**	**50**		**$515,808**
	Grand Total (ex. GST)				**$1,547,424**

		Spring Grove Road - preferred access				Spring Grove Road - alternate access		
Pay Item	**Description**	**Unit**	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**
1	**General Requirements**							
1.1	Site Establishment	Lump sum	1	$77,430	$77,430	1	$49,465	$49,465
1.2	Traffic Control	Lump sum	1	$116,145	$116,145	1	$74,198	$74,198
1.3	Project Management	Lump sum	1	$348,436	$348,436	1	$222,593	$222,593
2	**Road works**							
2.1	**Roundabout**							
2.1.1	Earthworks	Cu m	3500	$25	$87,500	3200	$25	$80,000
2.1.2	Preparation, trim and compaction of existing surface	Sq m	5440	$6	$32,640	5440	$6	$32,640
	Select subgrade, 300mm thick	Cu.m	1,877	$90	$168,912	1,877	$90	$168,912
2.1.3	Supply, place and compact min 300 mm thick DGS20 (or approved equivalent)	Cu.m	1,877	$115	$215,832	1,877	$115	$215,832
2.1.4	Supply, place and compact min 200 mm thick DGB20 (or approved equivalent)	Cu.m	1,251	$130	$162,656	1,251	$130	$162,656
2.1.5	Prime seal	Sq m	5,440	$6	$32,640	5,440	$6	$32,640
2.1.6	Asphalt	Sq m	5,440	$30	$163,200	5,440	$30	$163,200
2.2	**Drainage**							
2.2.1	Pipes	m	300	$450	$135,000	400	$450	$180,000
2.2.2	Pits	each	8	$3,000	$24,000	10	$3,000	$30,000
2.3	**Additional works**							
2.3.1	Kerb and gutter	m				990	$85.00	$84,150
2.3.3	Medians	Sq m	1125	$65.00	$73,125	600	$110.00	$66,000
2.3.4	Chevrons	each		$65	$0		$65	$0
2.3.5	E&S	each	1	$15,000	$15,000	1	$15,000	$15,000
2.3.6	Signs	each	15	$350	$5,250	16	$350	$5,600
2.4	**Easement drainage**							
2.4.1	Supply and install box culvert - 6 x (1200x900)	m	20	$9,000.00	$820,000			
	Total (ex. GST)				**$2,477,766**			**$1,582,886**
	Contingency	**%**	**50**		**$1,238,883**	**50**		**$791,443**
	Grand Total (ex. GST)				**$3,716,650**			**$2,374,330**

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The Power of Commitment